Year 11

2023   Mathematics   **2024**

Unit 22 Tasks

DO NOT WRITE INSIDE

Question 1: Shown is a rectangle with length 3m and width 2m

(a) Find the area of the rectangle in m^2

(b) What is the length of the rectangle in cm?

(c) What is the width of the rectangle in cm?

(d) Find the area of the rectangle in cm^2

(e) Fill in the missing number using your answers to (a) and (d)

$$1m^2 = \boxed{} cm^2$$

3m

2m
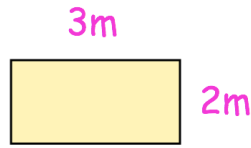
Question 2: Convert the following areas into cm^2

(a) $5m^2$ (b) $9m^2$ (c) $25m^2$ (d) $104m^2$

(e) $0.7m^2$ (f) $4.3m^2$ (g) $0.09m^2$ (h) $60.2m^2$

Question 3: Convert the following areas into m^2

(a) $40,000cm^2$ (b) $70,000cm^2$ (c) $180,000cm^2$

(d) $600,000cm^2$ (e) $3,830,000cm^2$ (f) $2,500cm^2$

(g) $900cm^2$ (h) $4,421cm^2$ (i) $12cm^2$

**Question 4:** Shown is a rectangle with length 5cm and width 3cm

(a) Find the area of the rectangle in cm^2

(b) What is the length of the rectangle in mm?

(c) What is the width of the rectangle in mm?

(d) Find the area of the rectangle in mm^2

(e) Fill in the missing number using your answers to (a) and (d)

$$1cm^2 = \boxed{} mm^2$$

5cm

3cm

Question 1: Shown is a cube with side length 1m

(a) Find the volume of the cube in m^3

(b) What is the side length of the cube in cm?

(c) Find the volume of the cube in cm^3

(d) Fill in the missing number using your answers to (a) and (c)

$$1m^3 = \boxed{} cm^3$$

1m
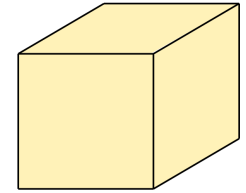
Question 2: Convert the following volumes into cm^3

(a) $3m^3$ (b) $11m^3$ (c) $80m^3$ (d) $205m^3$

(e) $0.5m^3$ (f) $0.17m^3$ (g) $0.006m^3$ (h) $4,000m^3$

Question 3: Convert the following volumes into m^3

(a) $7,000,000cm^3$ (b) $33,000,000cm^3$ (c) $190,000,000cm^3$

(d) $200,000cm^3$ (e) $45,000cm^3$ (f) $1,000,000,000cm^3$

Question 4: Shown is a cube with side length 1cm

(a) Find the volume of the cube in cm^3

(b) What is the side length of the cube in mm?

(c) Find the volume of the cube in mm^3

(d) Fill in the missing number using your answers to (a) and (c)

$$1cm^3 = \boxed{} mm^3$$

1cm

Question 5: Convert the following volumes into mm^3

(a) $6cm^3$ (b) $75cm^3$ (c) $300cm^3$ (d) $0.9cm^3$

(e) $0.01cm^3$ (f) $0.008cm^3$ (g) $27.52cm^3$

Question 6: Convert the following volumes into cm^3

(a) $4,000mm^3$ (b) $88,000mm^3$ (c) $500,000mm^3$ (d) $300mm^3$

(e) $2mm^3$ (f) $100.5mm^3$ (g) $60,000,000mm^3$
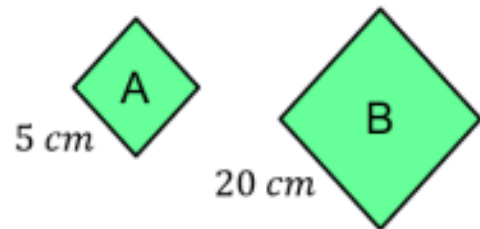
Question 7: Convert $2m^3$ to mm^3

Question 8: Given 1 litre = $1000cm^3$
Convert each of the following into cm^3

(a) 2 litres   (b) 9 litres   (c) 30 litres   (d) 18 litres

(e) 0.4 litres   (f) 500ml   (g) 7,500 litres   (h) 330ml

(i) 15ml   (j) 7.5ml   (k) 1ml

Question 9: Convert each of the following into litres

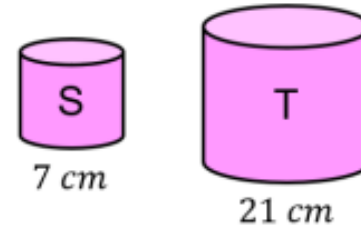(a) $5,000cm^3$ (b) $2,400cm^3$ (c) $20,000cm^3$ (d) $400cm^3$

Apply

Similar Areas and Volumes

(a) Find the linear scale factor.
(b) Find the area scale factor.
(c) The area of shape A is $15\ cm^2$, find the area of shape B.
(d) The area of shape B is $360\ cm^2$, find the area of shape A.
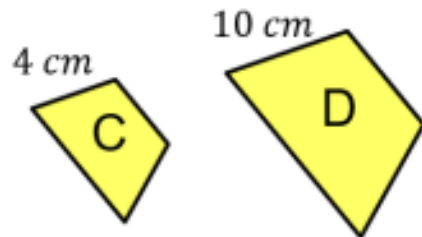
(a) The area of shape C is $12\ cm^2$, find the area of shape D.
(b) The area of shape D is $50\ cm^2$, find the area of shape C.

(a) The volume of shape S is $70\ cm^3$, find the volume of shape T.
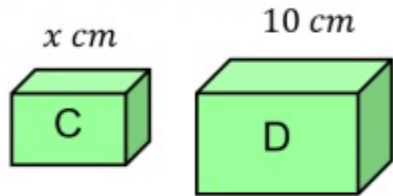(b) The volume of shape T is $810\ cm^3$, find the volume of shape S.
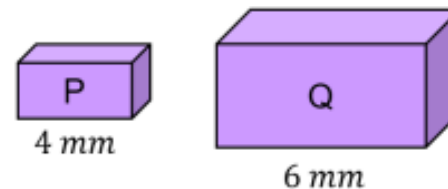
(a) The volume of shape P is $24\ cm^3$, find the volume of shape Q.
(b) The volume of shape Q is $270\ cm^3$, find the volume of shape P.
(c) The surface area of shape P is $110\ cm^2$, find the surface area of shape Q.
(d) The surface area of shape Q is $180\ cm^2$, find the surface area of shape P.
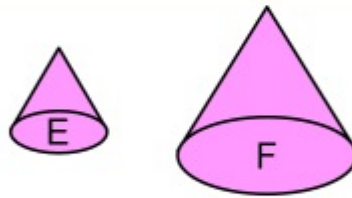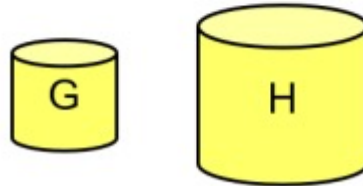
Harder Similar Areas and Volumes

4 cm **x cm**

A   B
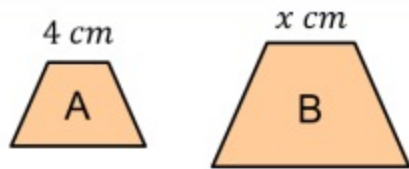
(a) The area of A is $20\ cm^2$ and the area of B is $180\ cm^2$. Find x.

x cm **10 cm**

C   D

(b) The volume of C is $5\ cm^3$ and the volume of D is $320\ cm^2$. Find x.

E   F

(c) The surface area of E is $15\ cm^2$ and the surface area of F is $60\ cm^2$. If the volume of E is $27\ cm^3$, find the volume of F.

G   H

(d) The volume of G is $4\ cm^3$ and the volume of H is $171.5\ cm^3$. If the surface area of H is $122.5\ cm^2$, find the surface area of G.

(e) If a painting with area of $220\ cm^2$ has a diagonal length of $21\ cm$, what will be the diagonal length of a similar painting with area $350\ cm^2$?

(f) It takes 5.6 litres of paint to paint a tower that is 3 m high. What is the tallest similar tower that can be painted with 8 litres of paint?

(g) A bronze statue has a mass of 300g and a height of 9 cm. A similar statue has a mass of 2 kg. What is its height?

Similar Solids

The following tables show measurements taken from two similar solids.

A. Copy and complete the table.

Smaller Solid Base(m)	Vol (m³)	Larger Solid Base(m)	Vol (m³)	Linear s.f.	Area s.f.	Volume s.f
1). 3	12	6				
2). 4	10	12				
3). 3	7	18				
4). 5	13	20				
5). 3		15	1125			
6). 1.5		4.5	216			
7). 4.5		18	576			
8). 11		22	192			
9). 1		10	4000			
10). 2	12	16				
11). 6	29	18				
12). 3		21	686			
13). 1.2		4.8	576			
14). 5	17	40				
15). 4		36	30618			

B. Copy and complete the table.

Smaller Solid Base(m)	Vol (m³)	Larger Solid Base(m)	Vol (m³)	Linear s.f.	Area s.f.	Volume s.f
1). 2	4		108			
2). 5.5	6		750			
3). 3	7		448			
4). 2.4	14		112			
5).	12	42	2592			
6).	10	72	5120			
7).	4	108	2916			
8).	27	75	3375			
9). 6	23		621			
10).	23	85	2875			
11).	4	30	4000			
12).	16	96	8192			
13). 4.6	42		9072			
14). 1.4	2		3456			
15).	8	54	5832			

C. Copy and complete the table.

Smaller Solid Area(m²)	Vol (m³)	Larger Solid Area(m²)	Vol (m³)	Linear s.f.	Area s.f.	Volume s.f
1). 4	5	400				
2). 5	8	245				
3). 2	7	162				
4). 3	6	147				
5). 12		48	136			
6). 11		99	378			
7). 7		343	1372			
8). 9		324	2592			
9). 11	15	275				
10). 8		72	351			
11). 11	18	275				
12). 6		384	6144			
13). 12	27	48				
14). 7		252	2376			
15). 2		200	8000			

D. Copy and complete the table.

Smaller Solid Area(m²)	Vol (m³)	Larger Solid Area(m²)	Vol (m³)	Linear s.f.	Area s.f.	Volume s.f
1). 2	8		512			
2). 5	13		351			
3). 4	7		56			
4). 2	4		2916			
5).	8	600	8000			
6).	16	72	432			
7).	8	192	4096			
8).	10	20	80			
9). 14	25		8575			
10).	13	225	1625			
11).	16	108	432			
12). 7	14		896			
13).	8	324	5832			
14).	7	320	3584			
15). 14	19		13851			

E.

1). Two cans are similar in shape and the larger can is twice as tall as the smaller can. The volume of the smaller can is 42 cm³, what is the volume of the larger can ?

2). The area of a rug in a dolls house is 50 cm². A similar rug in the child's bedroom is 4 times the lengths. What is the area of this rug ?

3). The volume of a cone of base area 12 cm² is 40 cm³. Find the volume of a similar cone whose base area is 3 cm².

4). A dolls house is built on a scale 1 cm to 1 m. The surface area of a door is 3 cm². What is the area of the actual door that the dolls house is modelled on ?

5). On a photograph a building is 3 cm high and has a wall of area 6 cm². If the actual building has a wall of area 1109400 cm², what is the height of the actual building ?

6). Two ponds are in the shape of a hemisphere.
   a). The smaller pond has a radius of 7 m and the surface area of water is 154 m². The larger pond has a surface area of 2464 m², what is the radius of this pond ?
   b). The smaller pond has a volume of 718.4 m³, what is the volume of the larger pond ?

7). The volume of a cone of base area 35 cm² is 84 cm³. Find the base area of a similar cone whose volume is 10500 cm³.

8). A rectangular lawn measures 6 m x 8 m and need 15 kg of fertiliser. How much fertiliser does a similar lawn need that is 3 times the length of the first lawn ?

Fluency Practice

SIMILAR SHAPES
LENGTHS, AREAS AND VOLUMES

Ref: G460. **1R1**

A1 Shape **A** is similar to shape **B**

4 cm
x cm
A
B
2.8 cm
4.2 cm

Work out the value of *x*.

A2 Shape **C** is similar to shape **D**

9 cm
C
x cm
D
9.6 cm
6 cm

Work out the value of *x*.

A3 Do some calculations to work out if the rectangles are mathematically similar.

12 cm
6.4 cm
9.6 cm
8 cm

A4 The two triangles are similar

12 cm
4 cm
x cm
9 cm

Work out the value of *x*.

B1 Shape **E** is similar to shape **F**
The area of **E** is 30 cm^2

7 cm
E
F
9.8 cm

Calculate the area of **F**.

B2 Shape **G** is similar to shape **H**
The area of **G** is 210 cm^2

10.6 cm
G
H
6 cm

Calculate the area of **H**.

B3 Shape **M** is similar to shape **N**
The height of **M** is 12 cm.

M
N
$A_M = 54$ cm^2 $A_N = 24$ cm^2

Calculate the height of **N**.

B4 Shape **P** is similar to shape **Q**
The width of **Q** is 14 cm.

P
Q
$A_P = 64$ cm^2 $A_Q = 100$ cm^2

Find the width of **P**.

C1 Cylinders **A** and **B** are similar
Cylinder **B** is 1.6 times as high as cylinder **A**.

$SA_A = 24$ cm^2
A
B

Calculate the surface area of **B**.

C2 Cylinders **A** and **B** are similar
Cylinder **B** is 1.4 times as high as cylinder **A**.

A
B
$V_B = 50$ cm^3

Calculate the volume of **A**.

C3 Cuboids **A** and **B** are similar
The volume of **A** is 250 cm^3.

A
B
12 cm
18 cm

Calculate the volume of **B**.

C4 Cuboids **A** and **B** are similar
The surface area of **B** is 1000 cm^2.

A
B
8 cm
20 cm

Calculate the surface area of **A**.

Fluency Practice

SPHERES, CONES AND CYLINDERS
WORKING BACKWARDS
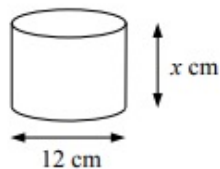
A1 Volume is 340 cm^3

Calculate the height, x.

A2 Volume is 1500 cm^3
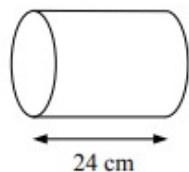
Calculate the radius.

A3 Surface area is 180 cm^2
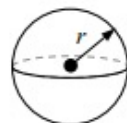
Calculate the radius, r.

A4 Volume is 140 cm^3
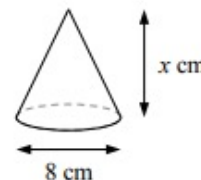
Calculate the height, x.
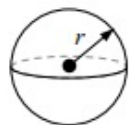
B1 Volume is 540 cm^3

Calculate the radius, r.

B2 **Curved** surface area is 90 m^2
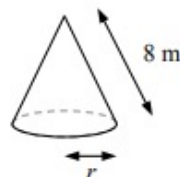
Calculate the radius, r.

B3 Volume is 300 cm^3
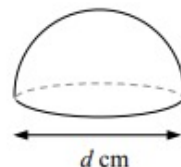
Calculate the diameter, d.

B4 **Total** surface area is 540 cm^2
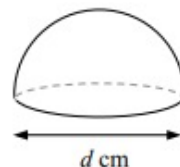
Calculate the diameter, d.

C1 Volume is 268 cm^3
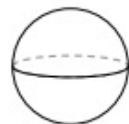
Find the surface area.

C2 Volume is 770 cm^3

find the **total** surface area.

C3 Volume is 594 cm^3

Find the curved surface area.

C4 **Total** surface area is 100 cm^2
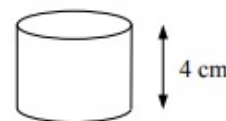
Find the volume.

(e) Area = 216cm²

Area = ☐ cm²

30cm

20cm

(f) Area = ☐ cm²

Area = 99cm²

12cm

20cm
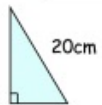
Question 4: Each pair of shapes below are similar. Find the missing lengths.

(a) Area = 15cm²

Area = 60cm²

6cm

☐ cm

(b) Area = 6cm²

Area = 1350cm²

4cm

☐ cm

(c) ☐ cm

24cm

Area = 7cm²

Area = 112cm²

(d) Area = 60cm²

Area = 735cm²

☐ cm

22.75cm

Question 5: The solid shapes below are mathematically similar. Find the missing surface areas.

(a) Surface area = ☐ cm²

Surface area = 50cm²

6cm

12cm

(b) Surface area = 506.25cm²

Surface area = ☐ cm²

4cm

9cm

Question 6: The solid shapes below are mathematically similar. Find the missing lengths.

(a) Surface area = 121m²

Surface area = 16m²

2m

☐ m

(b) Surface area = 5400cm²

Surface area = 6cm²

☐ cm

10cm

Workout 2

Question 1: Cube B is an enlargement of cube A.

(a) What is the scale factor of enlargement?

(b) How many times larger is the surface area of B than A?

(c) How many times larger is the volume of cube B than A?

A 2cm

B 6cm
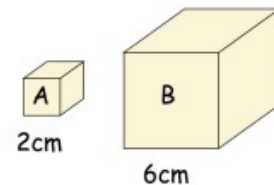
Question 2: Cones C and D are similar.

How many times larger is the volume of D than C?

12cm C

D 60cm
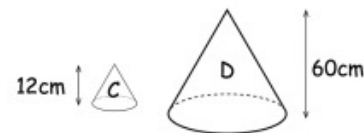
Question 3: The solids below are mathematically similar. Find the missing volumes.

(a) Volume = ☐ cm³

Volume = 20cm³

3cm

9cm

(b) Volume = 160000cm³

Volume = ☐ cm³

5cm

40cm

(c) Volume = ☐ cm³

Volume = 138.24cm³

5cm

6cm

(d) Volume = ☐ mm³

Volume = 65mm³

2.5mm

1cm

Question 4: The solid shapes below are mathematically similar. Find the missing lengths.

(a) Volume = 960cm³

Volume = 120cm³

9cm

☐ cm

(b) Volume = 6cm³

Volume = 750cm³

☐ cm

15cm

(c)   Volume = 10000cm³

20cm

Volume = 640cm³

cm

(d)   Volume = 14288.4cm³

Volume = 2450cm³

12cm

cm
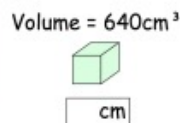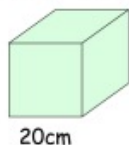
Question 5:   The solid shapes below are similar.
Find the missing volumes.

(a)

Surface area = 300cm²

Surface area = 1200cm²

A

B
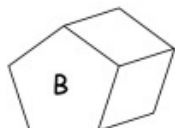
Volume = 600cm³

Volume =   cm³

(b)

Surface area = 18cm²

Surface area = 450cm²

Volume =   cm³

Volume = 400cm³

(c)

Surface area = 2124cm²

Surface area = 944cm²

Volume =   cm³

Volume = 1920cm³

(d)

Surface area = 36π cm²

Surface area = 5184π cm²

Volume = 16π cm³

Volume =   cm³

Question 6:   The solid shapes below are similar.
Find the missing surface areas.

(a)

Surface area =   cm²

Surface area = 576cm²

Volume = 20cm³

Volume = 540cm³

(b)

Surface area = 324π cm²

Surface area =   cm²

Volume = 972π cm³

Volume = 2304π cm³

Question 1:   A and B are mathematically similar.

The height of A : the height of B = 3 : 5

(a) Find the surface area of A : the surface area of B

(b) Find the volume of A : the volume of B

A   B
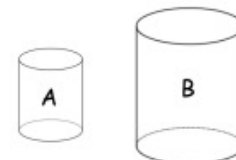
Question 2:   Solids C and D are similar.

The length of C : the length of D = 9 : 2

(a) Find the surface area of C : the surface area of D

(b) Find the volume of C : the volume of D

C   D

Question 3:   Shown are spheres E and F.

The surface area of E : the surface area of F = 4 : 49

(a) Find the diameter of E : the diameter of F

(b) Find the volume of E : the volume of F

E   F
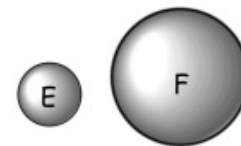
Question 4:   Shown are similar solids G and H.

The volume of G : the volume of H = 27 : 1000

(a) Find the height of G : the height of H

(b) Find the surface area of G : the surface area of H

G   H
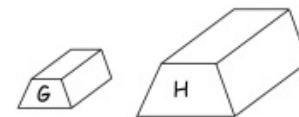
Question 5:   The surface areas of two similar shapes are in the ratio 25 : 81
The length of the smaller shape is 30cm.

Work out the length of the larger shape.

Question 6:   The volumes of two similar shapes are in the ratio 1000 : 27
The surface area of the larger shape is 250cm²

Work out the surface area of the smaller shape.

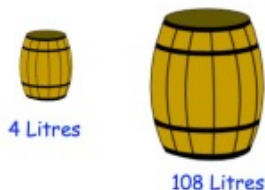**Question 1:** Myles says that the surface area of B is three times larger than the surface area of A.
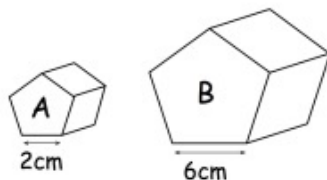
Explain why Myles is incorrect.

2cm   6cm

Question 2: Two vases are similar.
The smaller vase holds 800ml.

How much does the larger vase hold?

30cm   45cm

Question 3: Two barrels are mathematically similar.
It takes 90ml of paint to paint the smaller barrel.

How much paint is needed for the larger barrel?

4 Litres   108 Litres

Question 4: A large bottle of cola is 16cm tall.
A small bottle of cola is 12cm tall.
The bottles are mathematically similar.
Fernando claims the small bottle contains three-quarters of the amount of cola than the large bottle.

Show Fernando is wrong.

Question 5: Nina bought a toy that grows when placed in water.
Before placing the toy in water, it was 4cm tall.
After placing the toy in water it grew to a similarly shaped toy that was 11cm tall.

Grows 20 times larger

Is the claim that it will "grow 20 times larger" reasonable?

Question 6: Alec makes two solid mathematically similar models of the Titanic.

The smaller model had a length of 10cm
The larger model had a length of 45cm
The mass of the larger model is 7.29kg

Work out the mass of the smaller model.

Question 7: Below are two similar cones.

12cm   25cm
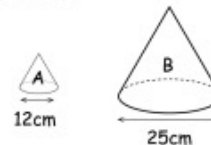
Anna says the volume of A is approximately 11% of the volume of B.
Is Anna correct? Explain your answer.

Question 8: Rectangles A and B are similar.
The area of rectangle A is 240
The area of rectangle B is 15.
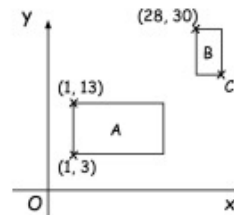
Find the coordinates of the point C.

(28, 30)   (1, 13)   (1, 3)

Question 9: Cylinders A and B are similar.

40cm
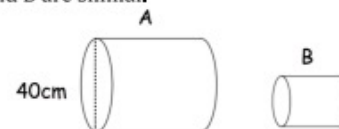
Volume B $\times \dfrac{512}{27}$ = Volume A

Find the radius of cylinder B.

Question 10: A, B and C are similar.

The volume of A is 729cm^3 and the volume of B is 64cm^3.

The surface area of B is 25cm^2 and the surface area of C is 121cm^2.

Find the ratio   length of A : length of B : length of C

Question 11: Shapes A, B and C are similar.
The height of shape A is 8cm.
The height of shape C is 4cm.
The ratio of the surface area of shape B to the surface area of shape C is 25:9

Work out the ratio of the volume of shape A to shape B.

Question 12: Two solid toys, C and D, are similar.
The volume of toy C is 40cm^3

The surface area of C : surface area of D = 2 : 9

Work out the volume of toy D.

Question 13: Washing powder is sold in two different sizes, a large box A and a smaller box B.
Cuboid boxes A and B are similar.

Surface area of A : Surface area of B = 81 : 4
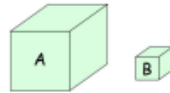
How many smaller boxes, B, can be completely filled using the contents of a full box A?

Question 14: Pyramid A and pyramid B are similar.

The surface area of B is 42.25 times larger than the surface area of A.

Find the ratio of the volume of A to the volume of B.

Question 15: Cuboids A and B are similar but made from different materials.
Both cuboids are placed on a table.

16cm   20cm
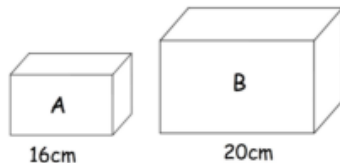
The pressure on the table due to cuboid A is 3.5 newtons/cm^2
Cuboid A exerts a force of 420N on the table.

The pressure on the table due to cuboid B is 4 times larger than cuboid A.

Work out the force exerted by cuboid B on the table.

Question 16: Ornament A and B are mathematically similar.
They are solid and both made from copper and zinc in the ratio 3:2

Ornament A has a height of 5cm and volume of 30cm^3
Ornament B has a height of 18cm.

The density of copper is 8.96g/cm^3
The density of zinc is 7.13g/cm^3

Work out the difference in mass between ornament A and ornament B.

Question 17: Cylinders A and B are similar.
The height of A is 6cm.
The volume of A is 240cm^3 to 2 significant figures.
The height of B is 15cm and the volume of B is y.

Work out the error interval of y.

Question 18: The square based pyramid A is divided into Pyramid B and Frustum C.
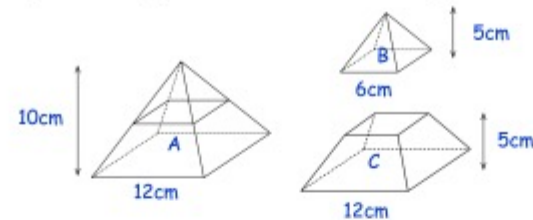
(a) Express the volume of Pyramid B as a fraction of the volume of Pyramid A.

(b) Express the volume of Frustum C as a fraction of the volume of Pyramid A.

Answers

Click here   Scan here

PR unit 22 vol and SA

Question 1

Skill involved: K161a: Find the volume of a cuboid by counting cubes.

The cuboid below is made of centimetre cubes.
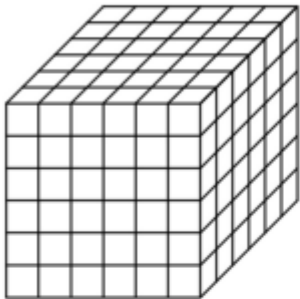
Determine the volume of the cuboid.

Question 2

Skill involved: K161a: Find the volume of a cuboid by counting cubes.

The cuboid below is made of centimetre cubes.
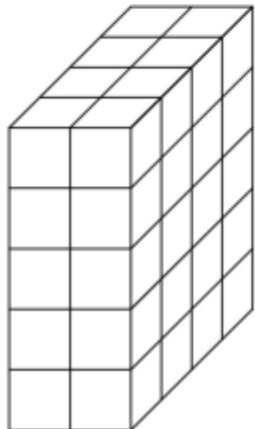
Find the volume of the cuboid.

Question 3

Skill involved: K161b: Find the volume of a cuboid.

Find the volume of the cuboid.
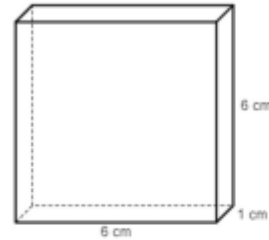
Question 4

Skill involved: K161b: Find the volume of a cuboid.

The diagram shows a fish tank in the shape of a cuboid.
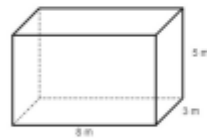
Work out the volume of the fish tank.

Question 5

Skill involved: K161c: Find a missing dimension of a cuboid given its volume.

The volume of the cuboid is 130 cm ^{3}.
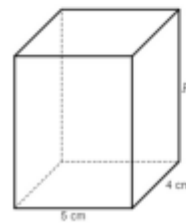
Find the value of p.

Question 6

Skill involved: K161c: Find a missing dimension of a cuboid given its volume.

The volume of the cuboid is 90 cm ^{3}.
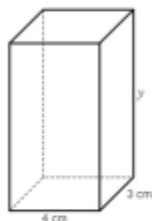
Find the value of y.

Question 7

Skill involved: K162a: Find the surface area of a cuboid.

Work out the surface area of the cuboid.
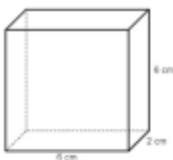
Question 8

Skill involved: K162a: Find the surface area of a cuboid.

Find the surface area of the cuboid.
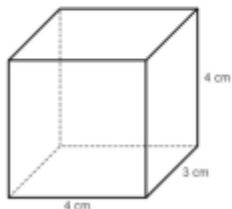
Question 9

Skill involved: K162b: Find the surface area of a prism.

Work out the surface area of the prism.
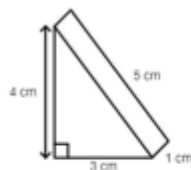
Question 10

Skill involved: K162b: Find the surface area of a prism.

Work out the surface area of the prism.
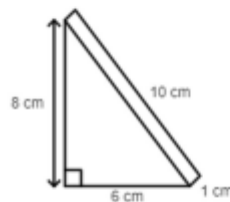
Question 11

Skill involved: K162c: Calculate costs using a surface area.

Lloyd has a rectangular wall to be painted.

Paint is sold in tins.
A tin of paint costs £47.99
Each tin of paint covers 3.5 m ^{2}

Calculate the cost of the paint needed to paint the wall.

Question 12

Skill involved: K162c: Calculate costs using a surface area.

Sam is going to paint the 4 walls and the ceiling of a room in the shape of a cuboid.

2 m

2.8 m

2.4 m
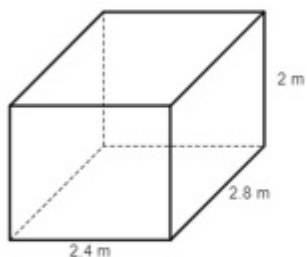
Paint is sold in tins.
A tin of paint costs £40.99
Each tin of paint covers 4 m^2

Calculate the cost of the paint needed to paint the 4 walls and the ceiling.

Question 13

Skill involved: K163a: Find the volume of a prism.

Work out the volume of the prism.

6 cm

2 cm

9 cm

10 cm
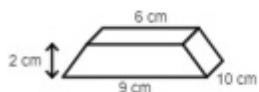
Question 14

Skill involved: K163a: Find the volume of a prism.

Work out the volume of the prism.

12 cm

10 cm

7 cm
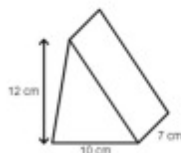
Question 15

Skill involved: K163b: Find a missing dimension in a triangular prism given the volume.

The volume of the prism is 216 cm^3.

x

6 cm

9 cm
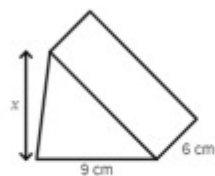
Find the value of x.

Question 16

Skill involved: K163b: Find a missing dimension in a triangular prism given the volume.

The volume of the prism is 90 cm^3.

5 cm

9 cm

x
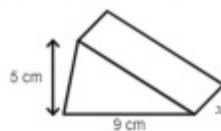
Find the value of x.

Question 17

Skill involved: K163c: Find the volume of a prism where the cross section is a compound shape.

The diagram below shows a prism.

5m

9m

7m

9 m
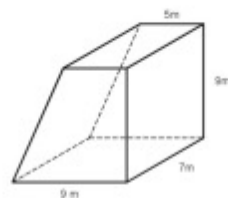
Find the volume of the prism.

Question 18

Skill involved: K163c: Find the volume of a prism where the cross section is a compound shape.

The diagram below shows a prism.

6 cm

12 cm

10 cm

4cm
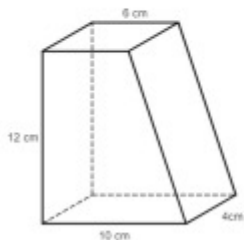
Find the volume of the prism.

Question 19

Skill involved: K164a: Find the volume of a cylinder from its radius and height.

A cylinder has a radius of 5 cm and height of 19 cm., as shown on the diagram below.

19 cm

5 cm
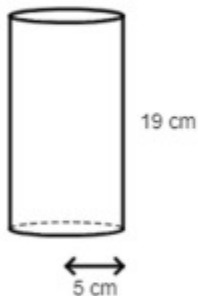
Work out the volume of the cylinder.
Give your answer correct to 1 decimal place.

Question 20

Skill involved: K164a: Find the volume of a cylinder from its radius and height.

A cylinder has a radius of 9 cm and height of 13 cm., as shown on the diagram below.

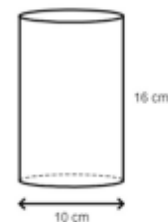13 cm

9 cm
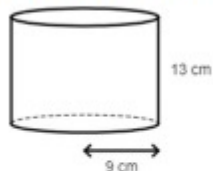
Work out the volume of the cylinder.
Give your answer correct to 1 decimal place.

Question 21

Skill involved: K164b: Find the volume of a cylinder from its diameter and height.

Find the volume of the cylinder with a diameter of 10 cm and height of 20 cm, as shown on the diagram below.

20 cm

10 cm
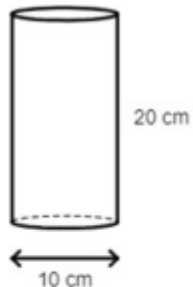
Give your answer correct to 1 decimal place.

Question 22

Skill involved: K164b: Find the volume of a cylinder from its diameter and height.

Find the volume of the cylinder with a diameter of 26 cm and height of 19 cm, as shown on the diagram below.

19 cm

26 cm
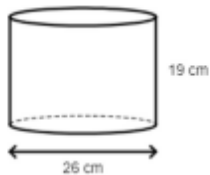
Give your answer correct to 1 decimal place.

Question 23

Skill involved: K164c: Find a missing dimension of a cylinder given its volume.

The volume of the cylinder is 4730 cm ^{3}.

16 cm

x
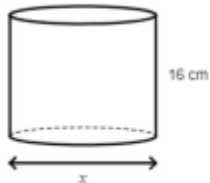
Find the value of x.
Give your answer correct to 1 decimal place.

Question 24

Skill involved: K164c: Find a missing dimension of a cylinder given its volume.

The volume of the cylinder is 1273 cm ^{3}.

x

18 cm
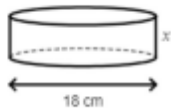
Find the value of x.
Give your answer correct to 1 decimal place.

Question 25

Skill involved: K165a: Find the surface area of a cylinder from its radius and height.

Find the surface area of the cylinder with a radius of 12 cm and height of 6 cm, as shown on the diagram below.

6 cm

12 cm
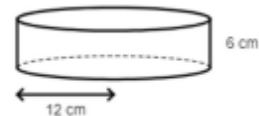
Give your answer correct to 1 decimal place.

Question 26

Skill involved: K165a: Find the surface area of a cylinder from its radius and height.

Find the surface area of the cylinder with a radius of 11 cm and height of 3 cm, as shown on the diagram below.

3 cm

11 cm

Give your answer correct to 1 decimal place.

Question 27

Skill involved: K165b: Find the surface area of a cylinder from its diameter and height.

Find the surface area of the cylinder with a diameter of 10 cm and height of 16 cm, as shown on the diagram below.

16 cm

10 cm

Give your answer correct to 1 decimal place.

Question 28

Skill involved: K165b: Find the surface area of a cylinder from its diameter and height.

Find the surface area of the cylinder with a diameter of 18 cm and height of 7 cm, as shown on the diagram below.

7 cm

18 cm
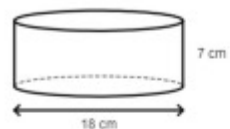
Give your answer correct to 1 decimal place.

