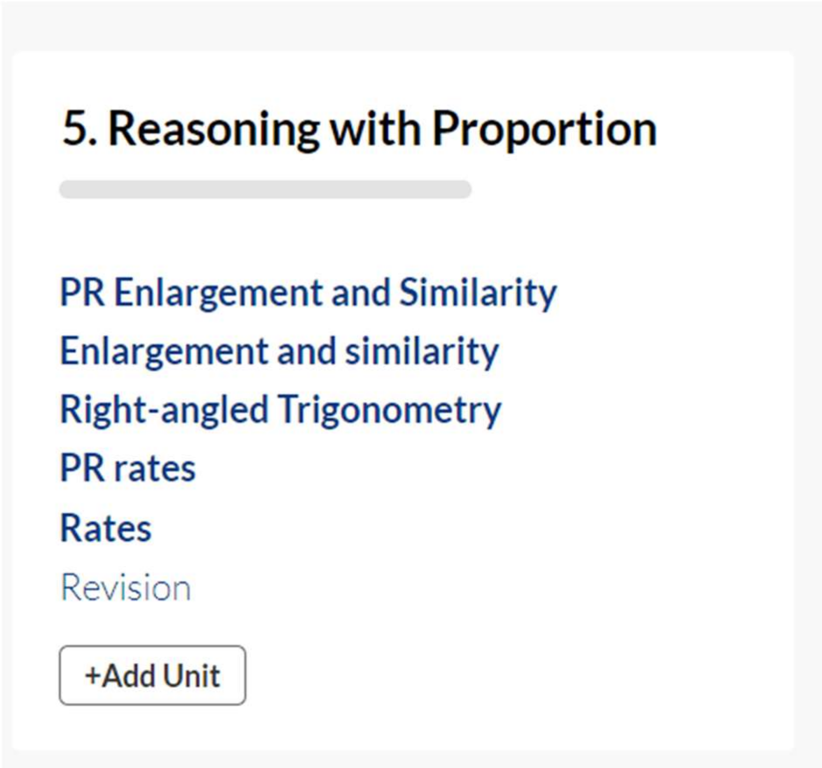
Year 9
Mathematics
UNIT 5

Name: ______________________________

Class: ______________________________

Contents Page

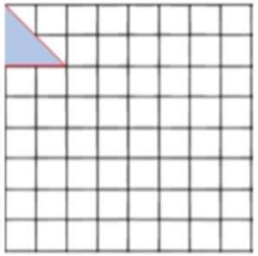
Please see unit 5 course on drfrostmaths.com



PR Enlargement and Similarity

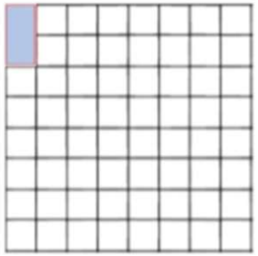
QU 1 - Enlargements

Enlarge by scale factor 2:



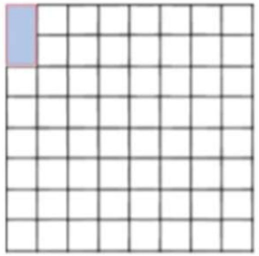
QU 2 - Enlargements

Enlarge by scale factor 3:



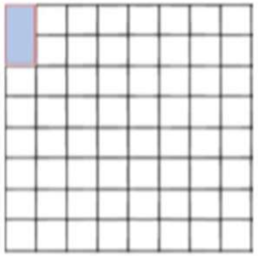
QU 3 - Enlargements

Enlarge by scale factor 3:



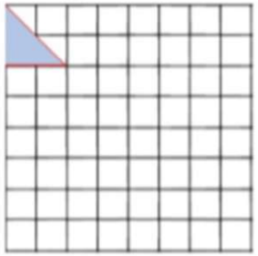
QU 4 - Enlargements

Enlarge by scale factor 1:



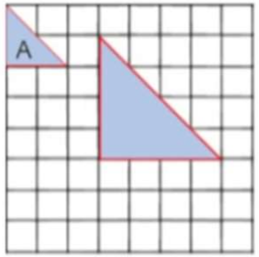
QU 5 - Enlargements

Enlarge by scale factor 1:



QU 6 - Enlargements

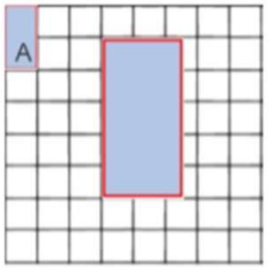
What is the scale factor to enlarge shape A?:



PR Enlargement and Similarity

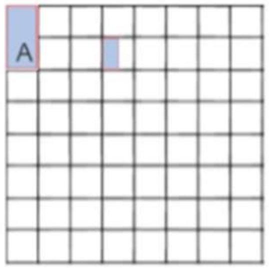
QU 7 - Enlargements

What is the scale factor to enlarge shape A?:



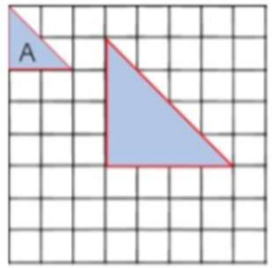
QU 8 - Enlargements

What is the scale factor to enlarge shape A?:



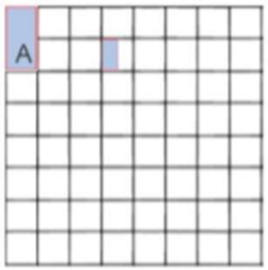
QU 9 - Enlargements

What is the scale factor to enlarge shape A?:



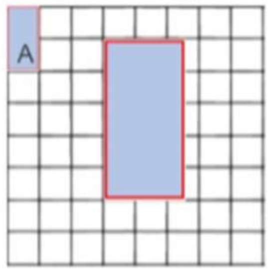
QU 10 - Enlargements

What is the scale factor to enlarge shape A?:



QU 11 - Enlargements

What is the scale factor to enlarge shape A?:



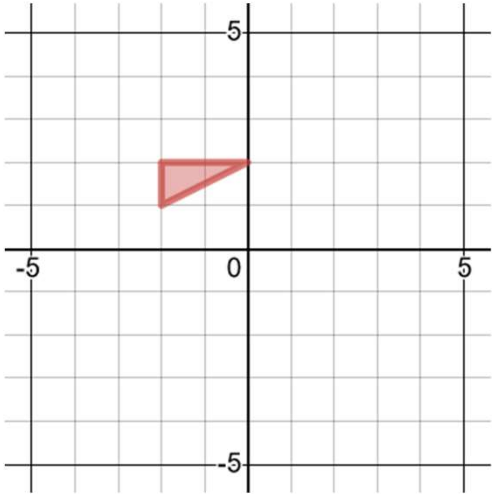
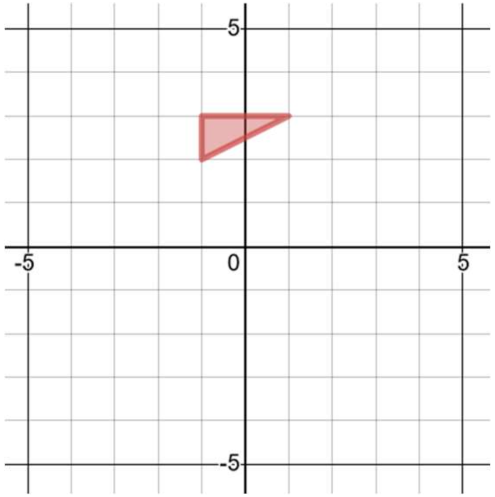
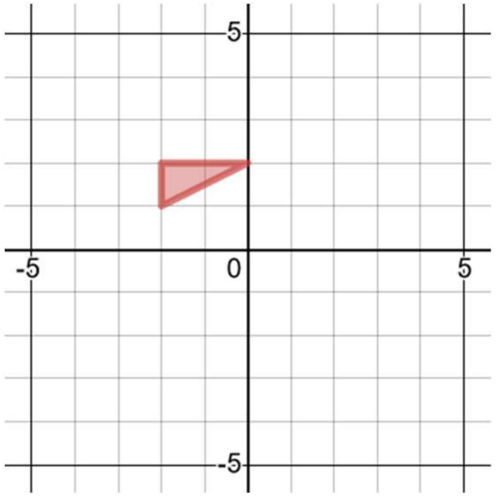
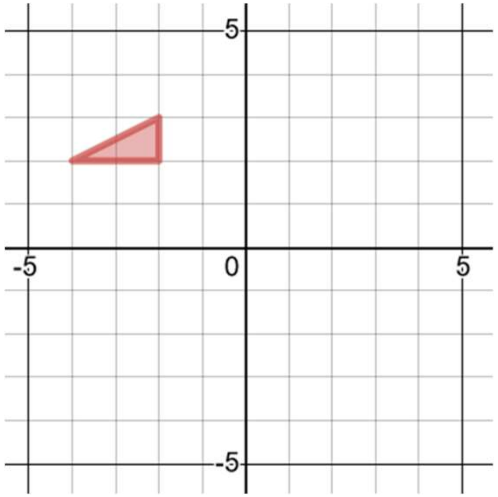
Enlargement

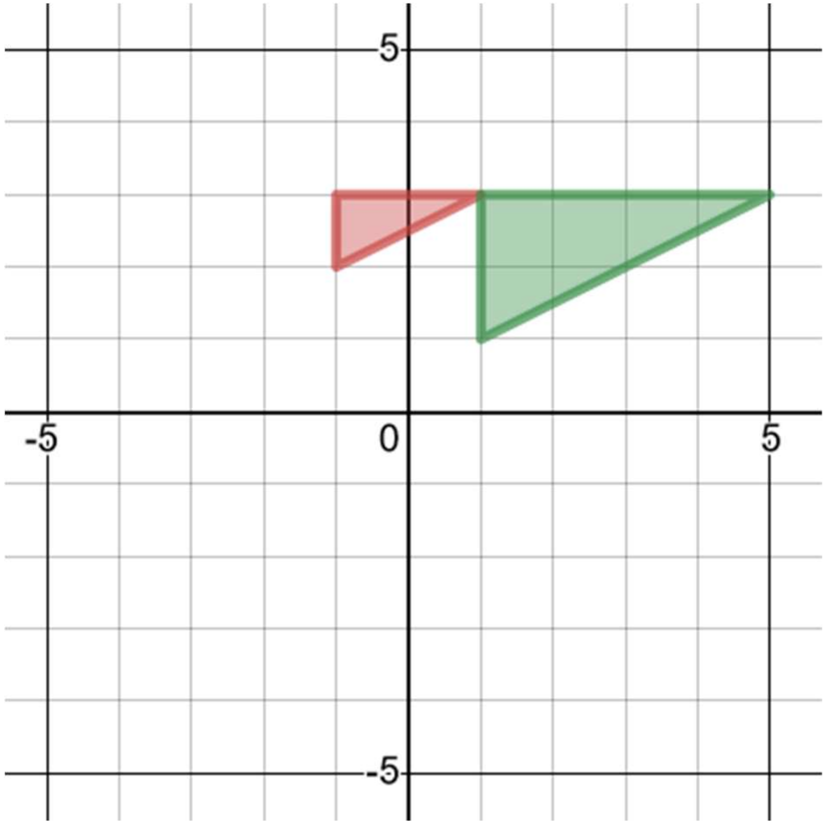
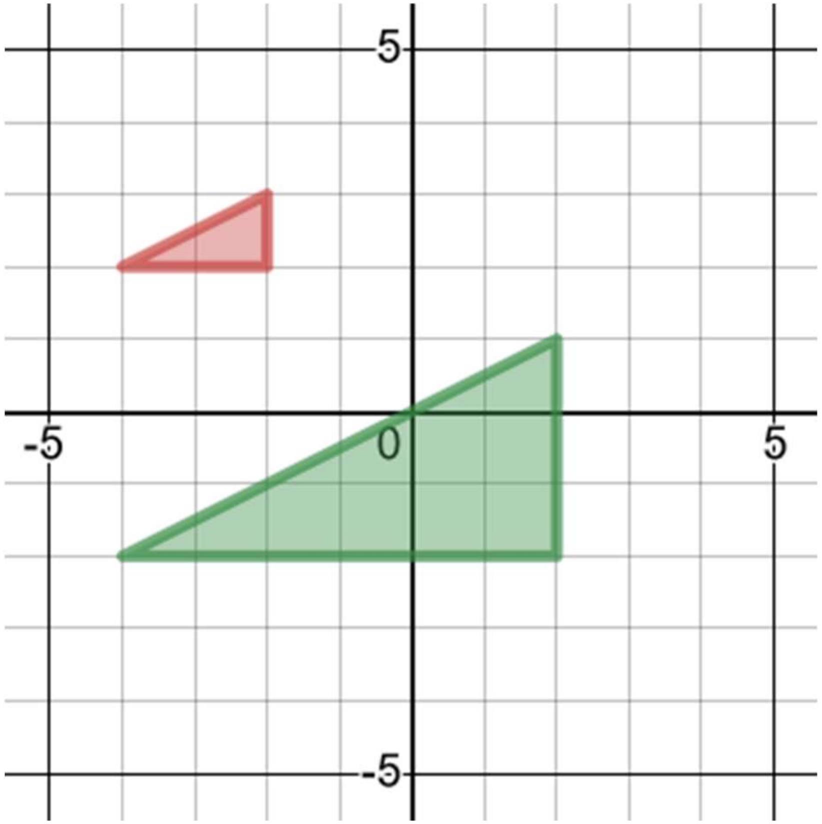
A transformation that moves all points a distance away from a centre point by applying a scale factor.

- Shapes change size.
- The scale factor multiplies distances, including the distance from the centre.

To fully describe an enlargement, we need to give three pieces of information:

1. Type of Transformation: Enlargement
2. Scale Factor: Positive or Negative Number
3. Centre of Enlargement: Coordinate (x, y)

Worked Example	Your Turn
Enlarge about $(-4, 3)$, scale factor 2  	Enlarge about $(-3, 3)$, scale factor 2 
Enlarge about $(-2, 4)$, scale factor 3  	Enlarge about $(-4, 4)$, scale factor 3 

Worked Example	Your Turn
Describe the single transformation of the red object onto the green image 	Describe the single transformation of the red object onto the green image 

Enlargements: Centre of Enlargement

Video 104a on www.corbettmaths.com

Examples

Workout

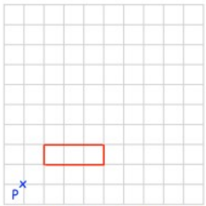
Click here

Scan here

*There are templates for questions 1, 2 and 3 at the end of this exercise

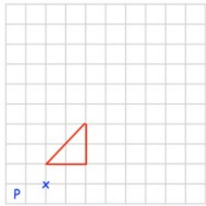
Question 1: Enlarge each shape by the scale factor given
Use P as the centre of enlargement.

(a)



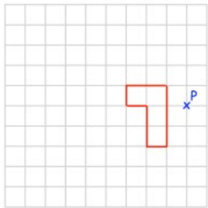
Enlarge by scale factor 2

(b)



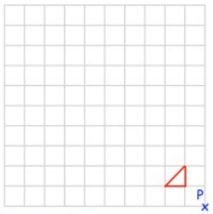
Enlarge by scale factor 3

(c)



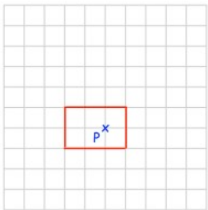
Enlarge by scale factor 2

(d)



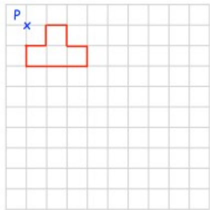
Enlarge by scale factor 4

(e)



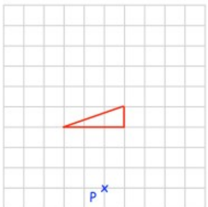
Enlarge by scale factor 2

(f)



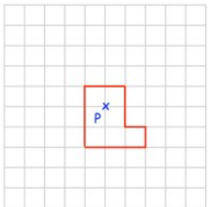
Enlarge by scale factor 3

(g)



Enlarge by scale factor 2

(h)



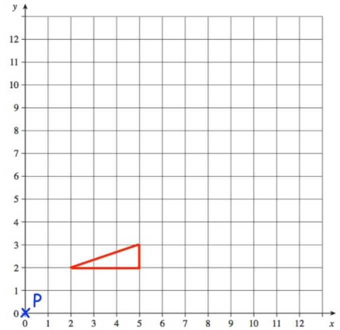
Enlarge by scale factor 2

Enlargements: Centre of Enlargement

Video 104a on www.corbettmaths.com

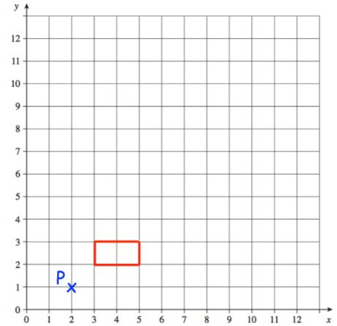
Question 2: Enlarge each shape by the scale factor given
Use P as the centre of enlargement.

(a)



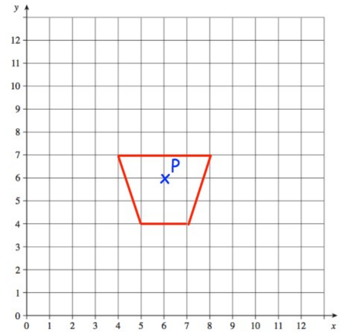
Enlarge by scale factor 2

(b)



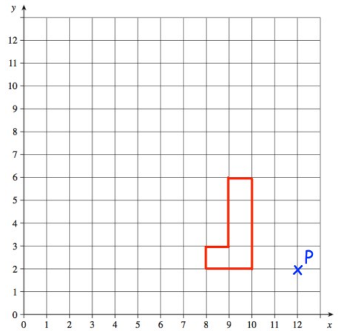
Enlarge by scale factor 3

(c)



Enlarge by scale factor 3

(d)

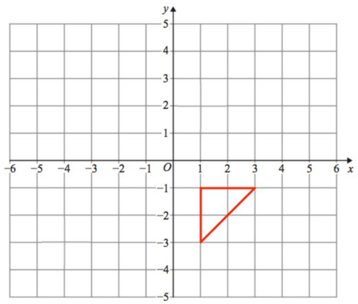


Enlarge by scale factor 2

Enlargements: Centre of Enlargement
Video 104a on www.corbettmaths.com

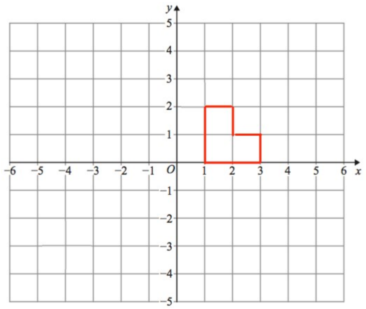
Question 3: Enlarge each shape by the scale factor given
The coordinates for each centre of enlargement are given.

(a)



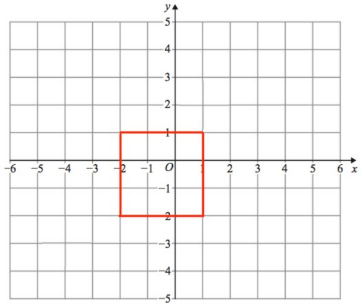
Enlarge by scale factor 2 using
(4, -3) as the centre of enlargement

(b)



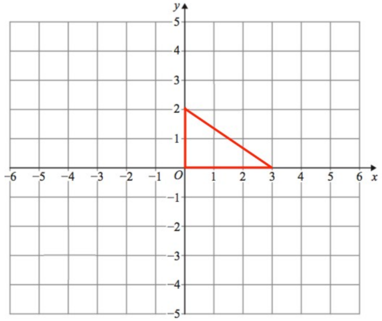
Enlarge by scale factor 3 using
(3, 2) as the centre of enlargement

(c)



Enlarge by scale factor 2 using
(0, -1) as the centre of enlargement

(d)

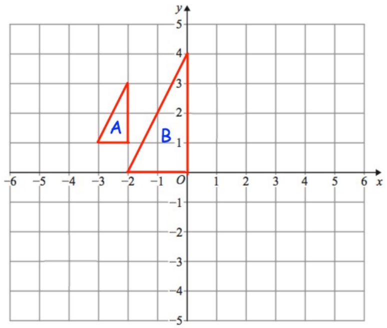


Enlarge by scale factor 2 using
the origin as the centre of enlargement

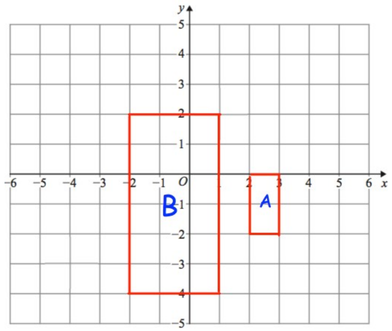
Enlargements: Centre of Enlargement
Video 104a on www.corbettmaths.com

Question 4: Describe fully the single transformation that takes shape A to shape B.