Question 29

Skill involved: K165c: Find the height of a cylinder given its surface area.
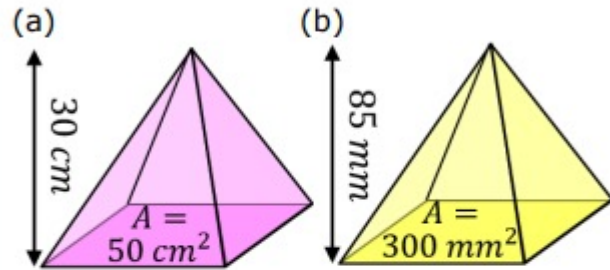
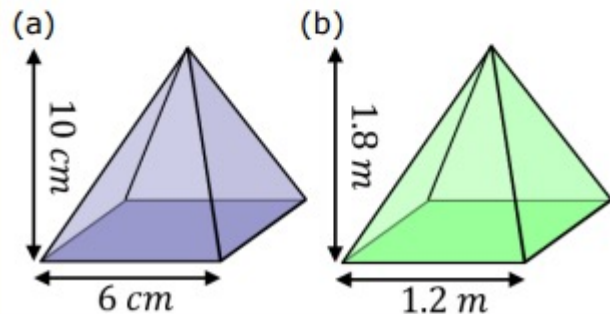The surface area of the cylinder is 1412 cm ^{2}.

x

21.6 cm
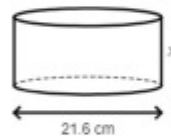
Find the value of x.
Give your answer correct to 1 decimal place.

Question 30

Skill involved: K165c: Find the height of a cylinder given its surface area.

The surface area of the cylinder is 527 cm ^{2}.

x

5.7 cm
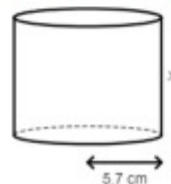
Find the value of x.
Give your answer correct to 1 decimal place.

Volume of a Pyramid

Find the volume of each of these pyramids.

(a)

30 cm

$A = 50\ cm^2$

(b)

85 mm

$A = 300\ mm^2$

Find the volumes of each of these pyramids.

(a)

27 cm

8 cm

5 cm

(b)

2 m

0.7 m

0.4 m

Find the volume of each of these square-based pyramids.

(a)

10 cm

6 cm

(b)

1.8 m

1.2 m
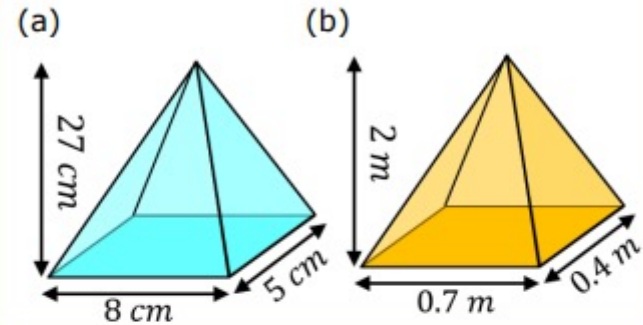
Find the missing measurements from each of these pyramids when given their volumes.

(a) $V = 14400\ cm^3$

h

40 cm

20 cm

(b) $V = 0.111\ m^3$

3.7 m

$x\ m$

$x\ m$
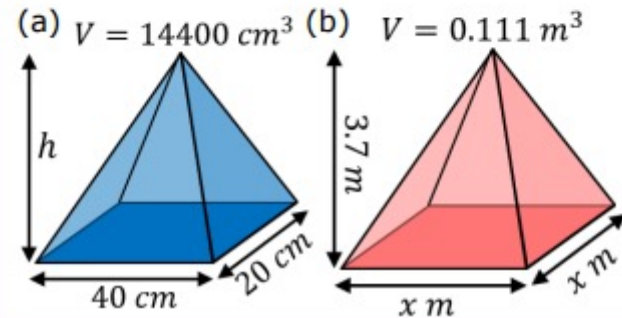
Question 1: Find the volume of each of these pyramids.
Give each answer to one decimal place (you may use a calculator)

(a)

7cm
6cm
9cm

(b)

8cm
6cm
6cm

(c)

3cm
3cm
4cm

(d)

12cm
5cm
7cm

(e)

20.6cm
15cm
10cm
10cm

(f)

90cm
1.5m
2m
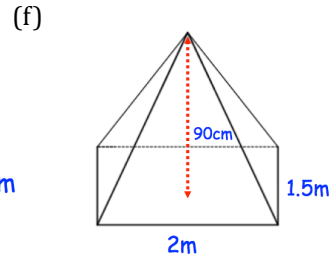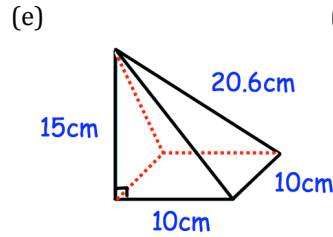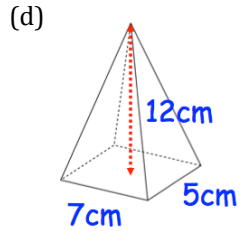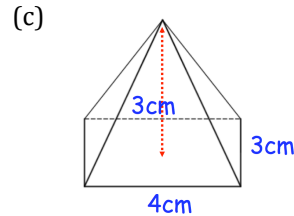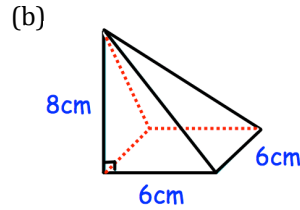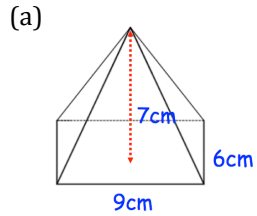
Question 2: A square-based pyramid has a base with side length 8cm.
The height of the pyramid is 11cm.
Calculate the volume of the pyramid.

Question 3: A rectangular-based pyramid has a base with length 12cm and width 6cm.
The height of the pyramid is 8cm.
Calculate the volume of the pyramid.

Question 4: An octagon-based pyramid has a height of 18cm.
The area of the octagon base is 20cm^2.
Calculate the volume of the pyramid

18cm
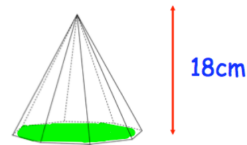
Question 5: A hexagon-based pyramid has a height of 54cm.
The volume of the pyramid is 1080cm^3.
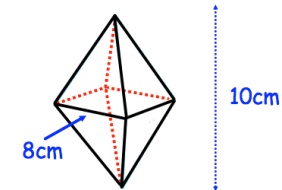Calculate the area of the base of the pyramid.

54cm

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(a)

12cm 12cm
12cm
10cm
8cm 6cm

(b)

20cm
13cm
12cm 5cm

Question 7: Find the volume of each of composite solids.

(a)

8cm 6cm
6cm
7cm

(b)

2cm
5cm
3cm
4cm

(c)

3.1m 1.8m
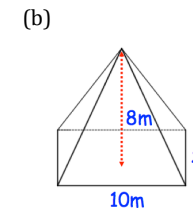2m
2.5m
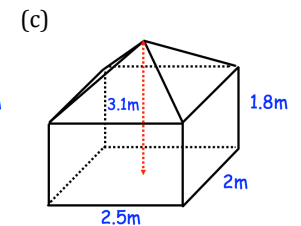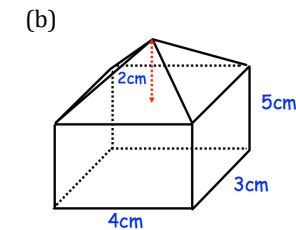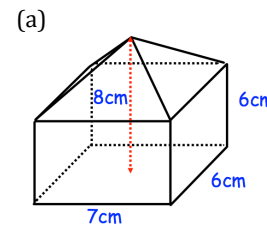
Question 8: A solid shape is created by joining two square based pyramids.
Find the volume of the shape.

10cm
8 8cm

Question 9: Find x for each of these pyramids.
The volume of each is given.

(a)

x
4m
6m

Volume = 36m^3

(b)

8m
x
10m

Volume = 256m^3

(c)

15cm
x
x

Volume = 605cm^3

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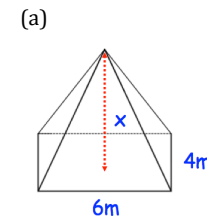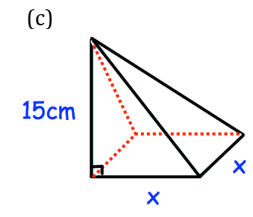
**Question 1:** The Great Pyramid of Giza is a square based pyramid.
The base has a side length of 440 cubits.
The height of the pyramid is 280 cubits.
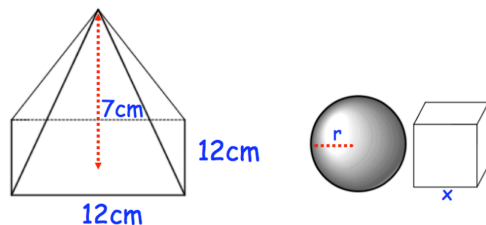Calculate the volume of the Great Pyramid of Giza.

Question 2: A solid rectangular based pyramid has a base with length 28cm and width 20cm.
The height of the pyramid is 16cm.
The pyramid has a mass of 35.84kg
Calculate the density of the material used to make the pyramid, in g/cm^3

Question 3: A solid triangular based pyramid is made from a material which has a density of $7.2g/cm^3$.
The dimensions of the pyramid are shown below.

7cm

5cm

4cm   3cm
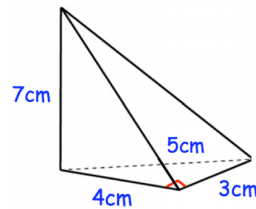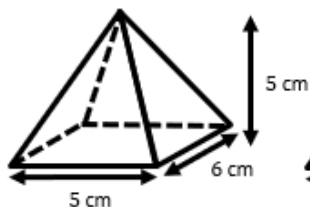
Calculate the mass of the pyramid.

Question 4: A solid square based pyramid is made out of gold.
The pyramid has base of length 12cm and a height of 7cm.
The pyramid is melted and the gold is used to make a sphere and a cube.
The sphere and cube have the same volume.
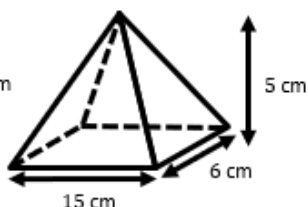Calculate the radius of the sphere, r, and the side length of the cube, x.

7cm

12cm

r

12cm

x

Calculate the volume.

Question 1

5 cm
6 cm
5 cm

Question 2

5 cm
6 cm
15 cm

Question 3

15 cm
6 cm
5 cm

Question 4

15 cm
6 cm
5 cm

Question 5

7.5 cm
3 cm
2.5 cm

Question 6

75 cm
30 cm
25 cm

- Why is the answer to question 3 the same as the answer to question 2?
- Why is the answer to question 6 thousand times the answer to question 5?
- Why is the answer to question 9 half the answer to question 8?

Find x given the volume.

Question 1

$V = 50$ cm³
x cm
6 cm
5 cm

Question 2

$V = 150$ cm³
5 cm
6 cm
x cm

Question 3
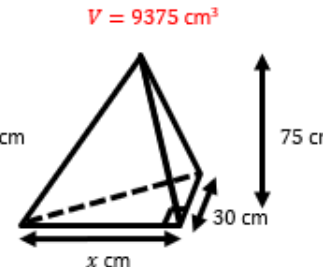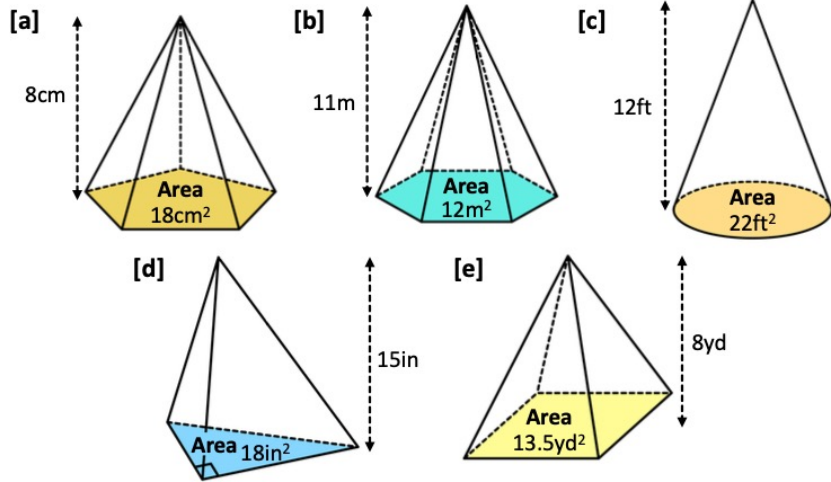
$V = 150$ cm³
x cm
6 cm
5 cm

Question 4

$V = 75$ cm³
x cm
6 cm
5 cm

Question 5

$V = 9.375$ cm³
7.5 cm
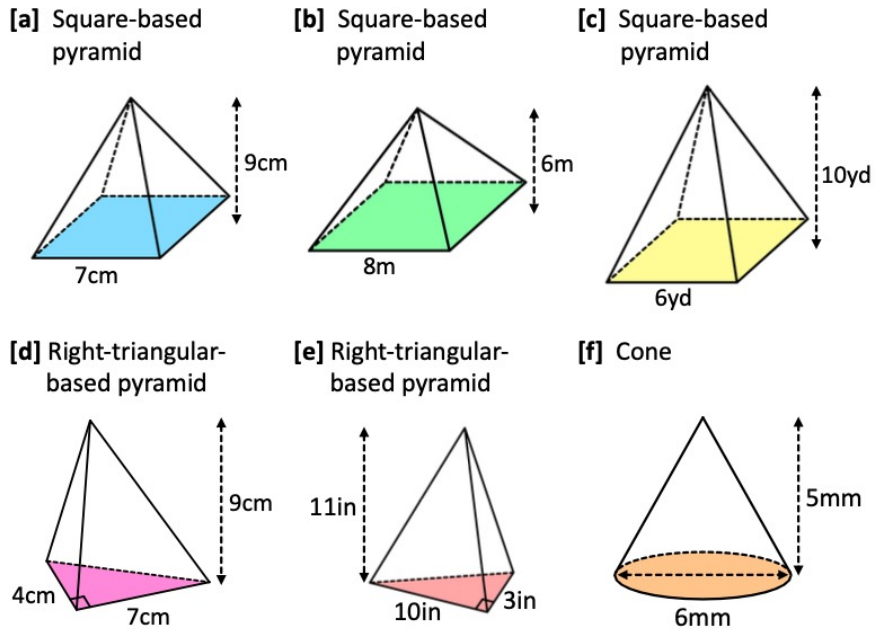3 cm
x cm

Question 6

$V = 9375$ cm³
75 cm
30 cm
x cm

- Why is the answer to question 3 the same as the answer to question 2?
- Why is the answer to question 6 ten times the answer to question 5?

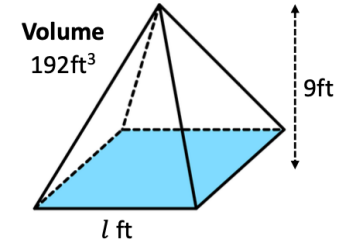**Q1** Work out the volume of each of the following pyramids.

[a]

8cm

Area 18cm²

[b]

11m

Area 12m²

[c]

12ft

Area 22ft²

[d]

15in

Area 18in²

[e]

8yd

Area 13.5yd²

Q2 Work out the volume of each of the following pyramids.

[a] Square-based pyramid

9cm

7cm

[b] Square-based pyramid

6m

8m

[c] Square-based pyramid

10yd

6yd

[d] Right-triangular-based pyramid

9cm

4cm

7cm

[e] Right-triangular-based pyramid

11in

10in   3in

[f] Cone

5mm

6mm

Ex4 The following square-based pyramid has a height of 9in. Given that the volume of the pyramid is 27in³, find the length of the base, l in.
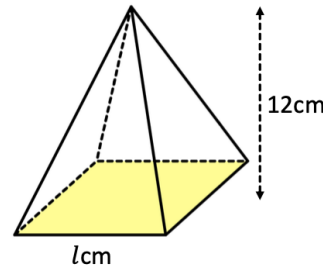
Volume 27in³

9in

l in
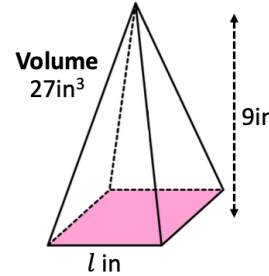
Q5 The following square-based pyramid has a height of 9ft. Given that the volume of the pyramid is 192ft³, find the length of the base, l ft.
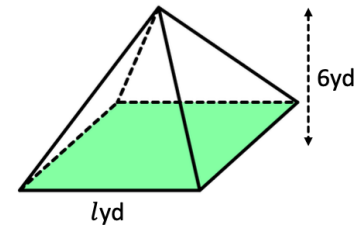
Volume 192ft³

9ft

l ft

Q6 Work out the missing length of each of the following pyramids given their volume.

[a] Volume = **100cm³**

12cm

$l$cm
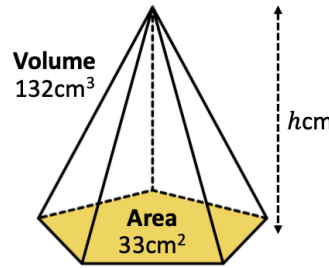
[b] Volume = **128yd³**

6yd

$l$yd

[c] Volume = **500m³**

15m

lm
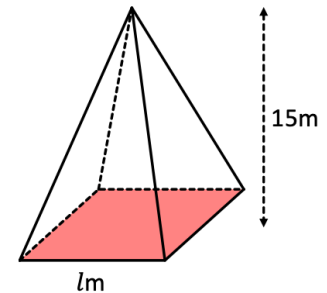
Ex3 The following pyramid has a base area of 24m². Given that the volume of the pyramid is 112m³, find its height, h m.

Volume 112m³

hm

Area 24m²
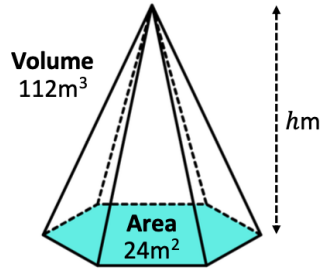
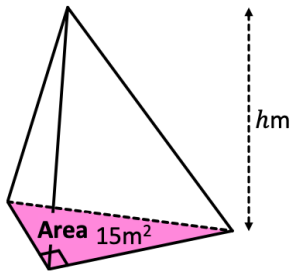**Q3** The following pyramid has a base area of 33cm². Given that the volume of the pyramid is 132cm³, find its height, h cm.
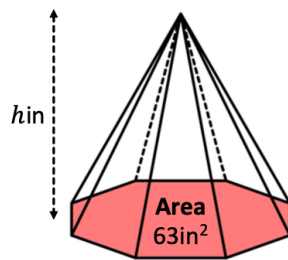
Volume 132cm³

$h$cm

Area 33cm²

Q4 Work out the height of each of the following pyramids given their volume.

[a] Volume = **105m³**

hm

Area 15m²

[b] Volume = **168in³**

$h$in

Area 63in²

[c] Volume = **108mm³**

$h$mm

Area 27mm
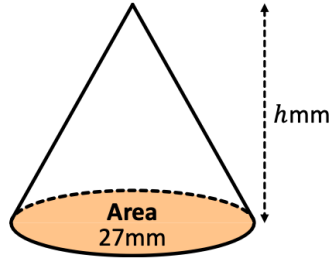
Q1 The pyramid and the cuboid have the same volume. Find the value of h.

$h$cm

Area 42cm²

5cm

7cm

6cm
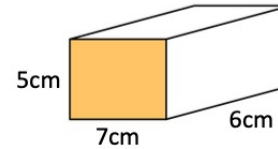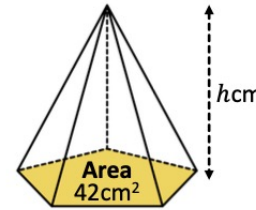
Q2 The following container is in the shape of a cone.
The container is filled with 3L of water. Use **1L = 1000cm³** to find the percentage of the volume of the cone that is taken up by the water to the nearest 1%.

12cm

36cm
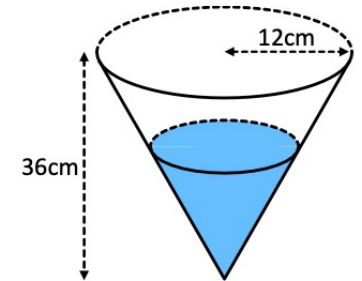
Q3 The following composite solid is made by joining a cuboid and square-based pyramid. Calculate the volume of the solid.

12cm

6cm

11cm
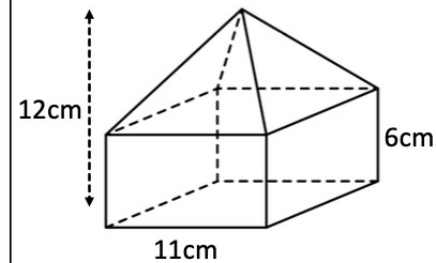
Q4 The following right-triangular-based pyramid has a height of 9ft. Given that the volume of the pyramid is 84ft³, find the missing length, x ft.

21ft

$x$ft

8ft

Corbett
mαths
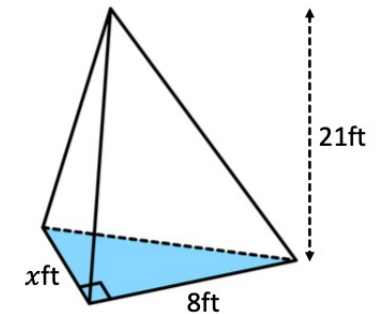
Question 1: Work out the volumes of each of following cones.
Give each answer to one decimal place.

(a)
20cm
7cm

(b)
5cm
1.5cm

(c)
9cm
8cm

Question 2: Work out the volumes of each of the following cones.
Give each answer in terms of **π**

(a)
20cm
9cm

(b)
15mm
12mm

(c)
50cm
30cm

Question 3: Work out the vertical height of each cone.
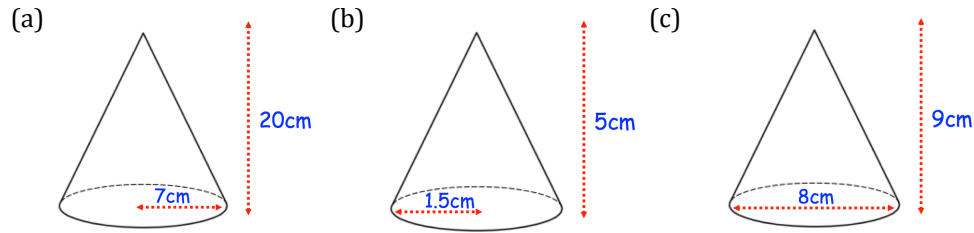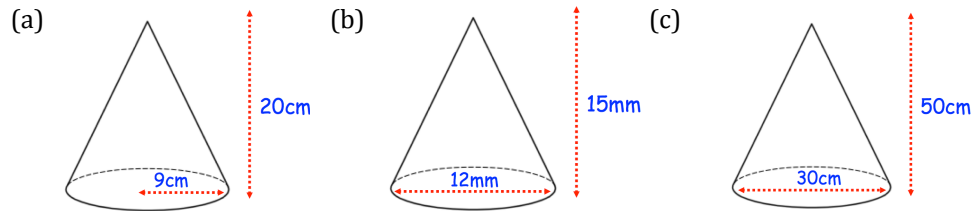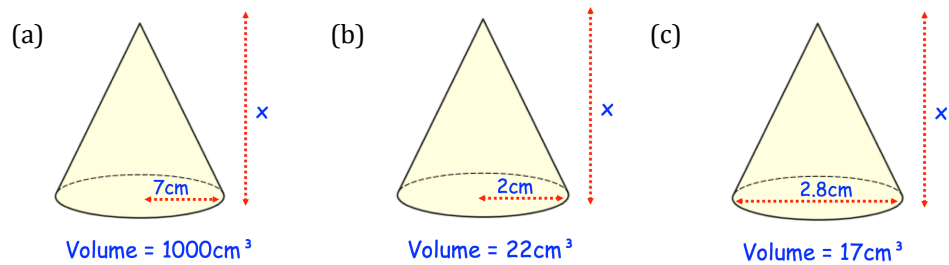Give each answer to a suitable degree of accuracy.

(a)
x
7cm
Volume = 1000cm³

(b)
x
2cm
Volume = 22cm³

(c)
x
2.8cm
Volume = 17cm³

Question 4: Calculate the length of the radius for each of these cones.
Give each answer to a suitable degree of accuracy.

(a)
π
20cm
x
Volume = 195cm³

(b)
12cm
12cm
x
Volume = 300cm³

(c)
10cm
10cm
x
Volume = 880cm³
)cm³
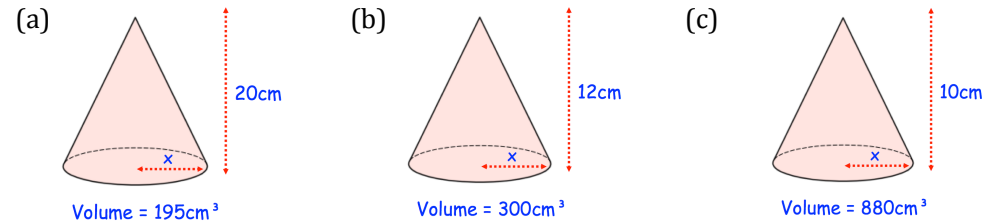
Apply

Question 1: A solid is formed from a cylinder and a cone.
Find the volume of the solid.

13cm
6cm
8cm
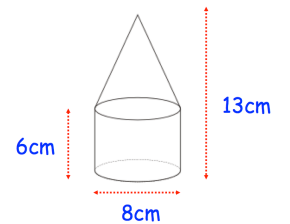
Question 2: A solid cone is made from a material which has a density of 8.7 g/cm³.
The dimensions of the cone are shown below.
Find the mass of the cone.

17cm
10cm
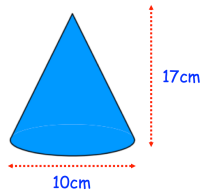
Question 3: The sphere and cone have an equal volume.
Find the radius of the sphere.

20cm
4cm
r
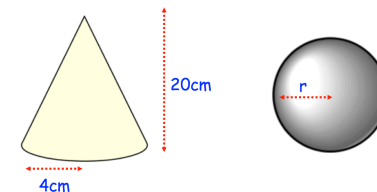
Question 4: Calculate the volume of the cone shown
Give your answer to 1 decimal place.

15cm
18cm
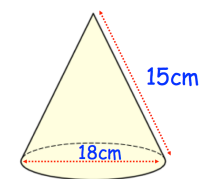
Find x given the volume. Give your answers to 1 decimal place if required.

Calculate the volume. Give your answers in terms of π and to 1 decimal place.
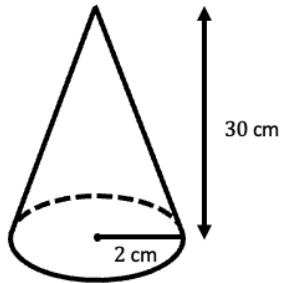
Question 1

30 cm

2 cm

Question 2

60 cm

2 cm

Question 3

15 cm

4 cm

Question 4

15 cm

8 cm

Question 5

17 cm

8 cm

Question 6

34 cm

16 cm

Question 1

x cm

2 cm

$V = 40\pi \text{ cm}^3$

Question 2

x cm

2 cm

$V = 80\pi \text{ cm}^3$

Question 3

x cm

4 cm

$V = 80\pi \text{ cm}^3$

Question 4

15 cm

x cm

$V = 80\pi \text{ cm}^3$

Question 5

15 cm

x cm

$V = 251.3 \text{ cm}^3$

Question 6

15 cm

x cm

$V = 1005.3 \text{ cm}^3$

Question 7

x cm

8 cm

$V = 1005.3 \text{ cm}^3$

Question 8

x cm

16 cm

$V = 8042.5 \text{ cm}^3$

Question 9

x cm

32 cm

$V = 16889.2 \text{ cm}^3$

volume of a cone

35.245cm

17cm
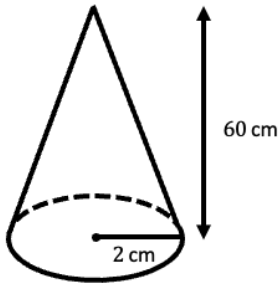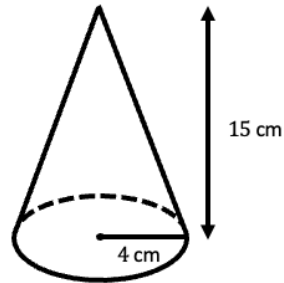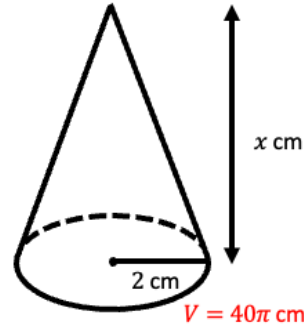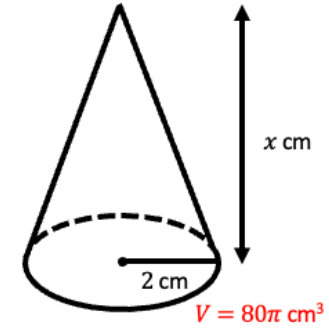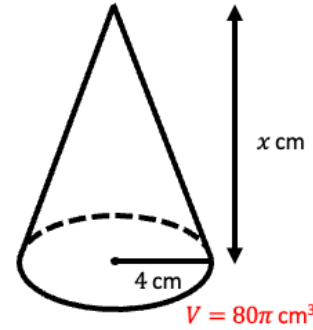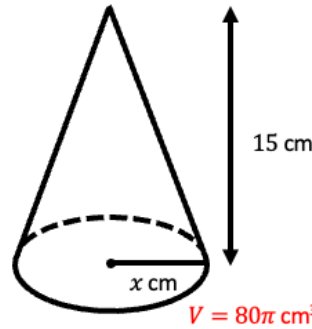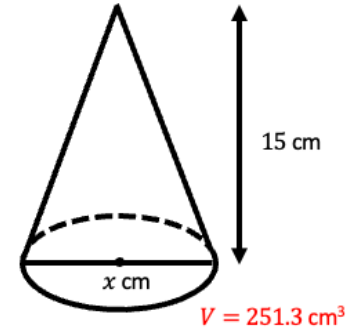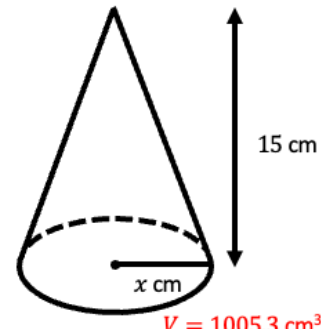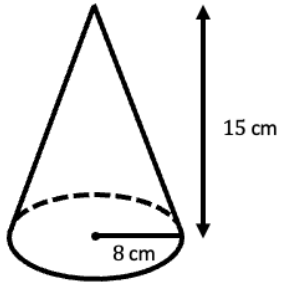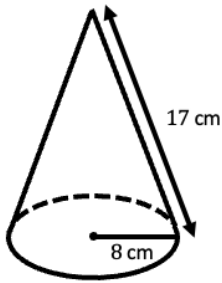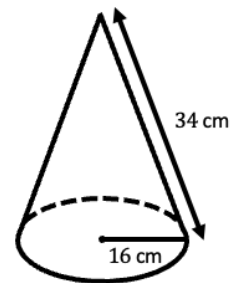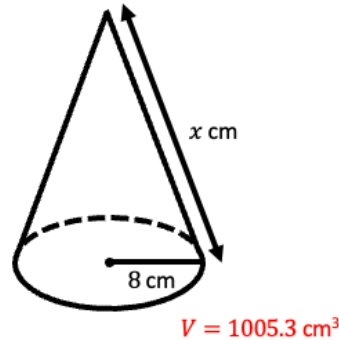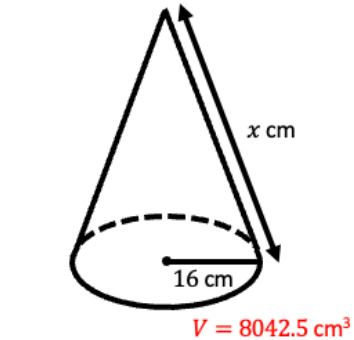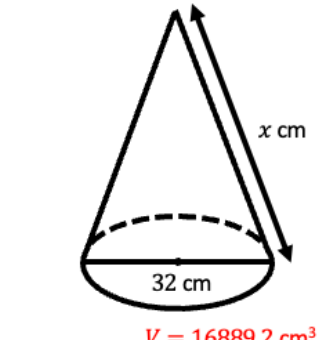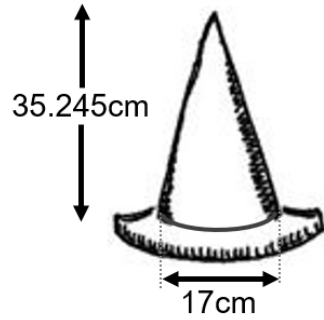
what volume of lizard soup would fit inside the witches' hat?

8.2cm

11.3cm
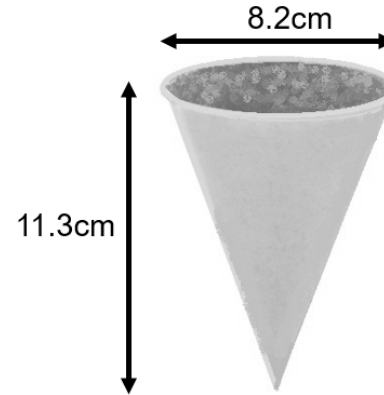
what volume of slush would fit inside the snowkone?

volume of a cone = $\frac{1}{3}\pi r^2 h$

volume of a sphere = $\frac{4}{3}\pi r^3$

?

5.5m
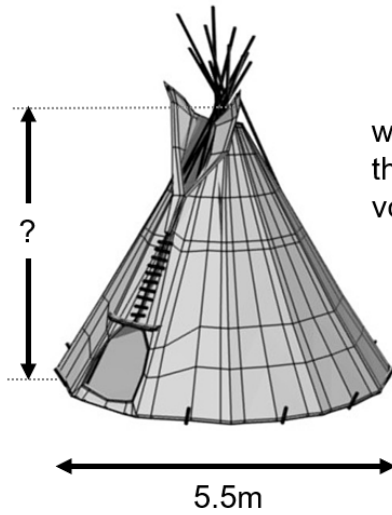
what is the height of the teepee if the volume is 35.6m³?

12cm

6cm
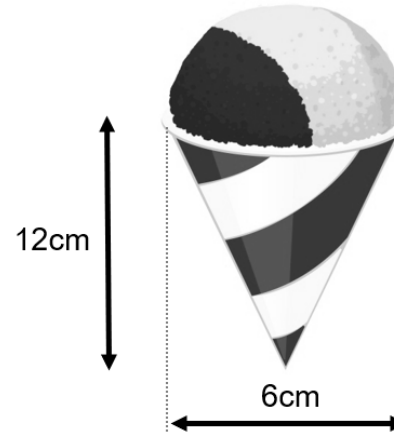
what is the volume of ice cream if the top is a hemisphere (and the cone is full)?

General Pyramids and Cones.

A pyramid has a polygonal base and triangular sloping sides. However, no matter what the shape of the base there is one formula which can be used to find the volume (which includes cones).
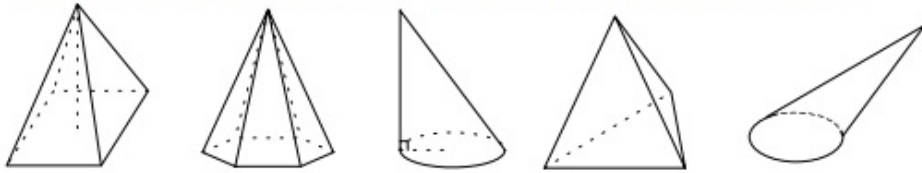
$$V = \frac{1}{3} \times \text{area of base} \times \text{height}$$

1. Find the volume of the following pyramids.

   (a)

   4 cm
   8 cm²

   (b)

   5 cm
   5 cm²

   (c)

   10 cm²
   8 cm

   (d)

   8 cm
   4 cm   6 cm

   (e)

   5 cm
   6 cm   4 cm

   (f)

   4 cm
   3 cm
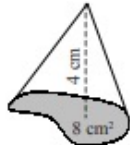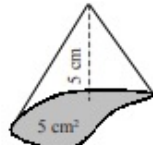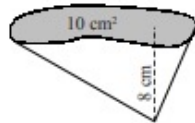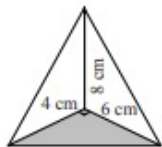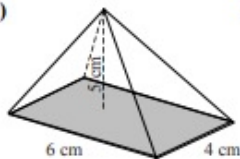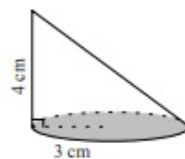
2. Draw a net of the pyramid shown, marking the lengths of each edge. Hence find the volume and surface area of the pyramid.

   12 cm
   3 cm
   4 cm
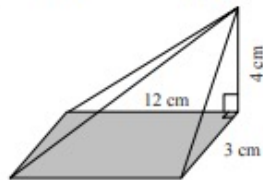
3. Find the height of a cone of volume 5 litres and base radius 10 cm.

4. Find the height of a pyramid of volume 30 m³ and base area 10 m².

5. Find the height of a square based pyramid, which has a base of 10 cm by 10 cm and whose surface area is 240 cm².

6. A bin, made from thin plastic has a square base of side 20 cm and an open square top of side 30 cm. The height of the bin is also 30 cm.
   (a) Find the volume of rubbish which the bin can hold (assuming that it is full but level with the top).
   (b) Find the area of plastic needed to make it.

Question 1: Work out the surface areas of each of the following cones. Give each answer in terms of **π**

(a)

11cm
6cm

(b)

17cm
15cm
8cm

(c)

53cm
45cm
56cm
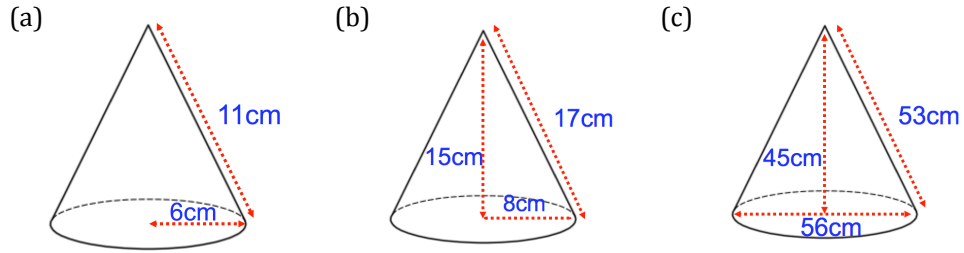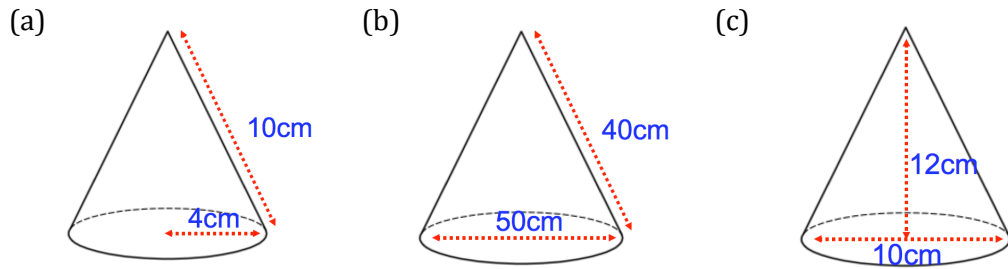
Question 2: Work out the surface areas of each of the following cones. Give each answer to one decimal place.

(a)

4.5mm
1.8mm

(b)

7cm
24cm
25cm

(c)

50cm
30cm
80cm

Question 3: Work out the surface areas of each of the following cones. Give each answer to one decimal place.

(a)

5cm
4cm

(b)

21cm
20cm

(c)

5cm
7cm

Question 4: Wo...
Giv...

(a)

x
9cm
Total surface area = 216π cm²

(b)

x
50cm
Total surface area = 792π cm²

(c)

11cm
x
10
Total surfac...
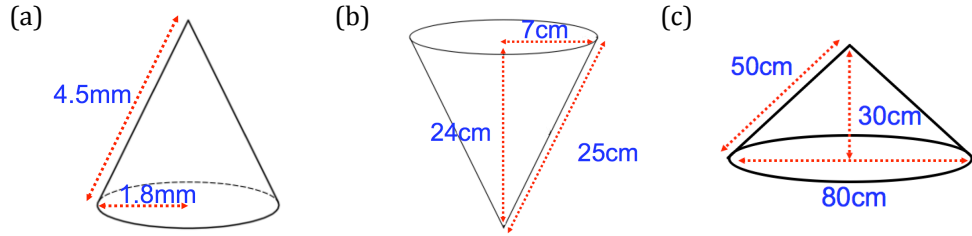
Question 5: Calculate the slant height for each of these cones
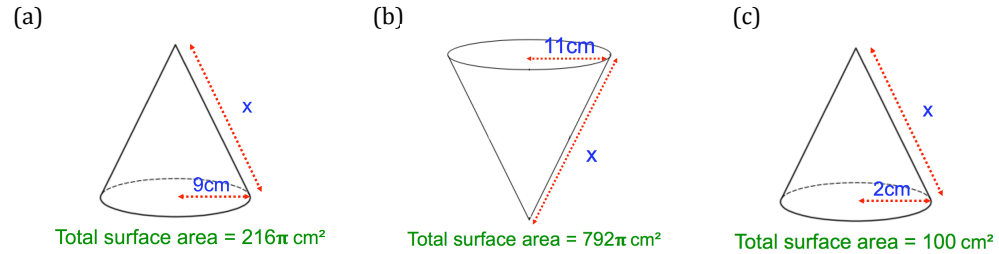
(a)

5cm
x
Total surface area = 36π cm²

(b)

11cm
x
Total surface area = 792π cm²

(c)

x
2cm
Total surface area = 100 cm²
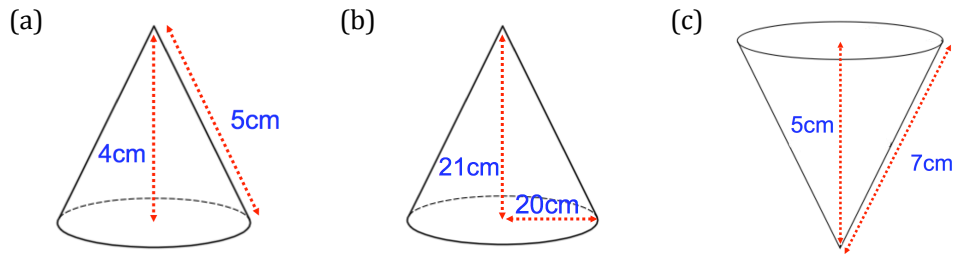
Question 7: Calculate the heights of these cones

(a)

x
16cm
Total surface area = 800π cm²

(b)

x
12cm
Total surface area = 750 cm²
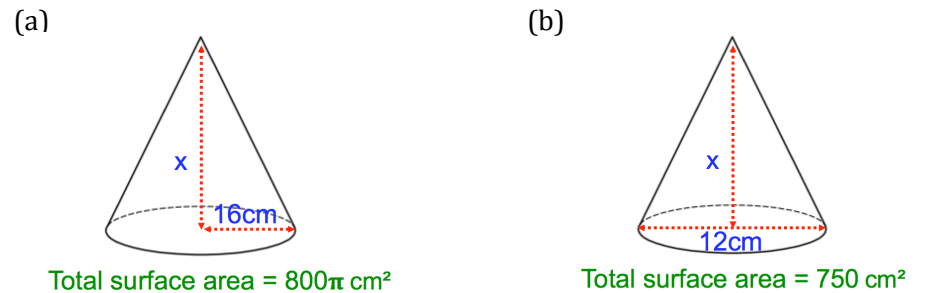
Question 1: The cone and cube below have the same surface areas.
Work out the side length of the cube, x.

2.5cm
2cm
1.5cm

x
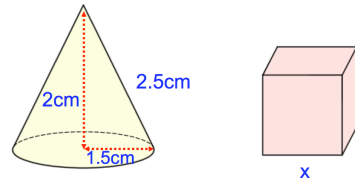
Question 2: The diagram shows a solid shape.
The shape is a cone on top of a cylinder.
Work out the surface area of the shape.
Give your answer correct to 2 significant figures

13cm
7cm
5cm
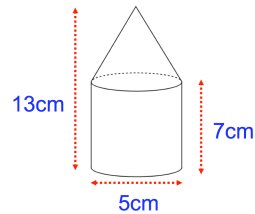
Question 3: A cone has a radius of 9cm.
The surface area of the cone is 450π cm^2
Work out the volume of the cone.
Give your answer in terms of π

Question 4: The diagram shows a solid shape.
The shape is a cone on top of a hemisphere.
Work out the surface area of the shape.
Give your answer correct to 2 significant figures

10cm
3cm
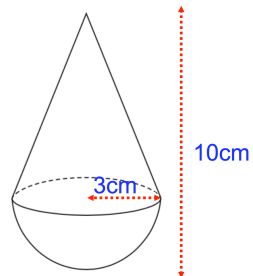
Question 5: The cylinder and cone has the same surface area.
Express L in terms of x.

3x
x

L

x
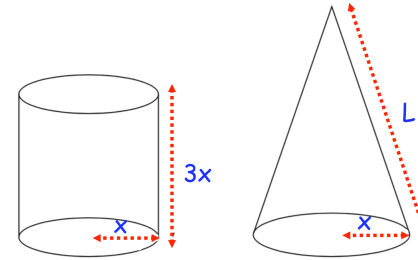
Question 6: A frustum is made from cutting a small cone from the top of a larger cone.
The larger cone was 21cm tall.

5cm
15cm
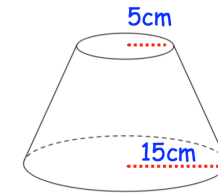
Calculate the surface area of the frustum

Question 7: A cone and cylinder are joined to make a solid.

$\dfrac{3r}{2}$

$(r+6)$

r
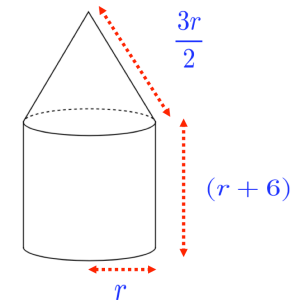
Show the total surface area of the solid is $\dfrac{3\pi r}{2}(3r+8)$

Answers

Calculate the total surface area. Give your answers in terms of π and to 1 decimal place.

Find x given the total surface area. Give your answers to 1 decimal place if required.

Question 1

13 cm

5 cm

Question 2

26 cm

10 cm

Question 3

24 cm

10 cm

Question 4

24 cm

7 cm

Question 5

24 cm

18 cm

Question 6

30 cm

16 cm

Question 1

x cm

5 cm

$SA = 90\pi$ cm²

Question 2

x cm
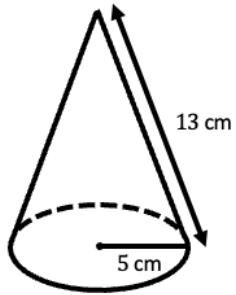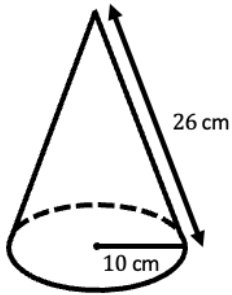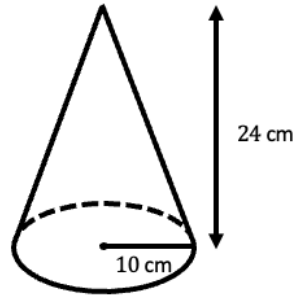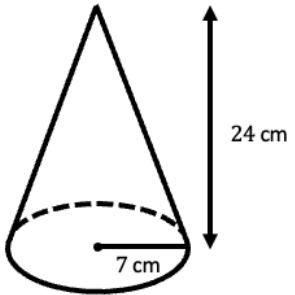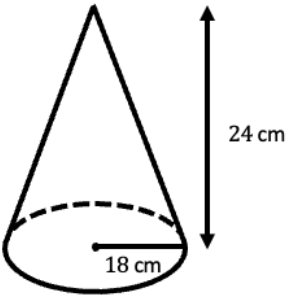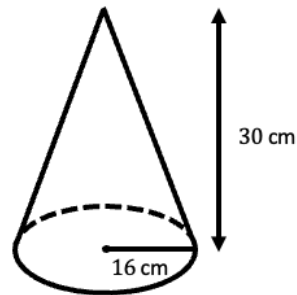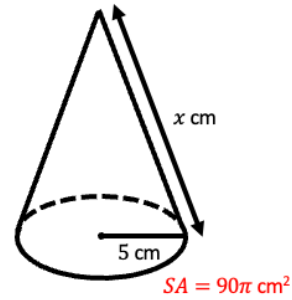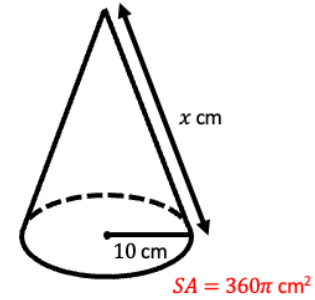
10 cm

$SA = 360\pi$ cm²

Question 3

x cm
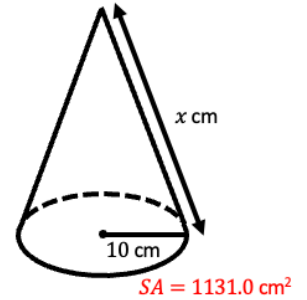
10 cm

$SA = 1131.0$ cm²

Question 4

x cm
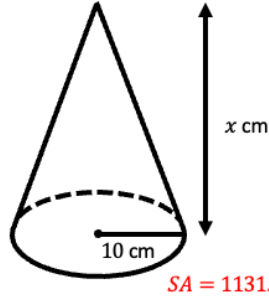
10 cm

$SA = 1131.0$ cm²

Question 5

x cm

7 cm
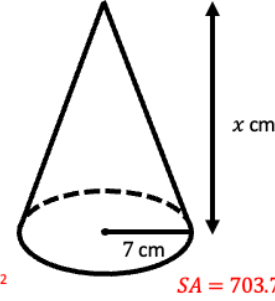
$SA = 703.7$ cm²

Question 6

x cm

48 cm
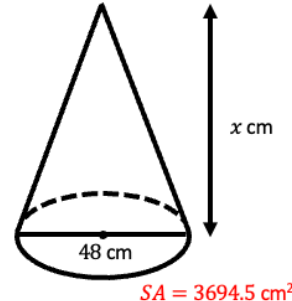
$SA = 3694.5$ cm²

Volume and Surface Area of Cones

Find the volume and total surface area of each of these cones.

(a)

10 cm

8 cm

6 cm

(b)

9.2 cm

8.5 cm

3.5 cm

(c)

1.3 m

1.2 m

1 m

(d)

25 mm

24 mm

7 mm
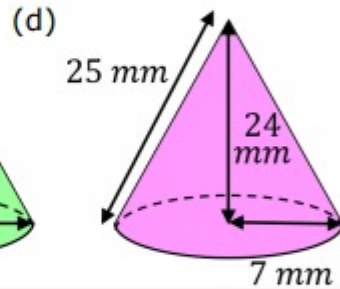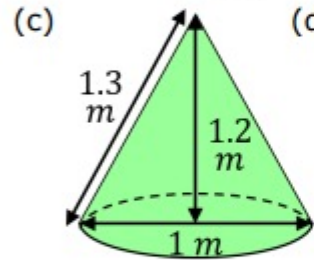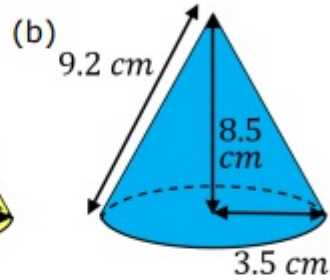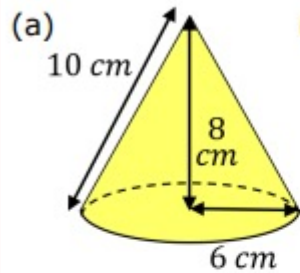
Find the slanted height and curved surface area of these cones.

(a)

16 cm

12 cm

(b)

10 cm

10 cm
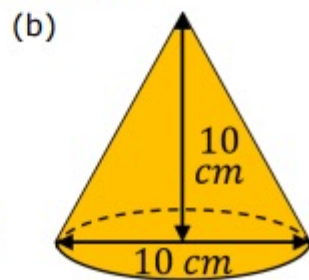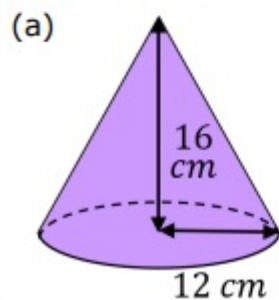
Find the missing lengths.

(a) $Volume = 1103\ cm^3$

h

9 cm
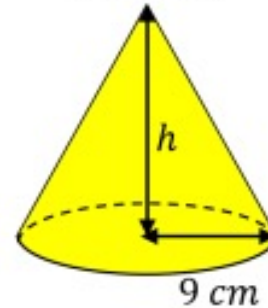
(b) $Curved\ Surface\ Area = 3300\ cm^2$

42 mm

r
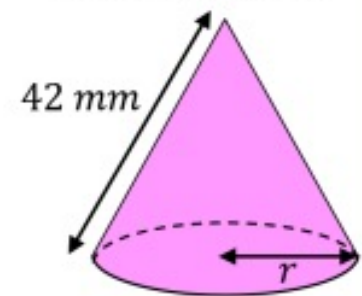
(a) A cone has a slanted height of 26 cm and a curved surface area of $260\pi\ cm^2$. Find its volume.

(b) A cone has a radius of 8.5 cm and a volume of $1059\ cm^3$. Find its total surface area.

surface area of a cone
leaving π in the answer

(1)   find the total surface area, including
      the circular base, for cones with:

   (a) r = 5 , L = 35
   (b) r = 4 , L = 46
   (c) r = 8 , h = 15
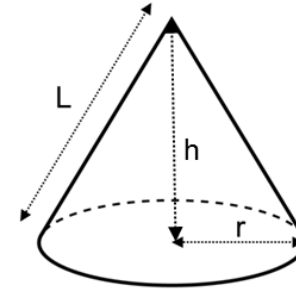
total
surface area $\pi r L + \pi r^2$

(2)   the total surface area, including the
      circular base, for cones is 300π

      what is L if:

   (a) r = 12
   (b) r = 10
   (c) r = 5
   (d) r = 4
   (e) r = 1

(3)   the total surface area, including the
      circular base, for cones is 100π

      what is r if:

   (a) L = 15
   (b) L = 21
   (c) L = 48
   (d) L = 99

      why these numbers for L?
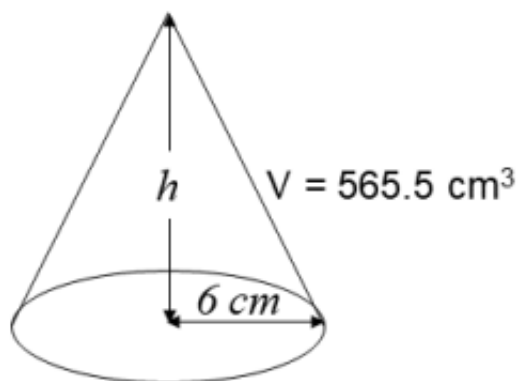
Calculate the vertical height, h to the nearest whole number.
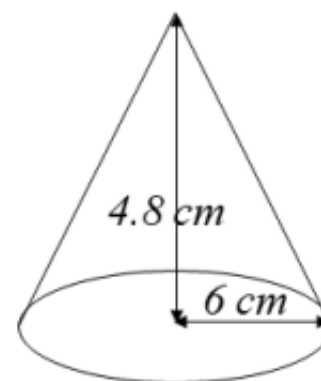
Calculate the volume.
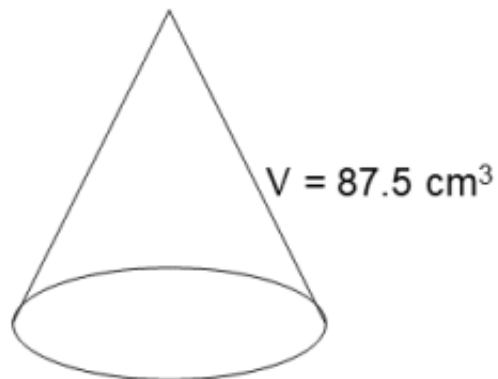
This cone is made out of gold and has a mass of 1688.75g.

Calculate the density of gold.
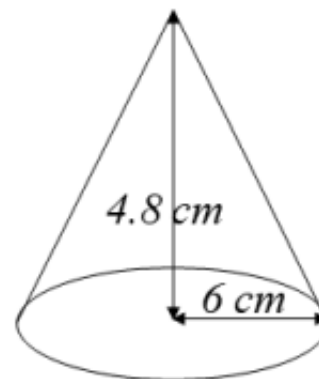
Calculate the total surface area.
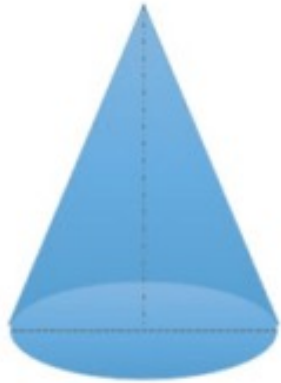
A cone has a base of radius 5 cm and a perpendicular height of 10 cm.

Find the circumference of the base of the cone.
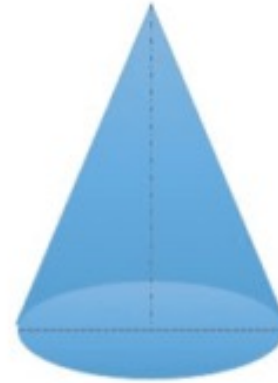
A cone has a base of radius 5 cm and a perpendicular height of 10 cm.

What is the smallest size of box required to pack the cone in?
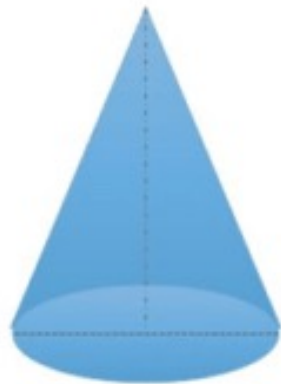
A cone has a base of radius 5 cm and a perpendicular height of 10 cm

Find the slant height of the cone.
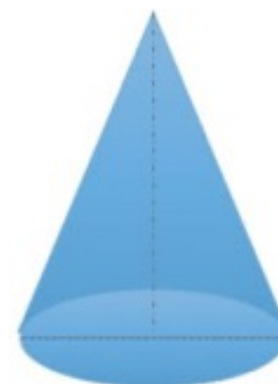
A cone has a base of radius 5 cm and a perpendicular height of 10 cm.

Find the volume of the cone.

Calculate the area of the sector.
Give your answer in terms of π

240°

8 cm

240°

8 cm
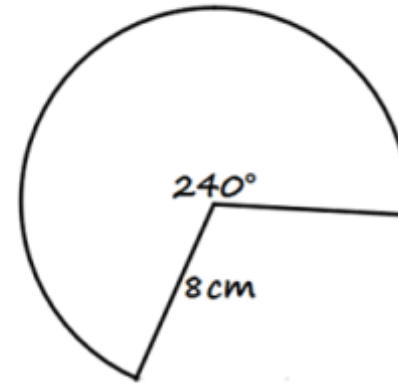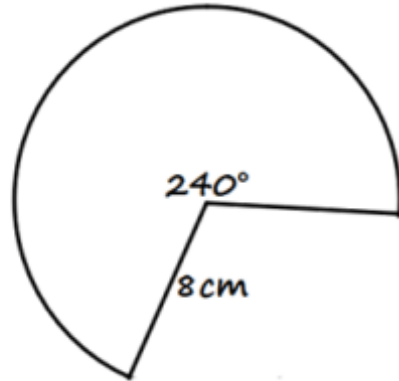
Find the perimeter of the sector

The sector is used to create a cone.

Find the volume of the cone to 3 s.f.

240°

8 cm

240°

8 cm
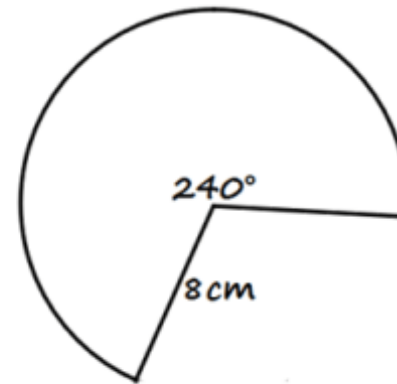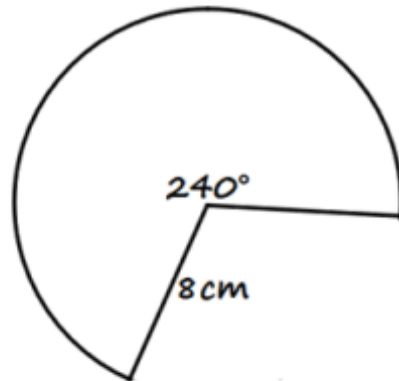
A similar sector has an area of 96π

Find the radius length of this sector.

A scoop of ice cream is a perfect sphere. It has a diameter of 8cm.

What is the volume of the ice cream?

A solid cone has a base diameter of 12cm and a slant height of 10cm.

What is the volume of the cone?

I scream
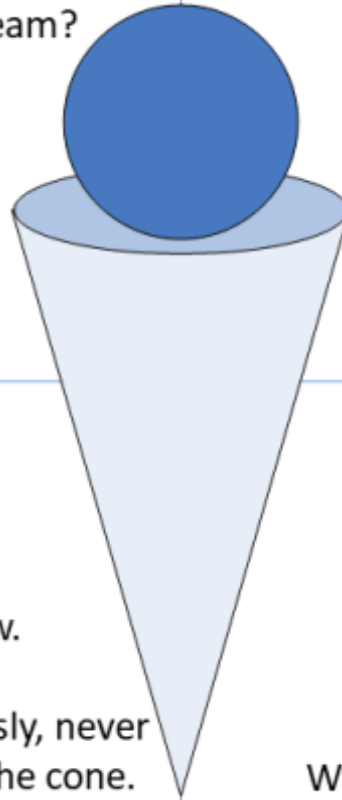
CONES!!!!

Magically, the cone is now hollow.

The ice cream, which, miraculously, never melts, is dropped carefully into the cone.

At what height, either above or below the cone rim, is the top of the ice cream?

What diameter would the ice cream sphere need to be so that the top of the ice cream is level with the rim of the cone once it is dropped in?

Volume and Surface Area of Frustums

Find the volume of each of these frustums.

(a)　　　　　　　　(b)

10 cm　10 cm　4 cm　8 cm

20 cm　10 cm　6 cm　9 cm

Find the volume of each of these frustums.

(a)　　　　　　　　(b)

50 mm　50 mm　24 mm

1 m　2 m　1.5 m
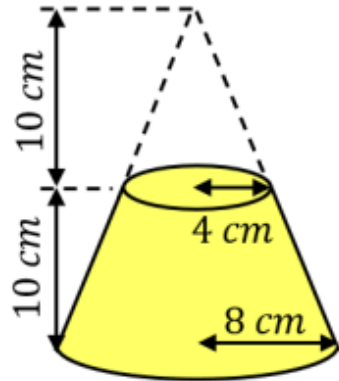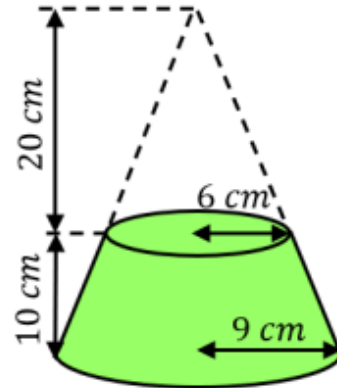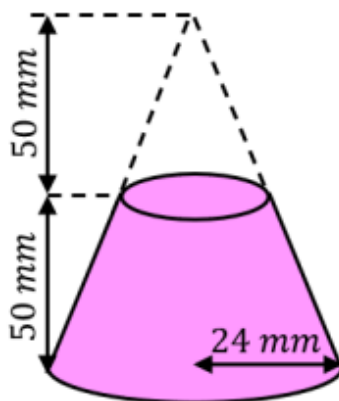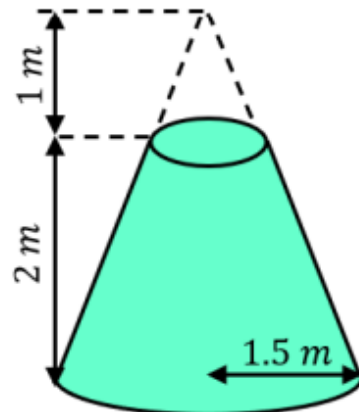
Find the curved surface area and total surface area of each of these frustums.

(a)　　　　　　　　(b)

5 cm　5 cm　6 cm

2.5 cm　6.5 cm　5 cm
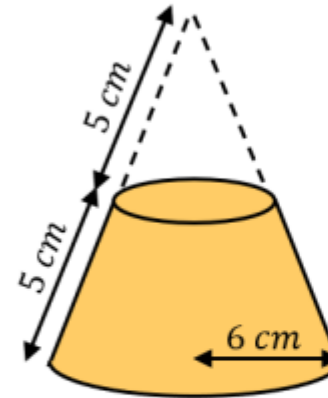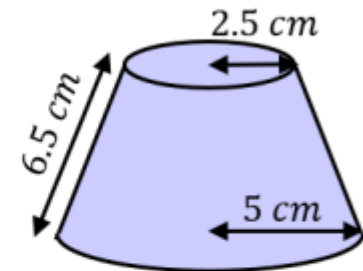
The base diameter of a frustum is $18 \ cm$ and the top diameter is $9 \ cm$. If the frustum has a volume of $378\pi \ cm^3$, find its height.

Question 1: Shown is a square based pyramid A.

(a) Find the volume of the square based pyramid.

12cm

A

9cm

9cm

9cm
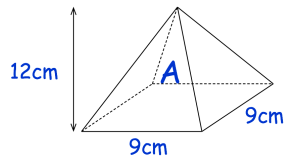
Shown is a smaller square based pyramid B.

(b) Find the volume of the smaller square based pyramid.

4cm

B

3cm

3cm

3cm
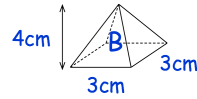
A frustum is created by removing the Pyramid B from the top of Pyramid A.

(c) Find the volume of the frustum.

3cm

8cm

C

9cm

9cm

9cm

Question 2: Find the volume of the following frustums.

(a)

3cm

6cm

5cm

4cm

12cm

15cm

(b)

8cm

2cm

12cm

12cm

15cm

15cm

(c)

8cm

3cm

3cm

6cm

6cm

(d)

24cm

10cm

10cm

30cm

30cm

(e)

10c 10cm

3cm

5cm

4cm

(f)

4cr 4cm

15cm

15cm

18cm

18cm

(g)

14cm

12c12cm

21cm

21cm

(h)

1cm

3c3cm

2cm

2.5cm
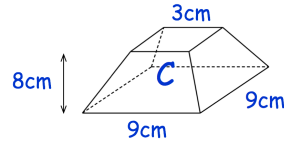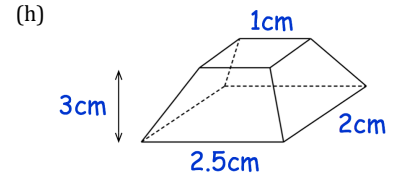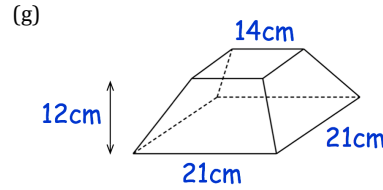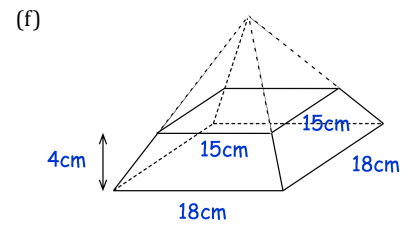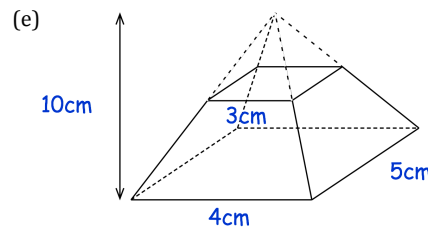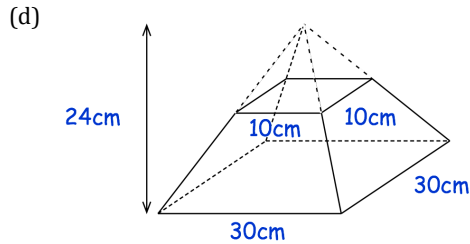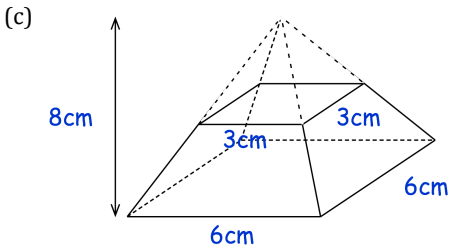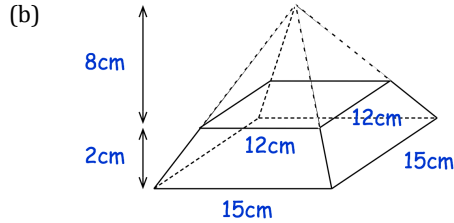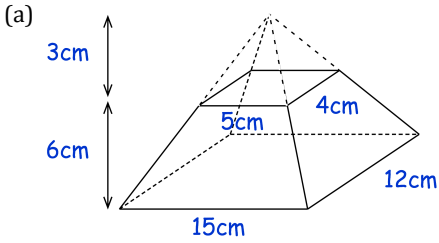
Question 3: Shown is Cone A.

(a) Find the volume of the cone.

20cm

A

10cm
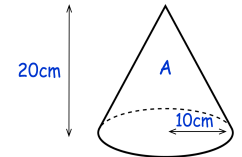
Shown is a smaller Cone, B.

(b) Find the volume of the smaller cone.

B

10cm

5cm
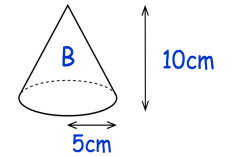
A frustum is created by removing Cone B from the top of Cone A.

(c) Find the volume of the frustum.

10cm

5cm

10cm

C 10cm
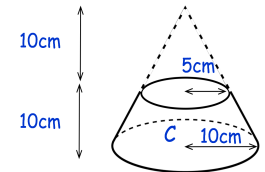
Question 4: Find the volume of the following frustums.