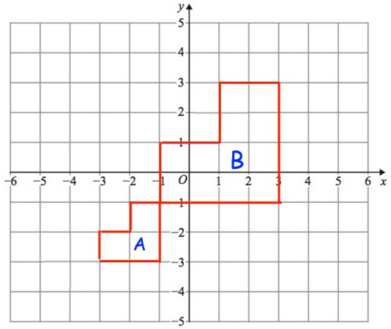
(a)



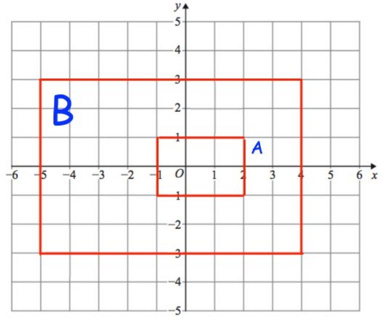
(b)



(c)



(d)



Answers

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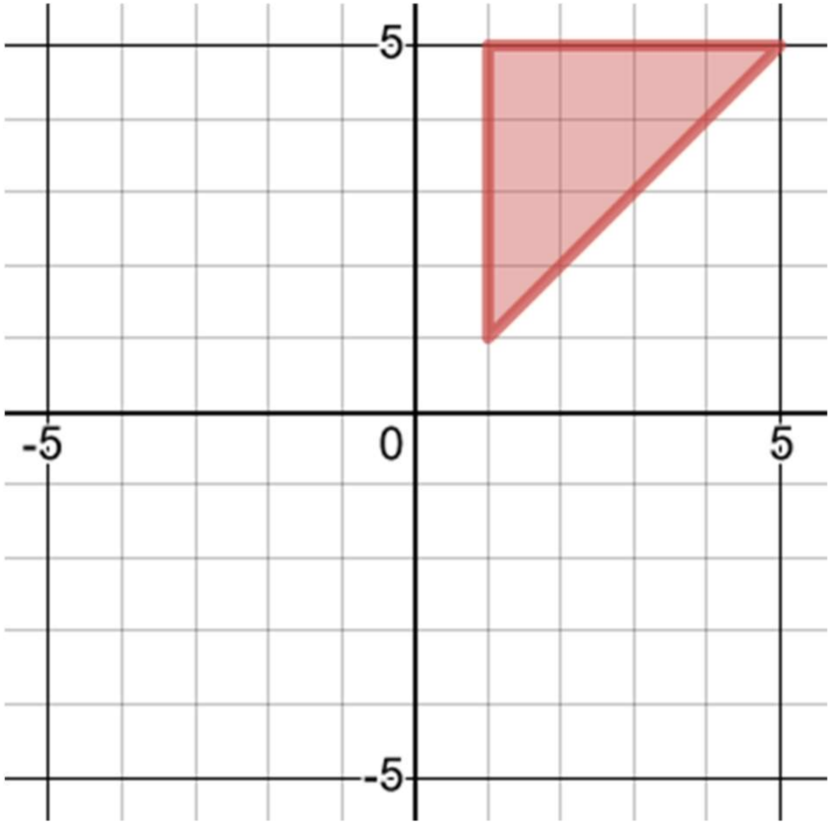
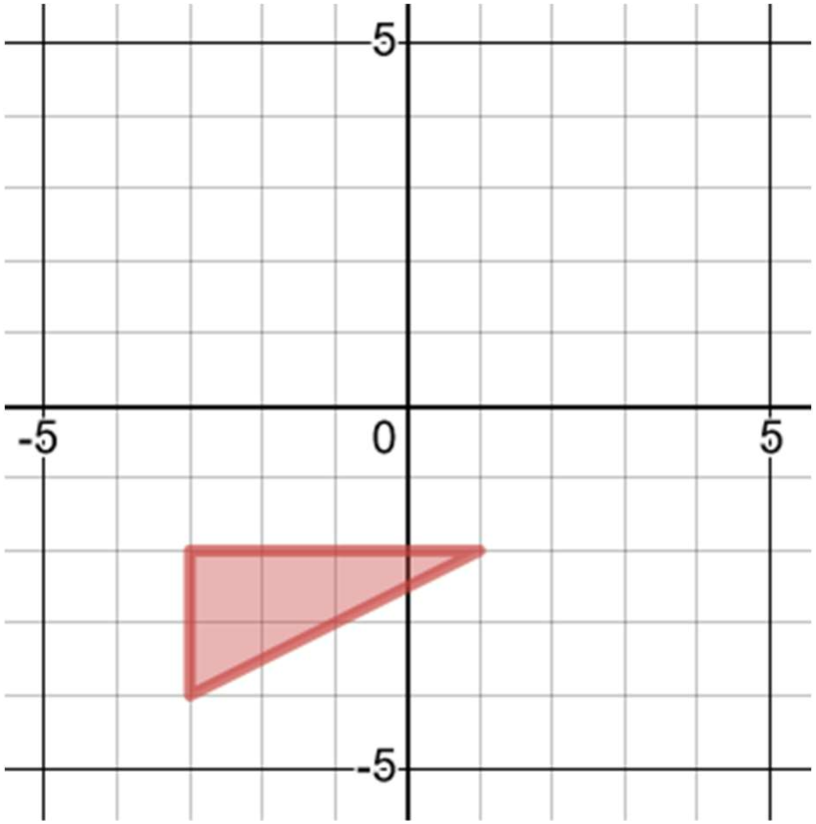
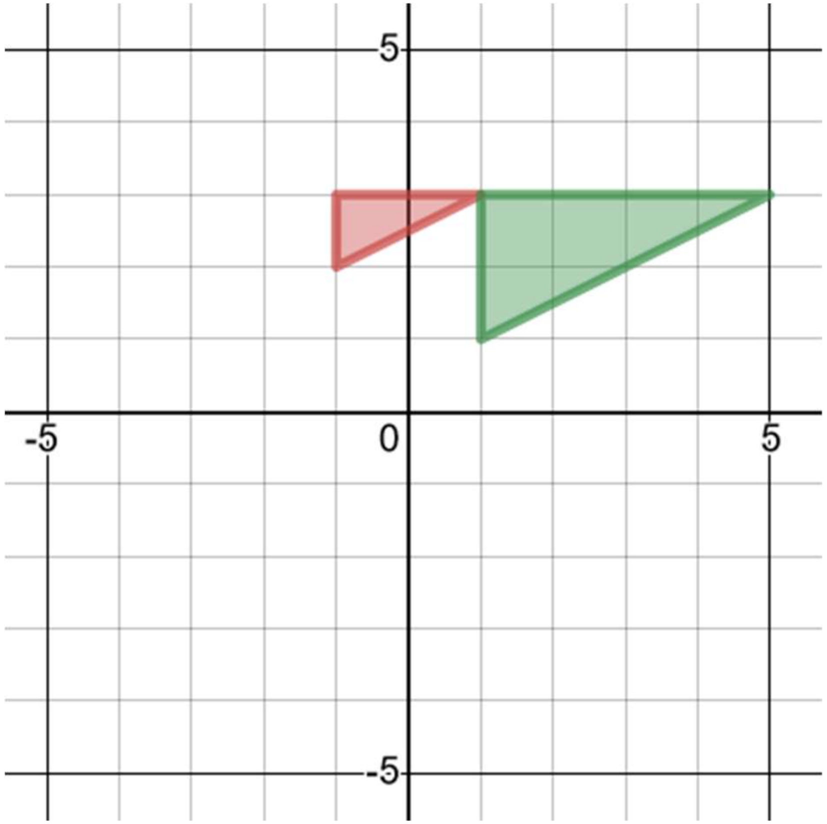
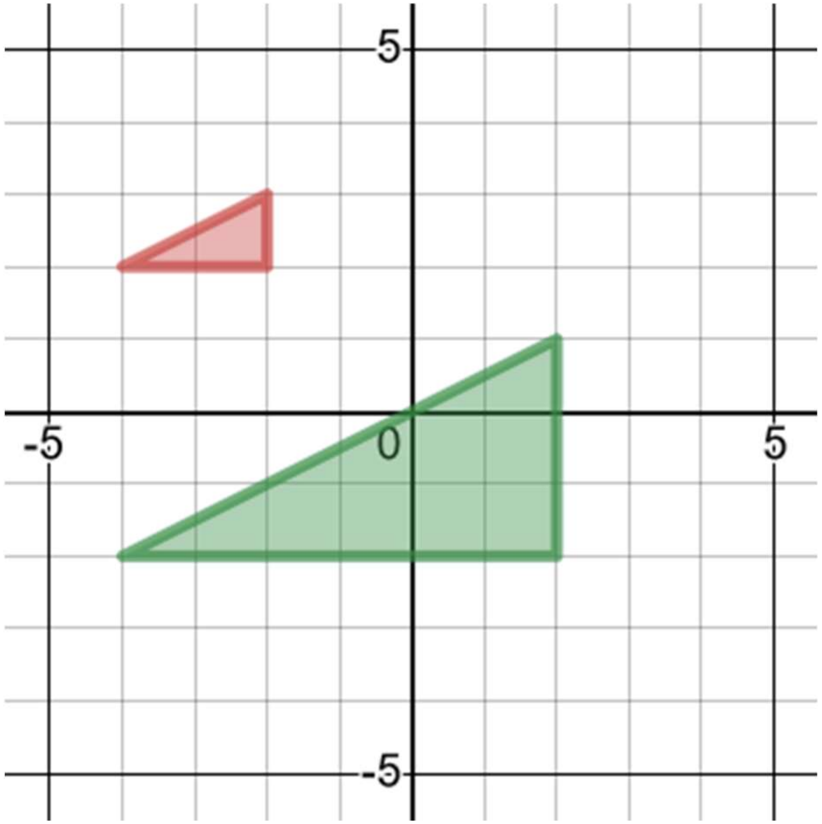
Worked Example	Your Turn
Enlarge about $(-3, -3)$, scale factor $\frac{1}{2}$ 	Enlarge about $(-1, 0)$, scale factor $\frac{1}{2}$ 

Worked Example	Your Turn
Describe the single transformation of the green object onto the red image  	Describe the single transformation of the green object onto the red image 

Enlargement: Fractional Scale Factor

Video 107 on www.corbettmaths.com

Examples

Workout

Click here

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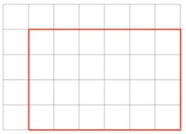
*There are templates for questions 3, 4 and 5 at the end of this exercise

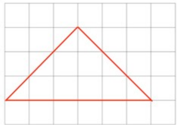
Question 1: Copy these shapes and then enlarge by the scale factor given.

(a)



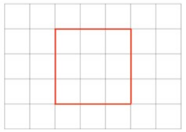
Enlarge by scale factor $\frac{1}{2}$

(b)



Enlarge by scale factor $\frac{1}{3}$

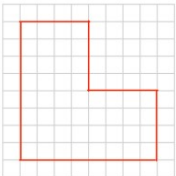
(c)



Enlarge by scale factor $\frac{2}{3}$

Question 2: Copy these shapes and then enlarge by the scale factor given.

(a)

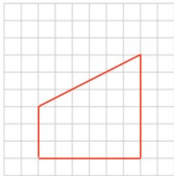


Enlarge by scale factor $\frac{1}{4}$

(b)

Enlarge by scale factor $\frac{1}{2}$

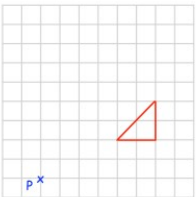
(c)



Enlarge by scale factor $1\frac{1}{3}$

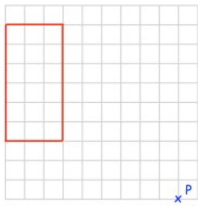
Question 3: Enlarge each shape by the scale factor given
Use P as the centre of enlargement.

(a)



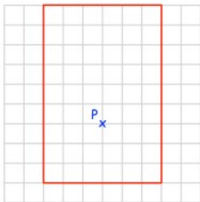
Enlarge by scale factor $\frac{1}{2}$

(b)



Enlarge by scale factor $\frac{1}{3}$

(c)



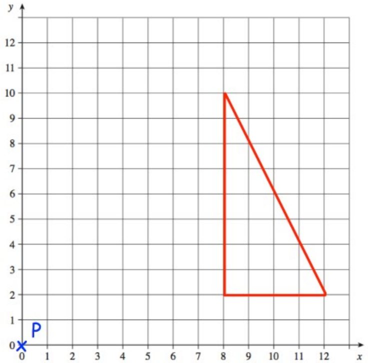
Enlarge by scale factor $\frac{2}{3}$

Enlargement: Fractional Scale Factor

Video 107 on www.corbettmaths.com

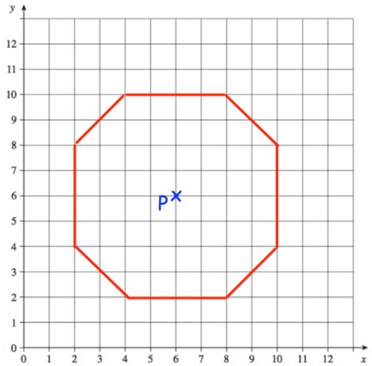
Question 4: Enlarge each shape by the scale factor given
Use P as the centre of enlargement.

(a)



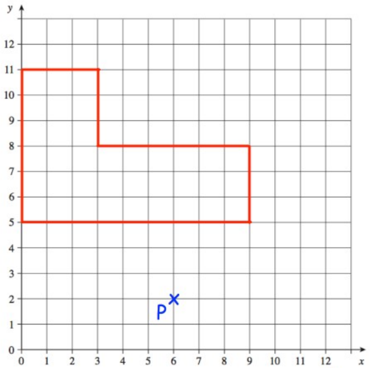
Enlarge by scale factor $\frac{1}{4}$

(b)



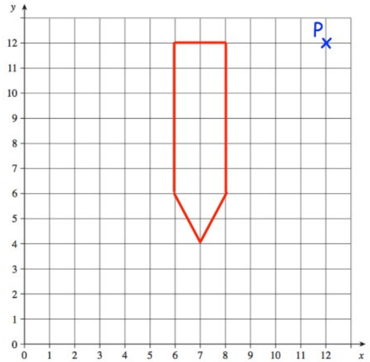
Enlarge by scale factor $\frac{1}{2}$

(c)



Enlarge by scale factor $\frac{2}{3}$

(d)



Enlarge by scale factor $1\frac{1}{2}$

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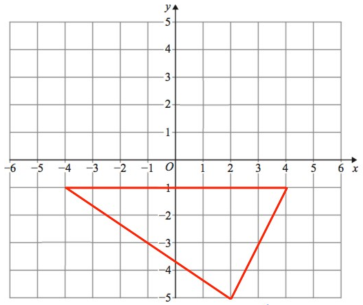
Enlargement: Fractional Scale Factor
Video 107 on www.corbettmaths.com

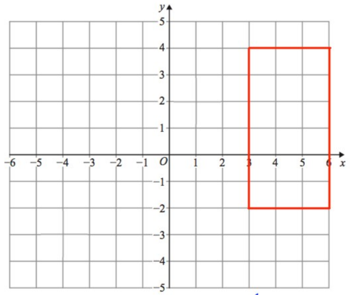
Question 5: Enlarge each shape by the scale factor given
The coordinates for each centre of enlargement are given.

(a)



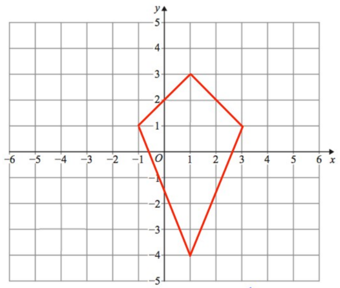
Enlarge by scale factor $\frac{1}{2}$ using (0, 1) as the centre of enlargement

(b)



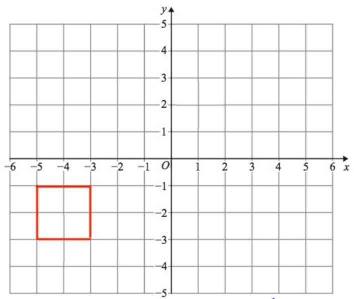
Enlarge by scale factor $\frac{1}{3}$ using (-3, 1) as the centre of enlargement

(c)



Enlarge by scale factor $\frac{1}{2}$ using (-5, -5) as the centre of enlargement

(d)



Enlarge by scale factor $2\frac{1}{2}$ using (-5, -3) as the centre of enlargement

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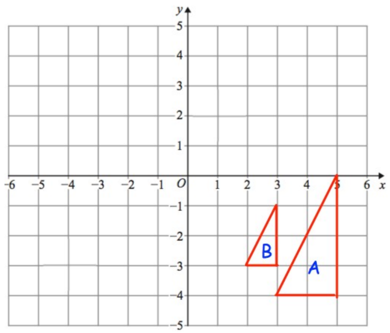
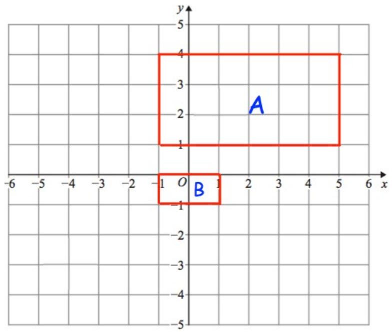
Enlargement: Fractional Scale Factor
Video 107 on www.corbettmaths.com

Question 6: Describe fully the single transformation that takes shape A to shape B.

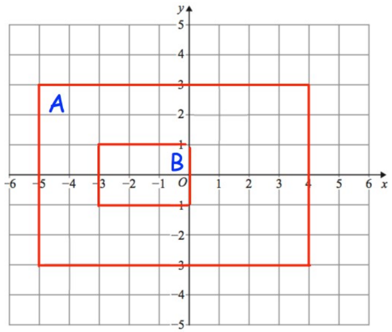
(a)



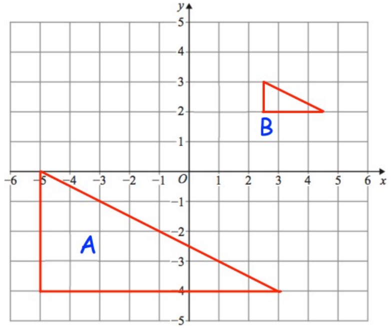
(b)



(c)



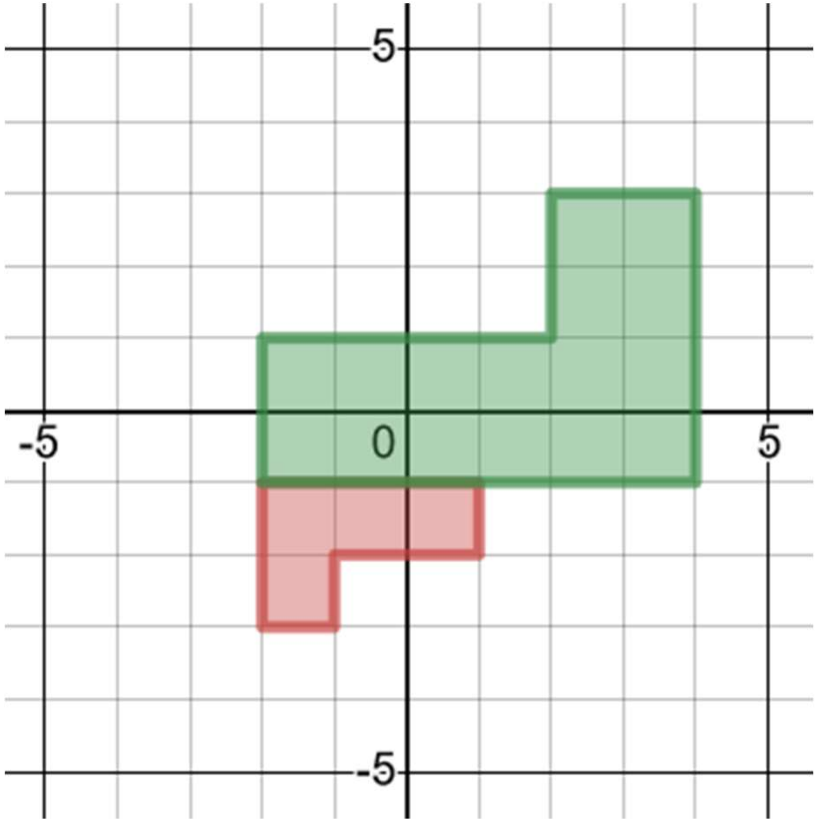
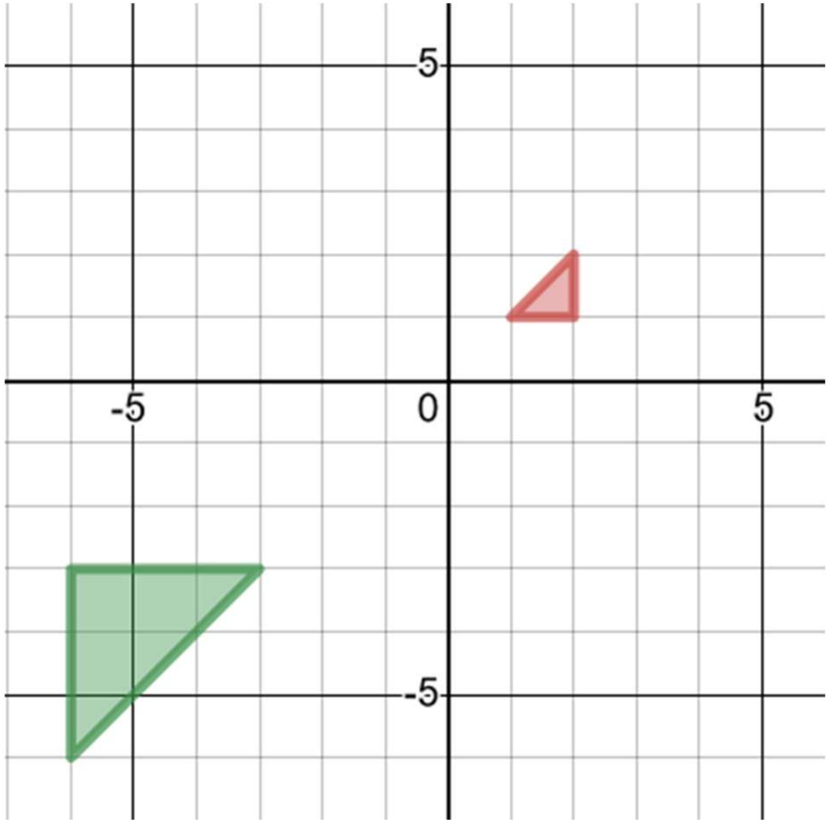
(d)



Answers

Click here

Scan here

Worked Example	Your Turn
Describe the single transformation of the red object onto the green image 	Describe the single transformation of the red object onto the green image 

Enlargement: Negative Scale Factor
Video 108 on www.corbettmaths.com

Examples

Workout

Click here

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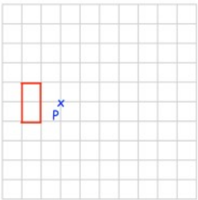
*There are templates for questions 1, 2 and 3 at the end of this exercise

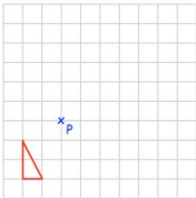
Question 1: Enlarge each shape by the scale factor given
Use P as the centre of enlargement.

(a)



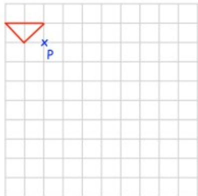
Enlarge by scale factor -3

(b)



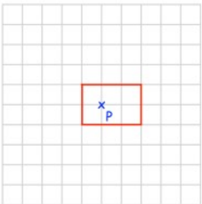
Enlarge by scale factor -2

(c)



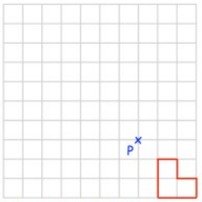
Enlarge by scale factor -4

(d)



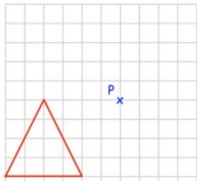
Enlarge by scale factor -2

(e)



Enlarge by scale factor -2

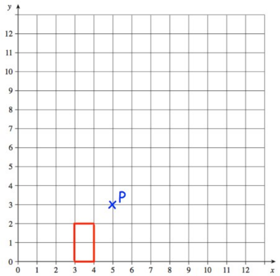
(f)



Enlarge by scale factor $-\frac{1}{2}$

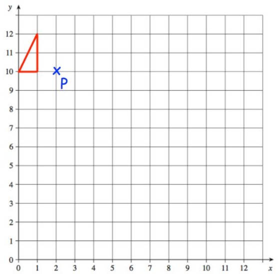
Question 2: Enlarge each shape by the scale factor given
Use P as the centre of enlargement.

(a)



Enlarge by scale factor -3

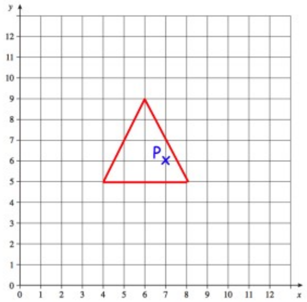
(b)



Enlarge by scale factor -4

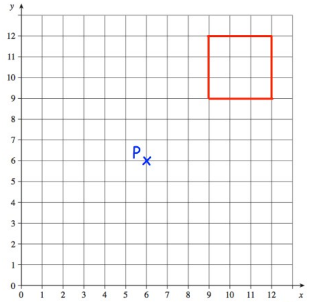
Enlargement: Negative Scale Factor
Video 108 on www.corbettmaths.com

(c)



Enlarge by scale factor -2

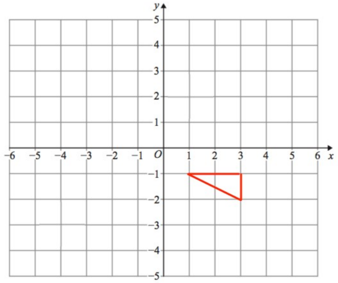
(d)



Enlarge by scale factor $-\frac{1}{3}$

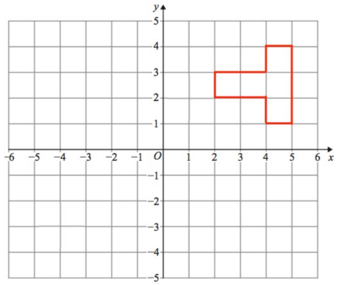
Question 3: Enlarge each shape by the scale factor given
The coordinates for each centre of enlargement are given.

(a)



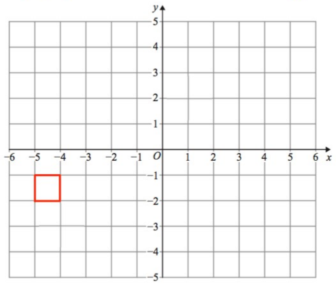
Enlarge by scale factor -2 using
(0, 0) as the centre of enlargement

(b)



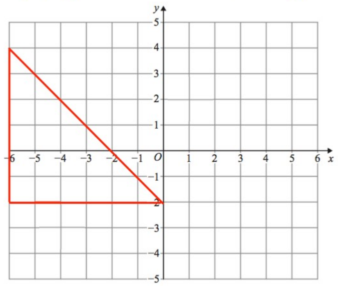
Enlarge by scale factor -2 using
(2, 2) as the centre of enlargement

(c)



Enlarge by scale factor -4 using
(-3, -1) as the centre of enlargement

(d)



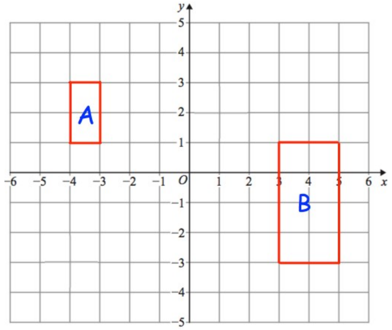
Enlarge by scale factor $-\frac{1}{2}$ using
(0, -2) as the centre of enlargement

Enlargement: Negative Scale Factor

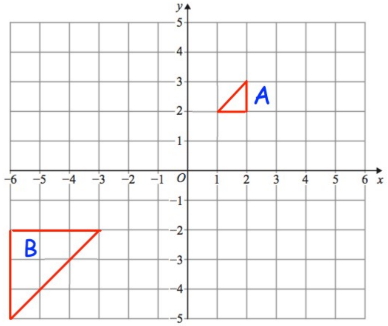
Video 108 on www.corbettmaths.com

Question 4: Describe fully the single transformation that takes shape A to shape B.