(a)

3cm

2cm

9cm

8cm

(b)

11cm

15cm

11cm

30cm

©

(c)

12cm | 6cm | 9cm

(d)

5cm | 15cm | 18cm

(e)

1cm | 10cm | 6cm

(f)

8mm | 6mm | 1.1cm

(g)

9cm | 15cm | 12cm

(h)

16cm | 4cm | 3.5cm

10cm | h | 6cm

5cm | 5cm | 3cm | 6cm
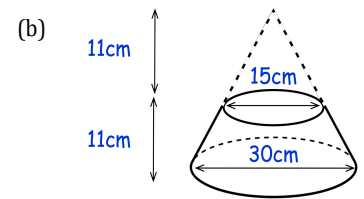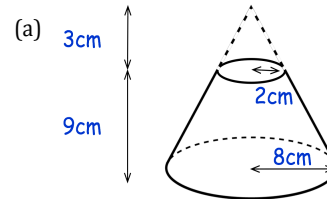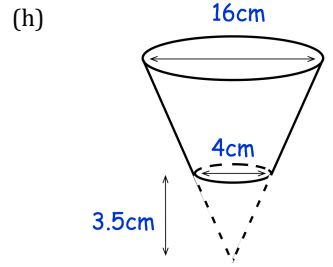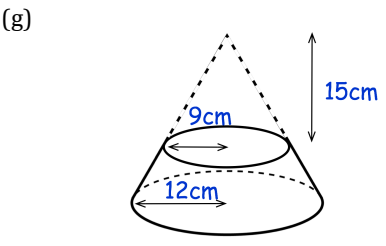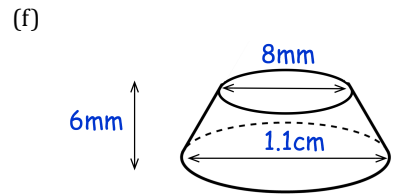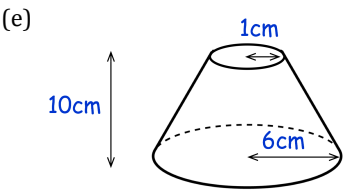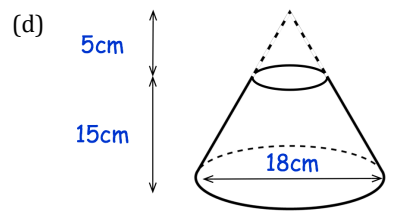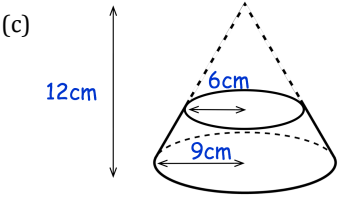
Question 5: Shown below is a cone with a radius of 6cm and a slant height of 10cm.

10cm | h | 6cm
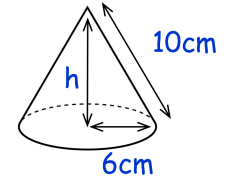
(a) Find the perpendicular height of the cone, h.

A frustum is made by removing a smaller cone from the top of the cone in (a).

5cm | 5cm | 3cm | 6cm
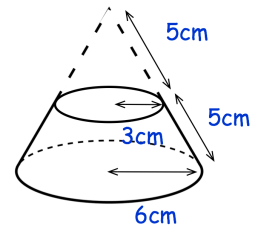
(b) Find the volume of the frustum.

Question 6: Find the volumes of the following frustums.

(a)

13cm | 4cm | 5cm

(b)

40cm | 30cm | 29cm

(c)

20cm | 12cm | 25cm

5cm | B | 6cm

10cm | 5cm
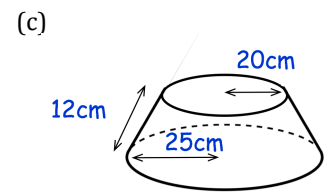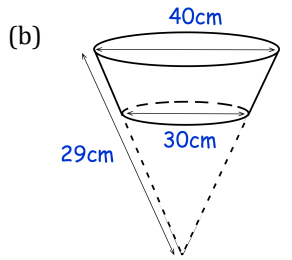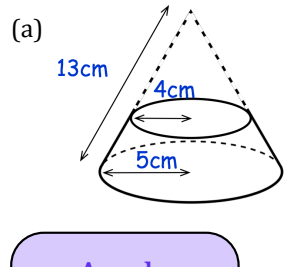
Ex1 Find the volume of the frustum.

6cm
3cm
12cm
6cm
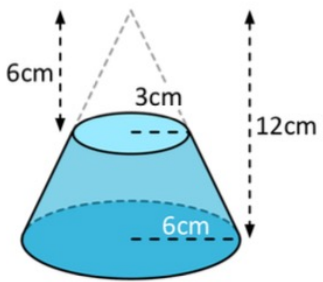
Ex2 Find the missing length of the frustum's top radius and hence find the volume of the frustum in terms of π.

10cm
$r$cm
15cm
6cm
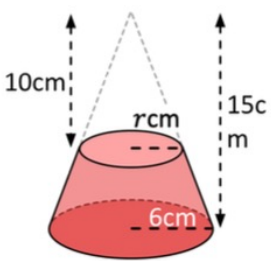
Ex3 Shown is a square-based pyramid with height 50cm and base side length 30cm. A smaller square-based pyramid height 20cm is removed to form a frustum.

[a] Work out the base side length, L, of the smaller pyramid.

[b] Work out the volume of the frustum.
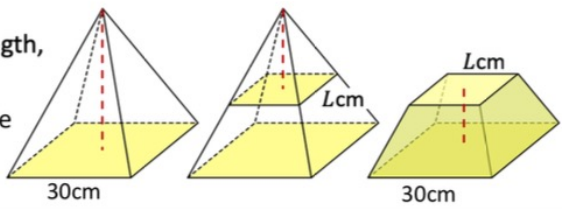
Lcm
Lcm
30cm
30cm

Q1 Work out the volume of each of the following frustums.
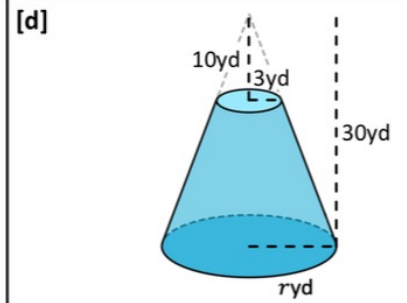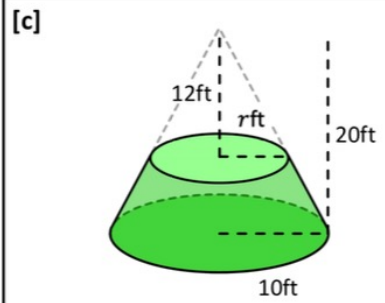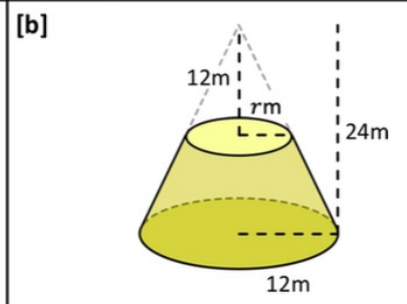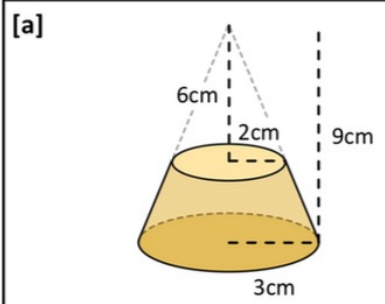
[a]

6cm
2cm
9cm
3cm

[b]

12m
rm
24m
12m

[c]

12ft
$r$ft
20ft
10ft

[d]

10yd
3yd
30yd
$r$yd

Calculate the volume. Give your answers in terms of π and to 1 decimal place.

Question 1

2 cm

Question 2

2 cm

Question 3

2 m

Question 4

1 m

Question 5

10 m

Question 6

10 m

Question 7

10 m

Question 8

20 m

Question 9

10 m
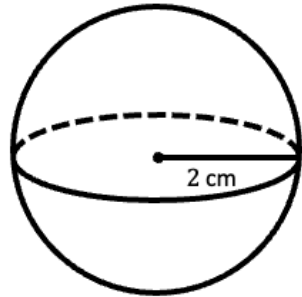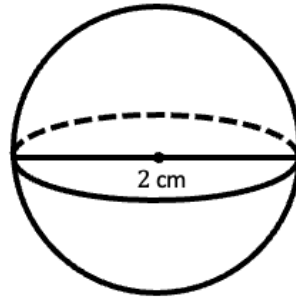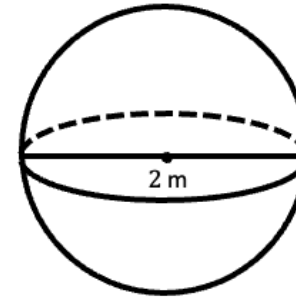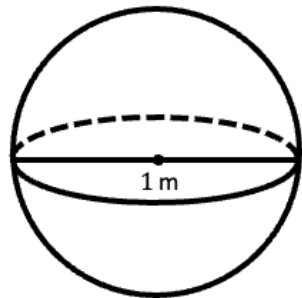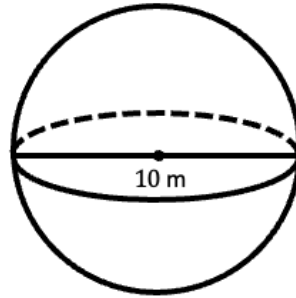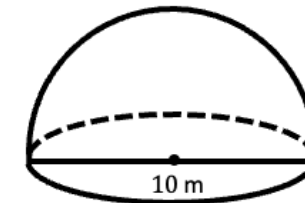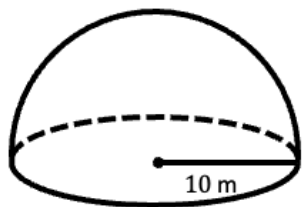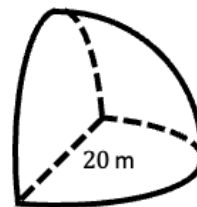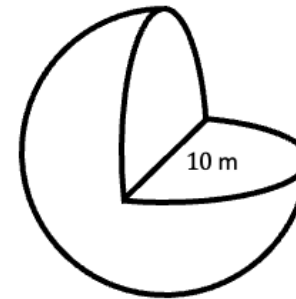
Volume and Surface Area of Spheres

Find the volume and surface area of these spheres.

(a)

9 cm

(b)

24 mm

(c)

4.8 m

(d)

25 cm

Find the missing lengths.

(a) $\begin{array}{l} Volume \\ = 972\pi \ cm^3 \end{array}$

r

(b) $\begin{array}{l} Surface\ Area \\ = 4072\ cm^2 \end{array}$

r

(c) $\begin{array}{l} Volume \\ = 1150\ cm^3 \end{array}$

r
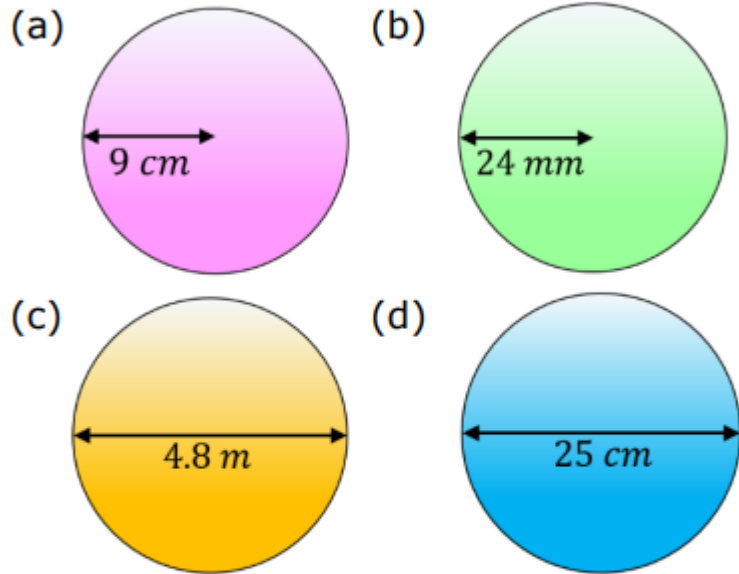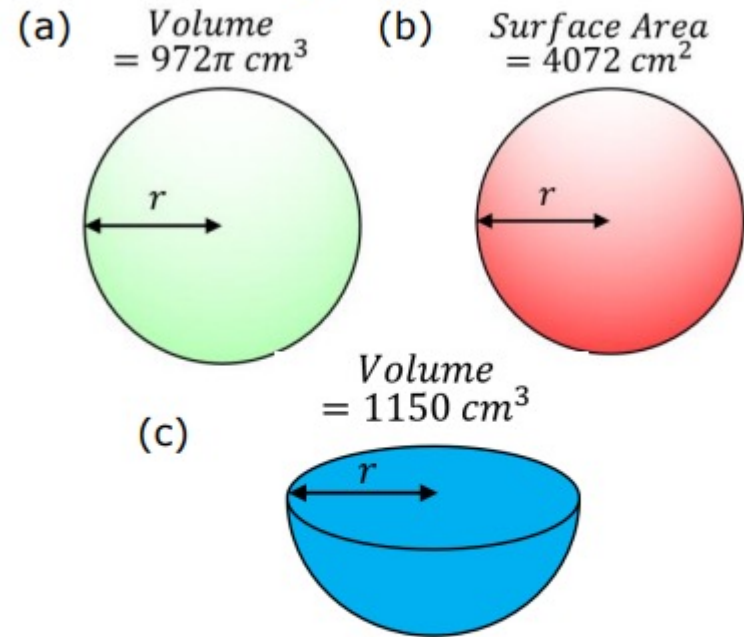
Find the volume and total surface area of these hemispheres.

(a) 7 cm

(b) 42 mm
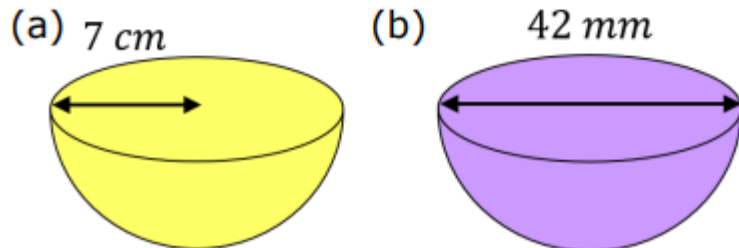
A container is made up of a hemisphere on top of a cylinder, both with the radius 26 cm. The total volume of the container is 230 000 cm^3. Find the height of the cylinder.

Question 1: Find the volume of each of these spheres.
Give each answer to one decimal place (you may use a calculator)

(a) 8cm (b) 3cm (c) 1.5m

(d) 22cm (e) 7m (f) 0.8cm

Question 2: Find the volume of each of these spheres.
Give each answer in terms of π (you may not use a calculator)

(a) 3cm (b) 12cm (c) 5cm
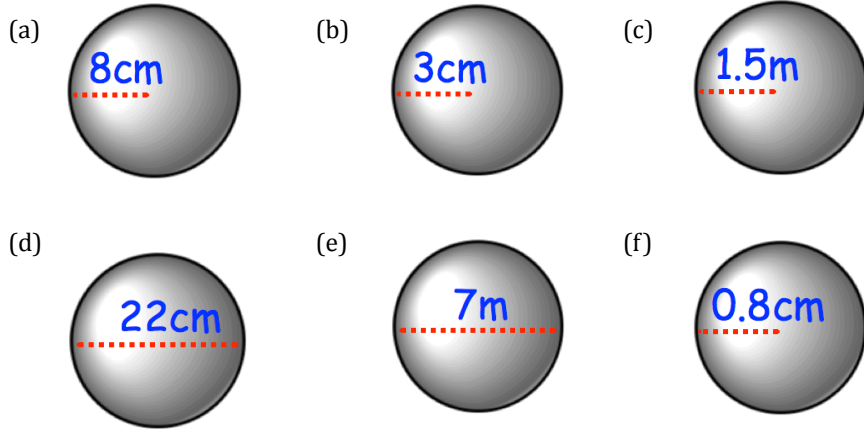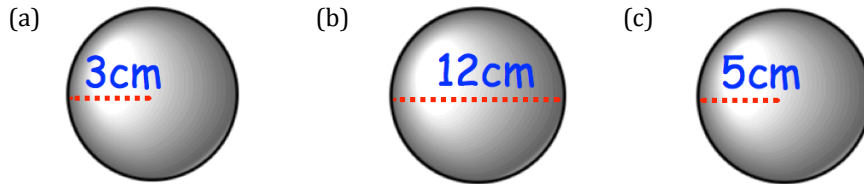
Question 3: Find the volume of each of these spheres.
Give your answers to three significant figures (you may use a calculator)

(a) A sphere with radius 9cm   (b) A sphere with diameter 38cm

(c) A sphere with diameter 6.7cm   (d) A sphere with radius 1.25 inches.

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Question 4: Find the size of the radius in each of the spheres below.
Give your answers to one decimal place (you may use a calculator)

(a) x Volume = 200cm^3
(b) x Volume = 1950cm^3
(c) x Volume = 1m^3
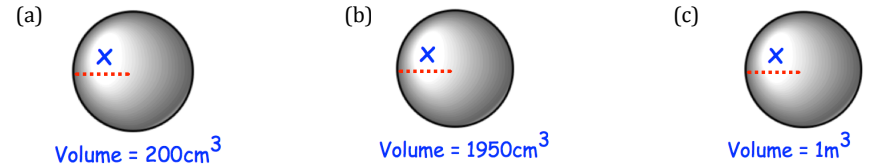
Question 5: Find the size of the diameter in each of the spheres below.
Give your answers to one decimal place (you may use a calculator)

(a) y Volume = 50cm^3
(b) y Volume = 2360cm^3
(c) y Volume = 0.4m^3

Apply
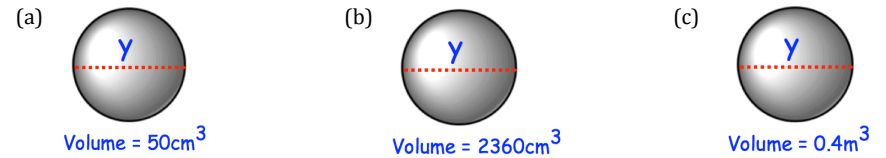
Question 1: A metal cuboid measuring 4cm by 5cm by 12cm is melted down and a sphere is made.
Calculate the radius of the sphere.

Question 2: Calculate the volume of a hemisphere with base of radius 8cm.

8cm
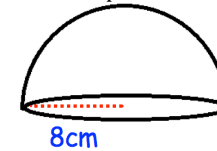
Question 3: A solid sphere fits perfectly inside of a cube box of side length 10cm.
What percentage of the box is empty?

Question 4: A ball of gold has a radius of 9cm.
The density of gold is 19.3g/cm^3.
Work out the mass of the ball.

Answers

Page 74   © CORBETTMATHS 2017   Click here   Scan here

Find x given the volume. Give your answers to 1 decimal place if required.

Question 1

$V = 972\pi \text{ cm}^3$

x cm

Question 2

$V = 4500\pi \text{ cm}^3$

x cm

Question 3

$V = 14137.2 \text{ cm}^3$

x cm

Question 4

$V = 14137.2 \text{ cm}^3$

x cm

Question 5

$V = 113097.3 \text{ cm}^3$

x cm

Question 6

$V = 113097.3 \text{ cm}^3$

x cm

Question 7

$V = 113.0973 \text{ cm}^3$

x cm

Question 8

x cm

$V = 113.0973 \text{ cm}^3$

Question 9

x cm

$V = 339.2920 \text{ cm}^3$
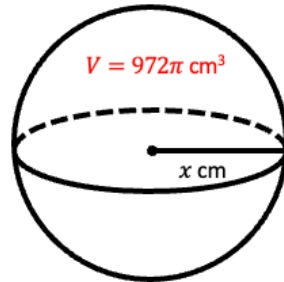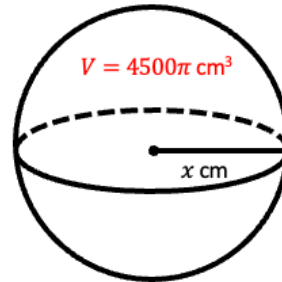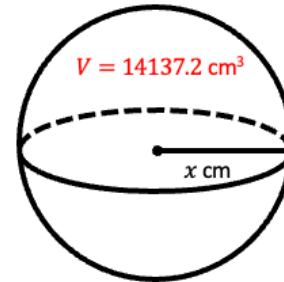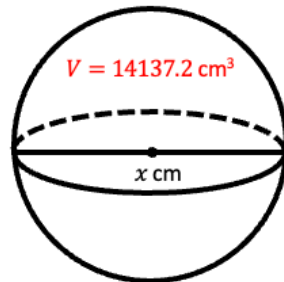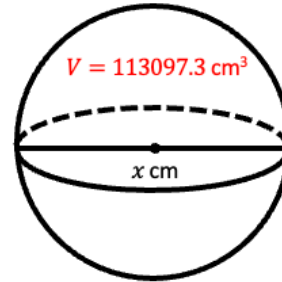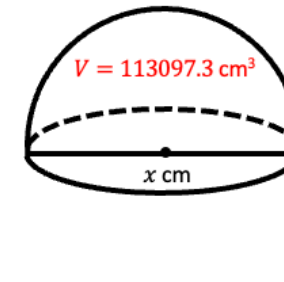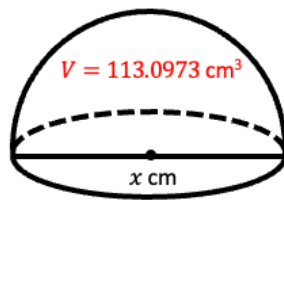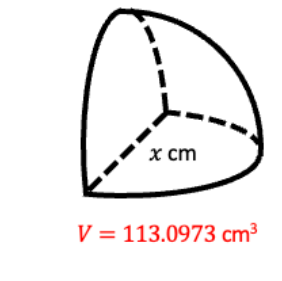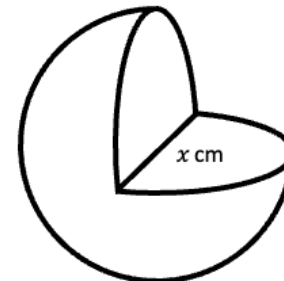
Ex3 The following sphere has a volume of $972\pi \text{in}^3$. Find the length of its radius, $r\text{in}$.

$r\text{in}$
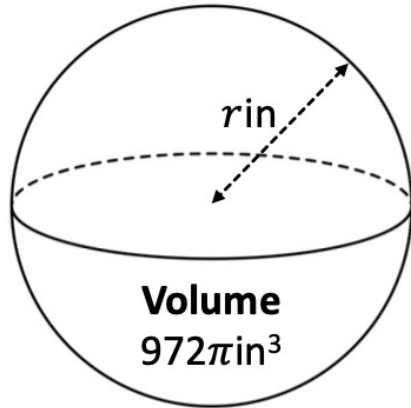
Volume
$972\pi \text{in}^3$

Q5 The following sphere has a volume of $4500\pi \text{m}^3$. Find the length of its radius, $r\text{m}$.

$r\text{m}$
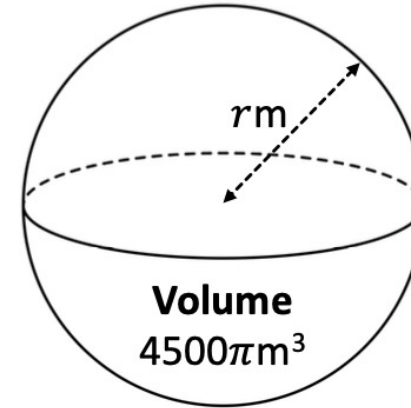
Volume
$4500\pi \text{m}^3$

Q6 Work out the radius of the following spheres given their volume.

[a]

Volume
$2304\pi \text{cm}^3$

[b]
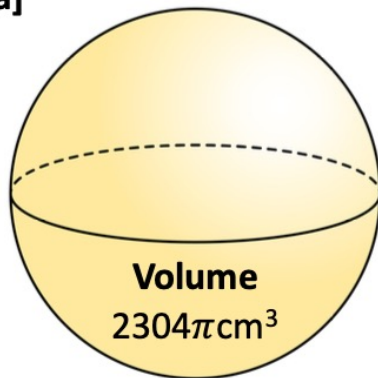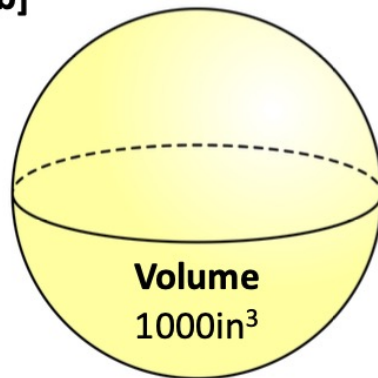
Volume
1000in^3

Q7 The following cylinder and sphere have the same volume. Find the diameter of the sphere.

3cm

11cm
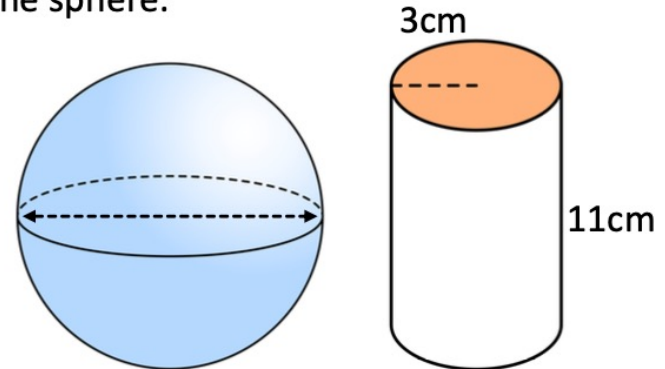
Q1 Craig buys two tennis balls which fit inside a cylindrical container of the same diameter. The tennis ball's diameter is 6cm. What fraction of the container's volume do the tennis balls take up?
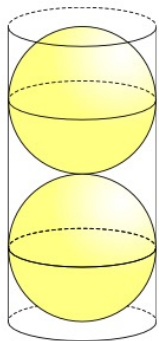
Q2 Marie has some hanging flower baskets in the shape of hemispheres with radius 14cm. Marie is going to fill the flower baskets completely with soil. She has 50 litres of compost. **1 litre = 1000cm³.** Work out how many flower baskets Marie can fill completely with compost.

14cm
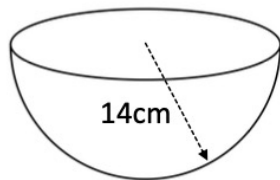
Q3 The following composite solid is made by joining a cylinder and hemisphere. Calculate the volume of the solid leaving your answer in terms of π.

11cm

5cm
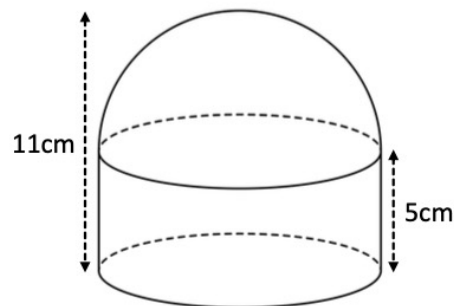
Q4 A child's toy is made from joining a cone and a hemisphere. The cone and the hemisphere both have a radius of 3cm. The ratio of the height of the toy to the radius of the hemisphere is 3:1. Calculate the volume of the toy in terms of π.

3cm
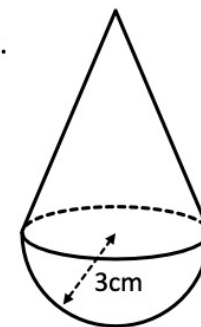
volume of a sphere   volume of a sphere = $\frac{4}{3}\pi r^3$

(1)

a standard tennis ball has a
diameter of 6.7 cm

what is the volume of the tennis ball?

(2)

a regulation football must have a
circumference of between 68 cm and 70 cm

what are the limits of the football's volumes?

(3)

how much larger (approximately) is
the volume of a 14" (diameter)
balloon to an 11" balloon?

(4)

the Earth has
a volume of 1,083,206,916,846 km³

how wide is a time zone if there are 24 of
them around the circumference?

Question 1: Work out the surface area of each of these spheres.
Give each answer to 2 decimal places (you may use a calculator)

(a)
5cm

(b)
14cm

(c)
6cm

(d)
1.3cm

(e)
27cm

(f)
0.9mm
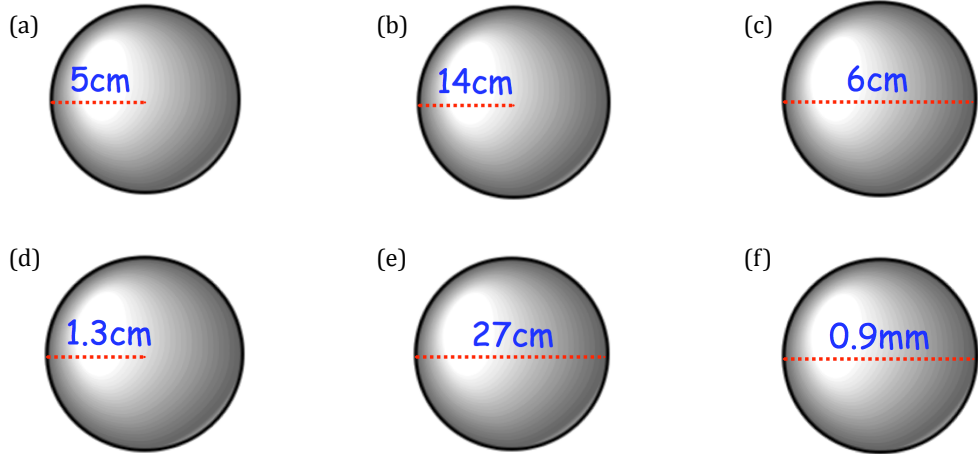
Question 2: Find the surface area of each of these spheres.
Give each answer in terms of π (you may not use a calculator)

(a)
7cm

(b)
8cm

(c)
1.1m
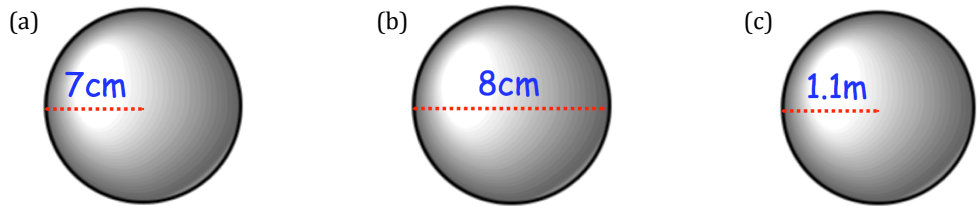
Question 3: Find the surface area of each of these spheres.
Give your answer to 3 significant figures (you may use a calculator)

(a)   A sphere with diameter 2cm

(b) A sphere with radius 36mm

(c)   A sphere with radius 0.4m

(d) A sphere with diameter 2.07 inches

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Question 4: Find the size of x in each of the sphere below.
Give your answers to two decimal places (you may use a calculator)

(a)
x
Surface area = 50cm²

(b)
x
Surface area = 940cm²

(c)
x
Surface area = 4800cm²
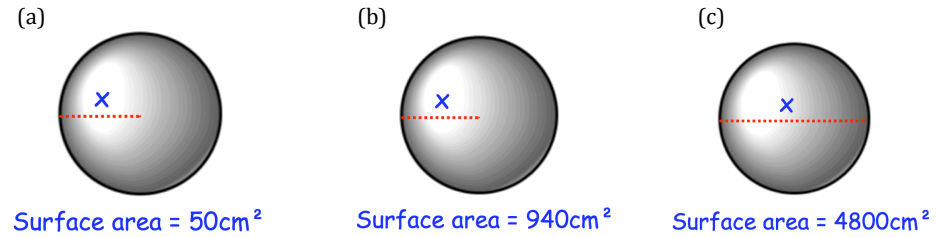
Question 5: Find the size of x in each of the sphere below.
You may not use a calculator

(a)
x
Surface area = 16π cm²

(b)
x
Surface area = 100π cm²

(c)
x
Surface area = 3600π cm²

Apply

9cm

Surface area = 16π cm²   Surface area = 100π cm²   Surface area = 3600π cm²

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Apply
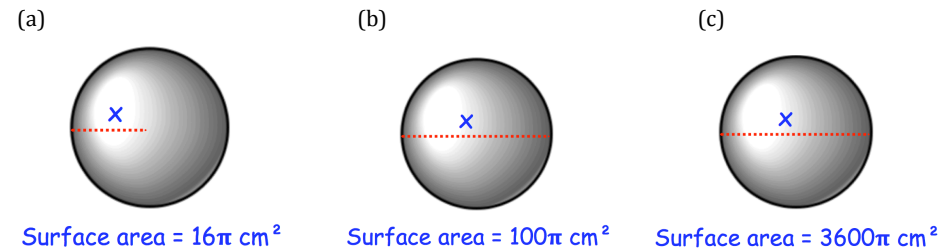
Question 1:   A glass paperweight is shown below.
The paperweight is a hemisphere with diameter 9cm.
Find the surface area of the paperweight

9cm
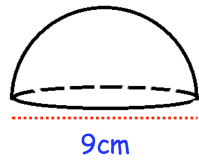
Question 2:   Show the surface area of a sphere with radius 6cm is four times larger than
the surface area of a sphere with radius 3cm.

Question 3:   The formula for the surface area of a sphere is $A = 4\pi r^2$
Make r the subject of the formula

Question 4:   The diameter of a sphere is equal to the side length of a cube.

x

x
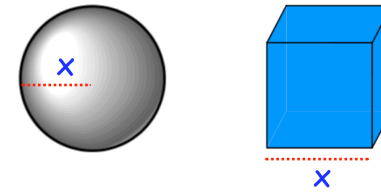
Peter says the surface area of the sphere is double the surface area of the cube.
Is Peter correct?

Question 5:   A sphere has a radius of x.
A cylinder has a radius of x and height h.

x

h

x
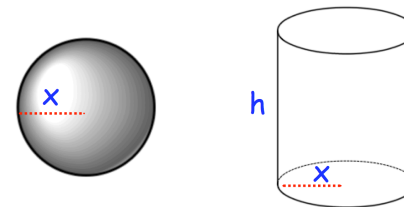
The surface area of the sphere and cylinder are equal.

Show h = x

Answers

Calculate the total surface area. Give your answers in terms of π and to 1 decimal place.

Question 1

2 cm

Question 2

2 cm

Question 3

2 m

Question 4

1 m

Question 5

10 m

Question 6

10 m

Question 7

10 m

Question 8

20 m

Question 9

10 m

Find x given the total surface area. Give your answers to 1 decimal place if required.