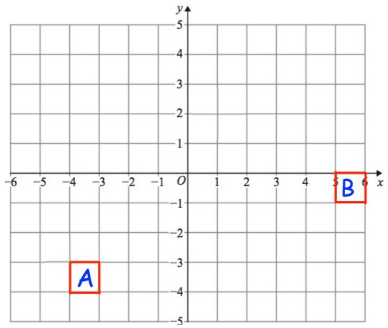
(a)



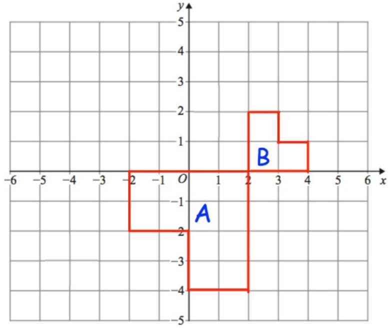
(b)



(c)



(d)

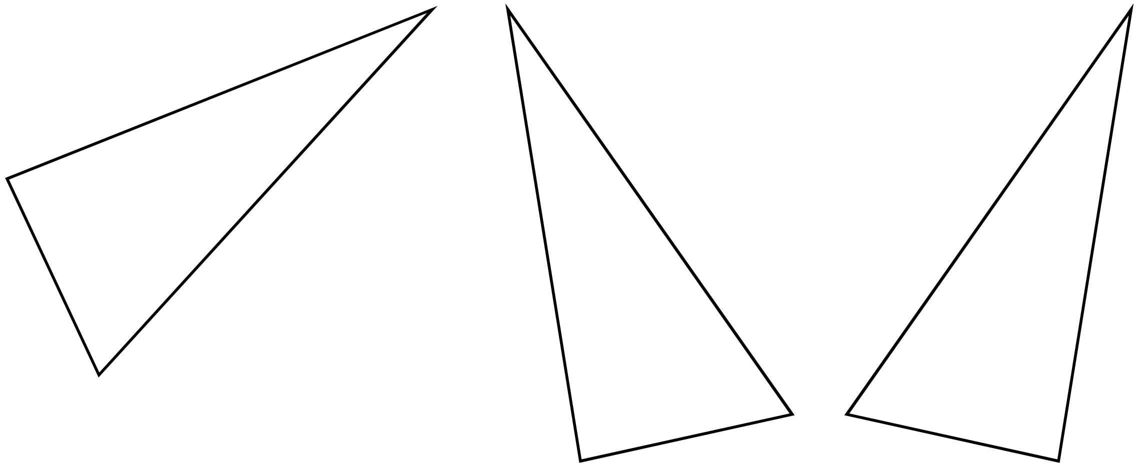


Answers

Click here

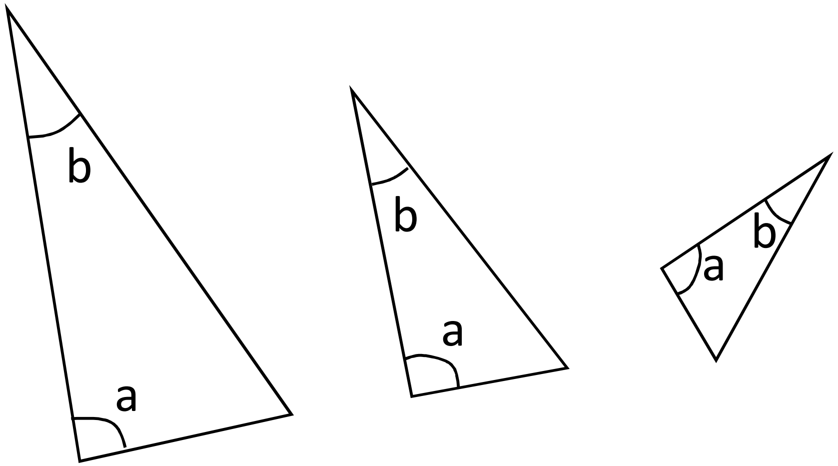
Scan here

Similarity vs Congruence



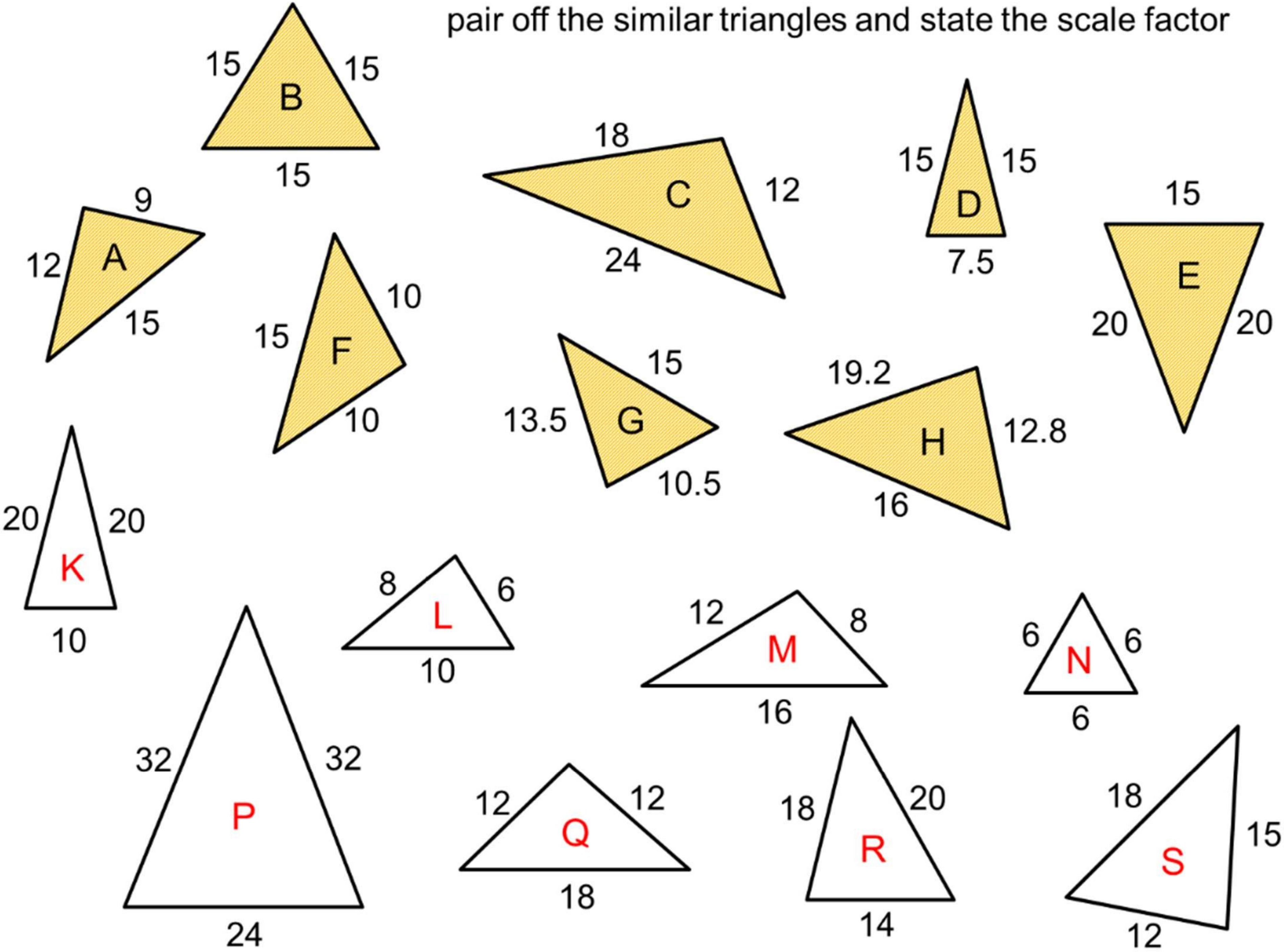
They are the same **shape and size**
(flipping is allowed)

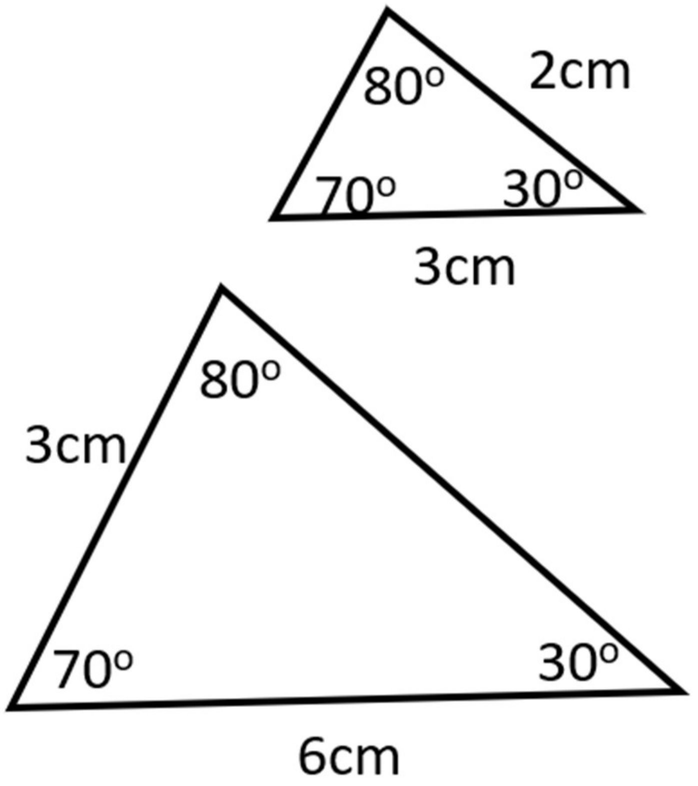
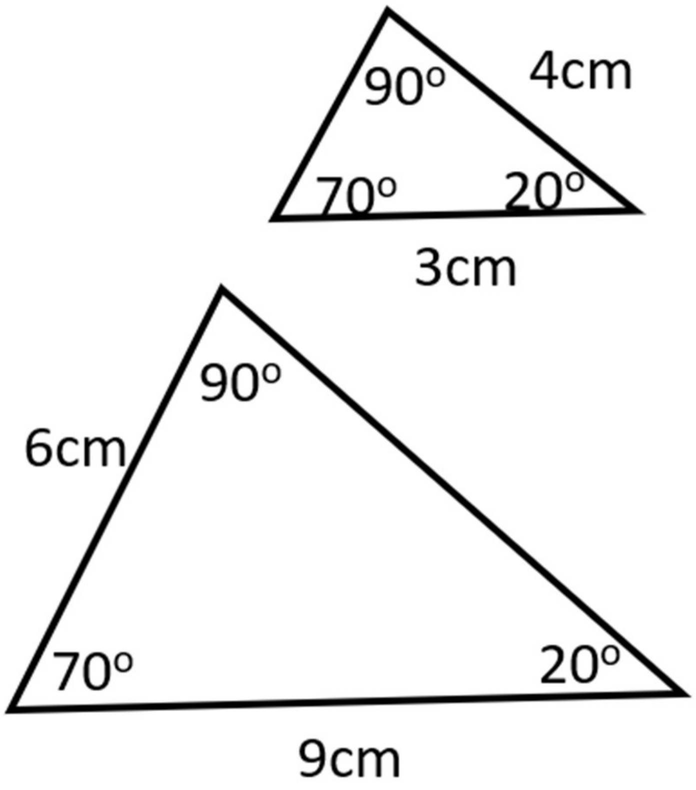
Two shapes are similar if:

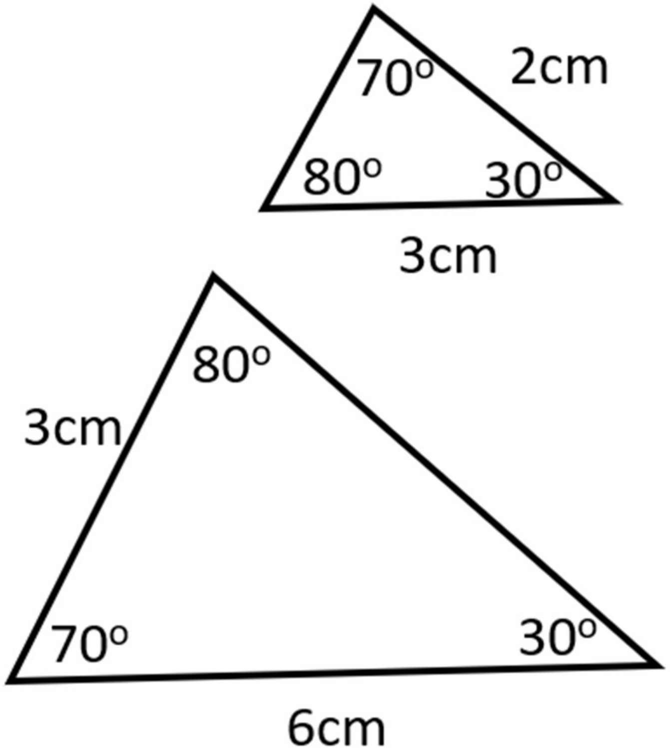
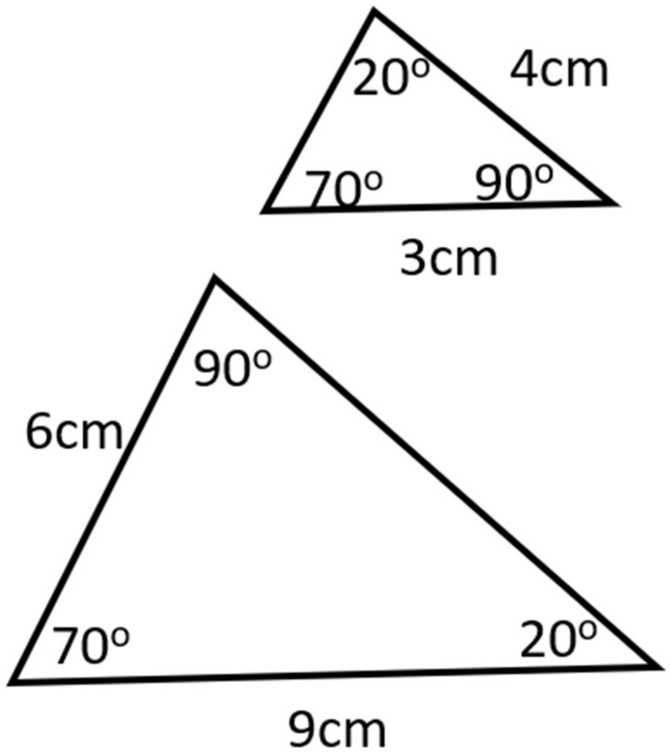


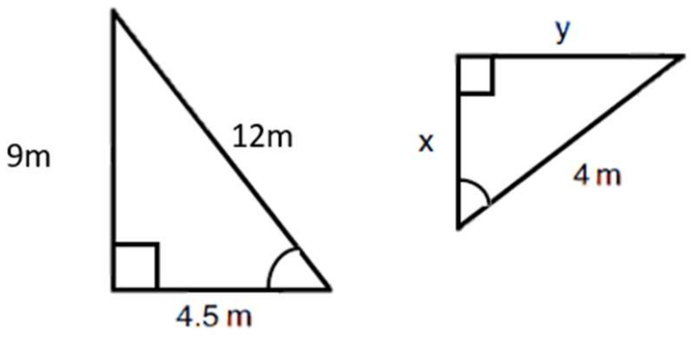
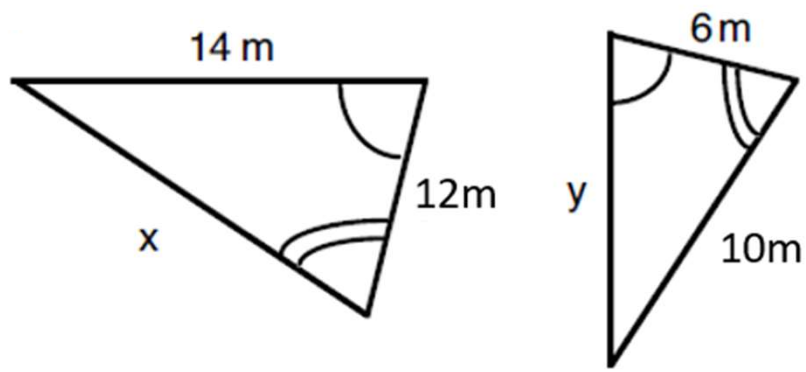
They are the same **shape**
(flipping is again allowed)

pair off the similar triangles and state the scale factor



Worked Example	Your Turn
What is the scale factor? Find the missing lengths. 	What is the scale factor? Find the missing lengths. 

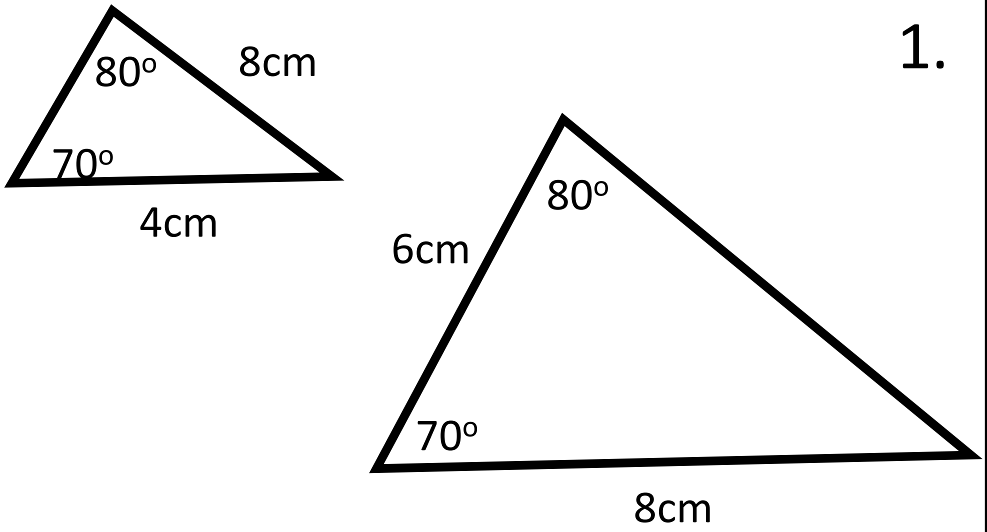
Worked Example	Your Turn
What is the scale factor? Find the missing lengths. 	What is the scale factor? Find the missing lengths. 

Worked Example	Your Turn
What is the scale factor? Find the missing lengths. 	What is the scale factor? Find the missing lengths. 

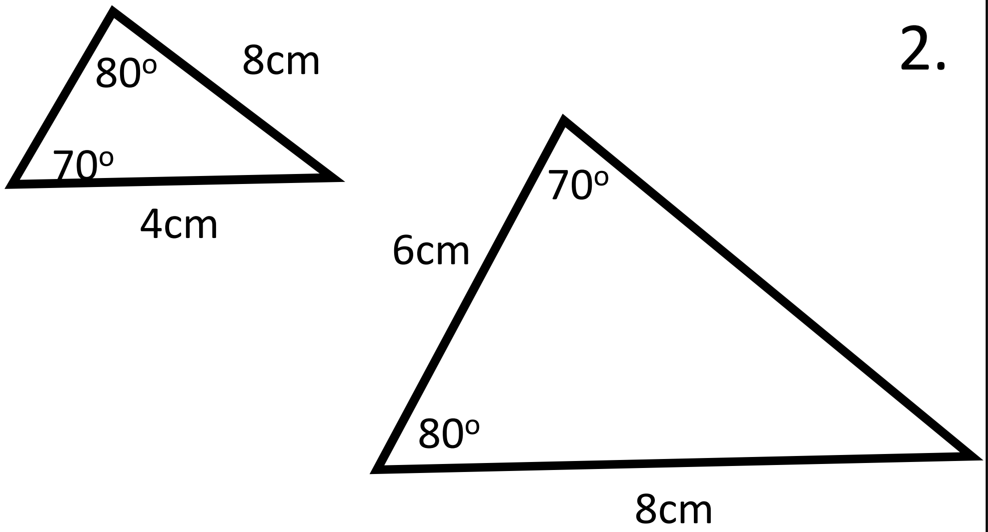
Intelligent Practice – Find the length of every missing side

Triangles not drawn to scale

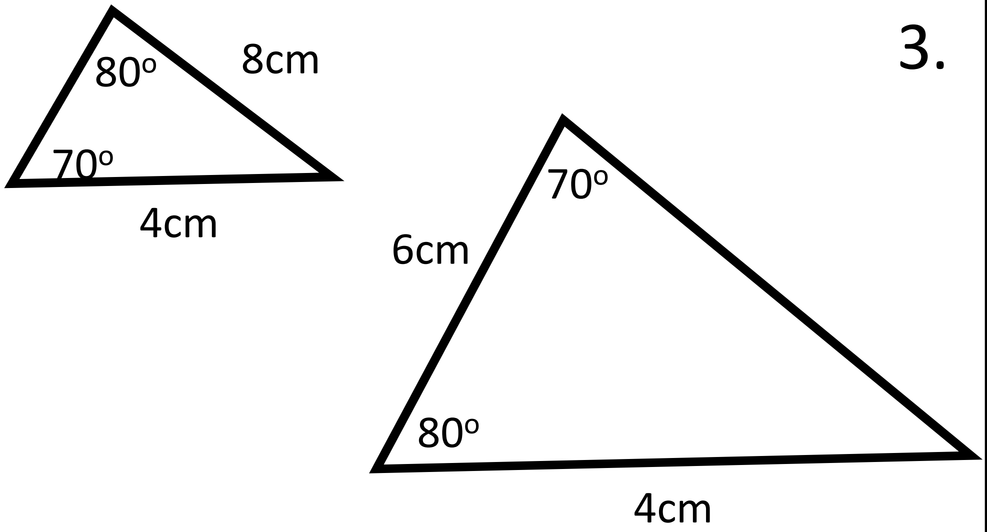
1.



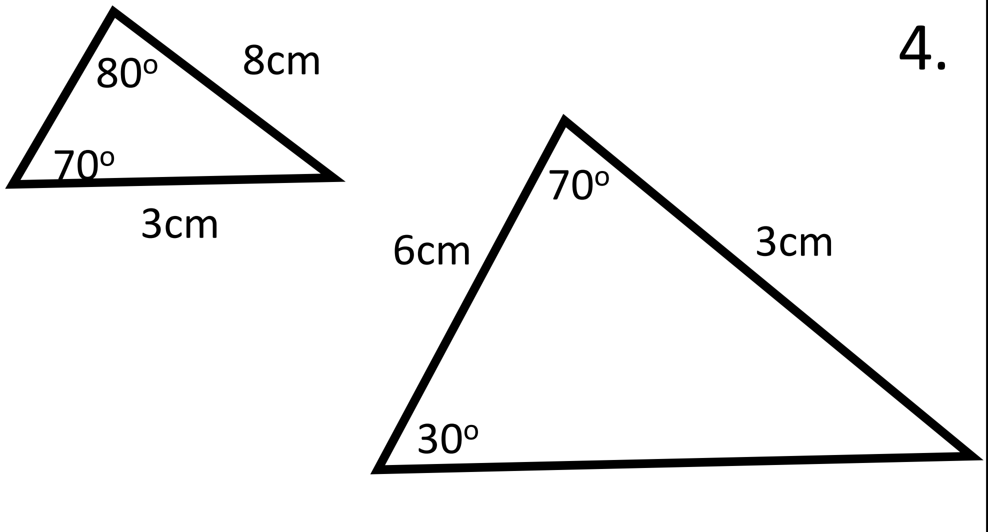
2.



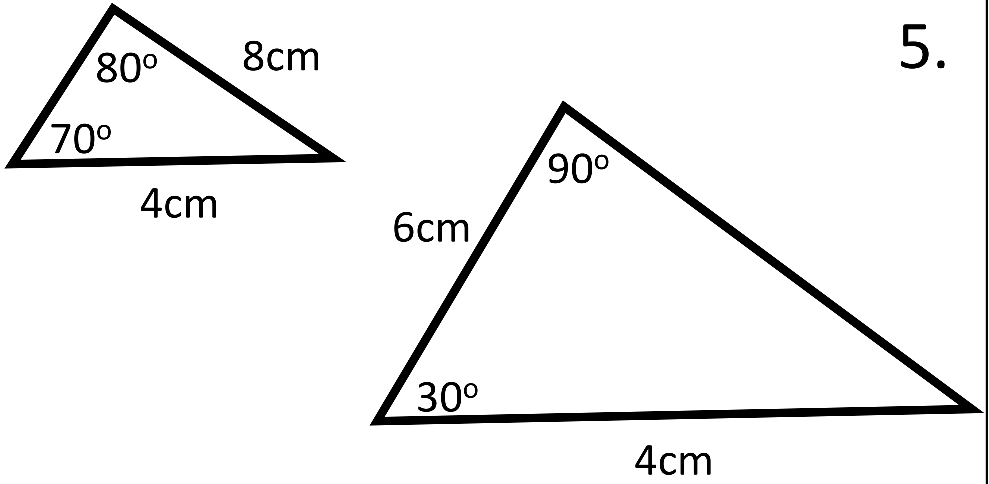
3.



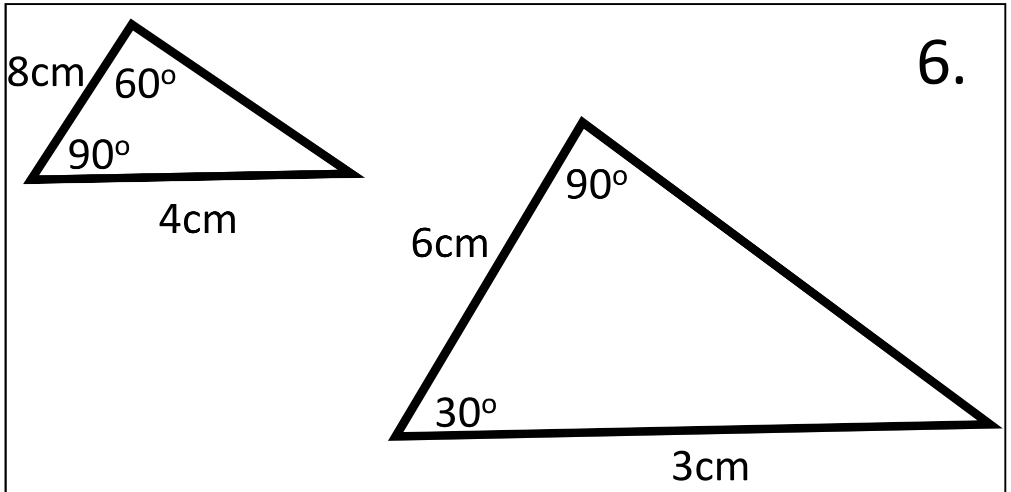
4.



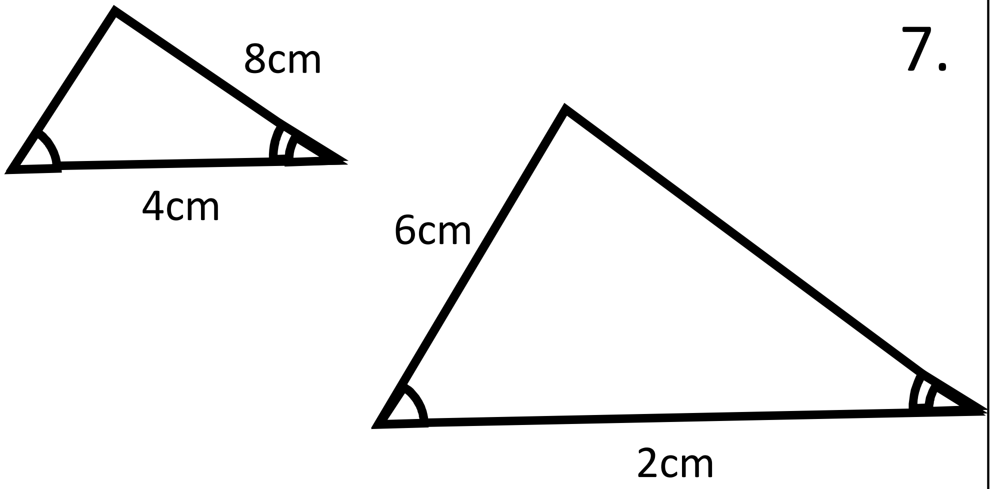
5.


80°
8cm
70°
4cm
90°
6cm
30°
4cm

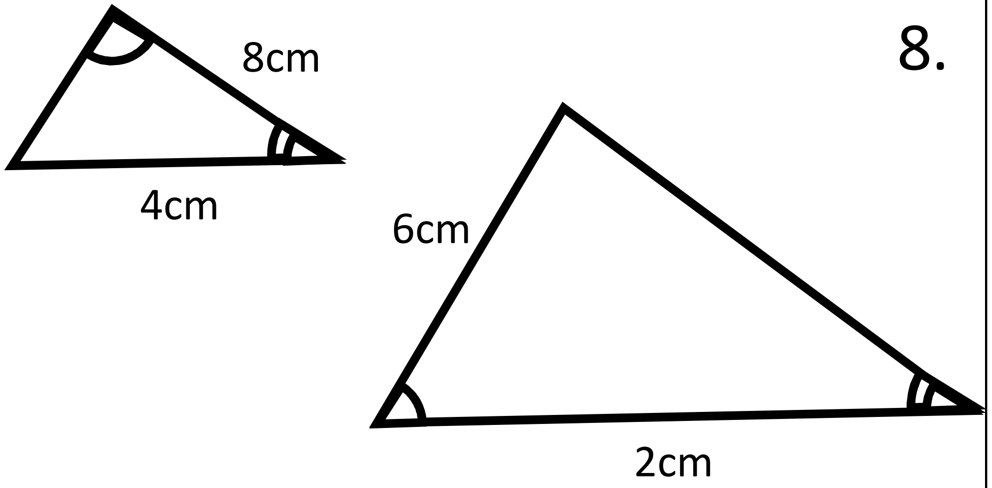
6.


8cm
60°
90°
4cm
90°
6cm
30°
3cm

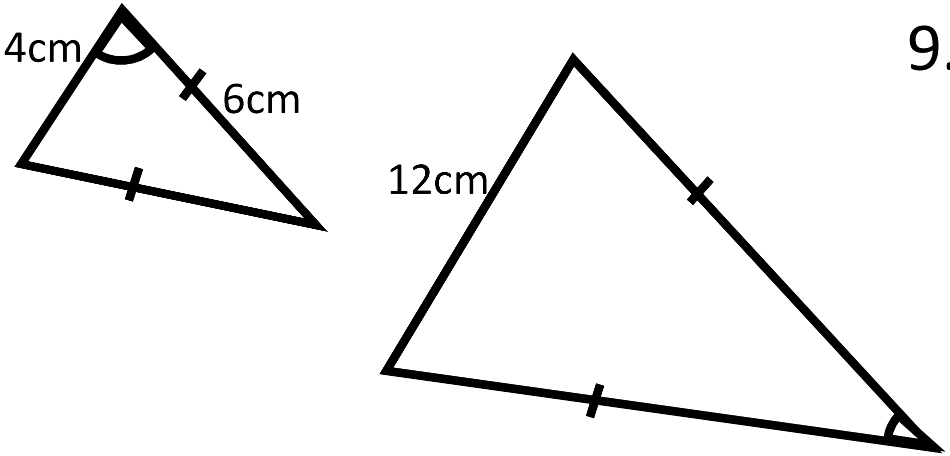
7.


8cm
4cm
6cm
2cm

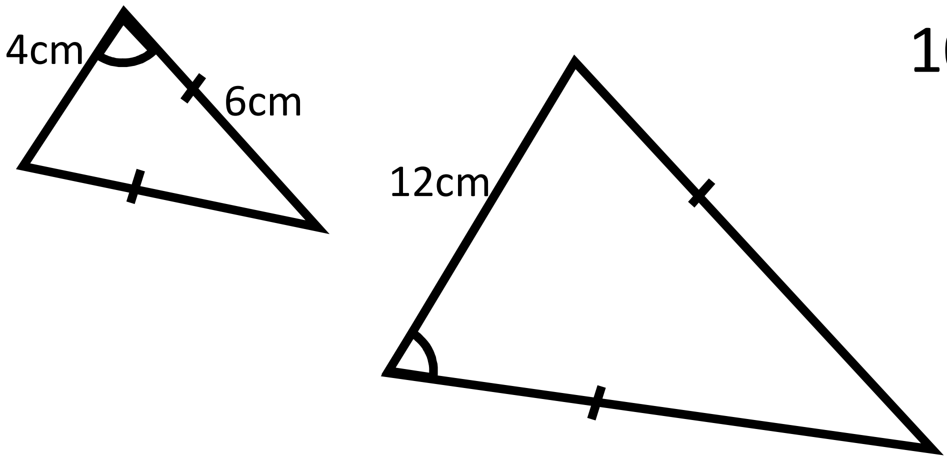
8.

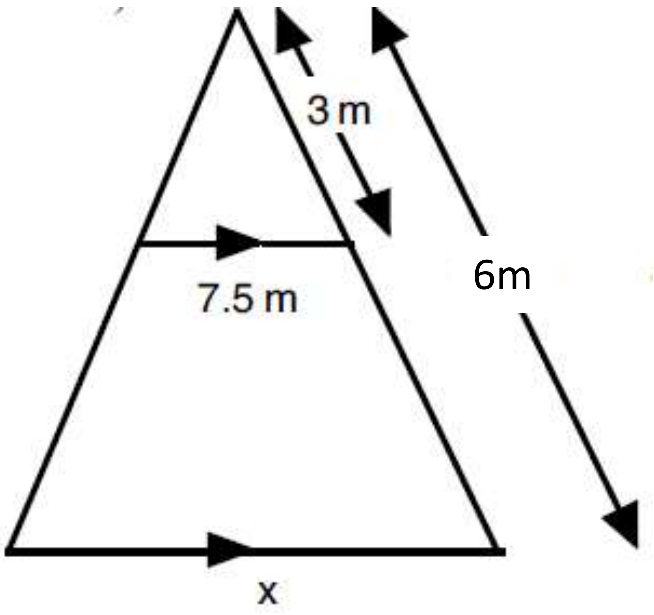
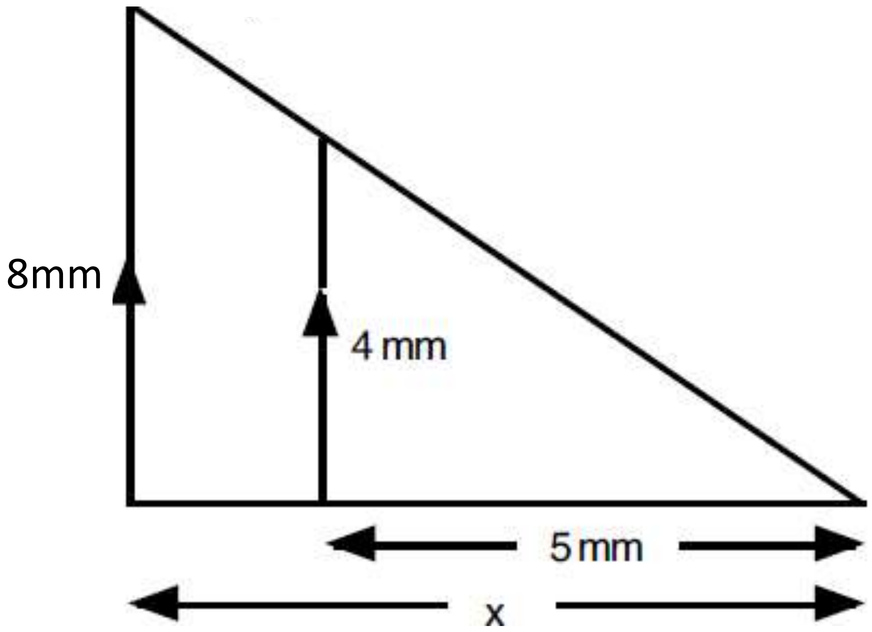

8cm
4cm
6cm
2cm

9.


4cm
6cm
12cm

10.

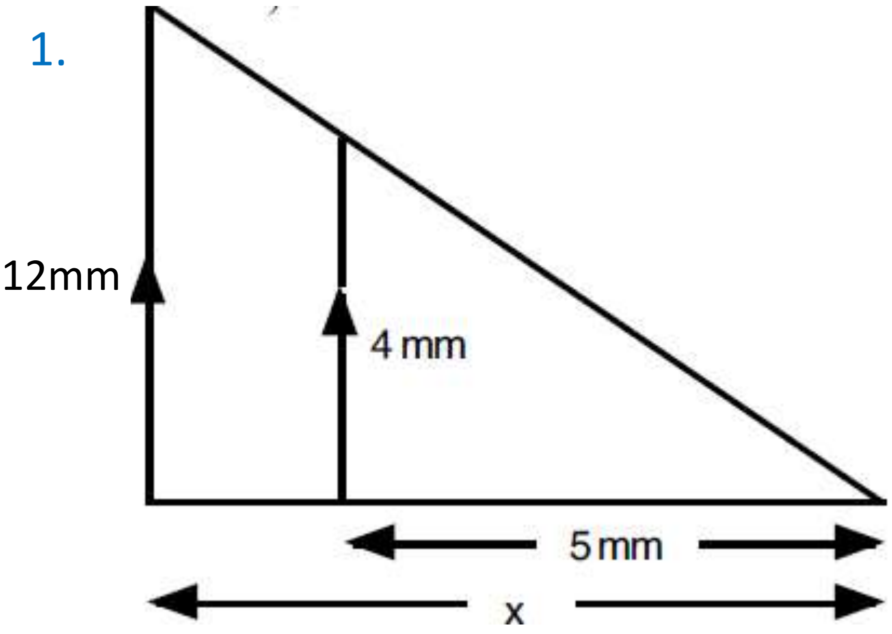

4cm
6cm
12cm

Worked Example	Your Turn
Find the length of every missing side 	Find the length of every missing side 

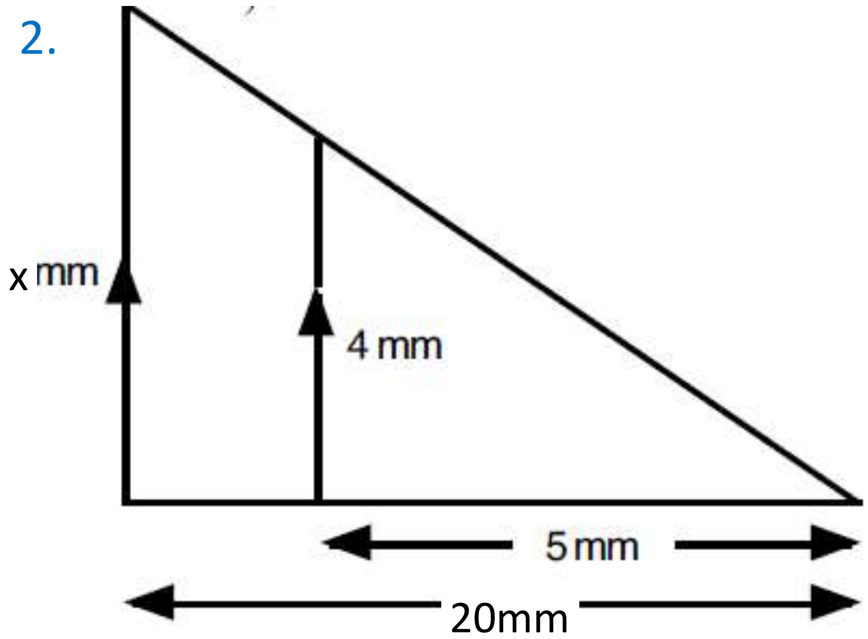
Intelligent Practice – Find the length of every missing side

Triangles not drawn to scale

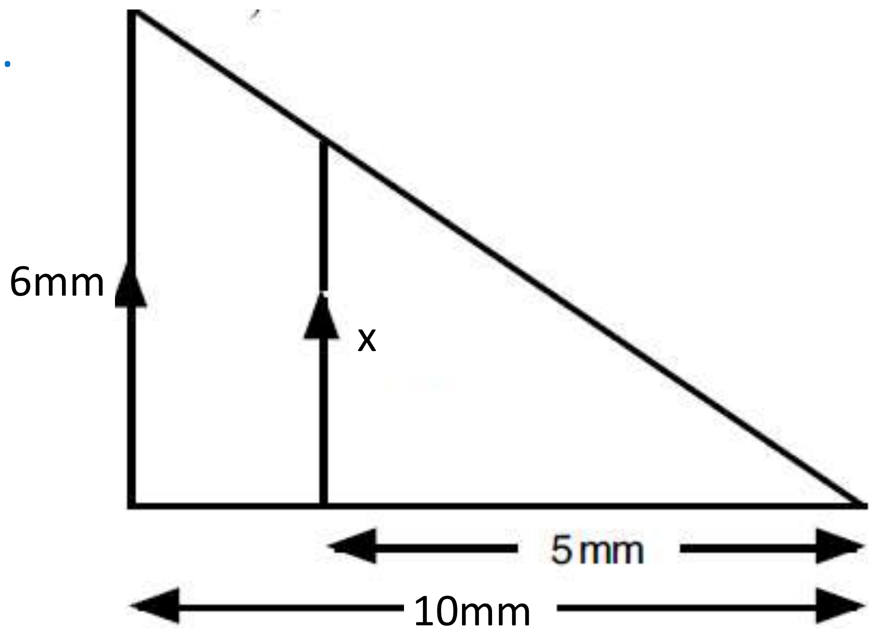
1.



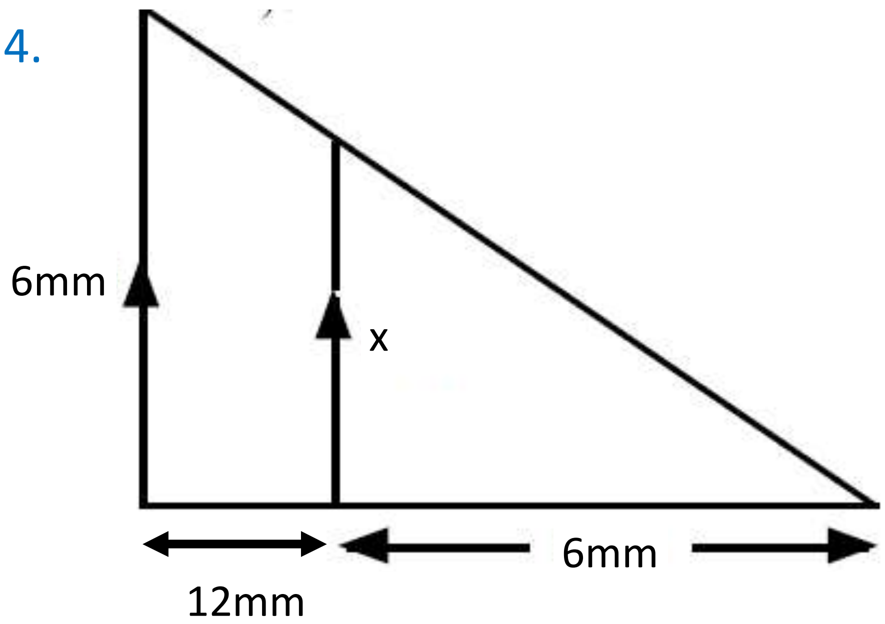
2.



3.



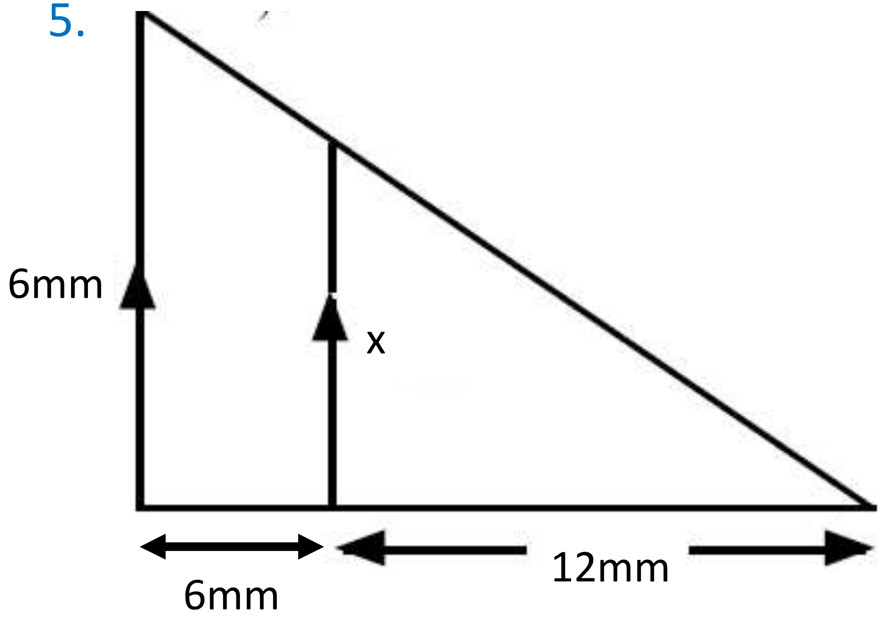
4.



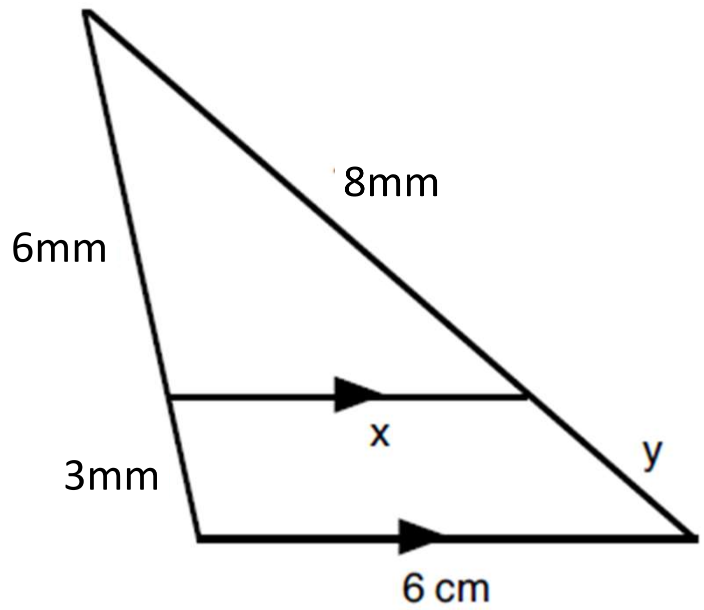
Intelligent Practice – Find the length of every missing side

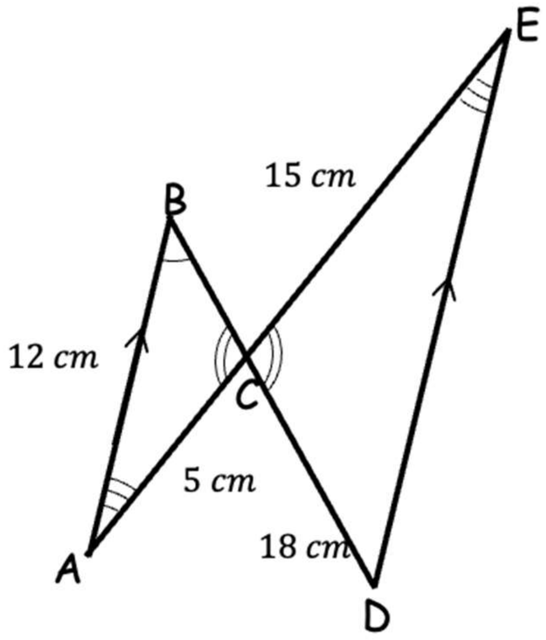
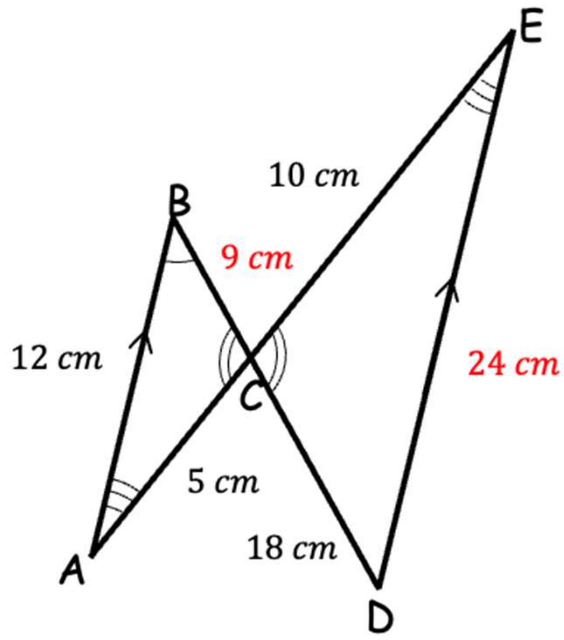
Triangles not drawn to scale

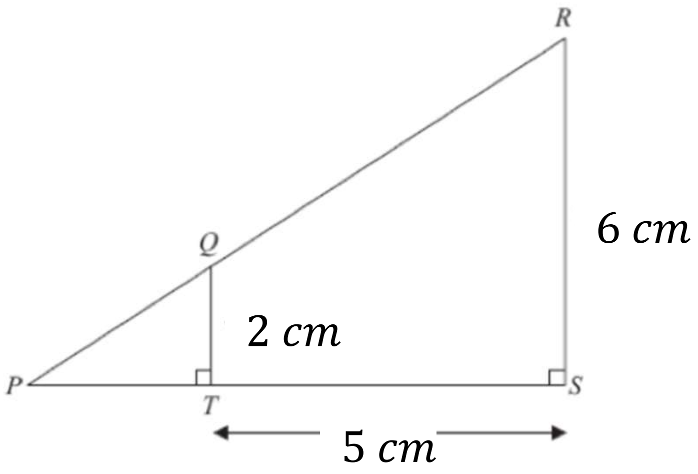
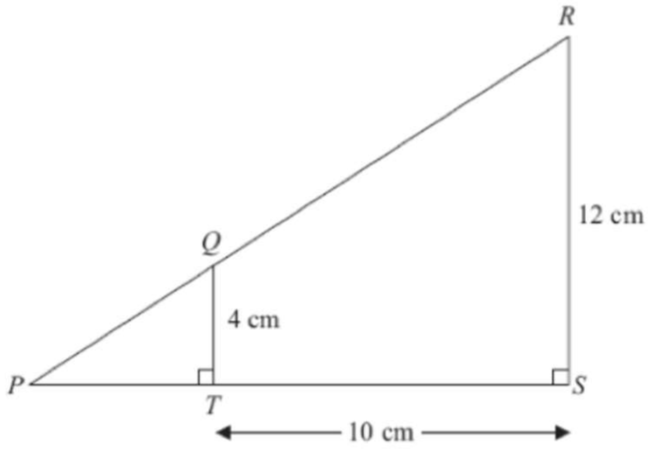
5.