Question 1

$SA = 324\pi$ cm^2

x cm

Question 2

$SA = 900\pi$ cm^2

x cm

Question 3

$SA = 2827.4$ cm^2

x cm

Question 4

$SA = 2827.4$ cm^2

x cm

Question 5

$SA = 11309.7$ cm^2

x cm

Question 6

$SA = 11309.7$ cm^2

x cm

Question 7

$SA = 113.097$ cm^2

x cm

Question 8

x cm
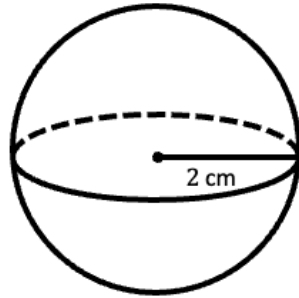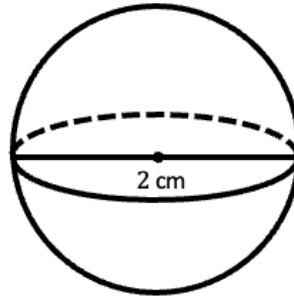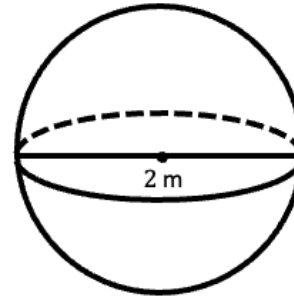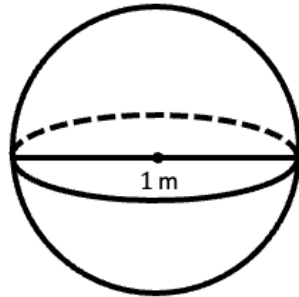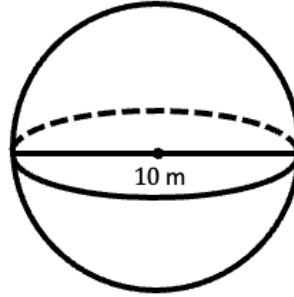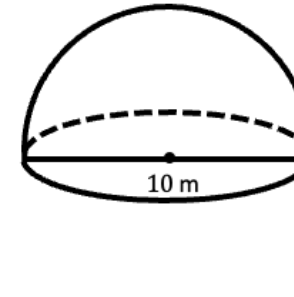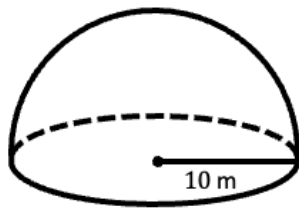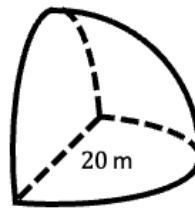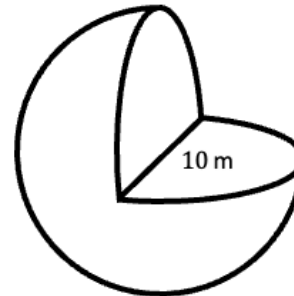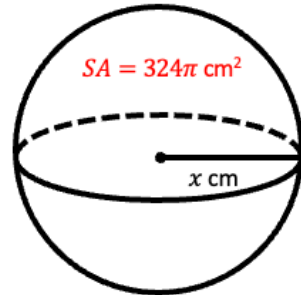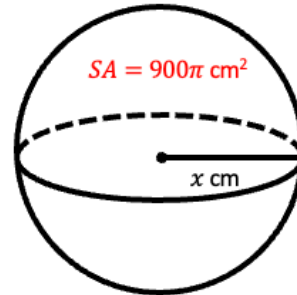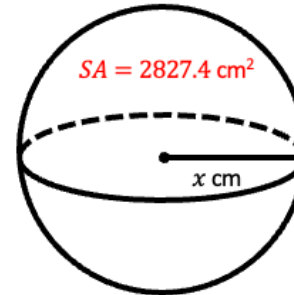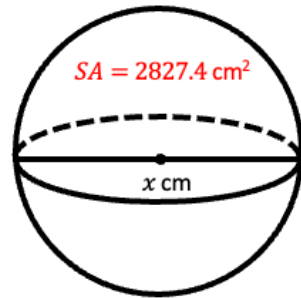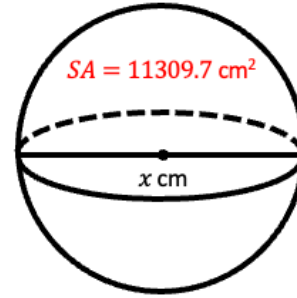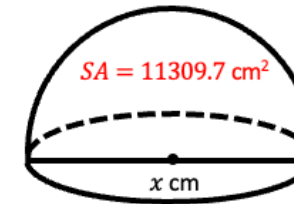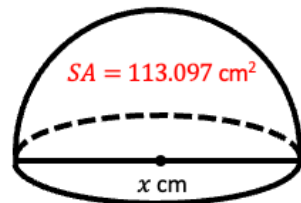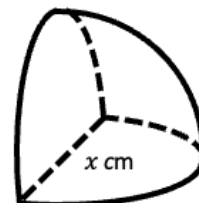
$SA = 113.097$ cm^2

Question 9

x cm
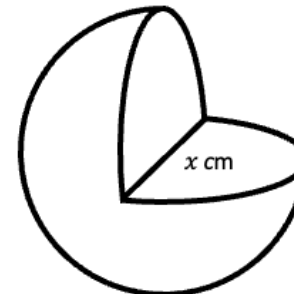
$SA = 226.194$ cm^2
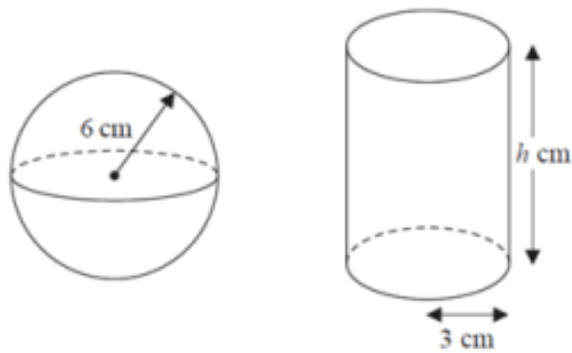
The two solids are the same height.
Calculate the ratio of their volumes.
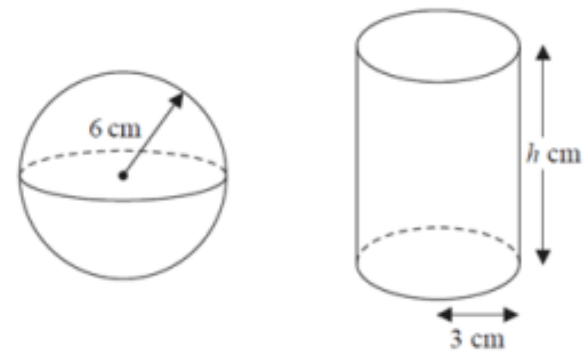
The sphere is melted down to make the cylinder. How tall will the cylinder be?
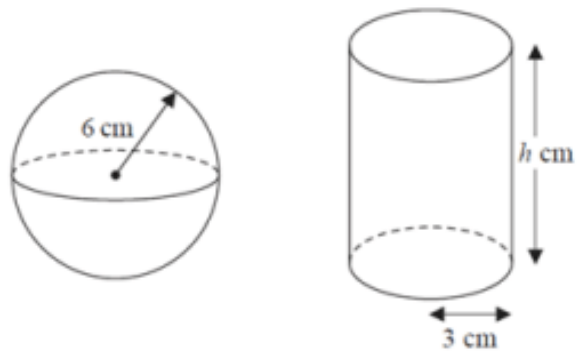
The total surface area of the cylinder is twice the surface area of sphere. Find h.
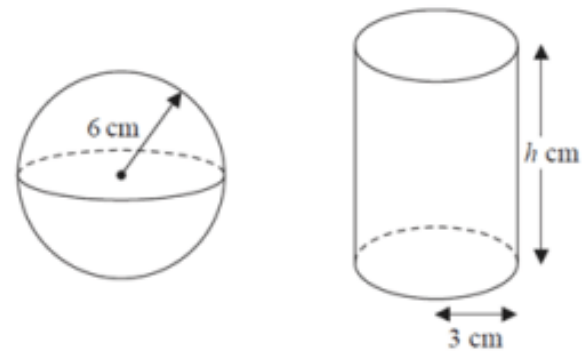
The longest stick that will fit inside the sphere is 12cm. The longest stick that will fit inside the cylinder is 20cm. Find the height of the cylinder.

6 cm

h cm

3 cm
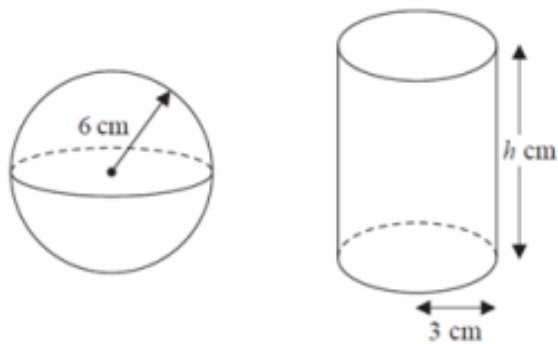
The volume of the cylinder is 72π cm³.
Find h.

6 cm

h cm

3 cm
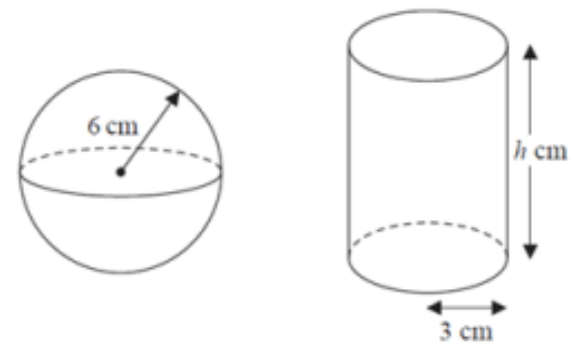
The equator of a globe measures 54π cm.
What is the ratio of the volume of the globe
to the volume of this sphere?

6 cm

h cm

3 cm
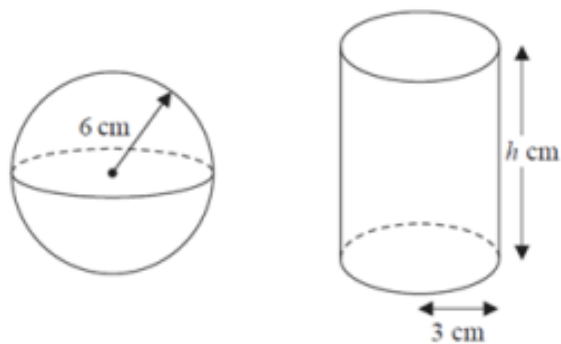
Calculate the surface area of the cylinder
when $h = 10$.
Give your answer in terms of π.

6 cm

1 m

6 cm
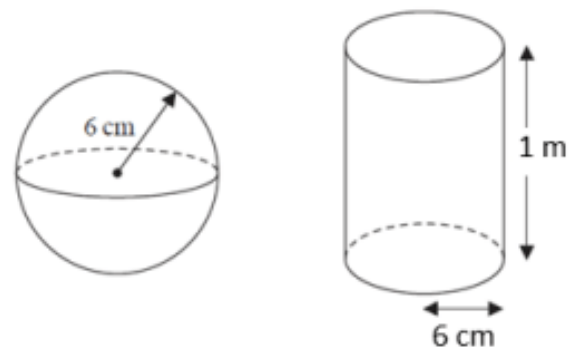
How many spheres could be stacked inside a
cylinder with radius 6cm and height 1m?
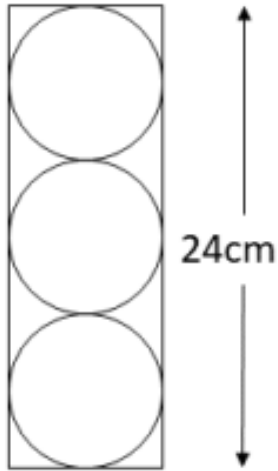
A cylindrical tube contains 3 tennis balls which fit exactly.

What is the surface area of the tube?

24cm

A cylindrical tube contains 3 tennis balls which fit exactly.

If the volume of one ball is $366\frac{1}{6}\pi$ cm³, how tall is the tube?

h
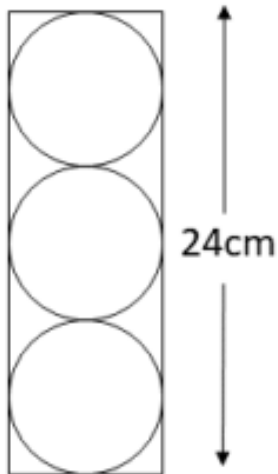
A cylindrical tube contains 3 tennis balls which fit exactly.

What volume of the tube is spare, in terms of π?

24cm
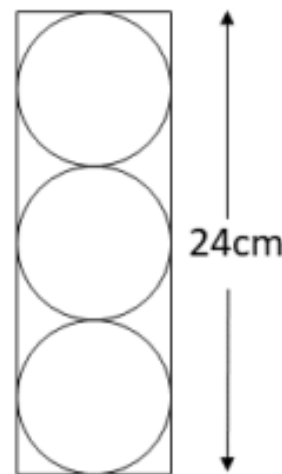
A cylindrical tube contains 3 tennis balls which fit exactly.

What percentage of the tube is filled by the tennis balls?
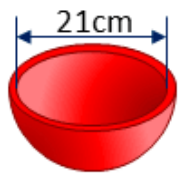
24cm

21cm

Ashley has a set of three nesting mixing bowls.
They are all made from the same thickness of plastic and each one is a hemisphere.
They nest together with no gaps.
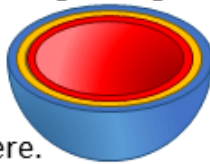
30cm

If the inner diameter of the smallest bowl is 21cm and the outer diameter of the biggest bowl is 30cm, how thick is the plastic on each bowl?

1.5cm
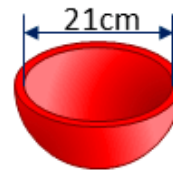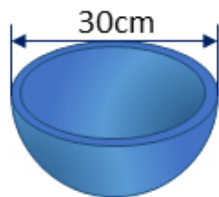
21cm

Ashley has a set of three nesting mixing bowls.
They are all made from the same thickness of plastic and each one is a hemisphere.
They nest together with no gaps.
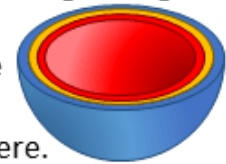
30cm

If the inner diameter of the smallest bowl is 21cm and the outer diameter of the biggest bowl is 30cm, what is the capacity of the middle bowl?
Leave your answer in terms of π
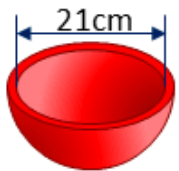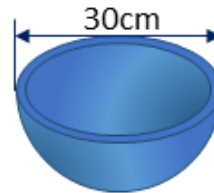
$1152\pi \ cm^3$

21cm

Ashley has a set of three nesting mixing bowls.
They are all made from the same thickness of plastic and each one is a hemisphere.
They nest together with no gaps.
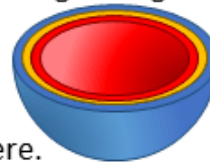
30cm

If the inner diameter of the smallest bowl is 21cm and the outer diameter of the biggest bowl is 30cm, what is the volume of plastic used to make the middle bowl?
Give your answer to 3 sf.

$1530 \ cm^3$
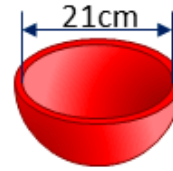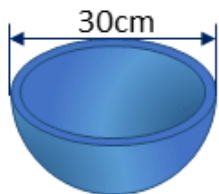
21cm

Ashley has a set of three nesting mixing bowls.
They are all made from the same thickness of plastic and each one is a hemisphere.
They nest together with no gaps.
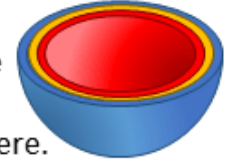
30cm

If the inner diameter of the smallest bowl is 21cm and the outer diameter of the biggest bowl is 30cm, what is the ratio of the capacity of the biggest bowl to the capacity of smallest bowl in the form n : 1 where n is given to 1 sf?

2 : 1
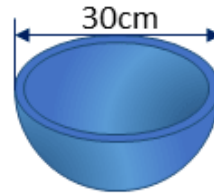
A1 Calculate the **curved** surface area. 6 cm, 8 cm	**A2** Calculate the volume. 9 cm, 12 cm	**A3** Calculate the **total** surface area. 7 mm, 13 mm	**A4** Calculate the volume. Hole, Ø = 5 cm, 3 cm, 9 cm
B1 Calculate the volume. 12 cm, 10 cm	**B2** Calculate the **curved** surface area. 8 m, 6 m	**B3** Calculate the volume. 15 m, 12 cm	**B4** Calculate the **total** surface area. 11 cm, 14 cm
C1 Calculate the surface area. 11 cm	**C2** Calculate the volume. 17 mm	**C3** Calculate the **total** surface area of the hemisphere. 28 cm	**C4** Calculate the **total** surface area. 6 m, 8.5 m
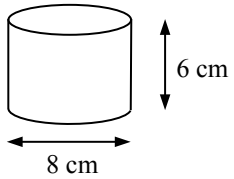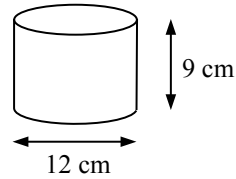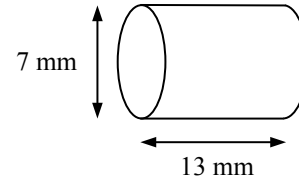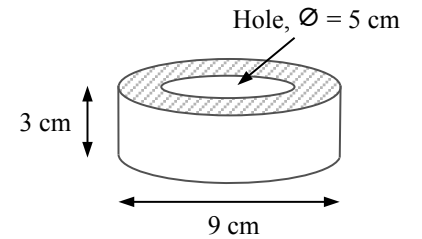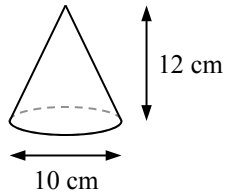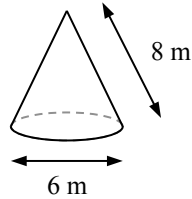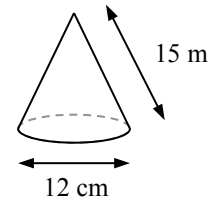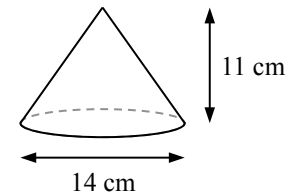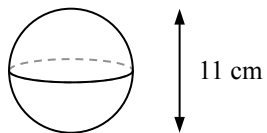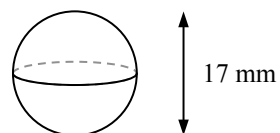
Worksheets, Videos, Interactive Quizzes and Exam Solutions

A1 Volume is 340 cm³	**A2** Volume is 1500 cm³	**A3** Surface area is 180 cm²	**A4** Volume is 140 cm³
x cm 12 cm Calculate the height, *x*.	24 cm Calculate the radius.	*r* Calculate the radius, *r*.	*x* cm 8 cm Calculate the height, *x*.
B1 Volume is 540 cm³	**B2** **Curved** surface area is 90 m²	**B3** Volume is 300 cm³	**B4** **Total** surface area is 540 cm²
r Calculate the radius, *r*.	8 m *r* Calculate the radius, *r*.	*d* cm Calculate the diameter, *d*.	*d* cm Calculate the diameter, *d*.
C1 Volume is 268 cm³	**C2** Volume is 770 cm³	**C3** Volume is 594 cm³	**C4** **Total** surface area is 100 cm²
Find the surface area.	14 cm find the **total** surface area.	18 cm Find the curved surface area.	4 cm Find the volume.

Functional Volume Questions

1) James has a swimming pool in the shape of a prism.

Diagram **NOT**

Accurately drawn

18m

1m

3m

6m

9m

The swimming pool is empty.

It is filled with water at a constant rate.

It takes 4 hours for the water to be 2 meters deep from the deepest point.

a) How long will it take to completely fill the pool?

Give your answer in hours.

(1m³ = 1000litres)

You must show all your working.

2) Abigail has a fish tank in the shape of a cuboid.

Diagram **NOT**

Accurately drawn

90cm

180cm

75cm
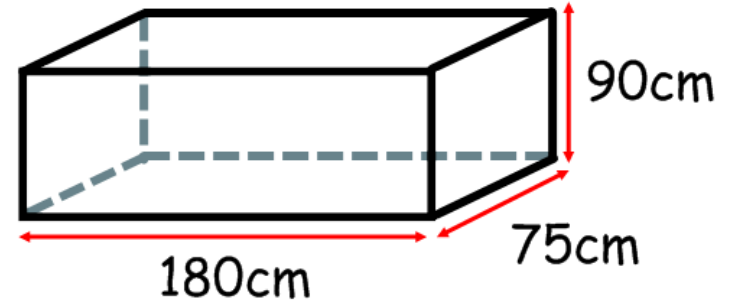
The fish tank is filled with water at a constant rate.

It takes 6.35 seconds to fill 1 gallon.

The fish tank is empty.

a) How long will it take to fill the whole tank?

1cm³ = 0.001 litres

1 gallon = 4.54609 litres

You must show all your working.

Functional Volume Questions

3) Sachyham has built a new structure to store grain.

4m

Diagram **NOT**

Accurately drawn

12m

3m

7m

15m
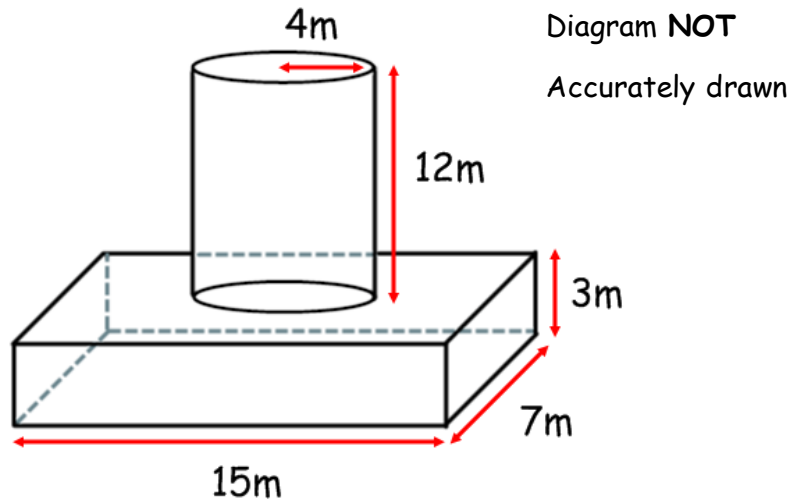
The structure is empty.
The structure fills with grain at a constant rate.
After 3 hours the structure is filled 5 meters above the centre of the base.
a) How long will it take to fill the structure?
Round your answer to the nearest minute.
You must show all your working.

Functional Volume Questions

4) The diagram shows a storage container for flour.

Diagram **NOT**

h   Accurately drawn

12m

3m
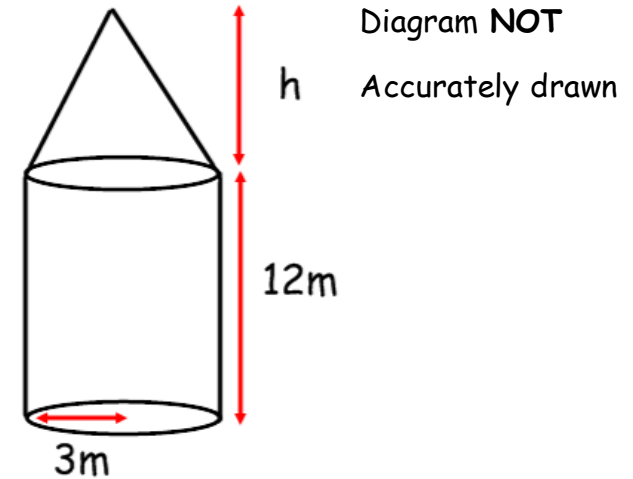
The container is a cone on top of a cylinder.
The cylinder has a radius of 3m and a height of 12m.
The cone has a radius of 3m and a height of hm.

The container is empty.
The container is then filled with flour at a constant rate.

After 3 hours the depth of the flour is 5 meters high.
After 8 hours the container if full of flour.

Work out the value of h.
You must show all your working.

Functional Volume Questions

5) The diagram shows a glass water container.
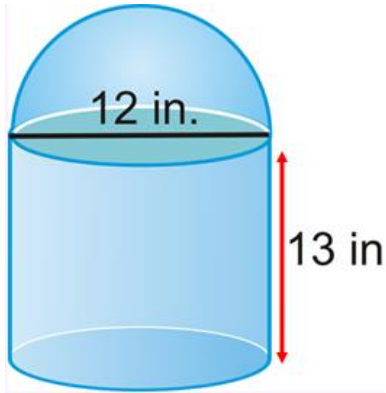
Diagram **NOT**

Accurately drawn

The container is a hemisphere on top of a cylinder.
The cylinder has a diameter of 12 inches and a height of 13 inches.
The hemisphere has a diameter of 12 inches.

The container is empty.
The container is then filled with water at a constant rate.

After 9 minutes the depth of the water is 7 inches high.
Will the container be full after 21 minutes?

Explain your answer.
You must show all your working.

Functional Volume Questions

6) The diagram shows a rocket.
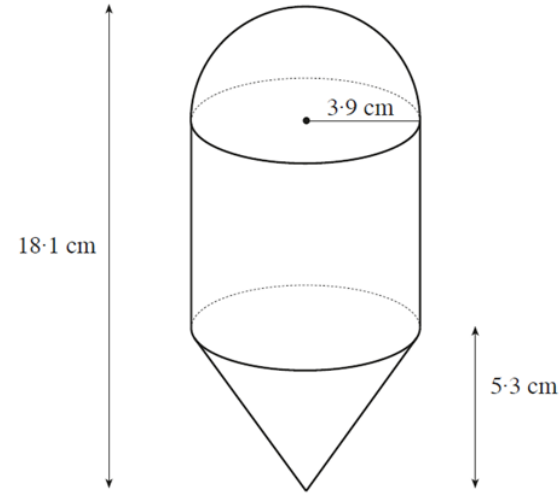
Diagram **NOT**

Accurately drawn

The rocket is a hemisphere on top of a cylinder on top of a cone.
The hemisphere has a radius of 3.9cm.
The cone has a height of 5.3cm.
The whole rocket has a height of 18.1cm.

The container is empty.
The rocket is then filled to the top with fuel at a constant rate.

After 15 minutes the depth of the fuel will be 7.7cm above the vertex of the cone.
How long will it take to fill the whole rocket?
Round your answer to the nearest minute.
You must show all your working.
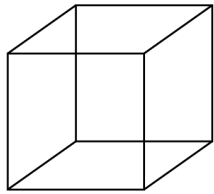
The cube has volume 125cm^3

Find its surface area.
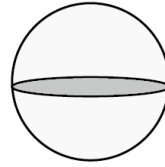
The shaded circle bisects the sphere.

If the circle has area 49π cm^2 find the surface area of the sphere.
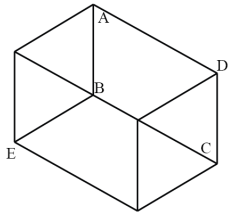
BC = 6cm

AC = $3\sqrt{5}$ cm

AE = $\sqrt{13}$ cm

Find the surface area of the shape.
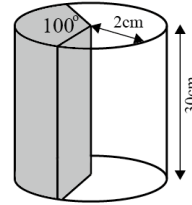
Find the surface area of the shaded shape.

100° 2cm

30cm

Find the surface area of the square based pyramid

6cm

3cm
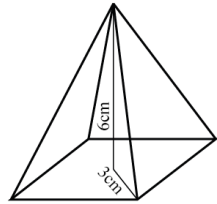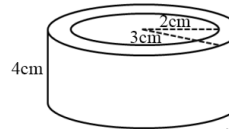
Find the surface area of the hollow tube.

2cm

3cm

4cm
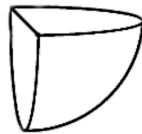
A quarter of a sphere is shown. If the volume of this shape is 9π cm^3 what is its surface area?

Find the surface area of the square-based pyramid.

70° 4cm
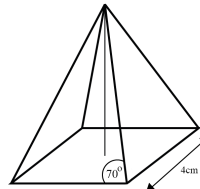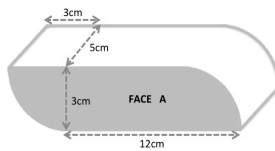
Assuming face A has rotational symmetry of order 2, calculate the surface area of the whole 3-D shape.

3cm

5cm

3cm FACE A

12cm
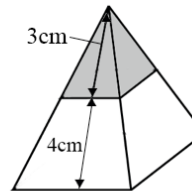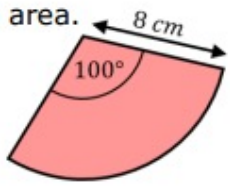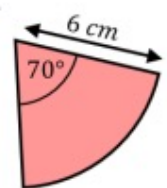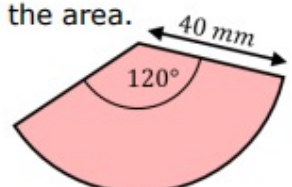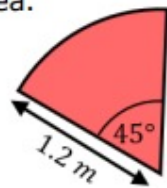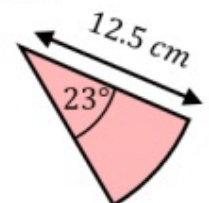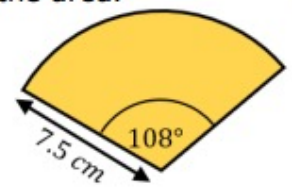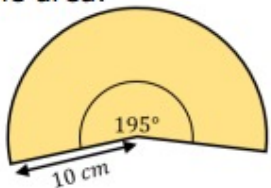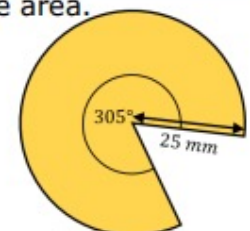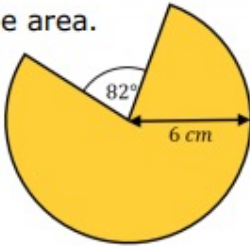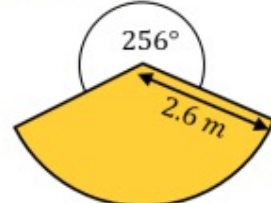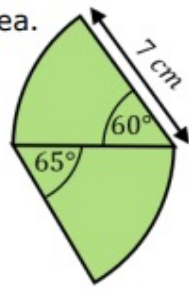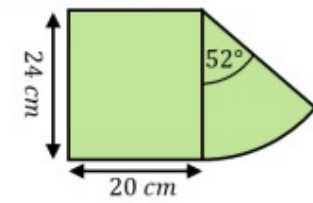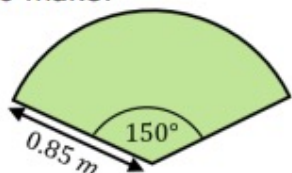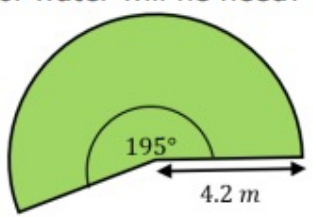
The tip of the square-based pyramid is painted as shown, using 30cm^2 of paint. If 200cm^2 more paint is needed to cover the entire shape, what is the width of the base?

3cm

4cm

Mixed Volume and Surface Area Problems

(a)	(b)	(c)	(d)
The surface area of a sphere with radius $10\ cm$ is equal to the curved surface area of a cylinder with the same radius as the sphere and height $h\ cm$. Find the height h.	A cylinder with height $h\ cm$ and radius $6\ cm$ has the same volume as a sphere with radius $9\ cm$. Find the value of h.	A metal cylinder is to be melted down and turned into spheres with radius $3\ cm$. The cylinder has a radius of $12\ cm$ and a height of $25\ cm$. How many whole spheres can be made?	A cone with slanted height $25\ cm$ and radius $8\ cm$ has the same curved surface area as a hemisphere. Find the radius r of the hemisphere.

(e)	(f)	(g)	(h)
A cylinder has a radius r and height $15r$. A sphere has radius $3r$. Find the ratio of the volume of the sphere to the volume of the cylinder in its simplest form.	A hemisphere with radius $2r$ has the same total surface area as a cylinder with radius r. Find the height of the cylinder in terms of r.	A cone has a radius of $\frac{3}{2}x$ and a height of $3x$. A sphere has a radius of kx. The ratio of the volume of the cone to the volume of the sphere is $4 : 1$. Find the value of k as a fraction in its simplest form.	A hemisphere of radius $(r+2)$ is attached to the base of a cone with radius $(r+2)$ and slant height $5r$. The total surface area of the compound shape is 273π. Find the volume of the compound shape.

Area of a Sector

(a)	(b)	(c)	(d)	(e)
Find the area.	Find the area.	Find the area.	Find the area.	Find the area.
8 cm, 100°	6 cm, 70°	40 mm, 120°	45°, 1.2 m	12.5 cm, 23°

(f)	(g)	(h)	(i)	(j)
Find the area.	Find the area.	Find the area.	Find the area.	Find the area.
108°, 7.5 cm	195°, 10 cm	305°, 25 mm	82°, 6 cm	256°, 2.6 m

(k)	(l)	(m)	(n)
Find the area.	Find the area.	Tia wants a fan-shaped mirror, as shown in the diagram. Mirrored glass costs £82.50 per m^2. How much will Tia's mirror cost to make?	Pablo has a sector-shaped swimming pool with dimensions shown. He wants to fill his pool to a depth of 1.8 m. How many litres of water will he need?
7 cm, 60°, 65°	24 cm, 20 cm, 52°	150°, 0.85 m	195°, 4.2 m

Area: Sectors
Video 46 on www.corbettmaths.com

Examples

Workout

Click here

Scan here

Question 1: Calculate the area of each of the following sectors.
Give each answer to one decimal place and include units.

(a)

6cm

(b)

15cm

(c)

120°

8cm

(d)

2cm

60°

(e)

36°

7m

(f)

72°

35cm

(g)

40°

16cm

(h)

240°

10cm

(i)

144°

3cm
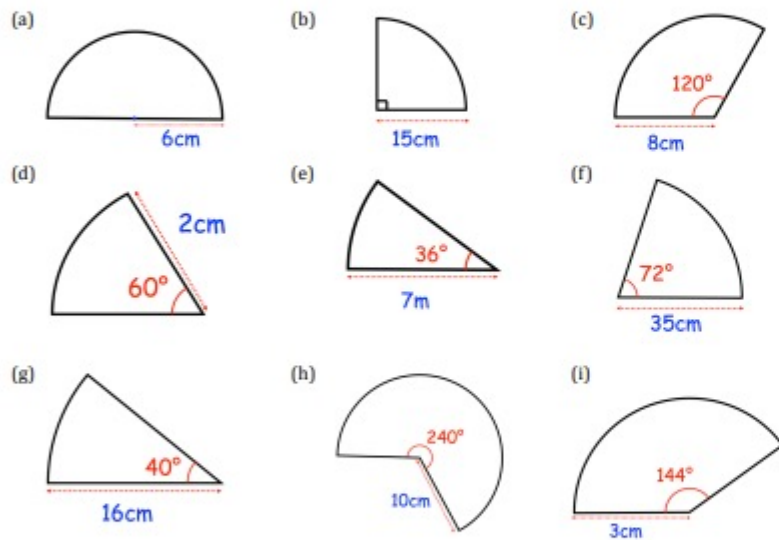
Question 2: Calculate the area of each of these sectors.
Give each answer to 2 decimal places and include suitable units.
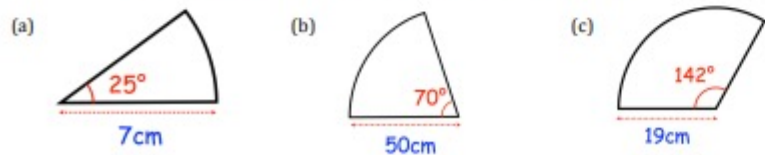
(a)

25°

7cm

(b)

70°

50cm

(c)

142°

19cm

Area: Sectors
Video 46 on www.corbettmaths.com

(d)

8cm

342°

(e)

4.2m

19°

(f)

109°

0.7cm

(g)

65.3°

11mm

(h)

15cm

110°

(i)

297°

8.25mm
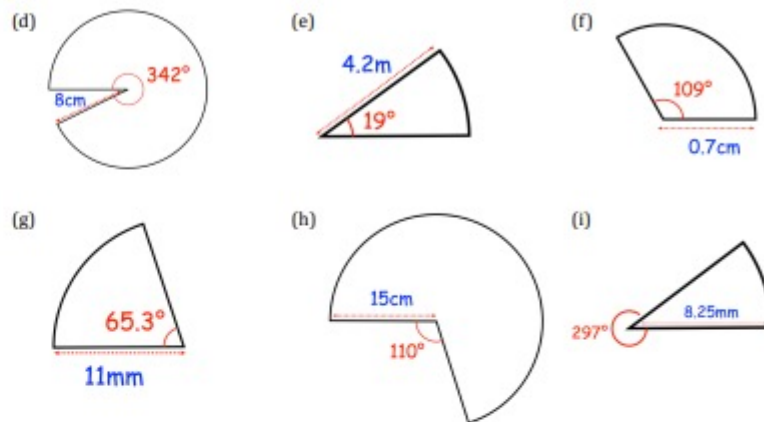
Question 3: Find the area of these sectors.
Leave your answer in terms of π

(a)

12cm

(b)

50cm

(c)

60°

12m

(d)

120°

9cm

(e)

18°

10cm

(f)

240°
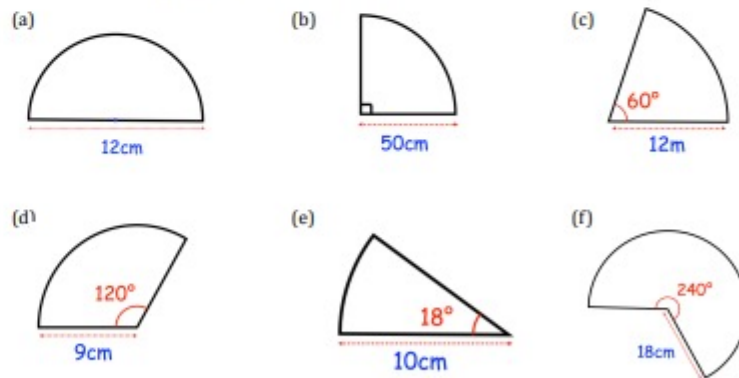
18cm

Question 4: The areas of these sectors have been given. Calculate x.