6.

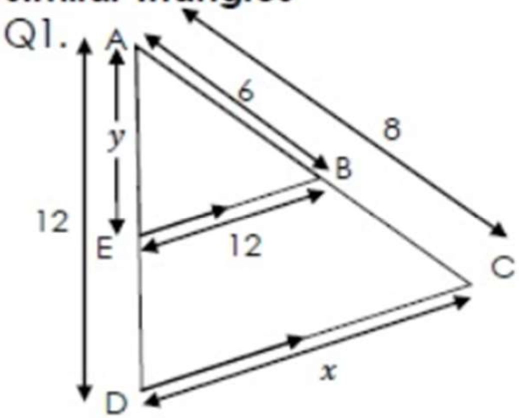


Worked Example	Your Turn
Calculate the missing lengths 	Calculate the missing lengths 

Worked Example	Your Turn
Calculate the length of PT 	Calculate the length of PT 

Similar Triangles

Q1.

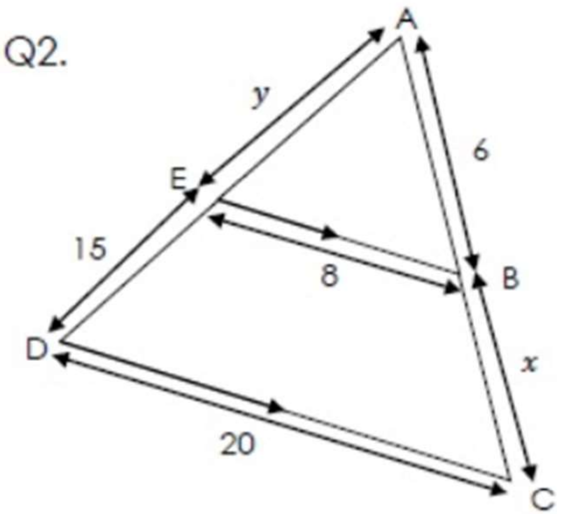


i) Find the scale factor between triangle ABE and triangle ACD

ii) Find the value of x

iii) Find the value of y

Q2.

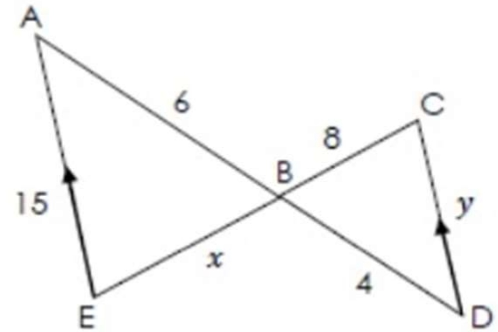


i) Find the scale factor between ABE and ACD

ii) Find the value of x

iii) Find the value of y

Q3.

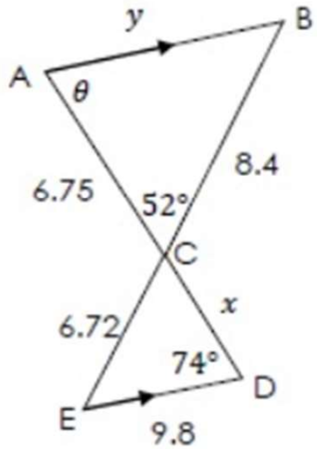


i) How can you tell that ABE and BCD are mathematically similar?

ii) Find the value of x

iii) Find the value of y

Q4

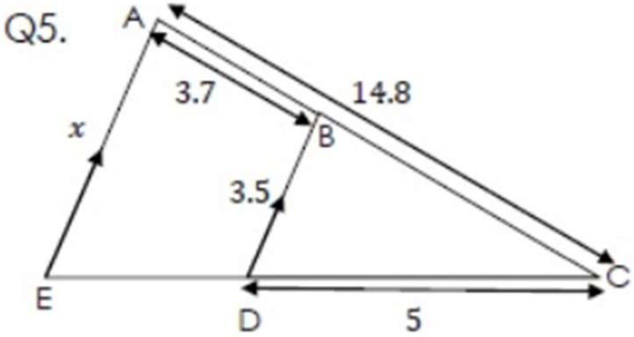


i) Find the value of x

ii) Find the value of y

iii) Find the size of angle θ

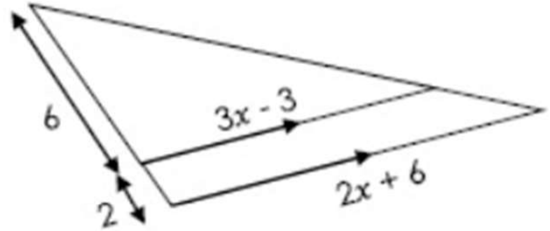
Q5.



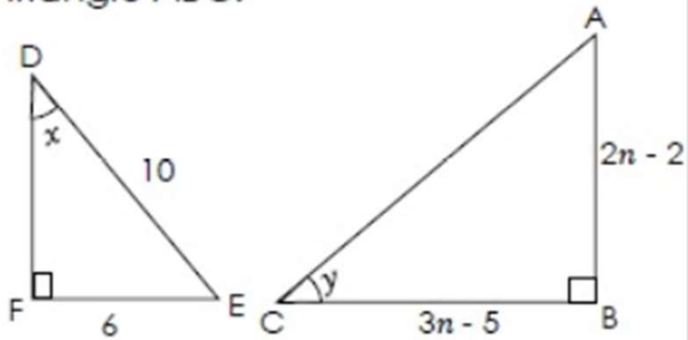
i) Find the value of x

ii) Hence, find the perimeter of trapezium ABDE

Q6. Find the value of x



Q7. [non-calculator] Given that $\tan(x) = \tan(y)$, find the area of triangle ABC.



Trigonometry

https://youtu.be/1s7V7Ai3Eaw - story of trigonometry

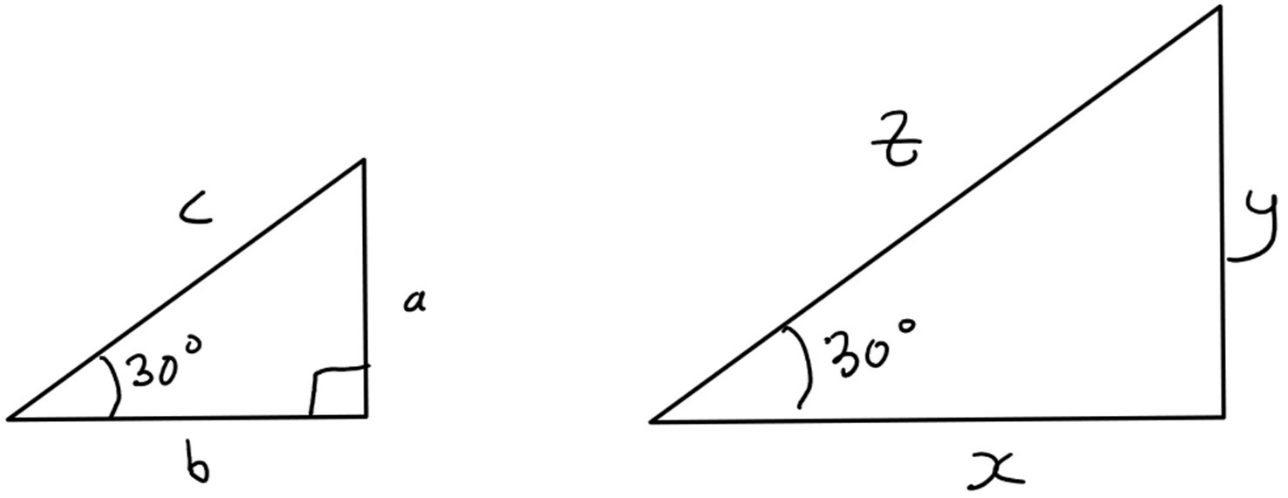
We know that for any **similar** triangles:

- Corresponding angles are the same
- Corresponding lengths are enlargements of each other

We are going to look at the special case **right-angled triangles** and the relationship between the 3 sides and the 2 non-right angles.

Trigonometry

Using the idea of similar triangles complete the statements below:



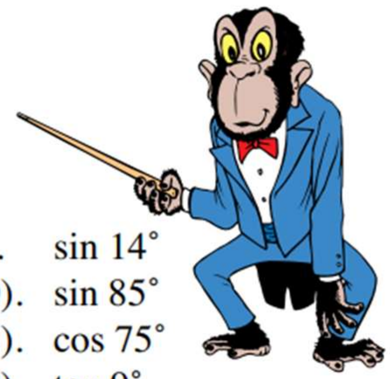
$$\frac{a}{b} = \boxed{}$$

$$\boxed{} = \frac{x}{z}$$

$$\frac{b}{c} = \boxed{}$$

How do we know what any of these ratios are?

Using your calculator exercise:



C. Find the value of the following to 3 d.p..

1). $\sin 10^\circ$	2). $\cos 45^\circ$	3). $\tan 45^\circ$	4). $\tan 62^\circ$	5). $\sin 14^\circ$
6). $\sin 69^\circ$	7). $\tan 14^\circ$	8). $\cos 32^\circ$	9). $\cos 5^\circ$	10). $\sin 85^\circ$
11). $\tan 68^\circ$	12). $\sin 55^\circ$	13). $\tan 4^\circ$	14). $\sin 15^\circ$	15). $\cos 75^\circ$
16). $\sin 90^\circ$	17). $\cos 90^\circ$	18). $\cos 12^\circ$	19). $\tan 78^\circ$	20). $\tan 9^\circ$

D. Calculate the following to 2 d.p..

1). $5 \tan 45^\circ$	2). $4 \sin 30^\circ$	3). $8 \cos 60^\circ$	4). $6 \sin 43^\circ$	5). $9 \cos 18^\circ$
6). $15 \tan 83^\circ$	7). $14 \cos 25^\circ$	8). $24 \cos 72^\circ$	9). $31 \sin 45^\circ$	10). $20 \cos 34^\circ$
11). $5 \cos 60^\circ$	12). $56 \sin 15^\circ$	13). $30 \tan 45^\circ$	14). $19 \sin 82^\circ$	15). $14 \tan 45^\circ$
16). $17 \tan 60^\circ$	17). $8 \cos 0^\circ$	18). $45 \tan 28^\circ$	19). $61 \sin 90^\circ$	20). $28 \tan 50^\circ$

E. Calculate the following to 2 d.p..

1). $\frac{6}{\sin 34^\circ}$	2). $\frac{12}{\cos 83^\circ}$	3). $\frac{4}{\tan 16^\circ}$	4). $\frac{23}{\tan 45^\circ}$	5). $\frac{31}{\sin 30^\circ}$
6). $\frac{38}{\cos 18^\circ}$	7). $\frac{48}{\tan 80^\circ}$	8). $\frac{8}{\sin 54^\circ}$	9). $\frac{18}{\sin 15^\circ}$	10). $\frac{5}{\cos 51^\circ}$
11). $\frac{25}{\tan 52^\circ}$	12). $\frac{62}{\cos 71^\circ}$	13). $\frac{82}{\sin 68^\circ}$	14). $\frac{16}{\cos 8^\circ}$	15). $\frac{2}{\sin 12^\circ}$
16). $\frac{6}{\sin 75^\circ}$	17). $\frac{18}{\tan 45^\circ}$	18). $\frac{48}{\cos 50^\circ}$	19). $\frac{37}{\tan 12^\circ}$	20). $\frac{52}{\tan 84^\circ}$

KEY SKILL – rearrangements and calculator use:

Q1. Rearrange to make **c** the subject.

a. $a = \frac{c}{b}$

b. $a = \frac{b}{c}$

c. $5 = \frac{c}{b}$

d. $20 = \frac{b}{c}$

e. $\sin A = \frac{c}{b}$

f. $sinA = \frac{b}{c}$

g. $sin5 = \frac{c}{b}$

h. $sin20 = \frac{b}{c}$

i. $cos\ A = \frac{c}{b}$

j. $cos\ 28 = \frac{b}{c}$

k. $tan\ A = \frac{b}{c}$

l. $tan\ A = \frac{10}{c}$

Q2. Calculate **a** to 2dp.

a. $sin40 = \frac{a}{6}$

b. $sin31 = \frac{a}{8}$

c. $cos70 = \frac{20}{a}$

d. $cos46 = \frac{12a}{7}$

e. $tan20 = \frac{a}{27}$

f. $tan58 = \frac{67}{a}$

Q3. Calculate **a** to 3sf.

a. $sin36 = \frac{a}{9}$

b. $sin71 = \frac{a}{6}$

c. $sin29 = \frac{6}{a}$

d. $sin81 = \frac{75}{a}$

e. $sin205 = \frac{a}{11}$

f. $cos53 = \frac{29}{a}$

g. $cos101 = \frac{a}{61}$

h. $tan44 = \frac{a}{7}$

i. $tan18 = \frac{50}{c}$

Worked Example	Your Turn
$\sin(30) = \frac{x}{5}$	$\cos(45) = \frac{x}{4}$

Find ‘x’. Give your solution to 2 decimal places.

1. $\tan(30) = \frac{x}{2}$
2. $\tan(45) = \frac{x}{2}$
3. $\sin(45) = \frac{x}{2}$
4. $\sin(45) = \frac{x}{4}$
5. $\frac{x}{4} = \sin(45)$
6. $x \times \sin(45) = 4$
7. $x \times \sin(30) = 4$
8. $x \times \cos(30) = 4$
9. $x \times \cos(30) = 8$
10. $x \times \cos(31) = 8$

Worked Example	Your Turn
$\sin(15) = \frac{5}{x}$	$\cos(45) = \frac{5}{x}$

Find 'x'. Give your solution to 2 decimal places.

1. $\cos(30) = \frac{2}{x}$

2. $\cos(45) = \frac{2}{x}$

3. $\sin(45) = \frac{2}{x}$

4. $\sin(45) = \frac{4}{x}$

5. $\sin(45) = \frac{8}{x}$

6. $\tan(45) = \frac{8}{x}$

7. $\tan(45) = \frac{x}{8}$

8. $\cos(45) = \frac{x}{8}$

9. $\cos(45) = \frac{8}{x}$

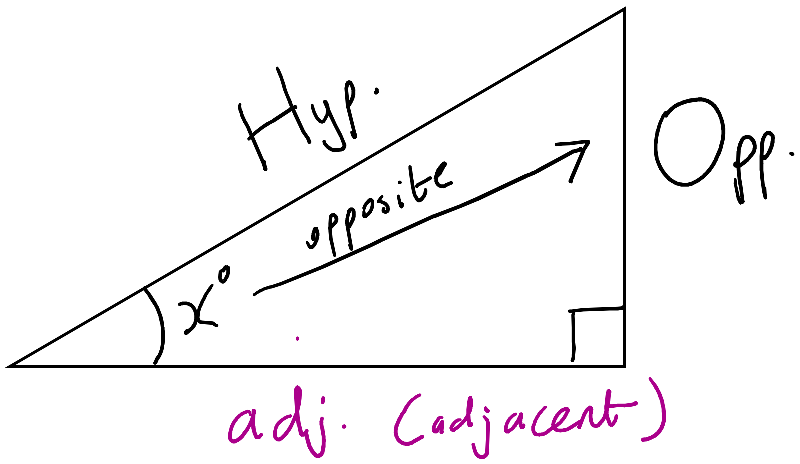
10. $\frac{8}{x} = \cos(45)$

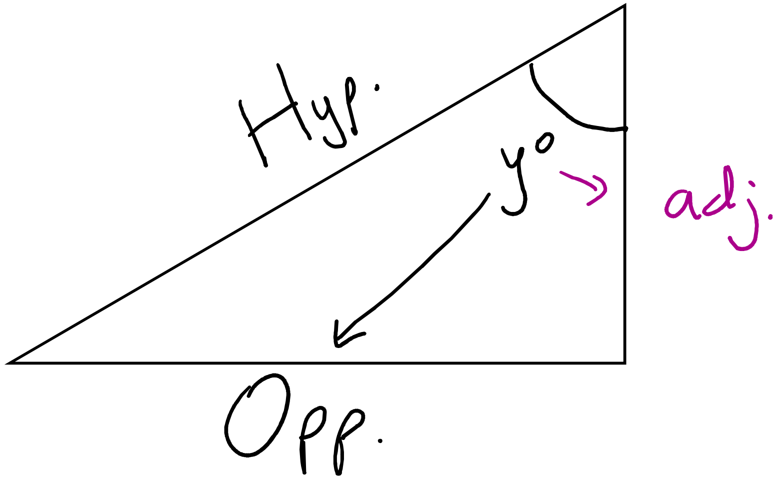
Trigonometric Functions

A function $f(x)$ takes an input x and outputs a value y. A **trigonometric function** takes an **angle** $\boldsymbol{x}°$ and outputs a **ratio of sides.**

For any **right-angled triangle** we **<u>always</u>** label the longest side as the hypotenuse *H.* For the purposes of trigonometry we label the other two sides **relative** to <u>one</u> of the non-right angles.

One of these is **opposite** the angle and the other **adjacent** (meaning next to).

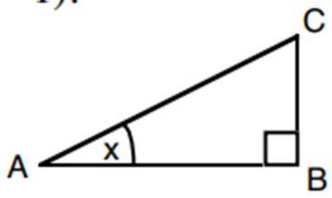




Labelling the sides exercise:

A. Name all the sides from the given angle, x°.

1).



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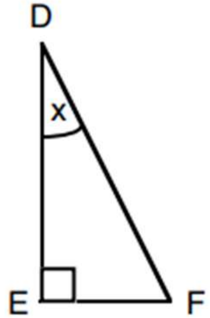

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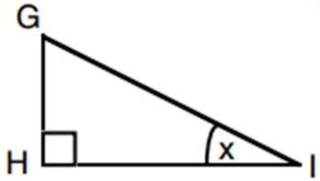

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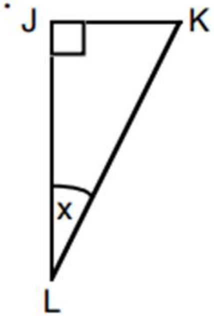

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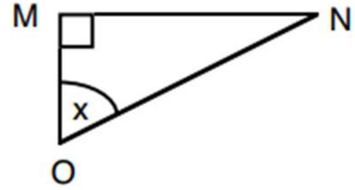

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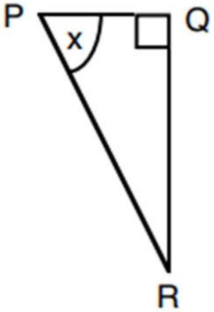

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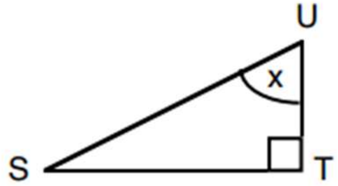

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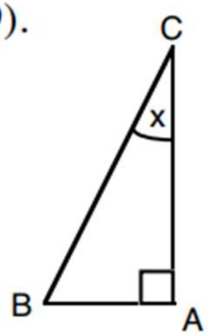

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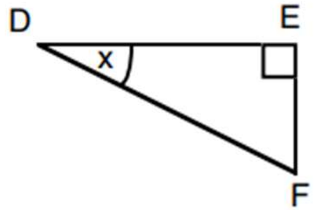

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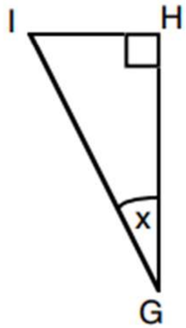

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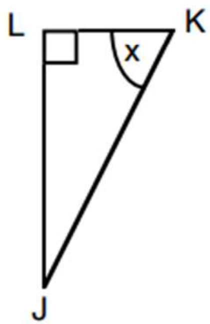

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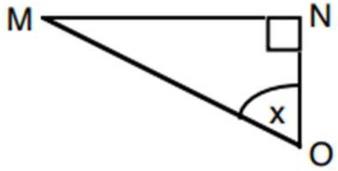

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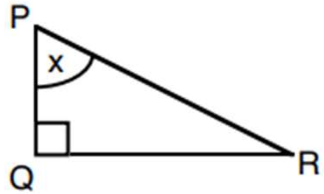

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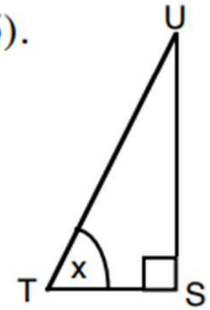


Trigonometric Functions

A function $f(x)$ takes an input x and outputs a value y. A **trigonometric function** takes an **angle $x°$** and outputs a **ratio of sides.**

The three sides of right-angled triangles are:

O – Opposite
A – Adjacent
H – Hypotenuse

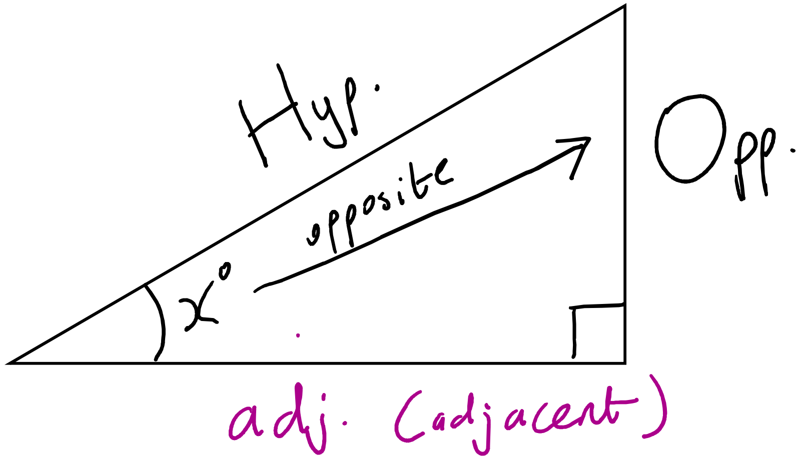
So the three ratios are: $\boldsymbol{O : H \text{ or } \frac{O}{H}}$ $\quad$ $\boldsymbol{A : H \text{ or } \frac{A}{H}}$ $\quad$ $\boldsymbol{O : A \text{ or } \frac{O}{A}}$

And so there are **three** trigonometric functions which **<u>take any angles $x°$</u>** and **output one of these ratios:**

$x° \longrightarrow \frac{O}{H}$ $\quad$ $x° \longrightarrow \frac{A}{H}$ $\quad$ $x° \longrightarrow \frac{O}{A}$

Sine (sin) $\quad$ Cosine (cos) $\quad$ tangent (tan)

So altogether if we have:



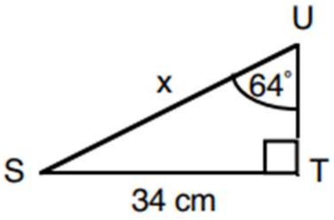
Then: $\sin(x^\circ) = \frac{opp}{hyp}$ $\cos(x^\circ) = \frac{adj}{hyp}$ $\tan(x^\circ) = \frac{opp}{adj}$

This is commonly given the acronym: **SOHCAHTOA**

Choosing the correct trignometric ratio exercise:

B. For each of the following questions look at the information given and the information you have to find. Which of the trigometrical ratios would you use to solve it for x?
Do not try to solve the questions.