(a) Area = 20cm²

115°

x

(b) Area = 98cm²

26°

x

(c) Area = 1m²

252°

x
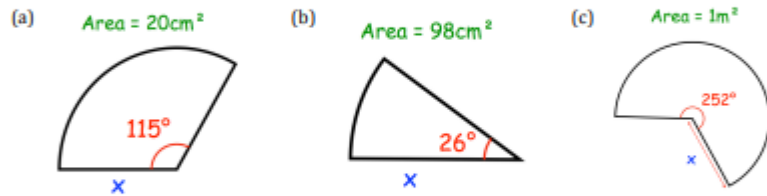
Question 5: The areas of these sectors have been given. Calculate the missing angles.

(a) Area = 17.45cm²

θ

5cm

(b) Area = 62cm²

8.5cm

θ

(c) Area = 625m²

θ   17m
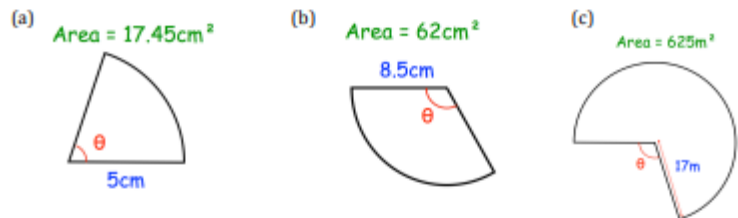
Question 6: The areas these sectors have been given in terms of π. Work out x

(a) Area = 40π cm²

36°

x

(b) Area = 75π cm²

120°

x

(c) Area = 245π cm²

72°

x
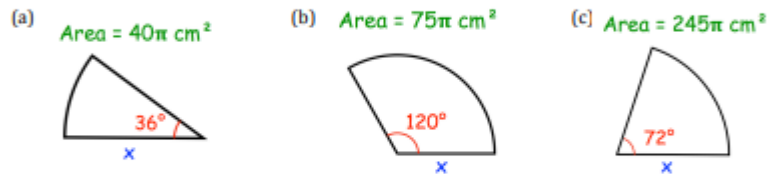
Apply

Question 1: The perimeter of the sector below is 103cm Find the area of the sector

40cm

Question 2: These two sectors have the same area. James says x is 2cm. Is he correct?

10°

48cm

240°

x

Answers

✓ ✗

Click here   **Scan here**
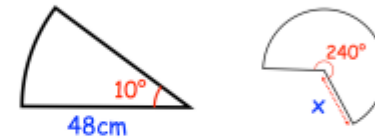
SECTORS
AREAS

Ref: G426. **2R1**

A1 Find the area.

78°
9.1 cm

A2 Find the area.

6.7 m
122°

A3 Find the area.

53 mm
256°

A4 Find the area.

4.6 cm
115°
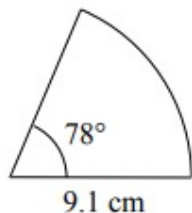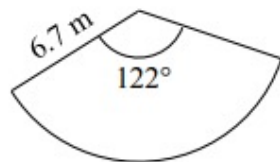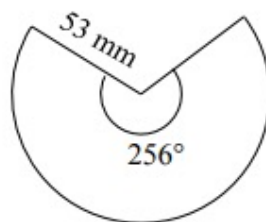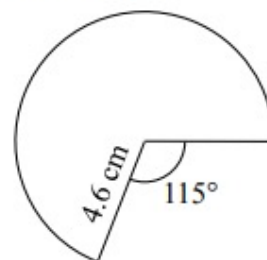
B1 The area is 75 cm², find x

$x°$
8.2 cm
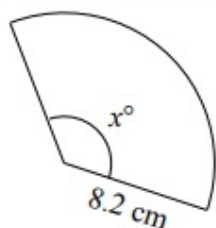
B2 The area is 20 cm², Find r

70°
r
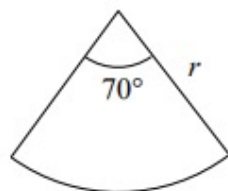
B3 The area is 65 cm², Find r

135°
r

B4 The area is 8 cm², find x

4 cm
$x°$
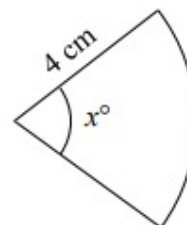
C1 Find the shaded area.

5 cm
60°
5 cm
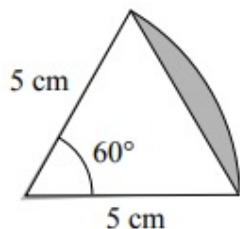
C2 Find the shaded area.

5 cm
4 cm
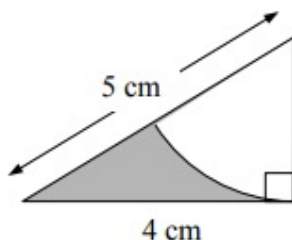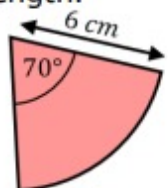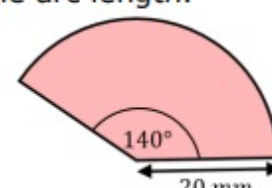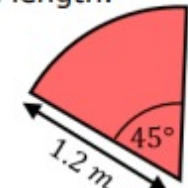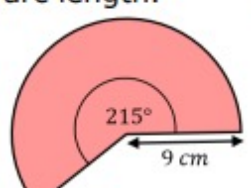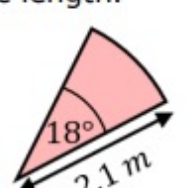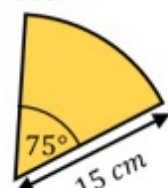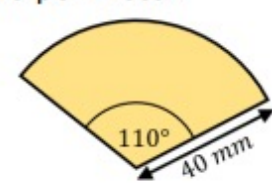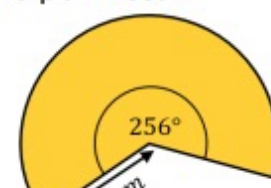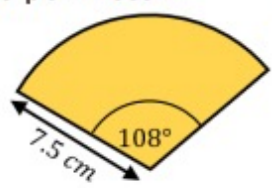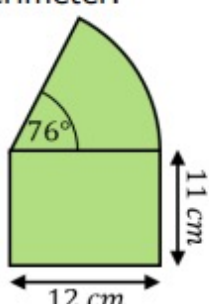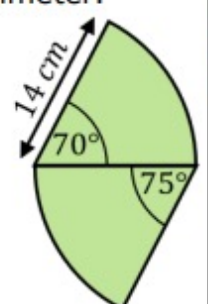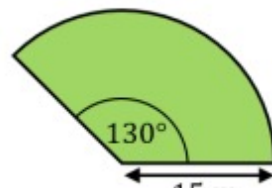
C3 Find the shaded area.

10 cm
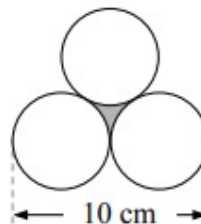
C4 The area of the shaded shape is 12 cm². Find the value of x.

2 m
2 m
x 74° x
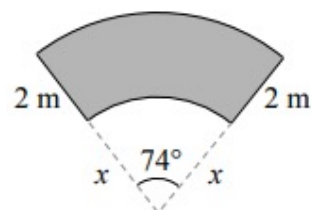
Arc Length and Perimeter of a Sector

(a)	(b)	(c)	(d)	(e)
Find the arc length.	Find the arc length.	Find the arc length.	Find the arc length.	Find the arc length.
6 cm, 70°	140°, 20 mm	45°, 1.2 m	215°, 9 cm	18°, 2.1 m

(f)	(g)	(h)	(i)	(j)
Find the perimeter.	Find the perimeter.	Find the perimeter.	Find the perimeter.	Find the perimeter.
75°, 15 cm	110°, 40 mm	256°, 0.9 m	7.5 cm, 108°	82°, 6 cm

(k)	(l)	(m)	(n)
Find the perimeter.	Find the perimeter.	Farmer Jo wants to put a fence around his sector-shaped field. Fencing costs £18.99 per metre. How much will it cost Farmer Jo?	The pendulum of a clock is 48 cm long and swings through an angle of 15°. The pendulum swings back and forth every two seconds. How far does the end of the pendulum swing in a minute?
76°, 11 cm, 12 cm	14 cm, 70°, 75°	130°, 15 m	

Arc Length
Video 58 on www.corbettmaths.com

▶ **Click here**   **Scan here**

Question 1: For each sector below, calculate the length of the arc.
Give your answers to one decimal place and include suitable units.

(a)
6cm

(b)
120°
15cm

(c)
30°
4m

(d)
72°
20cm

Question 2: For each sector below, calculate the length of the arc.
Give your answers to one decimal place and include suitable units.

(a)
14°
8cm

(b)
150°
19cm

(c)
73°
25.2cm

(d)
235°
60cm

Question 3: For each sector below, calculate the length of the arc.
Leave your answer in terms of π

(a)
120°
18cm

(b)
36°
70cm

(c)
24°
1.5cm

(d)
14mm
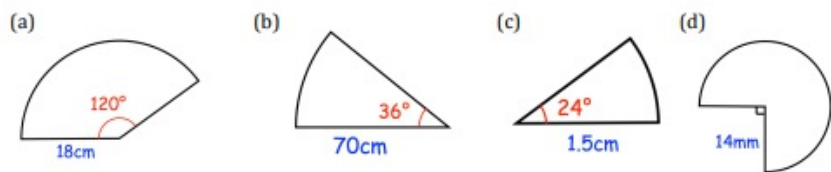
Question 4: Calculate the perimeter of each sector below
Give your answers to one decimal place and include suitable units.

(a)
9cm

(b)
144°
23cm

(c)
220°
3cm

(d)
58°
0.7m

Question 5: Calculate the perimeter of each sector below
Leave your answer in terms of π

(a)
60°
6cm

(b)
20°
90cm

(c)
240°
6cm

(d)
80°
18cm
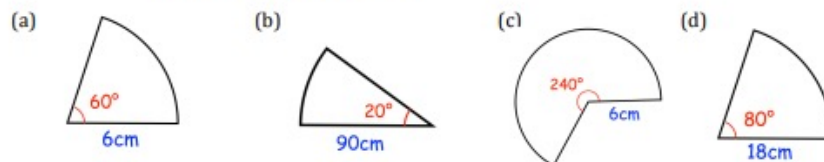
Question 6: The arc length of each sector has been given.
Calculate x
Give your answers to one decimal place and include suitable units.

(a) Arc Length = 50cm
20°
x

(b) Arc Length = 85.2cm
325°
x

(c) Arc Length = 9cm
237°
x
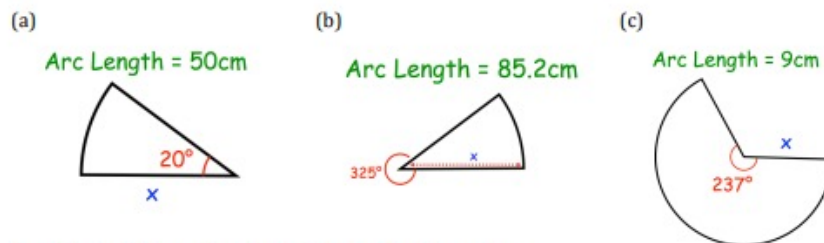
Question 7: The arc length of each sector has been given.
Calculate x

(a) Arc Length = 15π cm
x

(b) Arc Length = 6π cm
40°
x

(c) Arc Length = 10π cm
144°
x
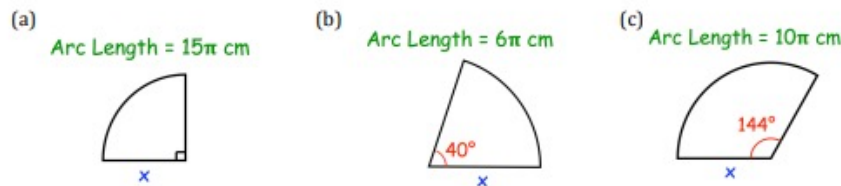
Question 8: The arc length of each sector has been given.
Calculate the size of the angle
Give your answers to one decimal place.

(a) Arc Length = 56cm
θ
27cm

(b) Arc Length = 1.8m
θ
1.5m

(c) Arc Length = 41cm
θ
7cm

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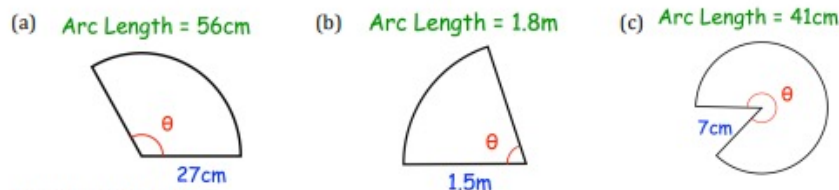
Question 9: The perimeter of each sector has been given.
Calculate the size of the angle
Give your answers to one decimal place.

(a) Perimeter = 36cm

θ

15cm
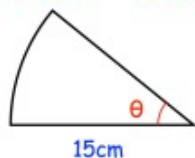
(b) Perimeter = 26.63cm

θ

7.8cm
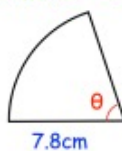
(c)

Perimeter = 22.81cm

5.3cm

θ

Question 10: The perimeter of each sector has been given.
Calculate x
Give your answers to one decimal place.

(a) Perimeter = 210cm

x

30°

(b) Perimeter = 40cm

x

250°
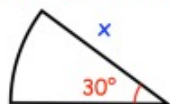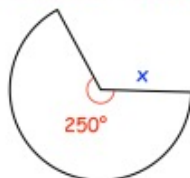
Apply

Question 1: Calculate the perimeter of the segment.

10cm

10cm
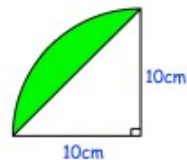
Question 2: James is calculating the perimeter of the sector.
Can you spot any mistakes?

20cm

30°
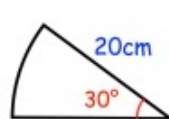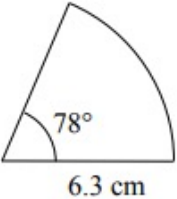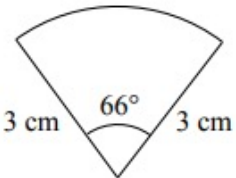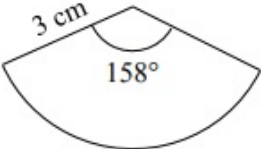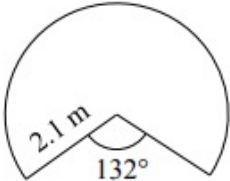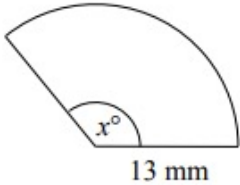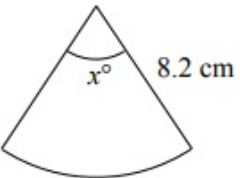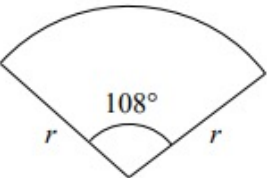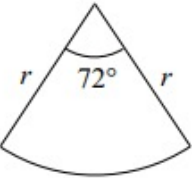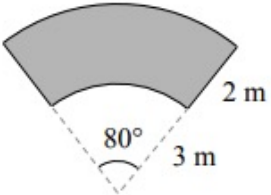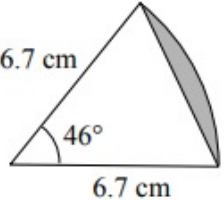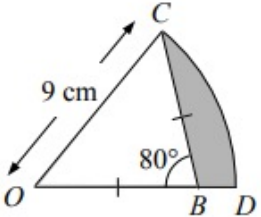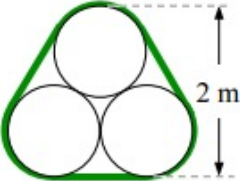
Perimeter

$$= \frac{30}{360} \times \pi \times 20$$

$$= 5.236cm$$

Answers

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SECTORS
ARC LENGTH AND PERIMETER

Ref: G426. **1R1**

A1 Find the length of the arc	**A2** Work out the perimeter	**A3** Find the length of the arc	**A4** Work out the perimeter
78° 6.3 cm	3 cm 66° 3 cm	3 cm 158°	2.1 m 132°
B1 Arc length is 32 mm, find x	**B2** Perimeter is 25 cm, find x	**B3** Arc length is 9 cm, find r	**B4** Perimeter is 40 cm, find r
$x°$ 13 mm	$x°$ 8.2 cm	108° r r	r 72° r
C1 Find the perimeter of the shaded shape.	**C2** Find the perimeter of the shaded segment.	**C3** $OB = BC$. Find the perimeter of the shaded shape.	**C4** Find length of the band that goes around the circles.
2 m 80° 3 m	6.7 cm 46° 6.7 cm	C 9 cm 80° O B D	2 m

Area and Perimeter of Sectors

Find the area of each of these sectors.

(a)

55°, 15 cm

(b)

5 m, 70°

(c)

170°, 30 cm

(d)

42 mm, 65
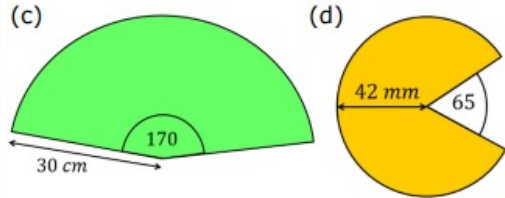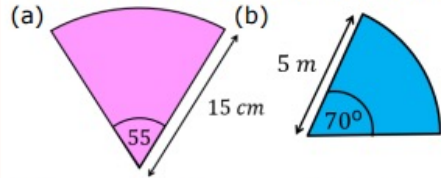
Find the arc length and perimeter of each of these sectors.

(a)

12 cm, 55

(b)

30 mm, 155

(c)

8 cm, 50

(d)

2 m, 260
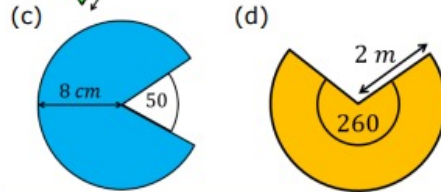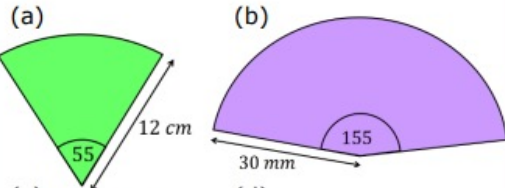
Find the area and perimeter of these shapes.

(a)

2 cm, 82, 6 cm

(b)

9 cm, 58, 4 cm
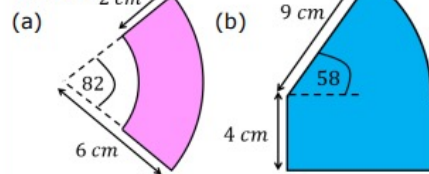
(a) A sector has an area of $70cm^2$ and a radius of $8\,cm$. Find its angle.

(b) A sector with angle 75° has an area of $30\,cm^2$. Find the radius of the sector.

(c) A sector has a perimeter of $35\,cm$ and a radius of $7\,cm$. Find its angle.

Match-Up

Sectors of Circles

1	3 cm, Area = ?, 60°	**2**	Perimeter = ?, 5 cm, 100°
3	Perimeter = ?, 5 cm, 80°	**4**	6 cm, Area = ?, 50°
5	Perimeter = ?, 30°, 10 cm	**6**	10 cm, Area = ?, 45°
7	Area = ?, 8 cm, 120°	**8**	10 cm, 120°, Perimeter = ?
9	Perimeter = ?, 60°, 5 cm	**10**	Area = ?, 135°, 4 cm
11	4 cm, Area = ?, 135°	**12**	10 cm, 120°, Perimeter = ?

A	$\dfrac{25\pi}{2}\ cm^2$
B	$\left(\dfrac{5\pi}{3}+10\right)cm$
C	$\left(\dfrac{20\pi}{3}+20\right)cm$
D	$\left(\dfrac{25\pi}{9}+10\right)cm$
E	$\dfrac{64\pi}{3}\ cm^2$
F	$\dfrac{3\pi}{2}\ cm^2$
G	$10\pi\ cm^2$
H	$\left(\dfrac{20\pi}{9}+10\right)cm$
I	$\left(\dfrac{40\pi}{3}+20\right)cm$
J	$5\pi\ cm^2$
K	$\left(\dfrac{5\pi}{3}+20\right)cm$
L	$12\pi\ cm^2$

1	2	3	4	5	6	7	8	9	10	11	12

Examples

Workout

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Question 1: Complete the two way table to show the information about the shapes below.

	Rhombus	Star	Total
Red			
Yellow			
Total			

Question 2: 50 children were asked if they wanted to go bowling or to the cinema.

17 girls and 11 boys wanted to go bowling.
12 boys wanted to go to the cinema.

(a) Use this information to complete the two-way table below.

	Bowling	Cinema	Total
Boys			
Girls			
Total			

(b) How many children, in total, want to go to the cinema?

Question 3: Complete the following two way tables:

(a)

	Car	Bus	Walk	Total
Year 9	10	8		24
Year 10		7	5	
Total	16			42

(b)

	English	Art	Total
Pass	25		
Fail		12	13
Total		19	

(c)

	Rugby	Football	Hockey	Total
Class 9A	7		6	24
Class 9B		3		
Total	12			40

(d)

	Child	Adult	Total
Male	52		86
Female		43	
Total			178

Question 4: This two-way table shows information about the students in years 8, 9 and 10.

	Year 8	Year 9	Year 10
Boys	45	38	51
Girls	32	52	28

(a) Find the total number of students in year 8.
(b) Find the total number of girls in years 8, 9 and 10.
(c) What fraction of the students are in year 10?
(d) What fraction of year 9 students are girls?

Question 5: This two-way table shows the number of goals scored in each match by three football teams throughout January, February and March.

	Rovers	City	United
0 goals	8	3	5
1 goal	3	8	9
2 or more	7	9	4

(a) Find the number of matches that Rovers played.
(b) Find the number of matches where 1 goal was scored by these teams.
(c) In what percentage of their matches did City score no goals?
(d) Find the fraction of United's matches where they scored 1 or more goals.

Apply

Question 1: Paul has a deck of 50 cards, each with a shape on it.
The shapes are either red or black.

	Square	Rectangle	Kite
Red	17	6	1
Black	4	9	13

Paul picks a card at random.

(a) What is the probability that the card has a black kite on it?
(b) What is the probability that the card has a red shape on it?
(c) What is the probability that the card has a square on it?
(d) What is the probability that the card has a shape with at least 2 lines of symmetry?

Question 2: 60 people visited a swimming pool one evening.
13 out of the 19 people who wore goggles were adults.
There were 15 children.

(a) Complete a two-way table for this information.
(b) How many adults did not were goggles?
(c) What fraction of the children wore goggles?

Question 3: 100 families booked a holiday in July or in August, at a travel agents.
Some of the families booked to go to France.
Some booked to go to Spain.
The rest of the families booked a holiday to Portugal.

59 families booked to go on holiday in August.
19 of the 35 families going to France booked to go in July.
30 families booked to go to Portugal.
20 families booked to go to Spain in August.

(a) Create a two-way table for this information.
(b) How many families booked to go to Portugal in July?

Question 4: There are 120 students in Year 11 at a school.
Each student studies one language, either French, Spanish, German or Welsh.
21 of the 40 students studying Welsh are male.
18 males and 9 females study French.
12 of the 17 students studying Spanish are female.
Twice as many females study German than males.

How many students in Year 11 are female?

Question 5: A teacher surveys 64 children on how they travelled to school.
20 of the students were in Year 7.
The teacher surveyed 30% more students in Year 9 than in Year 7.
The rest of the students surveyed were in Year 11.
75% of the students in Year 7 walked to school.
8 more students in Year 9 walked to school than did not walk.
Out of students surveyed, more Year 11 students walked to school than Year 9 students.

One of these students is picked at random

Write down the probability that the student chosen will walk to school.

Question 6: Isla has a box of counters.
The table shows information about the shape and colours of the counters.

		Circle	Triangle	Square
Colour	Blue	6	2	5
	Red	8	9	11

(Shape across top; Colour down side)

Isla picks a counter at random, looked at it and then returned it to the box.

(a) Given it is a circular counter, what is the probability that it was red?

David picks a counter at random, looked at it and then returned it to the box.

(b) Given it is a blue counter, what is the probability that it was triangular?

Emily adds a number of red square counters to the box.
The probability of Emily picking a red square at random is now $\frac{2}{3}$

(c) How many red square counters did Emily add to the box?

Answers

✓ ✗

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Two-Way Tables and Probability

100 students each chose one activity.
(a) Copy and complete the two-way table.

	Painting	Karate	Singing	Total
Year 7		12		42
Year 8			30	
Total	27	18		100

(b) A student is chosen at random. Find the probability that they are a Year 8 who chose karate.
(c) A Year 7 student is chosen at random. Find the probability that they chose painting.

150 sixth formers visit a school canteen. Students choose burger or chilli. 59 out of the 85 students who have burger are Year 13. There are 72 Year 12 students.
(a) Draw a two-way table.
(b) A student is chosen at random from those who preferred chilli. Find the probability that they are a Year 12.

100 people study one language at an adult college. Some people study French. Some people study Spanish. The rest of the people study Italian. 54 of the people are 40 or under. 20 of the 29 people who study Spanish are over 40. 31 people study Italian. 15 over 40s study French.
(a) Draw a two-way table.
(b) A person is chosen at random. Find the probability that they are an over 40 who studies Italian.

100 people visit a leisure centre. They are either going swimming, to play tennis, to play badminton, or to the gym. 21 out of the 40 going to the gym are adults. 19 adults and 6 children are going swimming. 13 out of the 20 people playing badminton are children. Twice as many children play tennis as adults.
(a) Draw a two-way table.
(b) An adult is chosen at random. Find the probability they play badminton.

A1 List {vowels}	**A2** List {the first six consonants}	**A3** List {vowels in the word 'NUMBER'}	**A4** List {consonants in the word 'MATHS'}
B1 List {vowels in the word 'ALGEBRA'}	**B2** List {consonants in the word 'SETS'}	**B3** List {letters in the word 'ISOSCELES'}	**B4** List {vowels in 'SQUARE ROOT'}
C1 List {days of the week}	**C2** List {seasons in the year}	**C3** List {colours in the rainbow}	**C4** List {countries in the United Kingdom}
D1 List {first three months of the year}	**D2** List {months of the year with four letters}	**D3** List {months of the year beginning with 'A'}	**D4** List {days of the week which contain an 'E'}
E1 Describe the following set: {spring, summer}	**E2** Describe the following set: {square, rhombus}	**E3** Describe the following set: {north, east, south, west}	**E4** Describe the following set: {orange, yellow, indigo, violet}

A1 List {the first six multiples of 3}	**A2** List {prime numbers less than 10}	**A3** List {all the factors of 12}	**A4** List {even numbers between 3 and 11}
B1 Describe the set: {1, 2, 3, 4, 5}	**B2** Describe the set: {1, 3, 5, 7, 9}	**B3** Describe the set: {1, 2, 3, 6, 9, 18}	**B4** Describe the set: {11, 13, 17, 19}
C1 A = {positive integers less than 5} List set A	**C2** B = {negative integers more than 6} List set B	**C3** C = {integers between 4 and 9} List set C	**C4** D = {integers between –3 and 4} List set D
D1 M = {the first five multiples of 6} List set M	**D2** F = {all the factors of 20} List set F	**D3** P = {the first six prime numbers} List set P	**D4** S = {square numbers less than 20} List set S
E1 A = {factors of 20} B = {1, 2, 5, 10, 20} Are the sets A and B the same?	**E2** C = {first five multiples of 7} D = {7, 14, 21, 27, 35} Are the sets C and D the same?	**E3** E = {prime numbers less than 20} F = {the first nine prime numbers} Are the sets E and F the same?	**E4** G = {numbers on a dice} H = {positive integers less than 7} Are the sets G and H the same?

Worksheets, Videos, Online Assessments and Exam Solutions

Venn Diagrams ①

Complete each Venn Diagram

A) ξ =

1	2	3
7	8	9
11	12	13
16	17	18

ξ   Odd   Over 10

B) ξ =
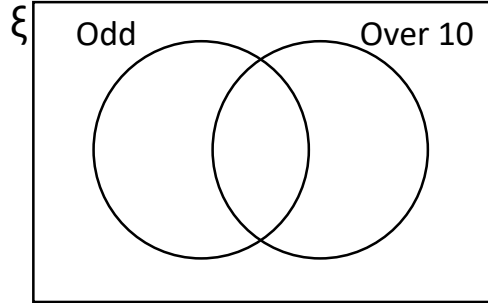
34	14	15	28
21	70	20	13
1	25	7	16
6	35	18	41

ξ   Multiple of 7   Even
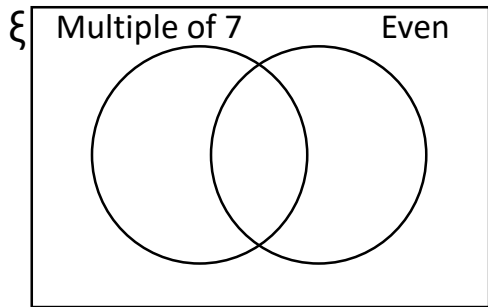
C) ξ =   Numbers from 1 to 25

What fraction of the numbers are not a multiple of 3 or 4?

ξ   Multiple of 3   Multiple of 4
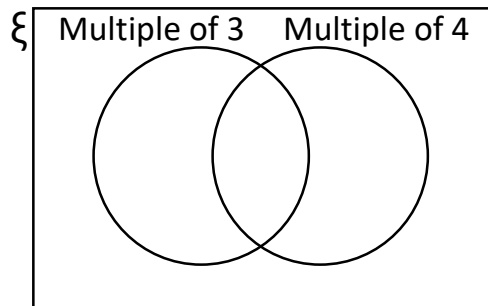
Venn Diagrams ②

Complete each Venn Diagram

A) ξ =

44	90	45	88
54	27	6	26
91	16	71	9
18	13	24	33

ξ   Even   Multiple of 9
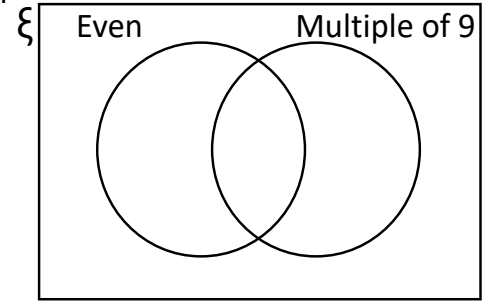
B) ξ =   Even numbers from 10 to 40

ξ   Multiple of 4   Multiple of 5

Page 132
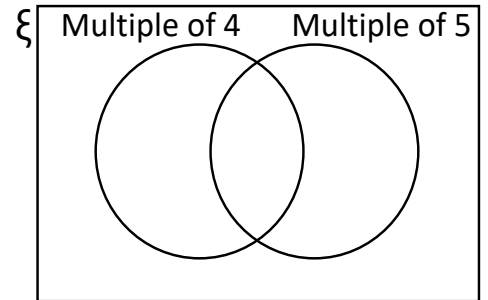
Venn Diagrams for Factors

A) ξ = Factors of 24
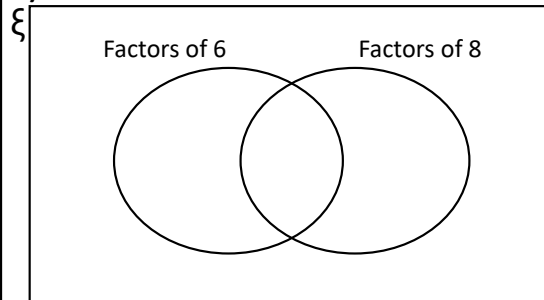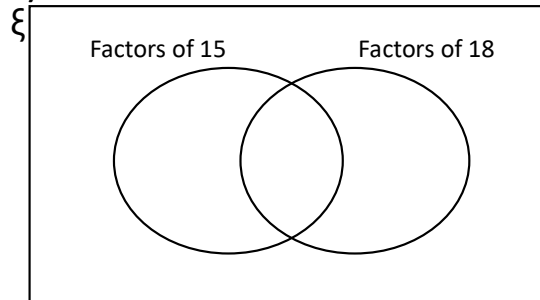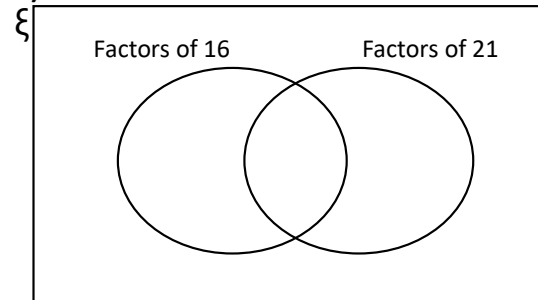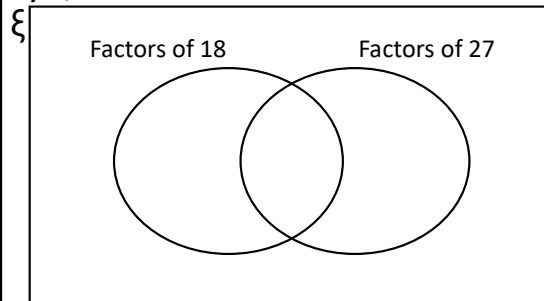
ξ