1).



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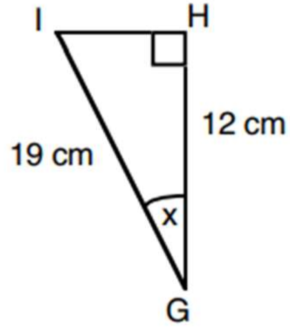

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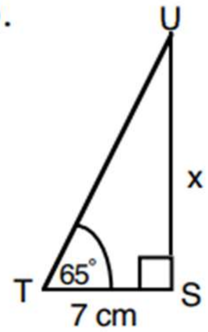

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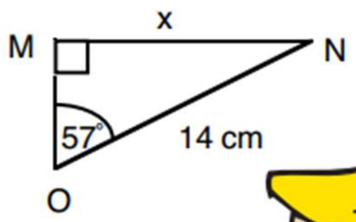

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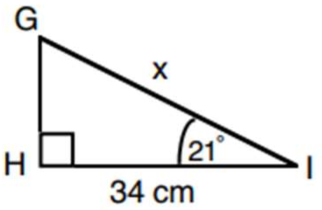

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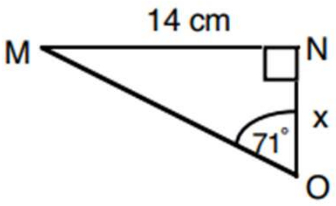

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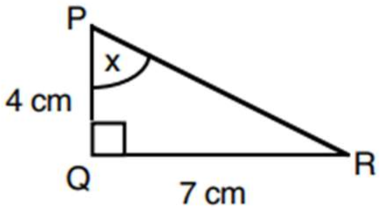

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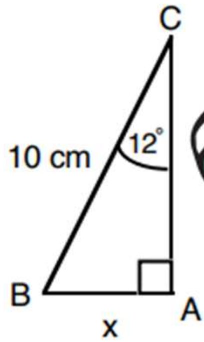

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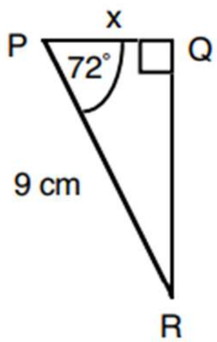

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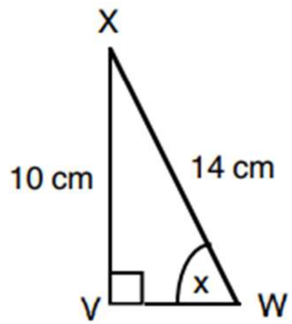

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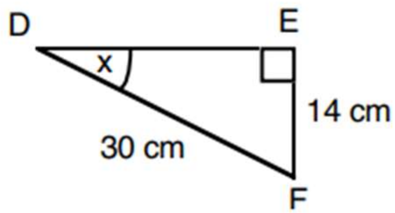

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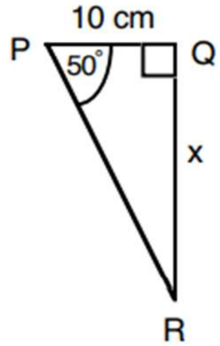
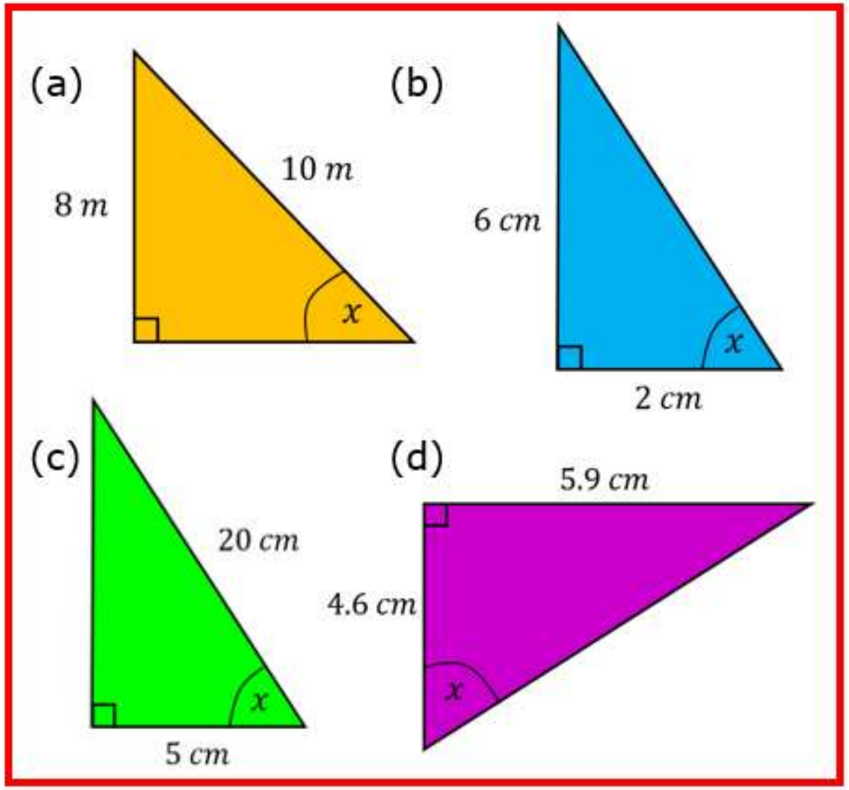
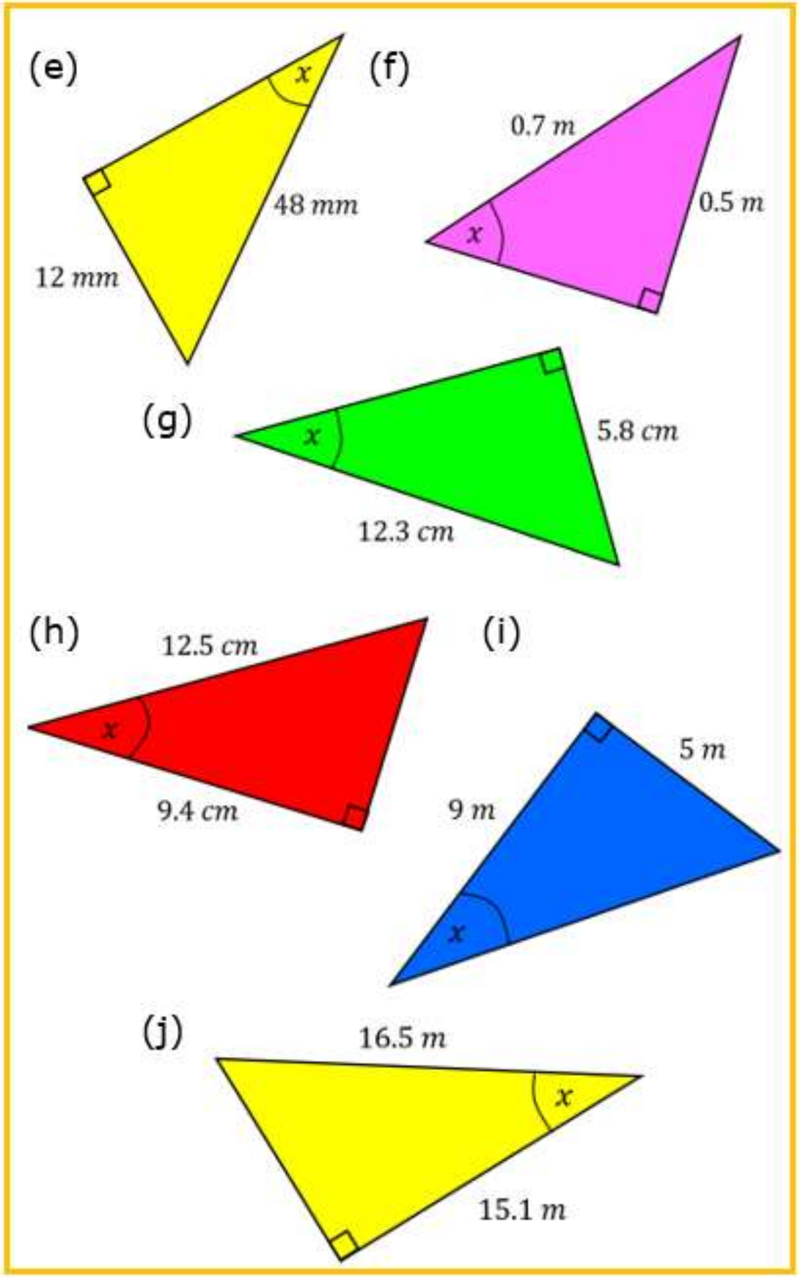
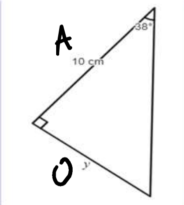
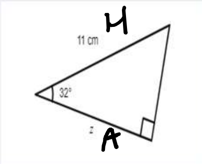
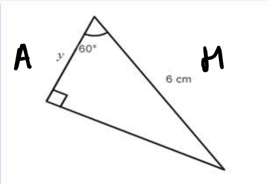
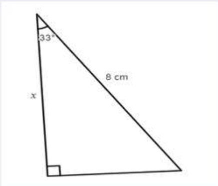
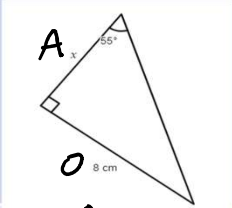
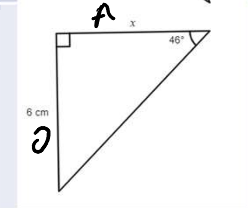
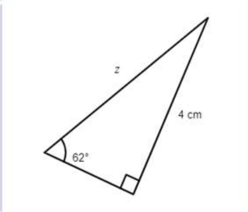


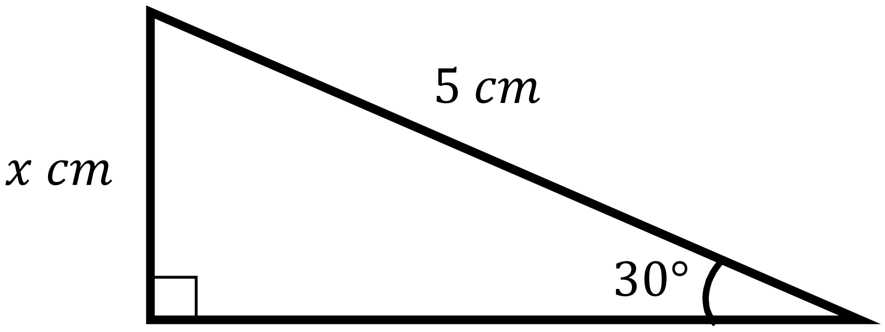
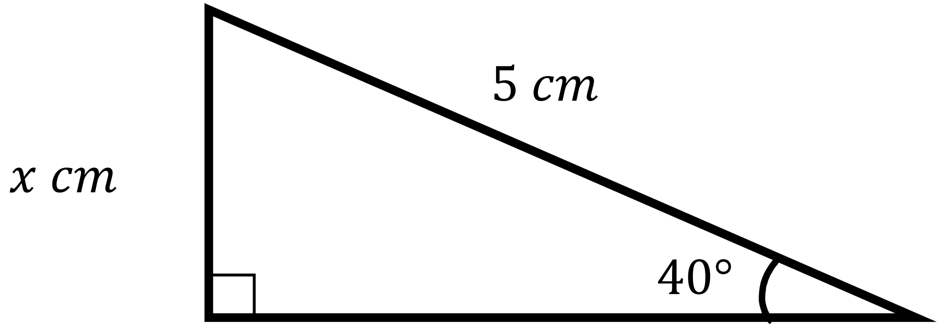
Label each of the triangles with opposite (O), adjacent (A) and hypotenuse (H). Use this to decide which ratio to use – sin (SOH), cos (CAH) or tan (TOA).

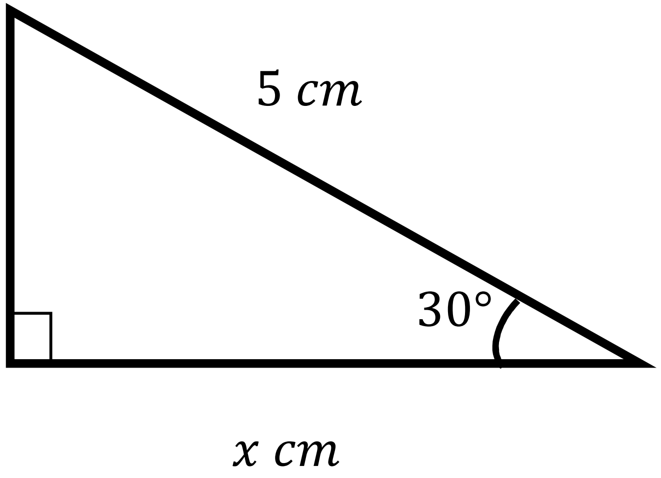
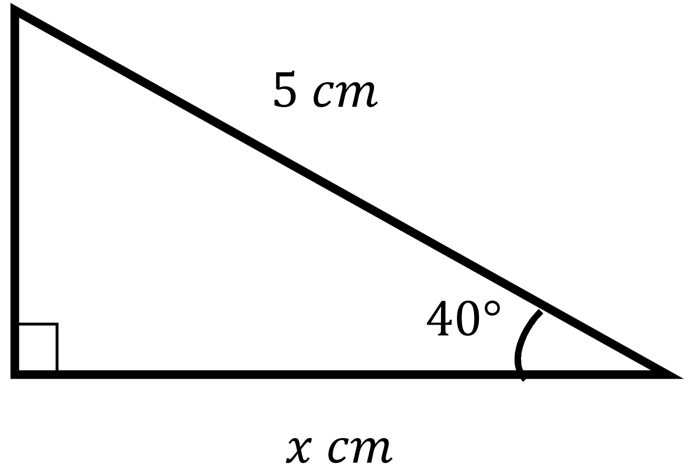


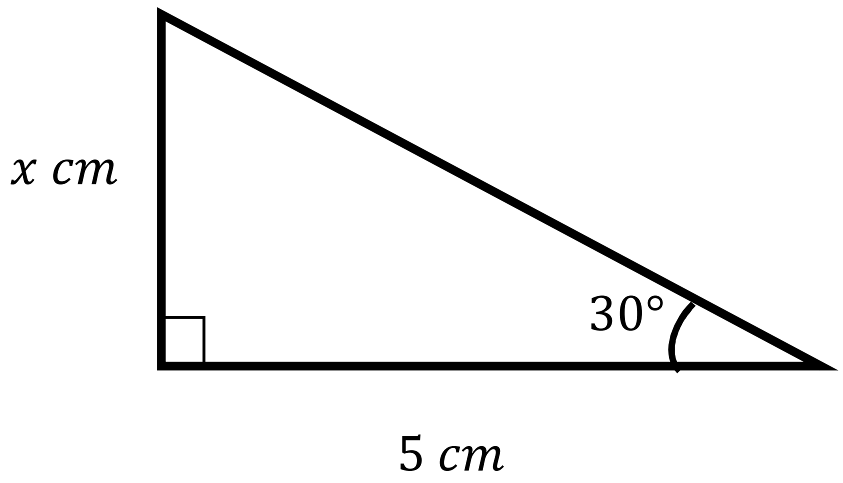
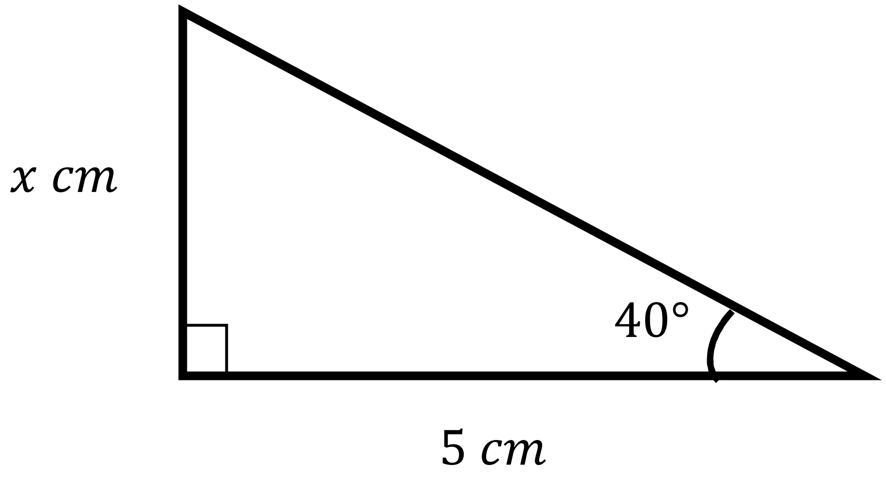


Q	Diagram (label sides)	Correct trigonometric ratio? (select sin / cos / tan)	Fill in formulae	rearrange	Answer (1 d.p)
1		tan	$\tan(38) = \frac{y}{10}$	$y = 10\tan(38)$	7.8 cm
2		cos			
3					
4				$x = 8\cos(33)$	
5			$\sin(32) = \frac{y}{6}$		
6			$\sin(48) = \frac{z}{10}$		

Q	Diagram (label sides)	Correct trigonometric ratio? (select sin / cos / tan)	Fill in formulae	rearrange	Answer (1 d.p)
7		tan	$\tan(55)=\frac{8}{x}$	$x=\frac{8}{\tan(55)}$	5.6 cm
8		tan			
9			$\sin(62)=\frac{4}{z}$		
10				$x=\frac{6}{\cos(52)}$	
11			$\tan(46)=\frac{6}{x}$		
12			$\sin(61)=\frac{5}{z}$		

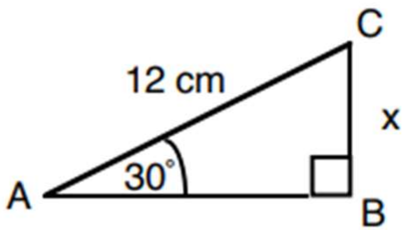
Worked Example	Your Turn
Calculate x: 	Calculate x: 

Worked Example	Your Turn
Calculate x: 	Calculate x: 

Worked Example	Your Turn
Calculate x: 	Calculate x: 

F. Find the length of the side marked x, leave all answers to 1 decimal place.
Diagrams not to scale.

1).



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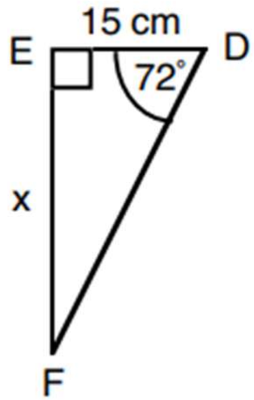

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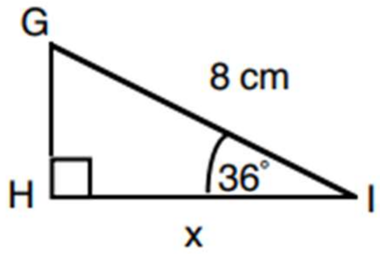

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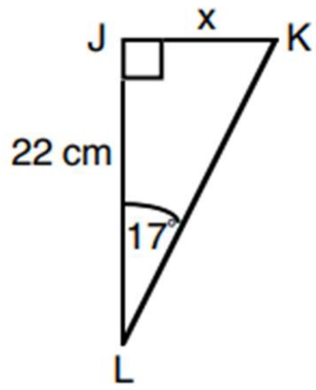

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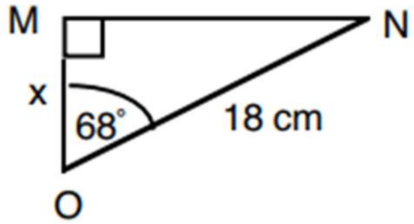

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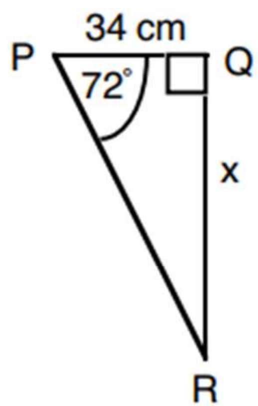

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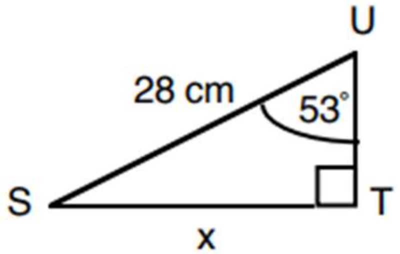

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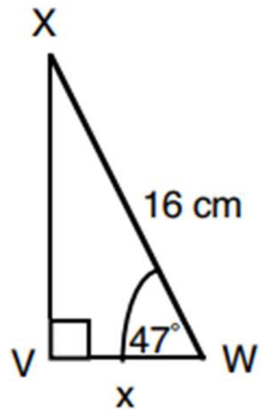

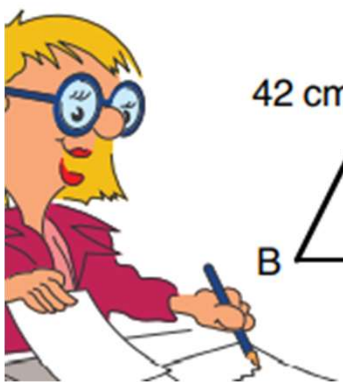

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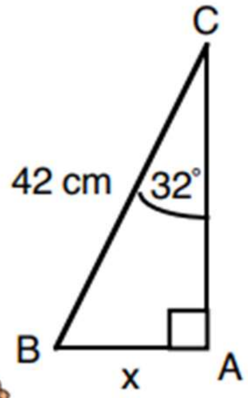

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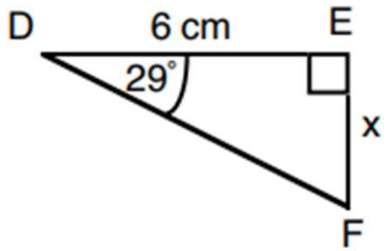

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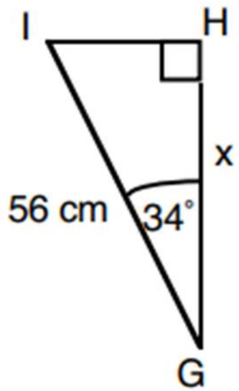
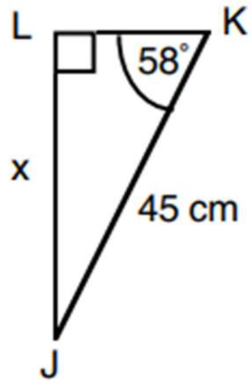
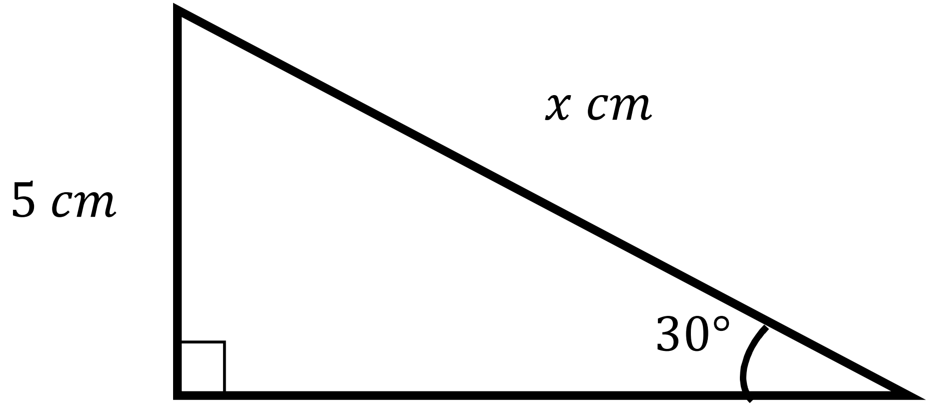
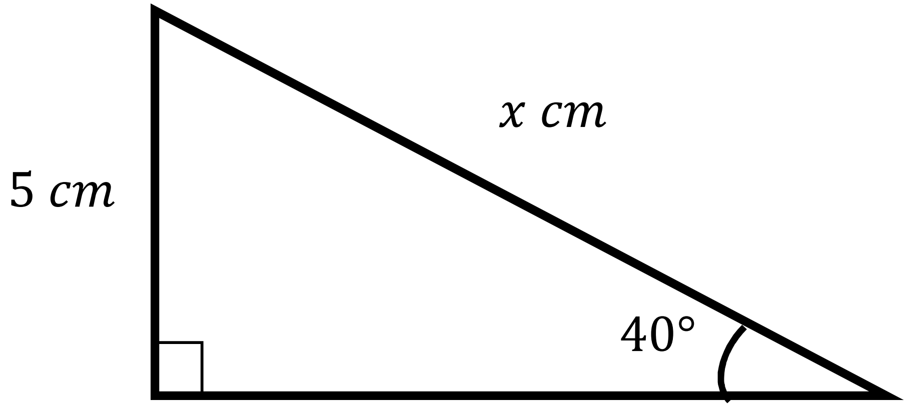
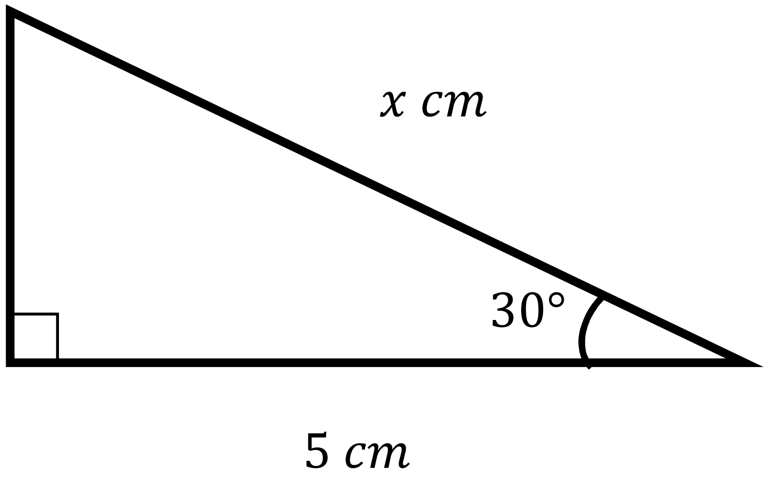
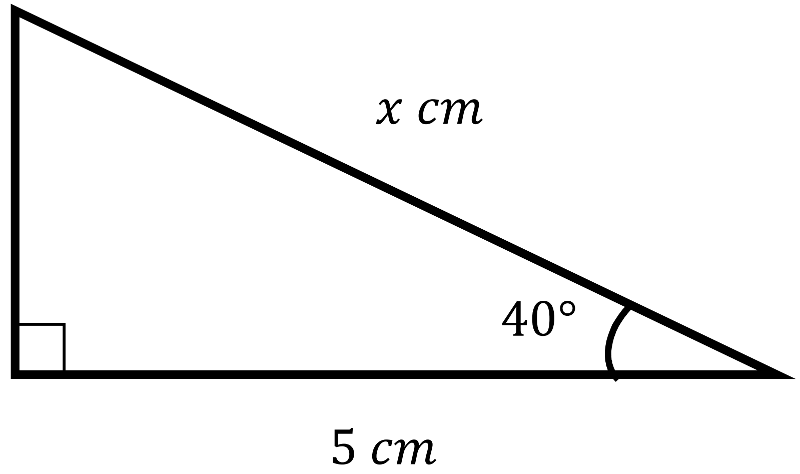
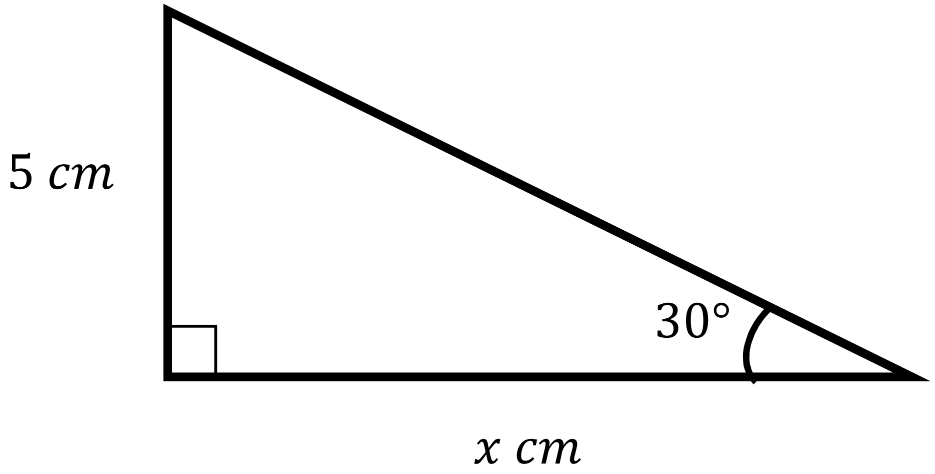
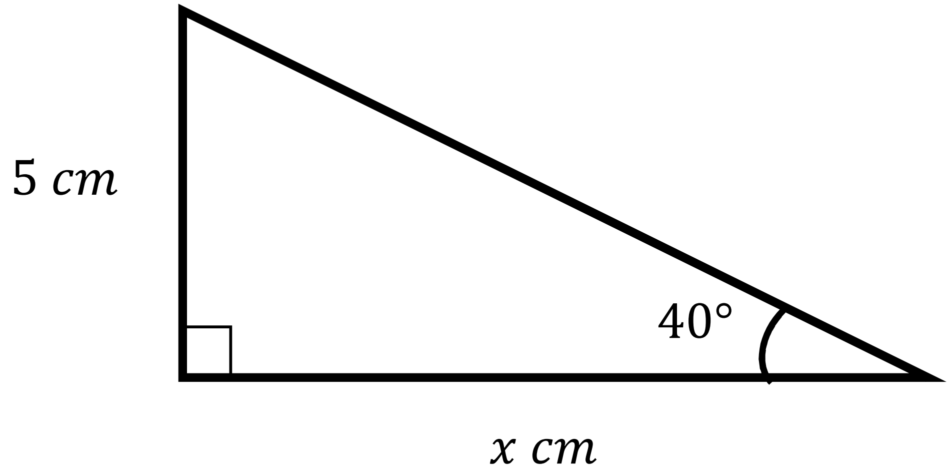


12).



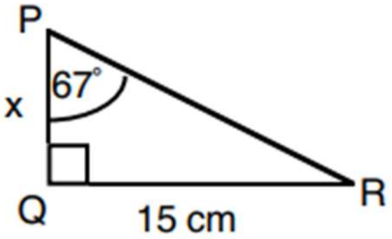
Worked Example	Your Turn
Calculate x: 	Calculate x: 

Worked Example	Your Turn
Calculate x:	Calculate x:
	

Worked Example	Your Turn
Calculate x: 	Calculate x: 

A. Find the length of the side marked x, leave all answers to 1 decimal place. Diagrams not to scale.

1).



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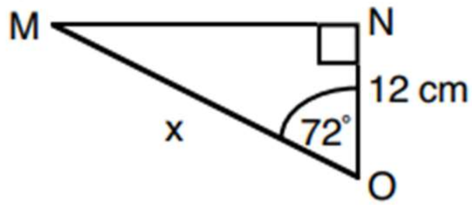
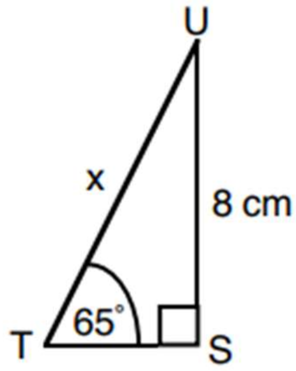


3).



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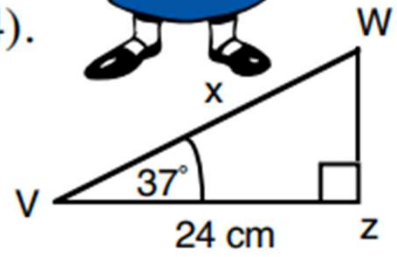

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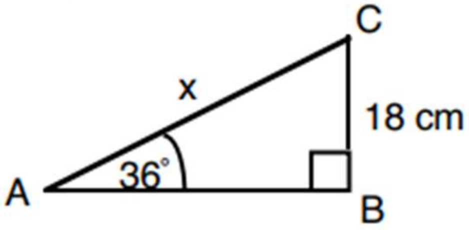

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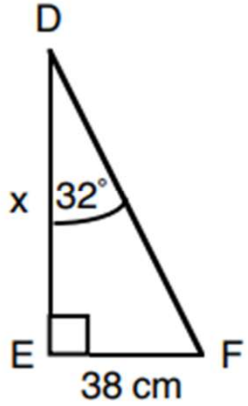

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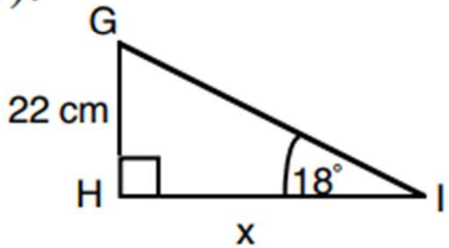
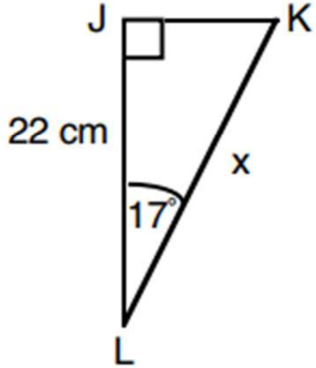


8).



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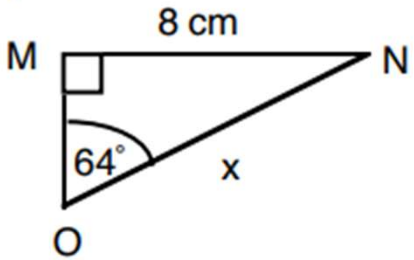

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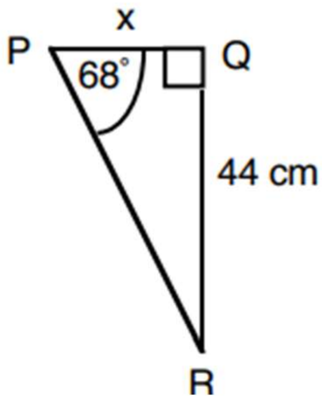
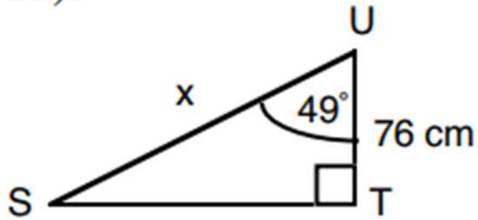


11).



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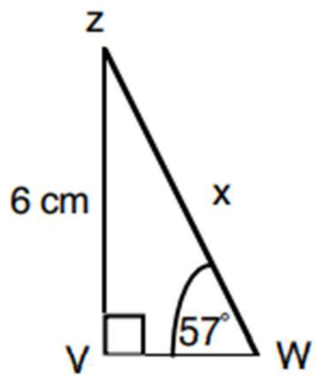
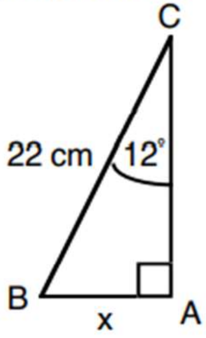


B. Find the length of the side marked x, leave all answers to 1 decimal place. Diagrams not to scale.

1).



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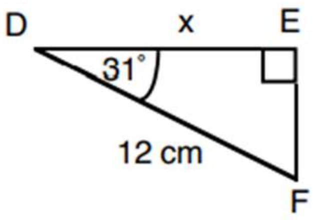

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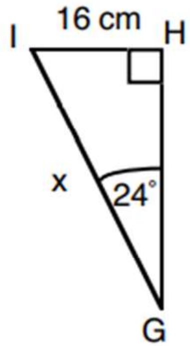

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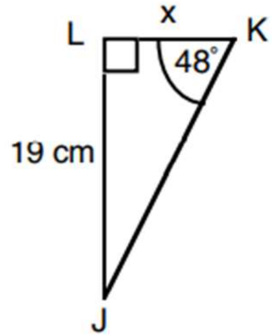

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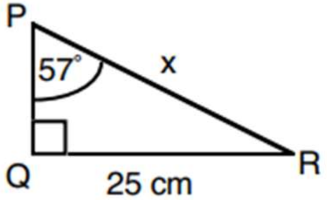

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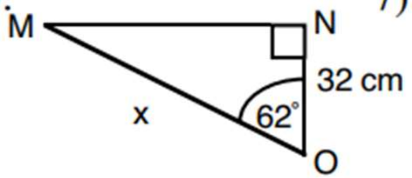

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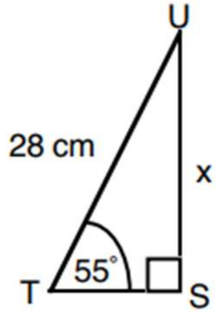

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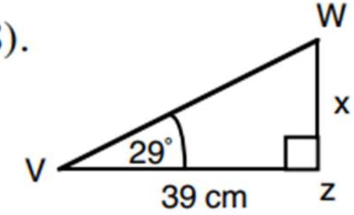

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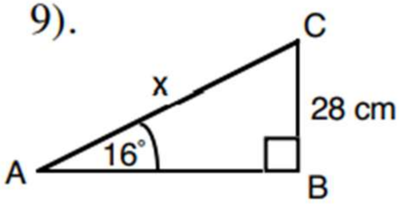

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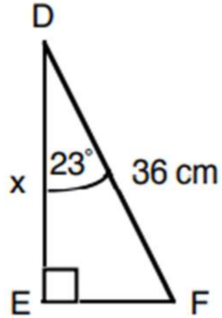

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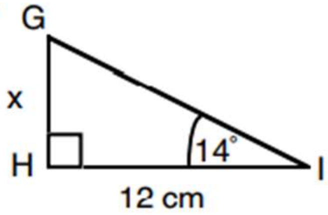

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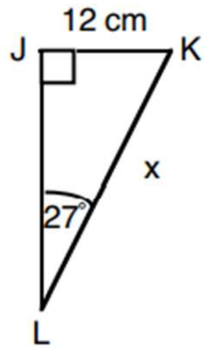

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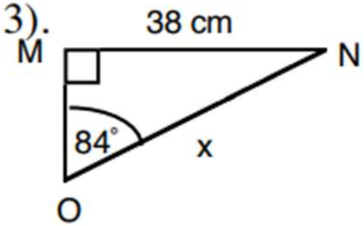

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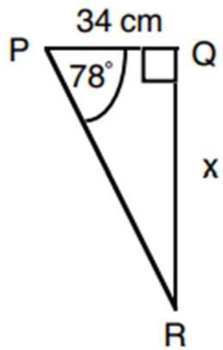

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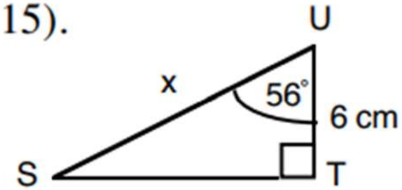

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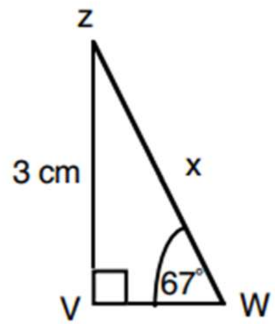


Inverse Trigonometric Functions

We have met the idea that: $f(x) = y$ so $f^{-1}(y) = x$

The trigonometric functions sin, cos and tan are all functions where the input is an angle giving an output which is a ratio of sides.

The inverse of these functions therefore does this in reverse.

if $\sin(30°) = 0.5$ then $\sin^{-1}(0.5) = 30°$

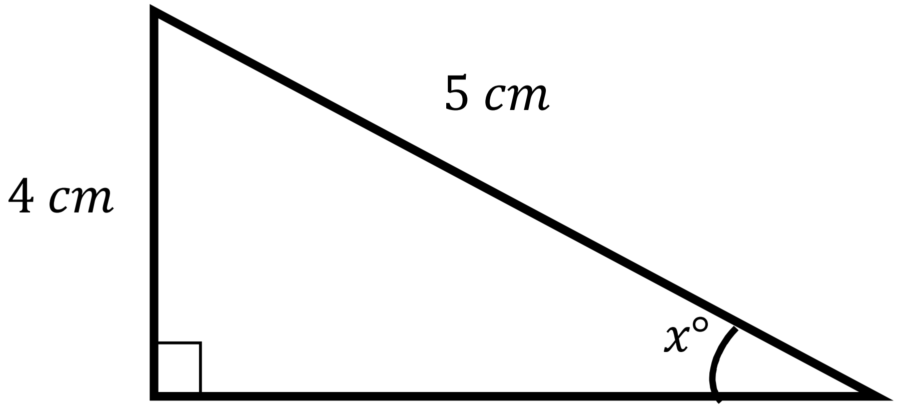
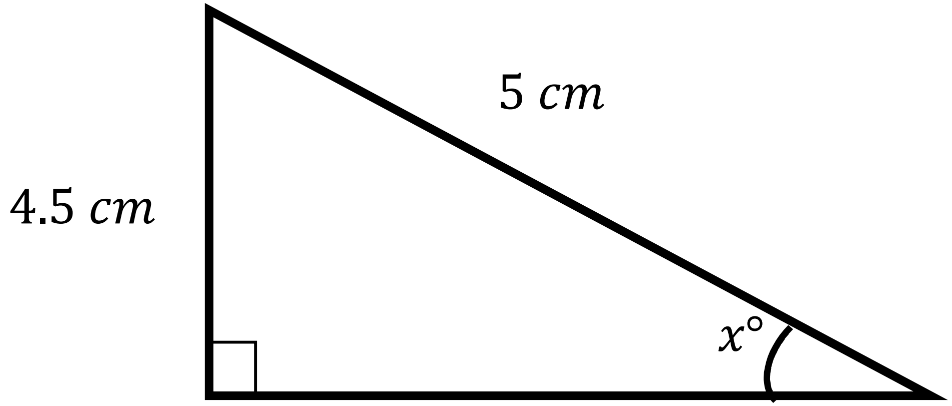
if $\cos(60°) = 0.5$ then $\cos^{-1}(0.5) = 60°$

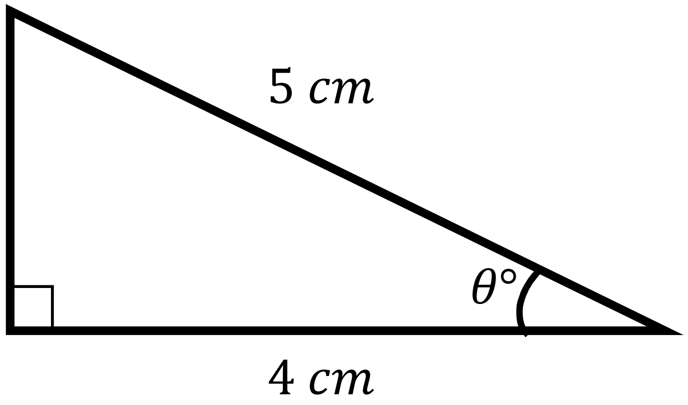
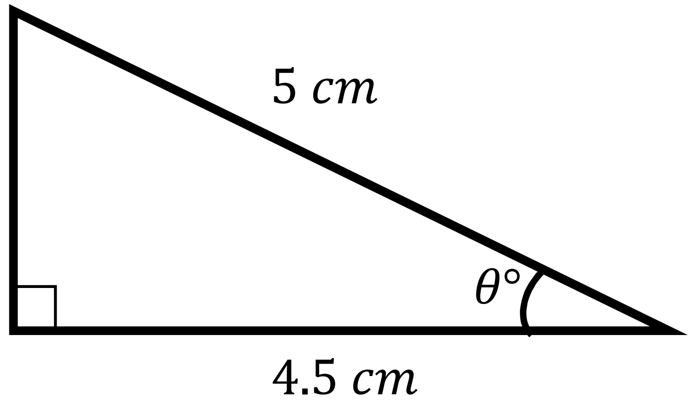
if $\tan(45°) = 1$ then $\tan^{-1}(1) = 45°$

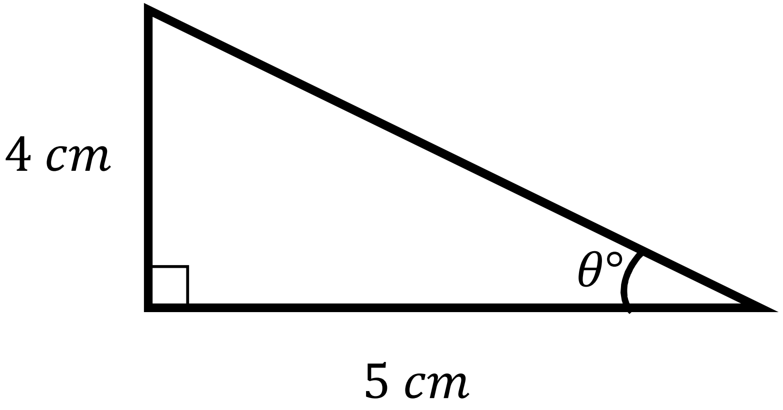
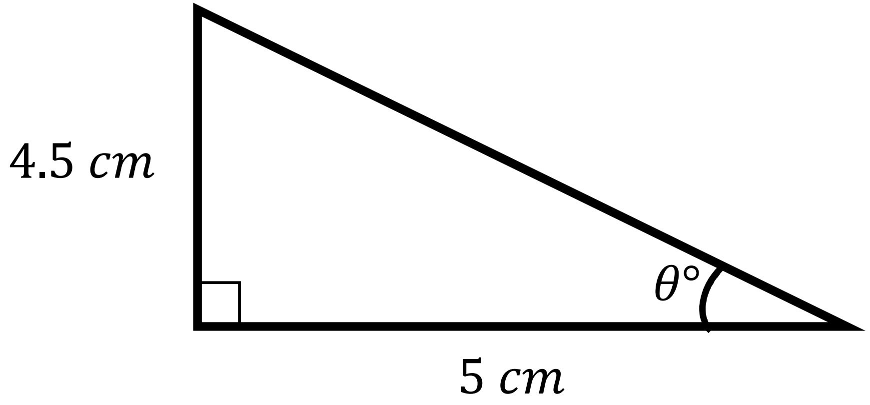
Worked Example	Your Turn
$\sin(x) = \frac{1}{2}$	$\sin(x) = \frac{2}{5}$

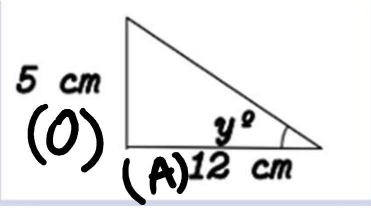
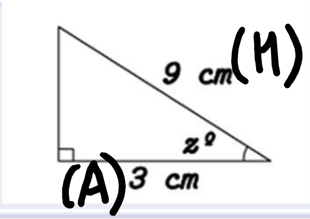
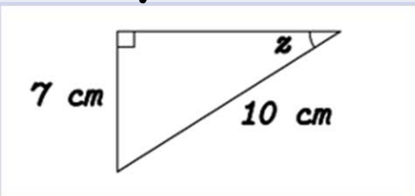
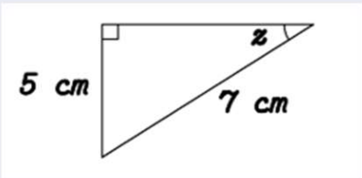
Find 'x'. Give your solution to 2 decimal places.