Factors of 6   Factors of 8

B) ξ = Factors of 36

ξ

Factors of 15   Factors of 18

C) ξ = Factors of 28

ξ

Factors of 16   Factors of 21

D) ξ = Factors of 54

ξ

Factors of 18   Factors of 27

E) ξ = Factors of 60

ξ

Factors of 30   Factors of 24

F) ξ = Factors of 90

ξ

Factors of 40   Factors of 15

G) ξ = Factors of 42

ξ

Factors of 56   Factors of 21

H) ξ = Factors of 140

ξ

Factors of 70   Factors of 30

I) ξ = Factors of 180

ξ
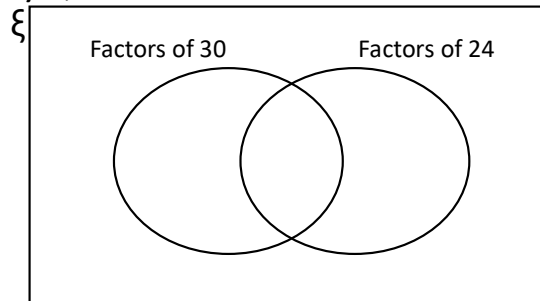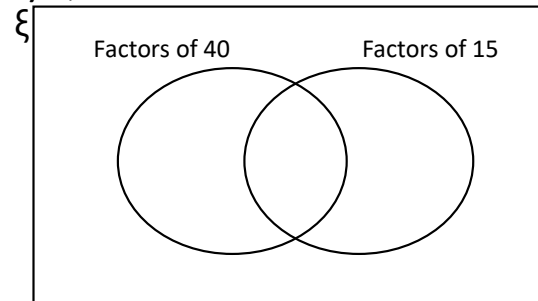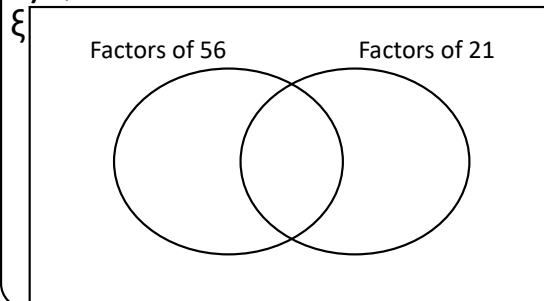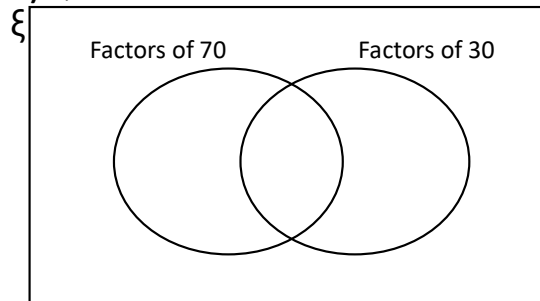
Factors of 135   Factors of 60
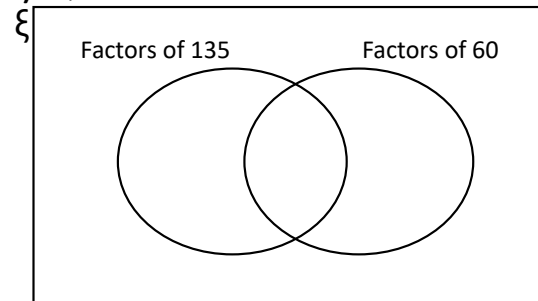
1. For each Venn diagram, describe the sets: ξ, P and Q

a.
P: 1, 3, 7, 9, 5
Q: 5, 10
2, 4, 6, 8

b.
P: 1, 3, 6, 4, 12, 2
Q: 8, 10
5, 7, 9, 11

c.
P: 1, 9, 4, 16, 36, 64, 100
25, 49, 81

d.
P: 3, 5, 7, 11, 13, 2, 4, 6, 8, 10, 12, 14
1, 9, 15
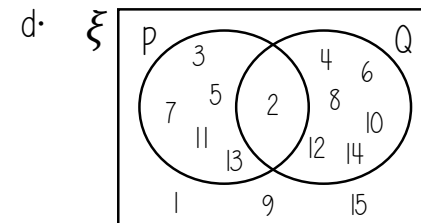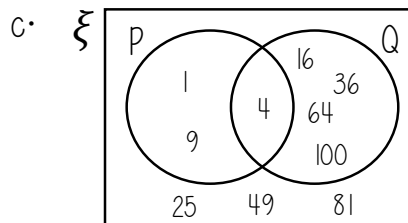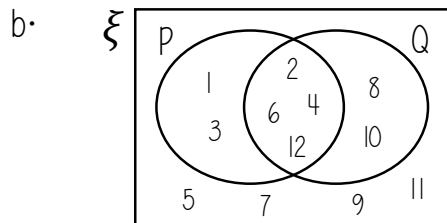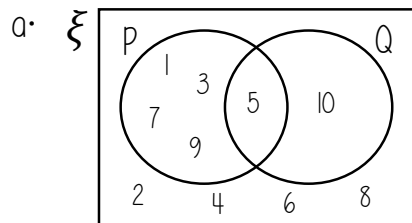
2. Given the sets, can you place the members into a Venn diagram

a.
ξ = {10, 11, 12, 13, 14, 15, 16}
P = {12, 14, 16}
Q = {10, 11, 12, 16}

b.
ξ = {integers from 15 to 21, inclusive}
X = {15, 18, 21}
Y = {16, 18, 20}

c.
ξ = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
E = {even numbers}
F = {factors of 10}

d.
ξ = {a, b, c, d, e, f, g, h, i, j}
A = {a, e, i}
B = {a, c, e, g, i}

e.
ξ = {integers from 1 to 12, inclusive}
M = {multiples of 2}
N = {numbers less than or equal to 5}

f.
ξ = {C, F, G, H, I, N, S, T, X}
L = {letters with lines of symmetry}
R = {letter with rotational symmetry of order 2}

1. Given the following information, complete the Venn diagram shown below.

- $\varepsilon = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$
- **A** is the set of factors of 24
- **B** is the set of multiples of 3
- **C** is the set of common factors of 30 and 70
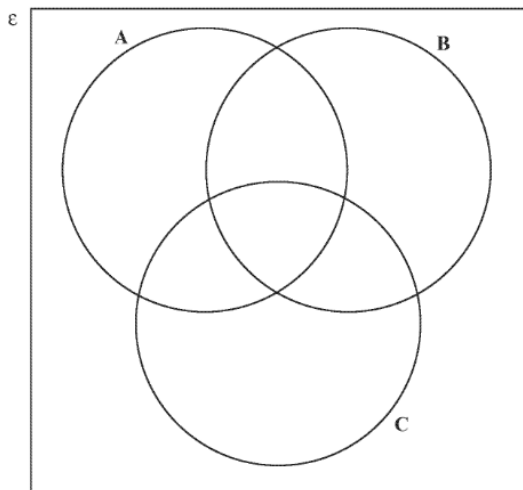
2. (i) Place each of the whole numbers 42, 43, 44, 45, 46, 47, 48, 49, 50 in the correct positions in the Venn diagram.
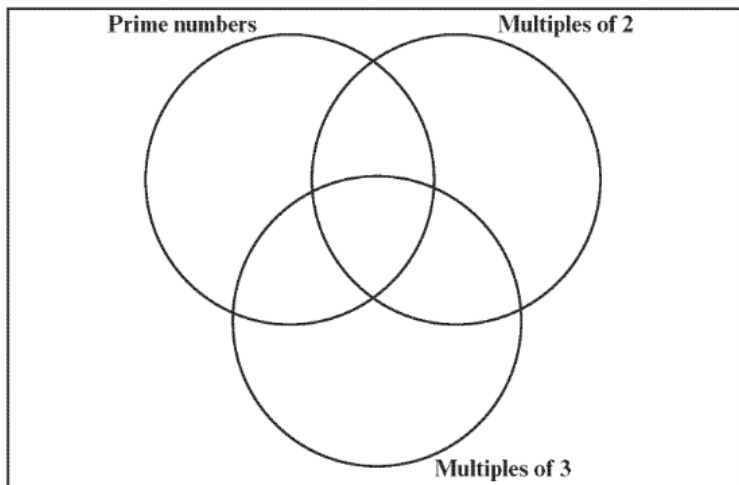
3. The universal set, $\varepsilon = \{22, 23, 24, 25, 26, 27, 28, 29, 30\}$.

Within this universal set ε,

- set A is the multiples of 2
- set B is the multiples of 4
- set C is the multiples of 5

(a) Complete the Venn diagram.   [3]
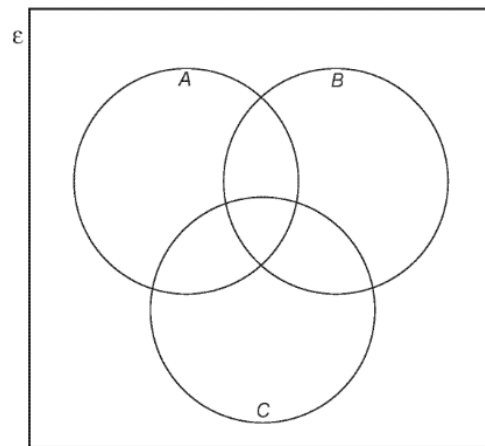
4. Place the whole numbers 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 in the correct positions in the Venn diagram.   [3]
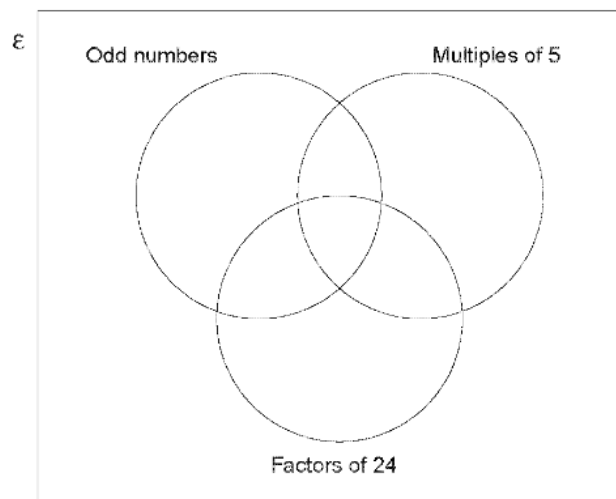
Two Set Practical Problems

A garage has 50 cars for sale. 15 of the cars have both air conditioning and cruise control. 31 of the cars have air conditioning. 17 of the cars have cruise control. Draw a Venn diagram to represent this information.

(a) How many cars do not have air conditioning or cruise control?

(b) How many cars have air conditioning but not cruise control?

90 people in a sports club were surveyed. 19 play tennis and squash. 50 play tennis. 32 play squash. Draw a Venn diagram to represent this information.

(a) How many people do not play squash, but do play tennis?

(b) How many people play neither squash nor tennis?

There are 16 people in a queue. Two are wearing both a hat and a scarf. Eight are wearing a hat. Seven are wearing neither a hat nor a scarf. Draw a Venn diagram to represent this information.

(a) How many people are wearing a scarf?

(b) How many people are wearing either a hat or a scarf or both?

The Venn shows how many students in a class play football (F) or hockey (H).
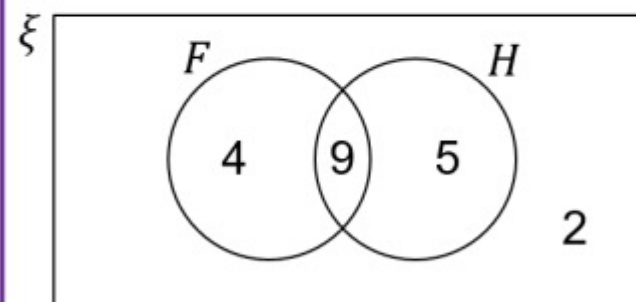
(a) How many students play both sports?

(b) Write down $n(H')$

(c) Write down $n(F' \cap H)$

Harder Two Set Practical Problems

There are 30 students in a class. 18 study Spanish. 13 study German. 7 study neither Spanish nor German. Complete the Venn diagram to represent this information and find the number of students who study Spanish and German.
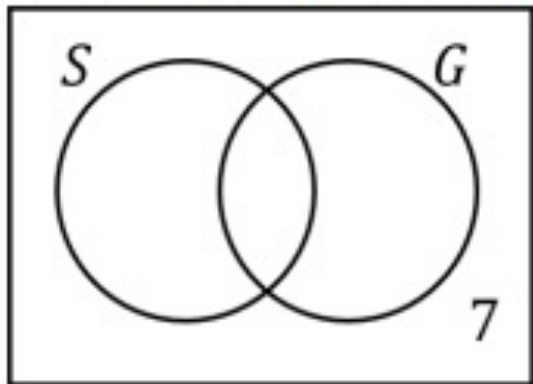
In a group of 25 people, 8 said they had been to the theatre recently. 15 said they had been to the library recently, and 10 said they had been to neither the theatre or the library recently. Draw a Venn diagram to represent this information and find the number of people who had only been to the library recently.

In a class of 30 students, 15 play football and 11 play tennis. Twice as many students play neither sport as play both sports. Draw a Venn diagram to represent this information and find the number of students who play both football and tennis.

There are 50 cars in a car park. 40% of the cars are Fords. Of the Fords, 6 were white. There were three times as many cars that were neither white nor Ford as there were white Fords. Draw a Venn diagram to represent this information. Find:
(a) the number of cars that were white, but not Fords.
(b) the number of cars that were Fords, but not white.

Three Set Practical Problems

In a group of 100 students, 42 study Statistics, 40 study Mathematics, and 50 study Physics. 21 study Mathematics and Physics, 19 study Statistics and Physics, 17 study Statistics and Mathematics and 5 study all three.

Draw a Venn diagram to represent this information.

(a) How many students study only **one** of these subjects?

(b) How many students study none of these subjects?

A group of 200 adults were asked which types of magazines they read. Their replies showed that 82 read Sports magazines, 80 read Garden magazines, and 84 read Fashion magazines. 36 read Sports magazines and Garden magazines. 31 read Sports magazines and Fashion magazines. 25 read Garden magazines and Fashion magazines. 14 read all three magazines.

(a) How many adults read Sports and Garden magazines, but not Fashion magazines?

(b) How many adults reads exactly two of these types of magazine?

There are 3 clubs - chess, drama and art. All the members of a group of 35 students belong to at least one club. 8 of the students belong to only art club. 6 of the students belong to all 3 clubs. 3 of the students belong to chess and art clubs but not to drama club. 18 of the students belong to art club. 3 of the students belong only to chess club. 4 of the students belong only to drama club.

(a) How many students belongs to chess club and to drama club but not to art club?

(b)   How many students belong to chess club?

Probability and Two Set Venns

The Venn diagram shows information of 150 patients in a local surgery. They were asked if they took any medication for cholesterol (C) or blood pressure (B).
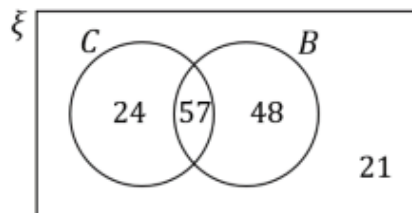
A patient is chosen at random.
(a) Work out the probability that a patient took neither medication.
(b) Work out the probability that a patient took cholesterol not but blood pressure medication.
(c) Given that the patient took blood pressure medication, what is the probability that they also took cholesterol medication?

90 people in a sports club were surveyed. 19 play tennis and squash. 50 play tennis. 32 play squash.
(a)   Represent this with a Venn diagram.
One person is chosen at random.
(b)   Work out the probability that the person chosen does not play tennis
(c) Work out the probability that the person chosen plays tennis or squash or both.
(d) Given that the person plays tennis, work out the probability that they also play squash.

In a group of 40 children there are 19 who can swim and 16 who can ride a bike. There are 5 children who can swim and ride a bike.
(a) Draw a Venn diagram.
A child is selected at random.
(b)   Find the probability that this child cannot swim or ride a bike.
Another child is selected at random.
(c)   Given that this child can ride a bike, work out the probability that this child can swim.

Probability and Three Set Venns

90 children were asked they had in their packed lunch. Their replies are as follows: 38 had sandwich, crisps and cake. 60 had sandwich and a cake. 52 had sandwich and crisps. One student had crisps and cake only, and 5 students had a sandwich only. 10 students had none of these items in their packed lunch.
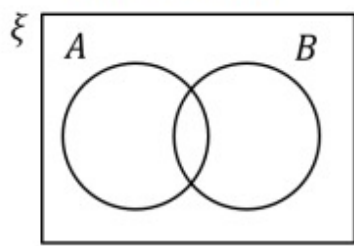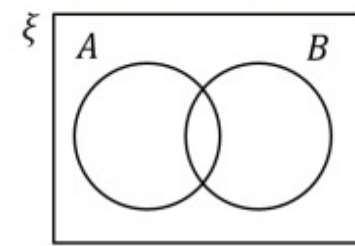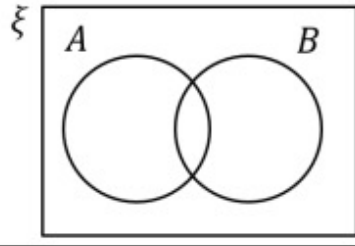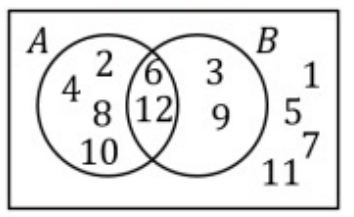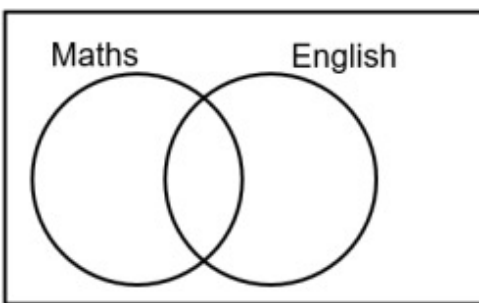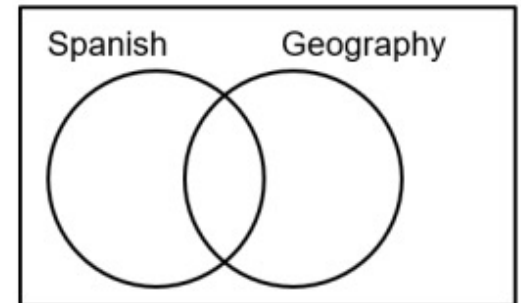
(a) Show this on a Venn diagram.
(b) Find the probability that a child chosen at random has both crisps and cake in their packed lunch.
(c) Given that a child had a sandwich, find the probability that this child also had crisps.

100 people were asked which sports they watched on television. Here are the results.
36 people watched cricket, 28 people watched rugby, 36 people watched football, 17 people watched both cricket and rugby, 19 people watched both cricket and football, 15 people watched both rugby and football, and 10 people watched all three sports.
(a) Draw a Venn diagram.
(b) One of the 100 people is selected at random. Find the probability that they watch none of these sports.
(c) Given that a person watches cricket, find the probability that this person also watches football.
(d) Given that a person watches at least one of the sports, find the probability that this person watches all three.

Sets and Venns Revision

(a)	(b)	(c)	(d)
$\xi = \{1,2,3,4,5,6,7,8,9,10\}$ $A = \{1,2,3,4,5,6\}$ $B = \{even\ numbers\}$ List the members of $A \cap B$	$\xi = \{1,2,3,4,5,6,7,8,9,10\}$ $A = \{factors\ of\ 9\}$ $B = \{multiples\ of\ 4\}$ List the members of $A \cup B$	$\xi = \{1,2,3,4,5,6,7,8,9,10\}$ $A = \{factors\ of\ 9\}$ $B = \{multiples\ of\ 4\}$ Anna says that $A \cap B = \emptyset$. Is she correct?	$A = \{1,3,5,7,9\}$ $A \cap B = \{1,3\}$ $A \cup B = \{0,1,2,3,4,5,7,9\}$ List the members of B

(e)	(f)	(g)	(h)
Shade the region which represents $A \cap B'$	Shade the region which represents $A' \cup B$	Show in a Venn diagram. $\xi = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ $A = \{1, 4, 9, 10\}$ $B = \{2, 4, 6, 8, 10\}$	List the members of B' and $A' \cap B'$

(i)	(j)
In a group of 20 students, 11 like Maths and 10 like English. 2 like neither subject. (a) Complete the Venn diagram. (b) How many students like Maths but not English?	There are 32 students in a class. 21 students like Spanish and 15 like Geography. There are twice as many students who like both subjects as like neither. (a) Complete the Venn diagram. (b) How many students like only Spanish?

One of these students is selected at random.

(*a*) Show that the probability that the student reads more than one magazine is $\frac{1}{6}$. **(2)**

(*b*) Find the probability that the student reads *A* or *B* (or both). **(2)**

(*c*) Write down the probability that the student reads both *A* and *C*. **(1)**

Given that the student reads at least one of the magazines,

(*d*) find the probability that the student reads *C*. **(2)**

3. **[Edexcel S1 Jan 2010 Q4]** There are 180 students at a college following a general course in computing. Students on this course can choose to take up to three extra options.

   112 take systems support,
   70 take developing software,
   81 take networking,
   35 take developing software and systems support,
   28 take networking and developing software,
   40 take systems support and networking,
   4   take all three extra options.

1. **[JMC 2002 Q11]** The Pythagoras School of Music has 100 students. Of these, 60 are in the band and 20 are in the orchestra. Given that 12 students are in both the band and the orchestra, how many are in neither the band nor the orchestra?

2. **[Edexcel S1 May 2010 Q4]** The Venn diagram in Figure 1 shows the number of students in a class who read any of 3 popular magazines *A*, *B* and *C*.

(*a*) Draw a Venn diagram to represent this information. **(5)**

A student from the course is chosen at random. Find the probability that the student takes

(*b*) none of the three extra options, **(1)**

(*c*) networking only. **(1)**

Students who want to become technicians take systems support and networking. Given that a randomly chosen student wants to become a technician,

(*d*) find the probability that this student takes all three extra options. **(2)**

4. **[Edexcel S1 May 2008 Q5]** A person's blood group is determined by whether or not it contains any of 3 substances *A*, *B* and *C*.

A doctor surveyed 300 patients' blood and produced the table below.

Blood contains	No. of Patients
only *C*	100
A and *C* but not *B*	100
only *A*	30
B and *C* but not *A*	25
only *B*	12
A, *B* and *C*	10
A and *B* but not *C*	3

(*a*) Draw a Venn diagram to represent this information. **(4)**

(*b*) Find the probability that a randomly chosen patient's blood contains substance *C*. **(2)**

Harry is one of the patients. Given that his blood contains substance *A*,

(*c*) find the probability that his blood contains all 3 substances. **(2)**

Patients whose blood contains none of these substances are called universal blood donors.

(*d*) Find the probability that a randomly chosen patient is a universal blood donor. **(2)**

only C	100
A and C but not B	100
only A	30
B and C but not A	25
only B	12
A, B and C	10
A and B but not C	3

5. **[Edexcel S1 Jan 2008 Q5]** The following shows the results of a wine tasting survey of 100 people.

96 like wine A, 93 like wine B,
96 like wine C, 92 like A and B,
91 like B and C, 93 like A and C,
90 like all three wines.

(a) Draw a Venn Diagram to represent these data. **(6)**

Find the probability that a randomly selected person from the survey likes

(b) none of the three wines, **(1)**
(c) wine A but not wine B, **(2)**
(d) any wine in the survey except wine C, **(2)**
(e) exactly two of the three kinds of wine. **(2)**

Given that a person from the survey likes wine A,

(f) find the probability that the person likes wine C. **(3)**

6. **[Edexcel S1 May 2006 Q6]** A group of 100 people produced the following information relating to three attributes. The attributes were wearing glasses, being left-handed and having dark hair.

Glasses were worn by 36 people, 28 were left-handed and 36 had dark hair. There were 17 who wore glasses and were left-handed, 19 who wore glasses and had dark hair and 15 who were left-handed and had dark hair. Only 10 people wore glasses, were left-handed and had dark hair.

(a) Represent this on a Venn diagram. **(6)**

A person was selected at random from this group. Find the probability that this person

(b) wore glasses but was not left-handed and did not have dark hair, **(1)**
(c) did not wear glasses, was not left-handed and did not have dark hair, **(1)**
(d) had only two of the attributes, **(2)**
(e) wore glasses, given they were left-handed and had dark hair. **(3)**

7. **[Edexcel S1 Jan 2005 Q5]** Articles made on a lathe are subject to three kinds of defect, A, B or C. A sample of 1000 articles was inspected and the following results were obtained.

31 had a type A defect
37 had a type B defect
42 had a type C defect
11 had both type A and type B defects
13 had both type B and type C defects
10 had both type A and type C defects
6 had all three types of defect.

(a) Draw a Venn diagram to represent this. **(6)**

Find the probability that a randomly selected article from this sample had

(b) no defects, **(1)**
(c) no more than one of these defects. **(2)**

An article selected at random from this sample had only one defect.

(d) Find the probability that it was a type B defect. **(2)**

Two different articles were selected at random from this sample.

(e) Find the probability that both had type B defects. **(2)**

☠ *[SMC 2011 Q17]* Jamie conducted a survey on the food preferences of pupils at a school and discovered that 70% of the pupils like pears, 75% like oranges, 80% like bananas and 85% like apples. What is the smallest possible percentage of pupils who like all four of these fruits?

A. At least 10%   B. At least 15%

C. At least 20%   D. At least 25%

E. At least 70%

ts

1. Draw a Venn diagram to represent each set of information

a.
There are 80 students.
9 students study French (F) and German (G).
35 students only study French.
2 students do not study French or German.

b.
50 children were eating lunch.
11 students only had chips (C).
20 students only had a burger (B).
13 students had both chips and a burger.

c.
In a group of 24 students,
13 like only oranges (O).
2 like only bananas (B).
4 don't like oranges or bananas.

d.
There are 32 students.
24 students study History (H), Geography (G) or both.
15 students only study History.
5 students only study Geography.

2. Draw a Venn diagram to represent each set of information

a.
40 people were asked if they had a cat (C)
or a dog (D).
10 people owned both pets.
17 people owned a cat.
14 people didn't own either pet.

b.
110 workers were asked if they liked tea (T)
or coffee (C).
90 workers liked tea.
41 worked liked coffee.
25 worked like tea and coffee.

c.
In a class of 24 students,
12 students play the piano (P).
13 students play the guitar (G).
4 students play neither instrument.

d.
100 people were asked if they had visited
Rome (R) or Paris (P).
38 had been to Rome.
80 had been to Paris.
11 had not been to either city.

3. Draw a Venn diagram to represent each set of information

a.
32 students were asked which club they belong to.
6 students are only part of the art club (A).
2 students are only part of the chess club (C).
3 students are only part of the drama club (D).
5 students belong to all three clubs.
2 students are part of the art and chess clubs, but not the drama club.
15 student is part of the art and drama clubs, but not the chess club.
7 students are not part of any of the clubs.

b.
60 people were asked which fruits they liked.
40 people said they liked melons (M).
42 people said they liked pears (P).
25 people said they liked strawberries (S).
6 people said they liked all three fruits.
20 people said they liked melons and pears, but not strawberries.
10 people said they liked pears and strawberries, but not melons.
6 people said they liked melons and strawberries, but not pears.

4. Find the value of x, and then find the frequency of each region.

a.
150 students were asked whether
they studied French or German.

ξ F [$2x+3$ (19) $x+9$] G 56
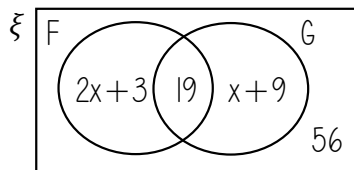
b.
30 people were asked whether
they had a dog (D) or a cat (C).

ξ C [$2x$ (x) $x+9$] D $2x-3$
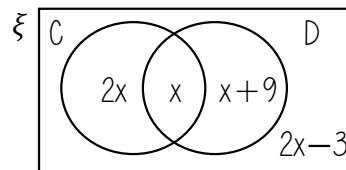
3. Write down the members of each set

a.
P = {11, 13, 15, 17}
Q = {12, 14, 16}
R = {4, 8, 12, 16}

(i)   Q ∪ R
(ii)   P ∪ Q
(iii) Q ∩ R

b.
F = {m, i, l, a, n}
G = {t, u, r, i, n}
H = {r, o, m, e}

(i)   G ∩ H
(ii)   F ∪ H
(iii) G ∪ F

c.
X = {Odd numbers less than 10}
Y = {3, 6, 9, 12, 15, 18, 21}
Z = {2, 3, 5, 7, 9, 11, 13, 17, 19}

(i)   X ∪ Z
(ii)   Y ∩ Z
(iii) X ∩ Y ∩ Z

d.
A = {multiples of 3 less than 17}
B = {multiples of 2 less than 17}
C = {multiples of 5 less than 17}

(i)   A ∪ C
(ii)   A ∩ B
(iii) B ∩ C

Janice is a professional tennis player. In a year, she played 120 matches. She won the first set in 75% of the matches she played.

Janice went on to win 80% of the matches where she won the first set.

Of the matches where she lost the first set, Janice went on to win only two-fifths of those.

a) Draw a frequency tree to show this information.
b) One of Janice's matches is selected at random. What is the probability that Janice lost the first set but won the match?

Alpha Exercise

There are 200 students in a year group. 182 pass their Maths exam at the end of the year. Of these, 179 pass their English exam. Of those who failed their Maths exam, 16 also failed their English exam. This information is shown in the frequency tree.
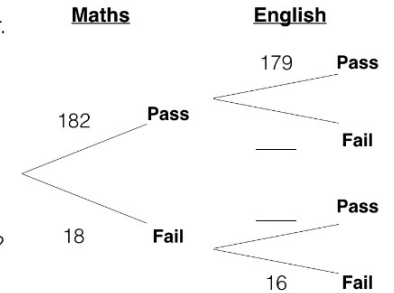
a) Fill in the two missing numbers in the frequency tree.
b) How many students failed both subjects?
c) How many students passed at least one subject?

Maths   **English**

182 — **Pass** — 179 — **Pass**
                        ____ — **Fail**

18 — **Fail** — ____ — **Pass**
                        16 — **Fail**

Beta Exercise

150 people were asked if they ate breakfast that morning. They were then asked if they rated their choice of lunch as "healthy" or "unhealthy".

Of the 72 people who had eaten breakfast, 54 rated their lunch as "healthy". One third of those who hadn't eaten breakfast thought their lunch was healthy.

a) Complete the frequency tree to show this information.
b) Find the probability that a randomly selected person from the survey thought their lunch was healthy.

Ate breakfast?   **Lunch**

Yes — Healthy
      Unhealthy

No — Healthy
     Unhealthy
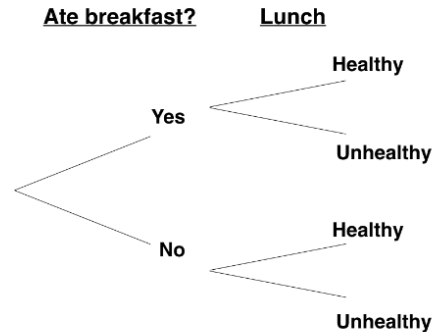
Gamma Exercise

A group of 72 people at a conference are served hot drinks. Two-thirds of the group chose coffee and the rest chose tea. Of those who chose coffee, 25% took sugar. Of those who chose tea, only one-eighth took sugar.

a) Draw a frequency tree to show this information.
b) One individual is selected at random. What is the probability that they added sugar to their drink?
c) One individual is selected at random. What is the probability that this individual had coffee without sugar?

(5) There are 130 people at a party. 20% are adults and the rest are children. Half of the adults take food and 2/13 of the children take food.

(a) Explain why 15% of the people can't be adults.

(b) Draw a frequency tree in the space below to show the information given.

Exam-style question

In the city of Southwood, it is estimated that there are 90,000 cars. Of these, 80% are petrol-powered and 20% are diesel-powered.

10% of diesel cars exceed pollution limits and that 5% of petrol cars exceed pollution limits.

a) Draw a frequency tree to show this information.
b) How many cars exceed the pollution limits in total?
c) A car is selected at random. What is the probability that it is a diesel car that does not exceed the pollution limits?

(c) Write the ratio of the number of adults bringing food to the number of children bringing food.

(d) What percentage of party goers were adults who took food?

(6) In a toy box there are pink toys and black toys. The toys are either electronic or they are manual. The frequency tree shows some information about the toys below.
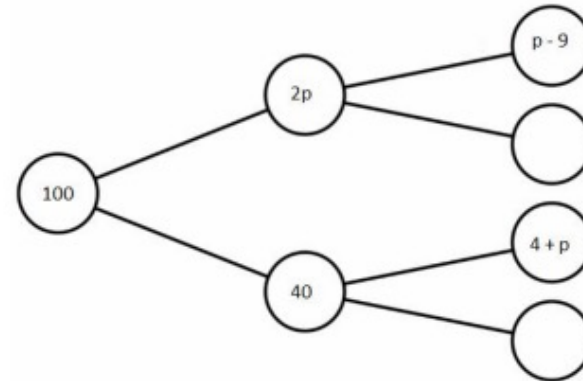
There are 40 black toys in the box.

Of the black toys 6 are manual.

(a) Complete the frequency tree above.

(b) One black electronic toy is taken from the box. What proportion of the toys left in the box are pink manual toys?

(c) Write the ratio of pink toys to black toys in its simplest form.

(d) n pink toys are removed from the box. What proportion of the toys in the box are now pink?

(e) K% of the items are electronic pink toys. Find the value of K.

Frequency Trees	Probability Trees: Unconditional	Probability Trees: Conditional
1A) A theme park recorded ticket sales on the weekend & whether it was upgraded to a fastpass.	**1B)** A dice is rolled twice.	**1C)** 10 cards are numbered 1-10. Two cards are picked simultaneously.

1A diagram labels: fastpass, Saturday, ordinary 37, 96, fastpass, Sunday 43, 34, ordinary
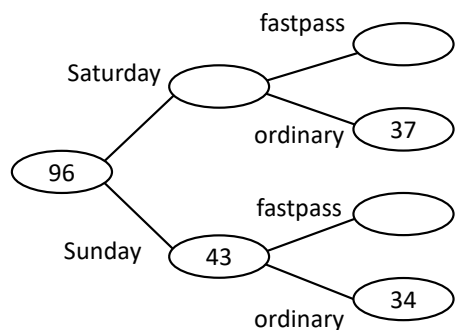
P(A ticket was bought on Saturday) =
P(A ticket on Sunday was a fastpass) =

1B diagram labels: $\frac{1}{6}$, 6, $\frac{1}{6}$, 6, 6, X, 6, X, X, X
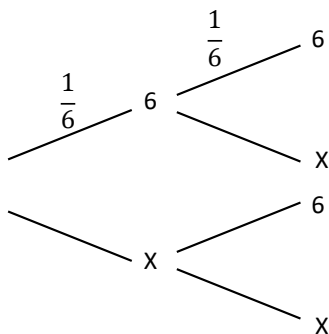
P(2 sixes) =
P(Exactly one six) =
P(1 or more sixes) =

1C diagram labels: O, O, E, O, E, E
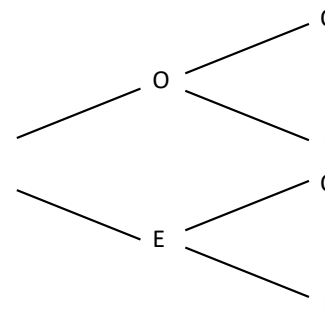
P(Both odd numbers) =
P(1 odd number & 1 even number) =
P(Both odd, or both even) =

2A) Ms Doolittle recorded end-of-year results for Art, Drama & Music.

diagram labels: pass 28, Art, fail, pass 46, Drama, fail 13, 154, pass 36, Music 60, fail
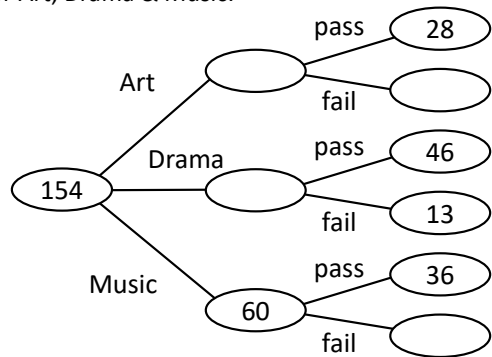
Did a greater proportion of Art students pass compared to Music students?
P(A student failed) =
P(A passing student took Drama) =

2B) Amir & Jo will both take a driving test.

diagram labels: Amir, Jo, $\frac{4}{7}$, Pass, $\frac{5}{9}$, Pass, F, P, F, F
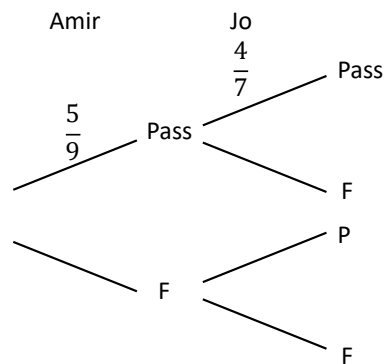
P(They both pass) =
P(Only one passes) =
P(They get the same result) =

2C) P(Sophie wins her first tennis match) = 0.7 If she wins that match, the probability she wins her next match is 0.8 If she loses, that probability changes to 0.4

P(Wins then loses) =
P(Wins or loses both) =
P(Wins at least 1) =

1. A bag contains 6 blue counters and 4 green counters. One is picked and then replaced. A second is then picked. **Complete the tree diagram below.**
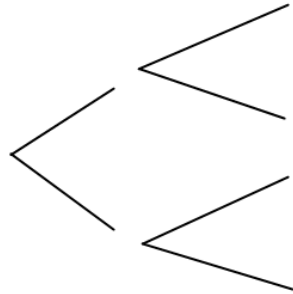
2. A box of chocolates contains three dark chocolates and two white chocolates. A chocolate is picked and then replaced. A second chocolate is then picked. **Complete the tree diagram below**
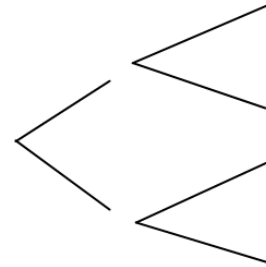
3. A wallet contains 2 gold coins and 8 silver coins. A coin is picked at random and then replaced. A second coin is then picked. **Draw a probability tree. What is the probability of getting two silver coins?**

4. Two suitcases each contain 3 hoodies and 9 t-shirts. An item of clothing is picked at random from both suitcases. **Draw a probability tree and calculate the probability of picking two t-shirts.**

5. A fair coin is thrown twice. **What is the probability of getting one head and one tail?**

6. A bag contains 5 red balls and 3 blue. A ball is picked at random and then replaced. A second ball is then picked. **Draw a probability tree. What is the probability that**

   a) **Both balls are red?**

   b) **Both balls are blue?**

   c) **One of each?**

7. There are 4 banana smoothies and three apple smoothies in a box. Jennie takes a random smoothie from a box then replaces it. She then takes another. **What is the probability that the smoothies will be the same flavour?**

8. There are 10 books on a shelf. 7 are fiction and 3 are non-fiction. A member of the public takes a book at random, looks at it, then replaces it. They then take another book. **What is the probability that**

a) **Both books are non-fiction?**

b) **Both books are fiction?**

c) **one of each?**

9. The probability that a biased coin will show heads is 0.4. It is flipped twice. **What is the probability that the coin will show heads on both flips?**

10. Suitcase A contains 3 hats and 7 t-shirts. Suitcase B contains 8 hats and 2 t-shirts. You randomly take an item of clothing from both suitcases. **What is the probability that you will have one hat and one t-shirt?**

Extension: A bag contains 5 red balls and 3 blue. A ball is picked at random and then **not** replaced. A second ball is then picked. **Draw a tree diagram. What is the probability of picking at least one red ball?**

1. A bag contains 6 yellow balls (Y) and 4 green balls (G). One ball is taken out at random and not put back. A second ball is then taken out. Copy and complete the tree diagram:
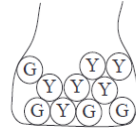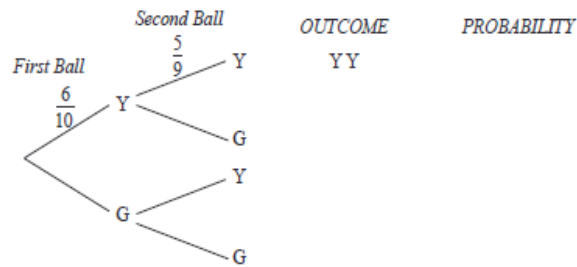
a. Calculate P(2 yellow balls)
b. Calculate P(2 green balls)
c. Calculate P(a green ball and a yellow ball in any order)

2. A drawer contains 8 green socks and 10 blue socks. One sock is taken out of the drawer at random and not replaced. A second sock is then taken out. Draw a probability tree and determine the probability that two socks of the same colour have been taken out of the drawer.