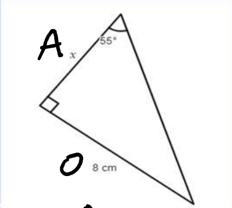
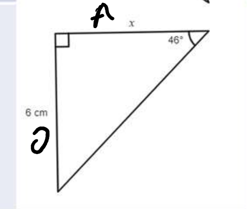
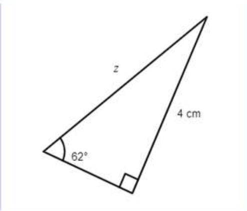
1. $\sin(x) = 0$
2. $\sin(x) = \frac{1}{5}$
3. $\sin(x) = \frac{2}{5}$
4. $\sin(x) = \frac{3}{5}$
5. $\sin(x) = \frac{4}{5}$
6. $\sin(x) = 1$
7. $\cos(x) = 0$
8. $\cos(x) = \frac{1}{5}$
9. $\cos(x) = \frac{2}{5}$
10. $\cos(x) = \frac{3}{5}$
11. $\cos(x) = \frac{4}{5}$
12. $\cos(x) = 1$

Worked Example	Your Turn
Calculate x: 	Calculate x: 

Worked Example	Your Turn
Calculate θ:	Calculate θ:
	

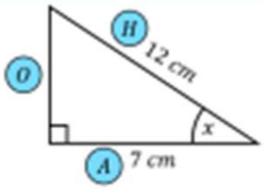
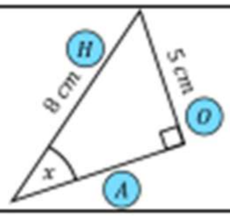
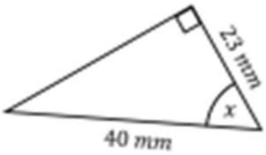
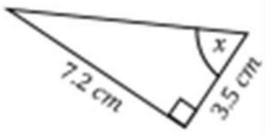
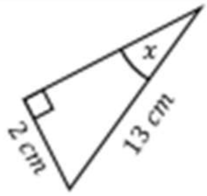
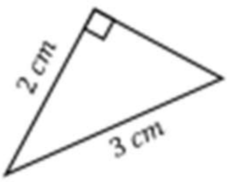
Worked Example	Your Turn
Calculate θ:	Calculate θ:
	

Q	Diagram (label sides)	Correct trigonometric ratio? (select sin / cos / tan)	Fill in formulae	Inverse function	Answer in degrees (1 d.p)
1		tan	$\tan y = \frac{5}{12}$	$y = \tan^{-1}\left(\frac{5}{12}\right)$	22.6
2		cos	$\cos z = \frac{3}{9}$		
3					
4					
5			$\cos y = \frac{3}{10}$		
6				$z = \sin^{-1}\left(\frac{3}{12}\right)$	

Q	Diagram (label sides)	Correct trigonometric ratio? (select sin / cos / tan)	Fill in formulae	rearrange	Answer (1 d.p)
7		tan	$\tan(55) = \frac{8}{x}$	$x = \frac{8}{\tan(55)}$	5.6 cm
8		tan			
9			$\sin(62) = \frac{4}{z}$		
10				$x = \frac{6}{\cos(52)}$	
11			$\tan(46) = \frac{6}{x}$		
12			$\sin(61) = \frac{5}{z}$		

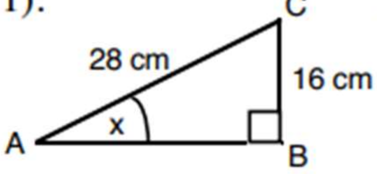
Fill In The Blanks...

Finding Angles Using Trigonometry

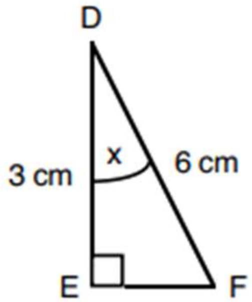
Labelled diagram	Choose ratio	Substitute into formula	Rearrange formula	Answer (1dp)
	cos	$\cos x = \frac{7}{12}$	$x = \cos^{-1}\left(\frac{7}{12}\right)$	
	sin			
				
				
				
				
		$\cos x = \frac{2}{3}$		
			$x = \tan^{-1}\left(\frac{15}{11}\right)$	

C). Find the angles marked x.

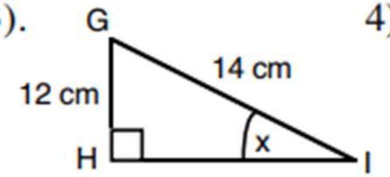
1).



2).



3).



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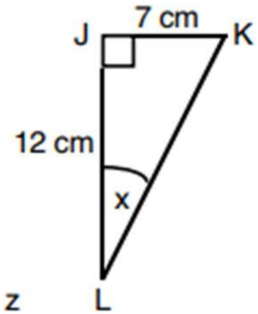

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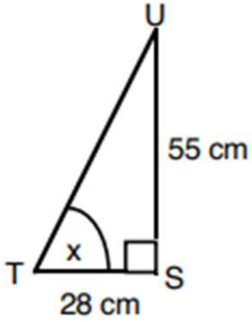

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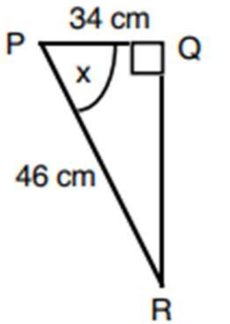

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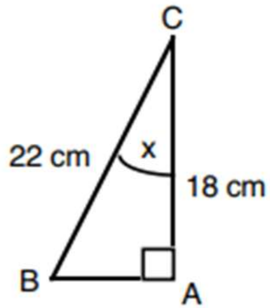

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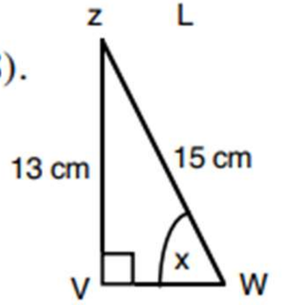

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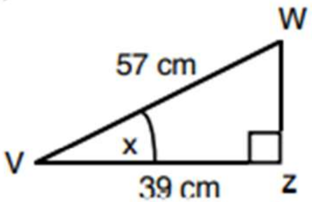
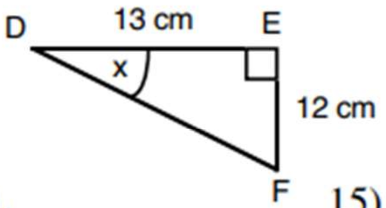


10).



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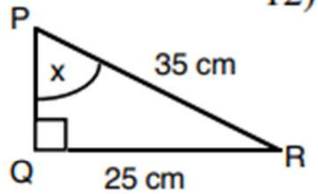

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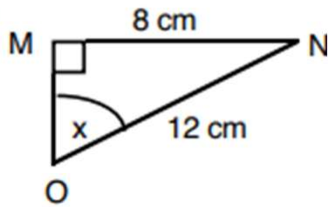
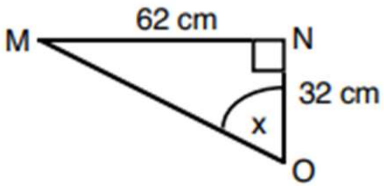


13).



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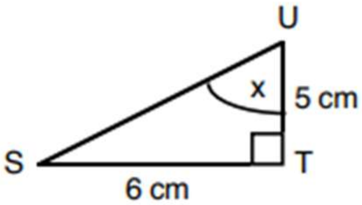

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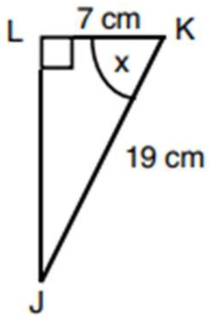

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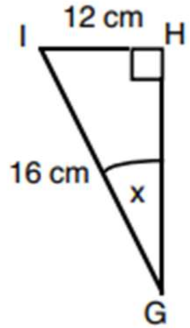
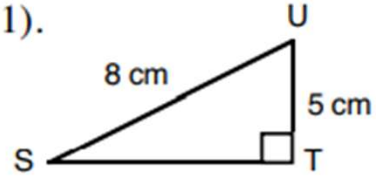


D). In the following triangles find **all the missing angles and sides.**

1).



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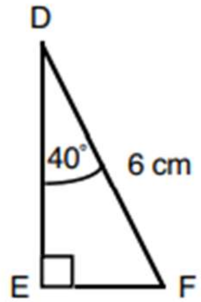

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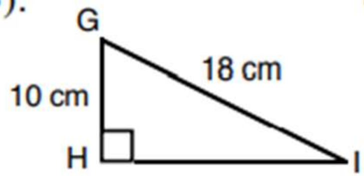

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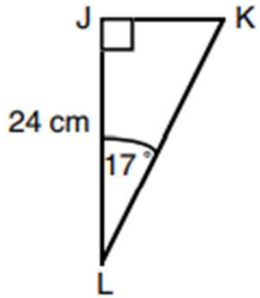

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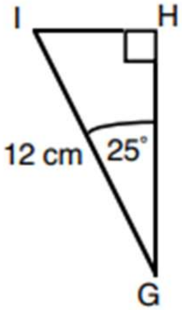

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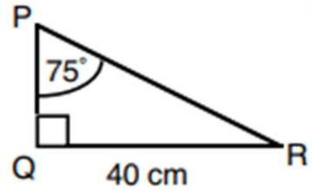

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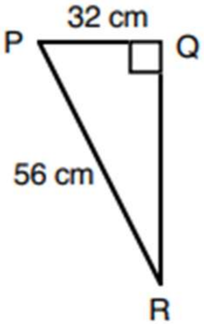

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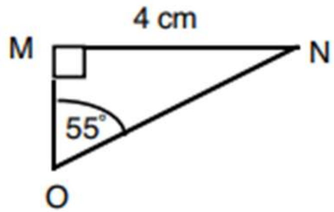

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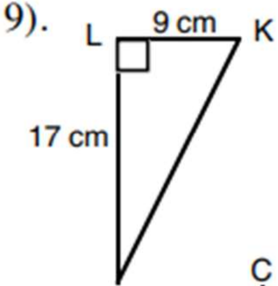

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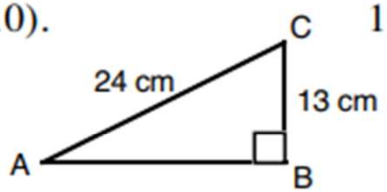

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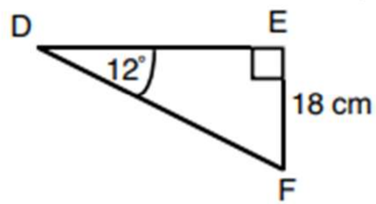

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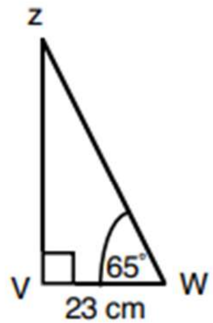

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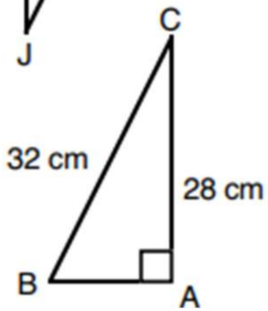

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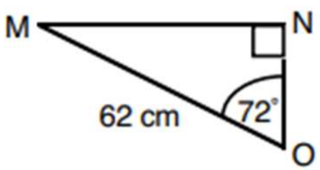

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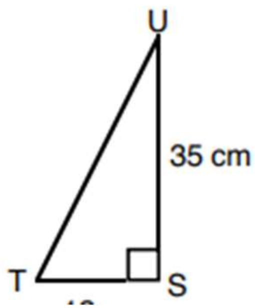

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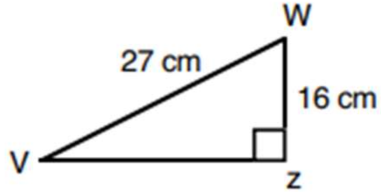
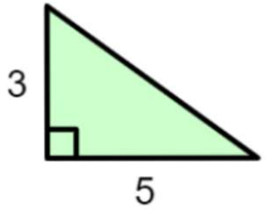


Perplexing Perimeters?

Work out the perimeter of each triangle to 2 d.p. Cross of your answers from those on the right as you go.

A


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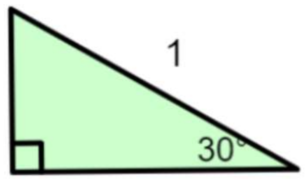

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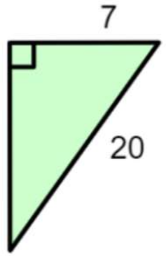

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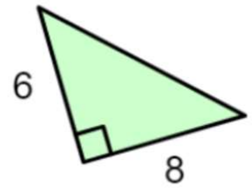

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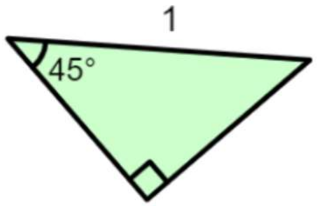

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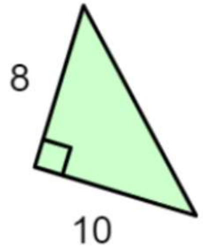

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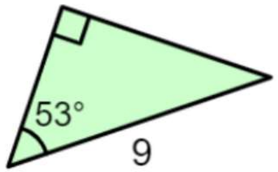

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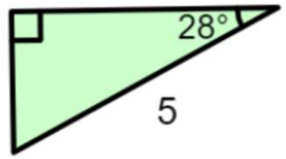

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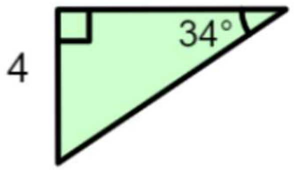

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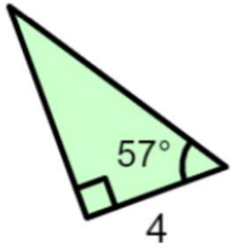

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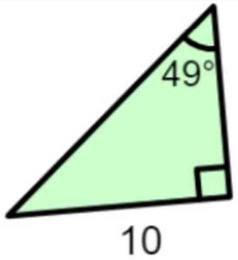

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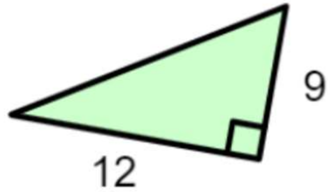

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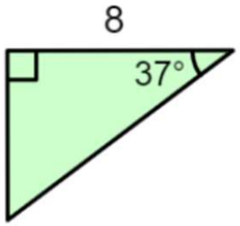

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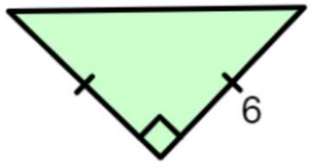

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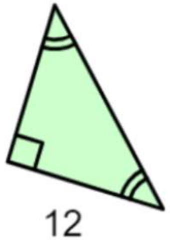

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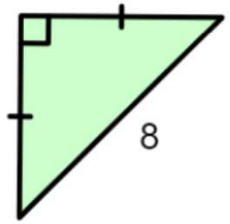
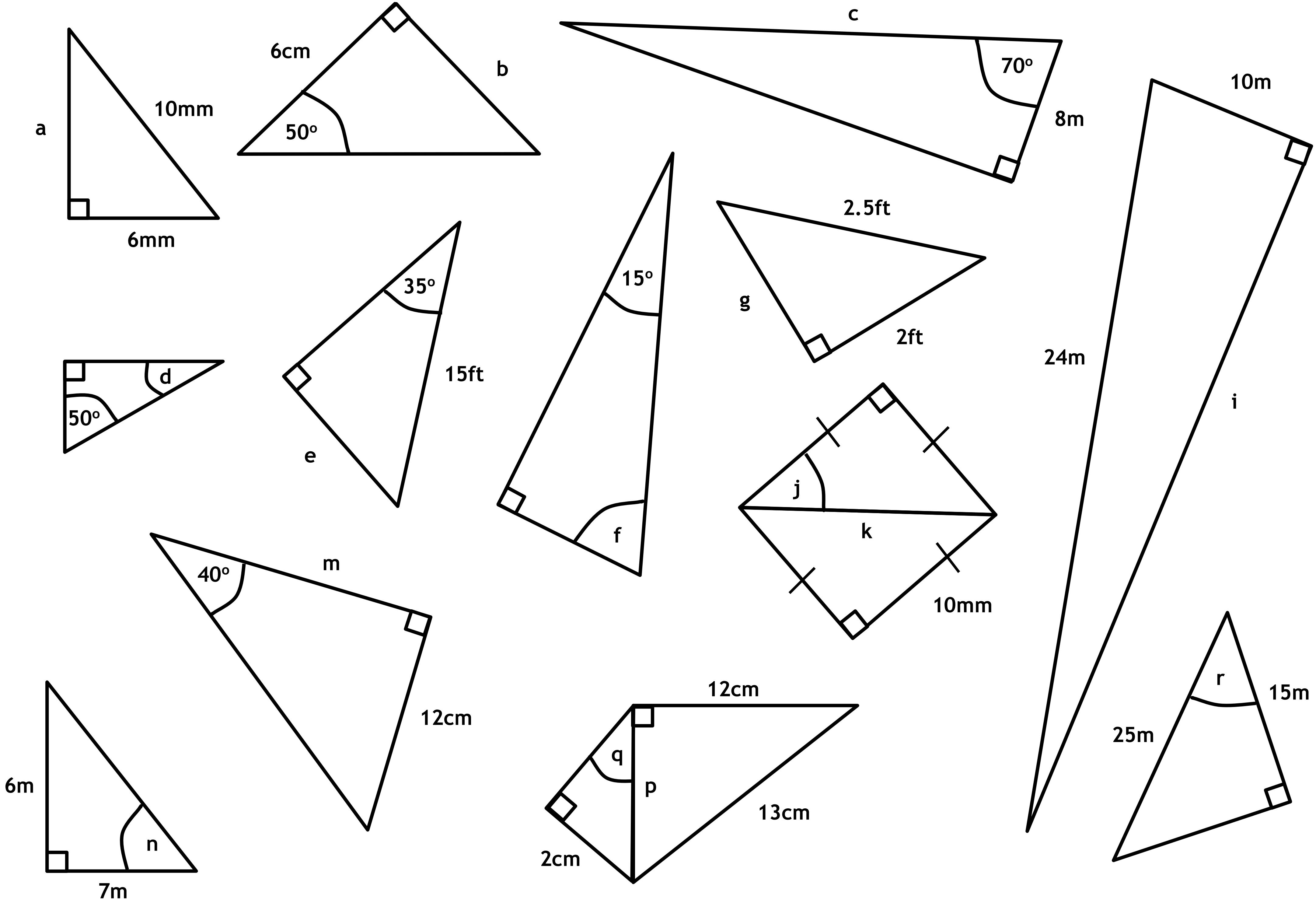
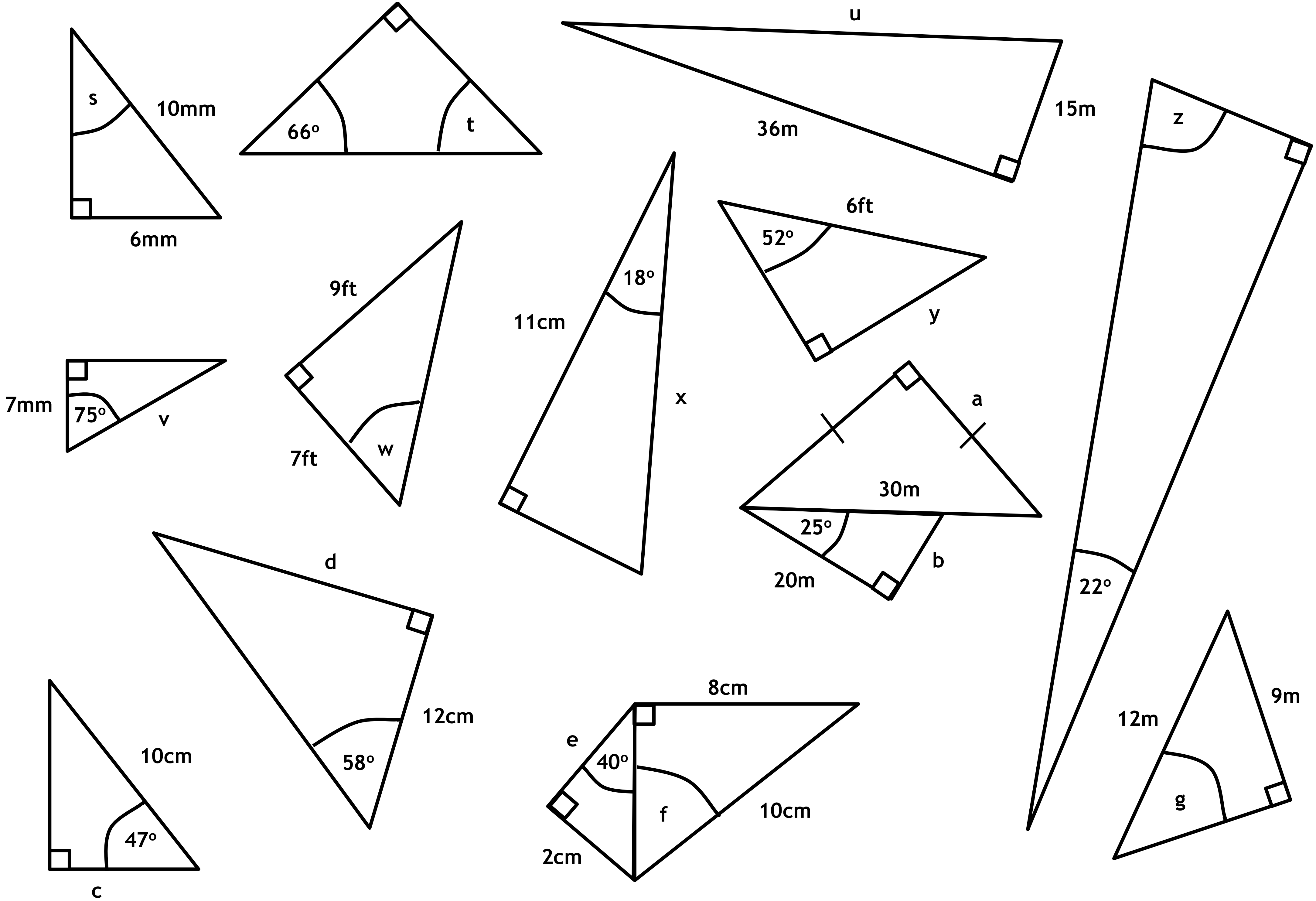


2.37
2.41
11.76
13.83
17.08
17.50
19.31
20.49
21.60
24
24.05
30.81
31.94
36
40.97
45.73



a
10mm
6mm
6cm
50º
b
c
70º
8m
10m
24m
i
d
50º
35º
15ft
e
15º
f
2.5ft
g
2ft
j
k
10mm
40º
m
12cm
6m
n
7m
12cm
q
p
13cm
2cm
r
15m
25m


s
10mm
6mm
66°
t
u
36m
15m
z
6ft
52°
y
9ft
18°
11cm
x
7mm
75°
v
7ft
w
a
30m
25°
20m
b
22°
d
12cm
58°
10cm
47°
c
8cm
e
40°
f
10cm
2cm
12m
9m
g

Compound Measures

Compound measures are measures that rely on other measures:

- Speed
- Density
- Pressure

Speed

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Distance} = \text{Speed} \times \text{Time}$$

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

Worked Example	Your Turn
An object travels 40 miles in 2 hours. Calculate its speed in mph?	An object travels 40 miles in 30 minutes. Calculate its speed in mph?

Worked Example	Your Turn
An object travels at 40 mph for 2 hours. How far has it travelled in miles?	An object travels at 40 mph for 30 minutes. How far has it travelled in miles?

Worked Example	Your Turn
An object travels 80 miles at 40 mph. How long does the journey take in hours?	An object travels 20 miles at 40 mph. How long does the journey take in hours?

Fill In The Blanks...

Speed, Distance and Time

Distance	Time	Speed	Units of Speed
120 km	4 hours		km/h
55 m	5 seconds		m/s
8000 m	2 hours		km/h
450 km	180 minutes		km/h
	20 seconds	10	m/s
	3 hours	25	km/h
900 cm	3 seconds		m/s
132 m		12	m/s
640 km		80	km/h
	120 minutes	65	km/h
30 m	1 minute		m/s
1750 cm		2.5	m/s
	150 minutes	88	km/h
	1.5 minutes	8.5	m/s
20000 m	30 minutes	40	

Density

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

$$\text{Mass} = \text{Density} \times \text{Volume}$$

$$\text{Volume} = \frac{\text{Mass}}{\text{Density}}$$

Worked Example	Your Turn
Work out the density of copper. 150 g of a copper block has a volume of 17 cm^3. Round your answer to 2 decimal places.	Work out the density of gold. 97 g of gold has a volume of 5 cm^3. Round your answer to 2 decimal places.

Pressure

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

$$\text{Force} = \text{Pressure} \times \text{Area}$$

$$\text{Area} = \frac{\text{Force}}{\text{Pressure}}$$

Worked Example	Your Turn
An object with an area of $5\ m^2$ exerts a force of 10 N. Find the pressure.	An object with an area of $2\ m^2$ exerts a force of 10 N. Find the pressure.

Worked Example	Your Turn
An object with a cross-sectional area of 2 m^2 exerts a pressure of 40 N/m^2. Find the force.	An object with a cross-sectional area of 2 m^2 exerts a pressure of 10 N/m^2. Find the force.