3. A bag contains 9 blue balls and 3 red balls. A ball is selected at random from the bag and its colour is recorded. The ball is not replaced. A second ball is selected at random and its colour is recorded. Draw a tree diagram to represent this information.

   Find the probability that
   (a)   both balls selected are red
   (b)   the second ball selected is red

4. A packet contains stamps from three different countries. The packet contains 4 Spanish stamps, 10 French stamps and 6 German stamps. Two stamps are to be removed, without replacement. By drawing a probability tree, calculate the probability that both stamps will be from the same country.

5. In a village, 3/5 of the pensioners have had a flu jab. If a pensioner has had the flu jab, the probability of catching flu is 1/30. If a pensioner has **not** had the flu jab, the probability of catching flu is 7/10.
   a) Calculate the probability that a pensioner, picked at random from this village, catches flu.
   b) A statistician calculated that 120 pensioners from this village are expected to catch flu. Calculate how many pensioners live in the village.

6.   After a flood, Debbie finds that all the labels have come off the tins in her cupboard. Debbie knows that she had 5 tins of tomatoes and 7 tins of baked beans. She opens 3 tins at random. What is the probability that she has opened 2 tins of baked beans and one tin of tomatoes?

7. A captain and five remaining passengers remain aboard a sinking ship. There are three lifejackets remaining. The captains knows that three of the passengers cannot swim. In his panic, the captain forgets who the non-swimmers are and hands out the lifejackets randomly to three of the five passengers. What is the probability that the gives the lifejackets to just two of the three non-swimmers?

1　A box contains 3 red discs, 5 blue discs and 6 green discs. I remove one disc at random, note its colour then return it to the box. I then remove a second disc at random.

   (a) Find the probability that both discs are the same colour.

   (b) Find the probability that exactly one disc is red.

   (c) If I take a total of 5 discs, replacing the disc each time, find the probability that all 5 discs are red.

2　Another box contains 4 yellow discs and 7 black discs. I remove one at random, place it in my pocket then remove a second disc at random.

   (a) Find the probability that the discs are different colours.

   (b) If I take a total of three discs, find the probability that:

   　　　(i) all are yellow　　　(ii) all three are different colours.

3　A bag contains some red balls, some blue balls and some green balls. When a ball is removed at random the probability that it is red is $\frac{1}{3}$ and the probability that it is blue is $\frac{2}{9}$. There are more than 30 balls in the box. What is the fewest number of green balls?

4　Each morning the probability that Anna gets up late is $\frac{1}{5}$. If she gets up late the probability that misses her bus is $\frac{5}{6}$. If she doesn't get up late the probability that she misses her bus is $\frac{1}{4}$.

   (a) Find the probability that, on Monday morning, she misses her bus.

   (b) Find the probability that she catches her bus every morning from Monday to Friday.

5　A box contains some red ball and some blue balls. There are four more blue balls than red balls. A ball is removed at random, replaced and a second ball randomly removed. The probability that the two balls are different colours is $\frac{21}{50}$. How many balls of each colour are in the box?

6　A box contains some white balls and some blue balls. There are 5 more blue balls than white balls. One ball is removed at random and not replaced. A second ball is then removed at random. The probability that the balls are different colours is $\frac{52}{105}$. Find the probability that both balls are white.

7　A prize must be randomly awarded to just one of a group of ten people. Which of the following methods is the fairest?

   A: Fold 10 identical pieces of paper in half and put them in a bag. Nine have 'LOSE' written on them and one has 'WIN'. Line the people in alphabetical order. The first person randomly takes a piece of paper. If it says 'WIN' they are the winner and the game stops there. If it says 'LOSE' they do not replace the paper and the next person has a go.

   B: Same as 'A' but this time the paper is put back in the bag before the next person has a go.

   C: Same as 'B', that is each piece of paper is returned to the bag, but there are 999 'LOSE' papers and one 'WIN' paper.

1. A spinner has four equally sized sectors: three grey and one white. The spinner is to be spun twice.
(a) Complete the tree diagram.

G — G   P(GG) =

G — W   P(GW) =

W — G

W — W
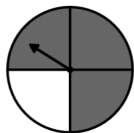
(b) Work out the probability that the spinner will land on the same colour on both spins.

(c) Work out the probability that the spinner will land on grey on at least one of the spins.

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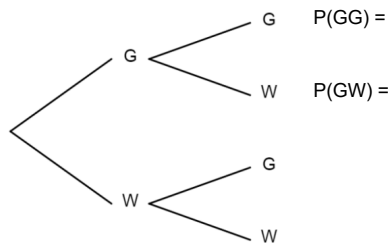
2. Simon has a biased coin, which has a probability of 0.68 of landing on heads. He is going to flip the coin twice.
(a) Complete the tree diagram.

H

T

(b) Shade the true statements.

| The probability of the coin landing on heads twice is greater than 50%. |
| The probability of two tails is a quarter of the probability of two heads. |
| P(HT) = P(TH). |
| The probability that the coin lands on heads at least once is 0.90 (correct to 2 d.p.) |

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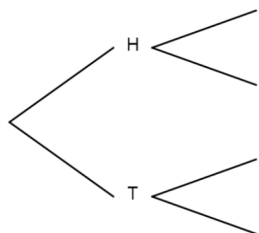
3. Angela is playing a game with two fair dice. She rolls both dice and wins a point for each die that lands on a multiple of 3.
(a) Complete the tree diagram, in which M stands for a multiple of 3.

M — M

M — M'

M' — M

M' — M'

(b) Work out the probability that Angela scores 2 points.

(c) Work out the probability that Angela scores at least 1 point.

(d) Work out the probability that Angela scores no points.

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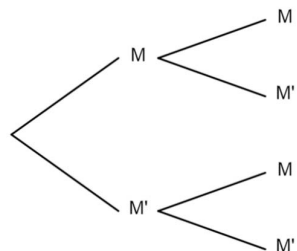
4. A pack of cards contains red and blue cards only. Sally is going to pick a card at random, replace it and then pick another. A tree diagram for this situation is shown.

There are 18 red cards in the pack. How many blue cards are there?

$\frac{5}{8}$ Blue — $\frac{5}{8}$ Blue
$\frac{5}{8}$ Blue — $\frac{3}{8}$ Red
$\frac{3}{8}$ Red — $\frac{5}{8}$ Blue
$\frac{3}{8}$ Red — $\frac{3}{8}$ Red

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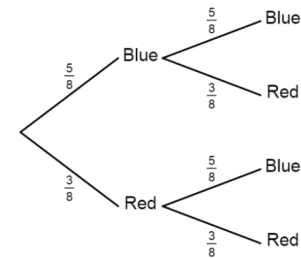
5. Liam coaches a football team. Based on their past performance, he works out that the team have a 44% probability of winning each match and a 21% probability of drawing.

(a) Complete the tree diagram for the team's next two matches.

(b) Work out the probability that the team will not lose either of their next two matches.

W — W
W — D
W — L
D — W
D — D
D — L
L — W
L — D
L — L

---
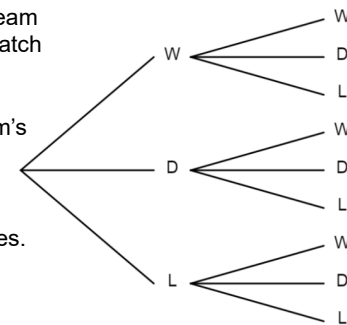
6. A fair coin is to be flipped three times.
(a) Complete the tree diagram.

(b) Work out the probability that the coin lands on heads exactly twice.

(c) Work out the probability that the coin lands on tails at least once.

H — H — H
H — H — T
H — T — H
H — T — T
T — H — H
T — H — T
T — T — H
T — T — T

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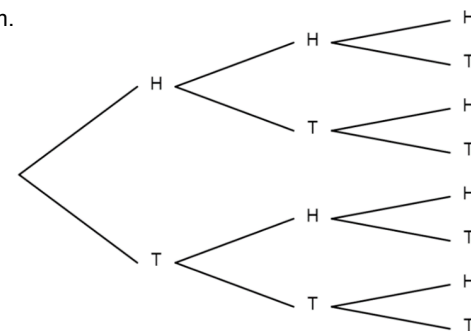
7. John cycles to and from work. He passes a level crossing on his route, which has the gates closed 8% of the time. Work out the probability that on a given day the gates are closed on at least one of his two journeys.

1. A box contains 8 milk chocolates and 4 plain chocolates. Linda is going to choose a chocolate at random, eat it, and then choose a second.
(a) Complete the tree diagram.
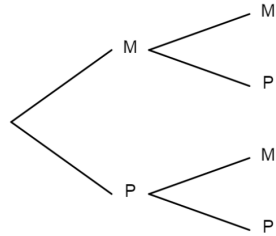
(b) Work out the probability that Linda will choose two milk chocolates.

(c) Work out the probability that Linda will choose one of each type of chocolate.

2. A bag contains five counters: three white and two black. Two counters are selected from the bag at random at the same time.
(a) Complete the tree diagram.
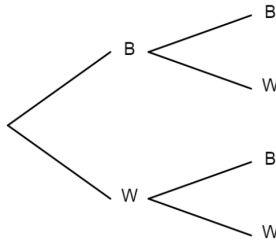
(b) Work out the probability that the counters will be the same colour.

(c) Work out the probability that the counters will be different colours.

3. Two boxes contain grey and white marbles, as shown. A box is chosen at random and then a marble from the box is chosen.
(a) Complete the tree diagram.
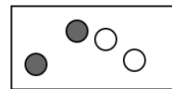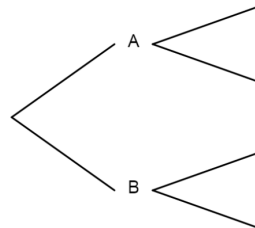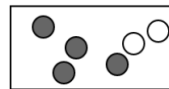
Box A   **Box B**

(b) Work out the probability that a grey marble is selected.

(c) Work out the probability that a white marble is selected.

4. Two bags contain black and white counters as shown.

A counter is to be picked at random from Bag A and placed into Bag B. A counter is then to be picked from Bag B.

Work out the probability that the counter picked from Bag B will be white.

Bag A   Bag B
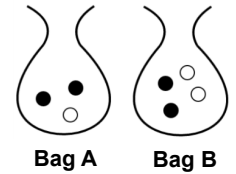
5. Two boxes contain black and white counters as shown.

A counter will be picked from Box A and placed into Box B.
A counter will then be picked from Box B and placed into Box A.

(a) Work out the probability that Box A will end up containing 3 white counters.

Box A

(b) Work out the probability that Box A will end up containing exactly 2 white counters.
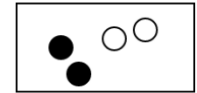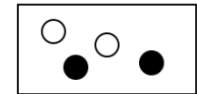
Box B

6. A jar contains eight 10p coins and six 5p coins. Three coins are picked at random from the jar, without replacement.

(a) Work out the probability that the total value of the three coins is 30p.

(b) Work out the probability that the total value of the three coins is 15p.

(c) Work out the probability that at least one of each type of coin is picked.

7. Each day, there is a 40% chance that Luke will cycle to work, otherwise he will take the bus.

If he cycles, there is a 5% chance he will arrive late. If he takes the bus, there is a 15% chance he will arrive late.

(a) Work out the probability that Luke will arrive late to work on any given day.

(b) Given that Luke was late one day, work out the probability that he had cycled on this day.

8. A particular disease affects 5% of the trees in a forest.

A test on a sample from the tree has a 90% chance of showing a positive result if the tree is diseased. The test has a 15% chance of showing a positive result if the tree is not diseased.

(a) Work out the probability that the test will show a positive result for a randomly selected tree.

(b) Given that the test on a tree sample has returned a positive result, work out the probability that the tree is diseased.

6. A bag contains red and blue counters.
There are n red counters and twice as many blue counters.

(a) Two counters are picked at random without replacement.
Work out the probabilities (in terms of n) for the tree diagram.
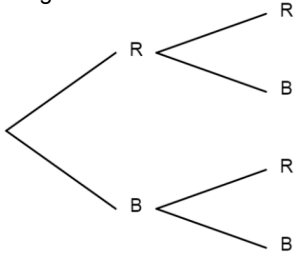
The probability that the counters are both red is $\frac{1}{10}$.

(b) Work out the value of n.

---

7. A bag contains yellow and red sweets in the ratio 1 : 4.

If two counters are picked at random (without replacement), the probability that they will both be yellow is $\frac{1}{35}$.

Work out how many yellow sweets are in the bag.

8. A bag contains black and white tokens.
There are 3 times as many white tokens as back discs.

If two tokens are picked at random (without replacement), the probability that they will be the same colour is $\frac{3}{5}$.

Work out how many black tokens are in the bag.

---

9. A bag contains n counters. 5 of the counters are blue and the rest are pink.

If two counters are picked at random (without replacement), the probability that they will both be blue is $\frac{5}{18}$.

(a) Show that $n^2 - n - 72 = 0$.

(b) Work out the value of n.

---

10. A bag contains n counters. 8 of the counters are green and the rest are yellow.

If two counters are picked at random (without replacement), the probability that they will be different colours is $\frac{16}{45}$.

(a) Show that $n^2 - 46n + 360 = 0$.

(b) Work out the two possible values of n.

---

11. A bag contains n red counters and 3 yellow counters.

If two counters are picked at random (without replacement), the probability that they will both be red is $\frac{5}{12}$.

(a) Show that $7n^2 - 37n - 30 = 0$.

(b) Work out the value of n.

---

12. A bag contains 5 gold counters and at least one silver counter.

If two counters are picked at random (without replacement), the probability that they will be the same colour is $\frac{2}{3}$.

Work out the two possible numbers of silver counters.

Examples

Workout

Click here   **Scan here**

Question 1:   A fair coin is flipped twice.

(a) Find the probability that the coin lands on heads twice.
(b) Find the probability that the coin lands on tails twice.
(c) Find the probability that the coin lands on heads exactly once.

Question 2:   Penelope is playing football.
When attempting to score a penalty, the probability she scores is $\frac{2}{3}$

During the game, Penelope takes two penalties.
Find the probability that Penelope scores both.

Question 3:   Trevor is taking part in a quiz.
The probability that he answer a question correctly is $\frac{3}{5}$

Trevor is asked two questions.

(a) Calculate the probability that Trevor answers both questions correctly.
(b) Calculate the probability that Trevor answers both questions incorrectly.

Question 4:   Daisy has a biased spinner.
The probability of each colour is:

Colour	Red	White	Black	Brown
Probability	0.1	0.4	0.3	0.2
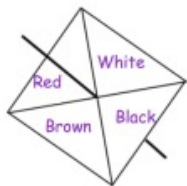
Daisy spins the spinner twice.

(a) Find the probability of the spinner landing on white twice.
(b) Find the probability of the spinner landing on black and then brown.
(c) Find the probability of the spinner landing on the same colour in both spins.

Question 5:   A fair six sided dice is rolled three times.

(a) Find the probability of getting a two all three times.
(b) Find the probability of getting no twos

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Question 6:   Mark is playing darts.
The probability he hits the bullseye is 0.4
Mark throws two darts

(a) Find the probability of Mark hitting the bullseye once.
(b) Find the probability of Mark hitting the bullseye at least once.

Question 7:   A bag contains five yellow sweets, three green sweets and one purple sweet.
A sweet is taken out of the bag and replaced.
Another sweet is taken out.

(a) Find the probability that both sweets are yellow.
(b) Find the probability of neither sweet is green.
(c) Find the probability that the two sweets are different colours.

Question 8:   The probability of a bus being on time is $\frac{3}{4}$

Archie catches the bus to work three times each week.

(a) Work out the probability that the bus is late every time.
(b) Work out the probability that the bus is on time every time.
(c) Work out the probability that the bus is late exactly once.

Question 9:   Jackson, Frederick and Kelvin each sit a test.

The probability Jackson passes is $\frac{9}{10}$

The probability Frederick passes is $\frac{2}{3}$

The probability Kelvin passes is $\frac{1}{2}$

(a) Find the probability that Jackson and Kelvin pass, but Fredrick fails.

(b) Find the probability that Frederick passes, but Jackson and Kelvin fail.

(c) Find the probability that at least two boys pass.

Question 10: The probability that Dylan reads at night is $\frac{4}{5}$

Calculate the probability that Dylan reads every night in one week.

Corbett maths

Apply

Question 1: Amelia is organising a game for a charity fête.
She has put 1 orange, 1 pink, 1 green and 2 yellow counters into a bag.

To play, each person will pay £1 and take out a counter at random.
They will then replace the counter and then take a second counter at random.
The person will win £2.50 if both counters are the same colour.

Amelia expects 200 people to play the game.

How much money would Amelia expect to raise for charity?

Question 2: There are 12 tiles in a bag, each with a letter written on it.

C O R B E T T M A T H S

A tile is selected at random and then replaced.
Another tile is then selected.

Find the probability that both tiles have different letters on them.

Question 3: A fair spinner has four sections.

The spinner is spun three times.
The three numbers are added together to give a score.

(a) Find the probability that the score is odd.
(b) Find the probability that the score is greater than 3.
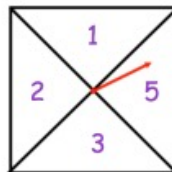
Question 4: Tom and Ben sit their driving test.
The probability Tom passes is 0.4
The probability that only one man passes is 0.56
Find the probability they both fail.

Answers

✓ ✗

Click here   Scan here

Examples

Workout

Click here

Scan here

Question 1: A fair coin is flipped twice.

(a) Find the probability of getting two heads

(b) Find the probability of getting a head and then a tail

(c) Find the probability of getting at least one head

1st flip | 2nd flip | outcome | probability

0.5 T TT 0.5 x 0.5 = 0.25
0.5 T
0.5 H TH
0.5 T HT
0.5 H
0.5 H HH
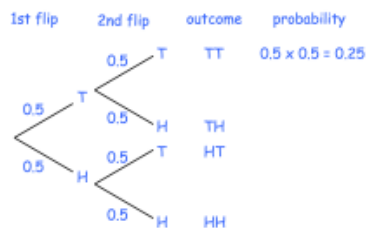
Question 2: Matt and Thomas each take a penalty.

The probability that Matt scores is 0.6
The probability that Thomas scores is 0.7

(a) Find the probability of both boys missing

(b) Find the probability of one boy scoring

(c) Find the probability of at least one boy missing

Matt | Thomas | outcome | probability

0.7 Score SS 0.7 x 0.6 = 0.42
0.6 Score
0.3 Miss SM
0.7 Score MS
0.4 Miss
0.3 Miss MM

Question 3: Megan and Rosie sit their driving tests.

The probability that Megan passes the test is 0.8
The probability the Rosie fails the test is 0.3

(a) Copy and complete the tree diagram

(b) Find the probability that both women pass

(c) Find the probability that Megan fails
and Rosie passes

(d) Find the probability that at least one woman passes

Megan | Rosie | outcome | probability

Pass
Pass
Fail
Pass
Fail
Fail

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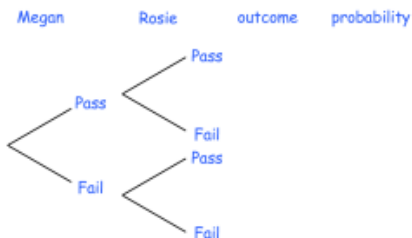
Question 4: Harry goes to an arcade. He has one go on the Teddy Grabber and one go on the Penny Drop.
The probability that he wins on the Teddy Grabber is ⅓
The probability that he wins on the Penny Drop is ⅖

(a) Copy and complete the tree diagram

(b) Work out the probability that Harry
loses on the Teddy Grabber and
he also loses on the Penny Drop

(c) Work out the probability that
Harry wins on exactly one machine

Teddy Grabber | Penny Drop | outcome | probability

$\frac{2}{5}$ Win WW $\frac{1}{3} \times \frac{2}{5} = \frac{2}{15}$
$\frac{1}{3}$ Win
Lose
Win
Lose
Lose

Question 5: There are 5 lemon and 4 strawberry sweets in a bag.

Hailey takes out a sweet at random, writes down its flavour and puts it back into the bag.
Then Hailey takes out a second sweet, at random, and writes down its flavour.

(a) Copy and complete the tree diagram
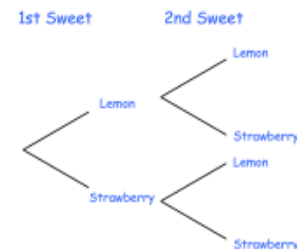
(b) Find the probability of two lemon sweets

(c) Find the probability of one of each flavour

(d) Find the probability of no lemon sweets

1st Sweet | 2nd Sweet

Lemon
Lemon
Strawberry
Lemon
Strawberry
Strawberry

Question 6: The probability that a bus arrives late is 0.1

Victor is travelling by bus on Monday and Tuesday.

(a) Show this information on a tree diagram

(b) Calculate the probability that the bus is on time both days.

Question 7: Each morning Martina attempts a crossword and a Sudoku

The probability that Martina successfully completes the crossword is 0.3
The probability that Martina successfully completes the Sudoku is 0.6

(a) Show this information on a tree diagram

(b) Work out the number of days that Martina successfully completes both the crossword
and Sudoku over a period of 200 days.

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Apply

Question 1: Timothy is taking part in an archery competition.

The probability of windy weather is 0.2

If it is windy, the probability of Timothy hitting the target is 0.35
If it is not windy, the probability of Timothy hitting the target is 0.8

(a) Draw a tree diagram to show this information

(b) Find the probability of Timothy hitting the target.

Question 2: A football team has two matches to play.

The probability that the team wins is 0.3
The probability that the team draws is 0.5

A win is worth 3 points, a draw 1 point and a loss 0 points.

Calculate the probability that the team will score at least 3 points
over the two matches.

Question 3: Shown is a spinner.
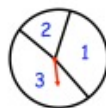
The probability of a 1 is 3x
The probability of a 2 is x
The probability of a 3 is 4x

(a) Calculate the value of x

The spinner is spun twice and the scores are multiplied together.

(b) Work out the probability that the final score is odd.

Question 4: Freddie and Martha have dentist appointments.

The probability that Freddie is on time to his appointment is 0.9
The probability that both Freddie and Martha are on time to their appointments is 0.72

(a) Draw a tree diagram for this information

(b) Find the probability that both people are late for their appointments

Question 5: A college course consists of 8 weeks of teaching with a final exam at the end of
the course

If a student fails the final exam, they have one opportunity to retake the exam.

The probability of a student passing the final exam is ⅞
The probability of a student passing the retake is ⅔

(a) Complete the tree diagram
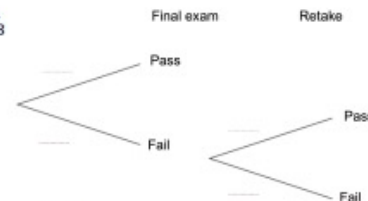
If a student passes the final exam or retake,
they receive a certificate.

(b) Work out the probability that a student receives a certificate.

Question 6: There are 10 counters in a bag, 7 are green and the rest of white.

Erin takes out a counter at random and records its colour.
Without replacement, Erin takes out another counter, at random.

(a) Complete the tree diagram

(b) Find the probability that both counters
are different colours

(c) Find the probability that both counters
are the same colour
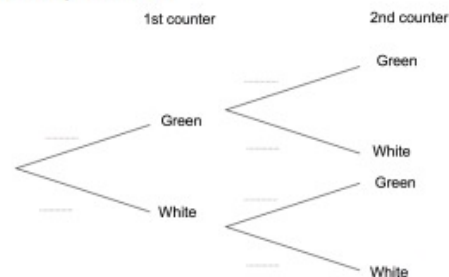
Question 7: Jenson is going to choose a ball at random from a bag and then flip a coin.

There are 5 balls in the bag, 2 white and 3 black.
A ball is picked at random from the bag and its colour is recorded.

If the ball is white, a fair coin is flipped.
If the ball is black, a biased coin is flipped, where heads has a probability of ⅞

(a) Draw a tree diagram to show this information

Jenson selects a ball and flips the appropriate coin.

(b) Find the probability that he obtains a tail.

Question 8: There are x apples in a crate.
3 of the apples are bad.

Robert chooses two apples from the crate, without replacement
The probability that he selects two bad apples is $^1/_{12}$

(a) Using the tree diagram, prove $x^2 - x - 72 = 0$

(b) Find the number of apples in the crate, x.

(c) Find the probability that both apples are good

1st Apple   **2nd Apple**

$\frac{3}{x}$ bad

$\frac{2}{x-1}$ bad

$\frac{x-3}{x-1}$ good

$\frac{x-3}{x}$ good

$\frac{3}{x-1}$ bad

$\frac{x-4}{x-1}$ good

Answers

✓ ✗
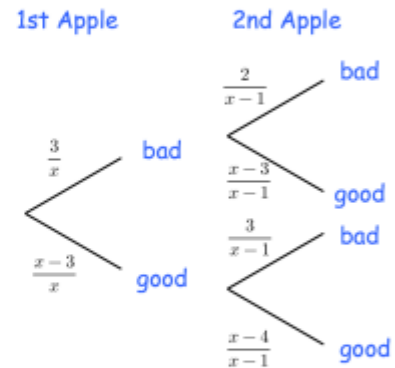
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Examples

Workout

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Question 1: A drawer contains 6 red socks and 2 green socks.

A red sock is taken out of the drawer and not replaced.

Dexter is going to pick a sock at random from the remaining socks in the drawer.
(a) Write down the probability that Dexter picks a red sock?
(b) Write down the probability that Dexter picks a green sock?

Question 2: There are 10 chocolates in a bag.
Four are milk chocolate and six are dark chocolate.
Two chocolates are taken out at random **without** replacement.

(a) Copy and complete the tree diagram

(b) Find the probability of getting two dark chocolates.

(c) Find the probability of getting one chocolate of each flavour.

(d) Find the probability of getting at least one milk chocolate.

1st chocolate 2nd chocolate outcome probability

$\frac{3}{9}$ Milk MM $\frac{4}{10} \times \frac{3}{9} = \frac{12}{90}$

$\frac{4}{10}$ Milk

$\frac{6}{9}$ Dark MD

$\frac{4}{9}$ Milk DM

$\frac{6}{10}$ Dark

$\frac{5}{9}$ Dark DD

Question 3: 13 of the 20 students in Mr Davidson's class are girls.
Two students are chosen at random.

1st student 2nd student outcome probability

(a) Copy and complete the tree diagram

(b) Work out the probability of two boys being selected.

(c) Work out the probability of two girls being selected.

boy BB

boy

girl BG

boy GB

girl

girl GG
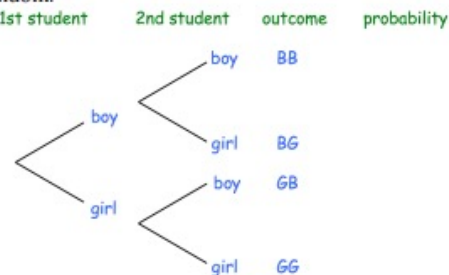
Question 4: There are 12 sweets in a bag
7 are lemon and 5 are orange.
Two sweets are taken out at random **without** replacement.

(a) Work out the probability that the two sweets are both lemon
(b) Work out the probability that the two sweets are both orange
(c) Work out the probability that the two sweets are the same flavour
(d) Work out the probability that the two sweets are different flavours

Question 5: There are five counters in a bag.
One counter is pink, one counter is green and three counters are yellow.
A counter is selected at random from the bag **without** replacement.
Then a second counter is taken at random.

(a) Find the probability that both counters are yellow.
(b) Find the probability of a pink counter then a yellow counter.

Question 6: In dry weather, the probability of a bus being late is $\frac{1}{10}$

In rainy weather, the probability of a bus being late is $\frac{1}{4}$

In snowy weather, the probability of a bus being late is $\frac{2}{3}$

The probability of dry weather is $\frac{3}{4}$

The probability of wet weather is $\frac{1}{5}$

The probability of snow is $\frac{1}{20}$

(a) Show this information on a tree diagram
(b) Calculate the probability that the weather is dry **and** the bus is on time.
(c) Calculate the probability that the bus is late

Question 7: Catherine has two bags of counters.
Bag A contains 6 red counters and 2 black counters.
Bag B contains 1 red counters and 4 black counters

Catherine rolls a fair ordinary six-sided dice.
If the dice lands on a 1, she takes a counter at random from Bag B.
If the dice lands on any other number, Catherine takes a counter randomly from Bag A.

Calculate the probability of Catherine getting a black counter.

Question 8: There are three flavours of crisps in a cafe.
There are 3 packets of salt and vinegar
5 packets of cheese and onion
1 packet of roast chicken
Bella takes two packets of crisps at random.

(a) Work out the probability that she takes 2 packets of crisps that are the **same** flavour.
(b) Work out the probability that she takes 2 packets of crisps that are **different** flavours.

Question 9: Toby has 20 counters in a bag.
11 counters are yellow.
6 counters are red.
3 counters are white.
Toby takes two counters from the bag at random.

Work out the probability that the two counters are **not** the same colour.

Question 10: There are 9 sweets in a bag.
Five sweets are purple, three sweets are white and one sweet is pink.
Three sweets are selected at random **without** replacement.
Calculate the probability that the sweets are **not** all the same colour.

Question 11: Florence has these letter tiles.

M A T H E M A T I C S

She picks three tiles at random without replacement.

(a) Calculate the probability that all three times are vowels.
(b) Calculate the probability that there are no vowels.
(c) Calculate the probability that exactly one T is taken from the bag.

Question 12: There are 11 lego blocks in a bag, with each block the same size.
Five are red and six are yellow.
Four blocks are selected at random.

(a) Calculate the probability that all the blocks are yellow
(b) Calculate the probability that at least 3 of the blocks are red.

Apply

Question 1: Samantha has 10 pens.
7 of the socks are blue and the rest are red.
Samantha takes a pen at random without replacement.
She then takes a second pen at random.

Samantha drew this tree diagram.
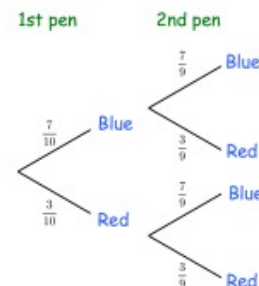
(a) Write down what is wrong with the probabilities in the tree diagram.

(b) Calculate the probability that Samantha picks at least one red pen.

1st pen   2nd pen

$\frac{7}{10}$ Blue
$\frac{7}{9}$ Blue
$\frac{3}{9}$ Red
$\frac{3}{10}$ Red
$\frac{7}{9}$ Blue
$\frac{3}{9}$ Red

Question 2: Here are six number tiles.

3 3 4 5 5 5

Charlie takes a tile at random without replacement.
Charlie then takes a second tile at random.

(a) Work out the probability the both tiles have the number 5 on them

(b) Work out the probability that the number on the second is less than the number on the first tile.

Question 3: There are 20 passengers on a coach.
70% of the passengers are going to Bristol.
The rest are going to Bath.
Four passengers are chosen at random to complete a survey.

Calculate the probability that all four passengers are going to Bath.

Question 4: Ethan has 12 coins.
There are three 10p coins and nine 20p coins.
Ethan chooses 3 coins at random.
Work out the probability that he takes exactly 50p.

Question 5: There are 50 students in Year 11.
Each student studies one language.

	French	German
Female	11	12
Male	7	20

Two of these students are selected at random.

Calculate the probability that the chosen students will be a female studying French and any male.

Question 6: A box contains 40 pens.
30 of the pens are blue and the rest are green.
One pen is taken out at random and replaced by five of the other colour.
Another pen is taken out at random and replaced by five of the other colour.
A final pen is taken out at random.

(a) Work out the probability that all three pens are green.
(b) Work out the probability that all three pens are the same colour.
(c) Work out the probability that all three pens are **not** the same colour.

Question 7: Jamie has some coins.

Jamie has to pay 60p for a car park ticket.
He selects 3 coins at random, without replacement, from his pocket.

Work out the probability that he has chosen the exact price of the ticket.

Question 8: Rebecca has 10 cards, each with a number on it.

| 2 | 2 | 2 | 3 | 4 | 5 | 6 | 7 | 7 | 9 |

She picks three cards at random, without replacement.
Rebecca adds the three numbers together to get a score.
Calculate the probability that the score is an odd number.

Question 9: Harrison has two bags, each containing discs.

Bag 1 contains one disc labelled one, two discs labelled two and one disc labelled three.
Bag 2 contains one disc labelled one, three discs labelled two and one disc labelled three.

Harrison chooses a disc at random from Bag 1.
If the disc is labelled 1, he puts the disc in Bag 2.
If the disc is not labelled 1, he does **not** put the disc in Bag 2.
Harrison then chooses a disc at random from Bag 2.
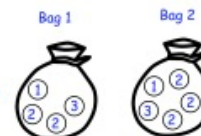
Harrison adds together the numbers from the two discs he selected to give his score.

Find the probability of Harrison scoring 4.

Question 10: 45 students were asked if they have visited Canada, Mexico or the USA.

11 students had been to Canada
1 student had visited all three countries
2 students had visited Canada and Mexico but not the USA.
3 students had visited Mexico and the USA.
12 students had not visited any of the countries.
6 out the 19 students who had visited the USA, had been to at least one of the other countries.

Two of the 45 students are chosen at random.

Work out the probability that they both had only visited Mexico.

Question 11: There are x apples in a crate.
2 of the apples are bad.

Jesse chooses two apples from the crate, without replacement.
The probability that he selects two bad apples is $\frac{1}{28}$

(a) Prove $x^2 - x - 56 = 0$

(b) Find x, the number of apples in the crate

Answers

✓ ✗

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