KING EDWARD VI
HANDSWORTH GRAMMAR
SCHOOL FOR BOYS

KING EDWARD VI
ACADEMY TRUST
BIRMINGHAM

Year 8

2023 Mathematics 2024

Unit 10 Booklet

HGS Maths

Tasks

Dr Frost Course

Name: _____

Class: _____

Contents

1 Estimation

1.1 Significant Figures

1.2 Estimations

Calculating an approximate answer to a calculation by rounding the numbers used in the calculation prior to carrying out the calculation.

- Typically, number used in the calculation will be rounded to 1 significant figure.
- The result of the calculation will be close to the actual real answer.
- Do not forget to use the correct notation: ≈ ‘approximately equal to’

Worked Example	Your Turn
Estimate: a) $409 + 571$ b) $\frac{409+571}{0.53}$ c) $\frac{409+571}{0.53-0.11}$	Estimate: a) $593 + 401$ b) $\frac{593+401}{0.47}$ c) $\frac{593+401}{0.47-0.43}$

Fill in the Gaps

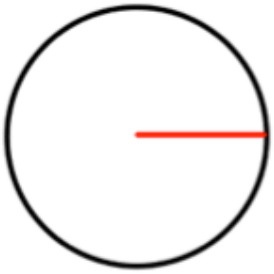
Question	Values Rounded to 1 sf			Calculation	Estimated Answer	Overestimate or Underestimate?	Actual Answer
$3.3 \times 2194 \times 1.2$	3.3	2194	1.2			*Underestimate*	8688.24
	3	2000	1				
$\frac{17.8 + 67.3}{12.29}$	17.8	67.3	12.29	$\frac{20 + 70}{10}$		*Overestimate*	6.92
	20	70	10				
$\frac{47 \times 78.6}{0.53}$	47	78.6	0.53	$\frac{50 \times 80}{0.5}$			
$\frac{1.78^3}{62.1 + 43.3}$	1.78	62.1	43.3				
$\frac{\sqrt{103}}{0.98 \times 19}$	103	0.98	19				
$\frac{5.34 + 3.296}{0.195}$	5.34	3.296	0.195				
$\frac{(4.12 \times 0.53)^2}{\sqrt[3]{7.97}}$	4.12	0.53	7.97				

Worked Example	Your Turn
Estimate: a) $354 \div 6.9$ b) $\sqrt{17} \times 14$	Estimate: a) $357 \div 8.9$ b) $\frac{\sqrt{150}}{3}$

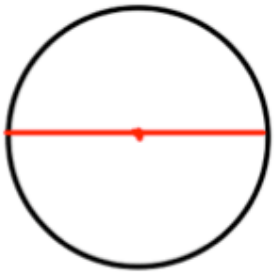
Worked Example	Your Turn
Estimate: a) $\sqrt{110}$ b) $\sqrt[3]{100}$	Estimate: a) $\sqrt{20}$ b) $\sqrt[3]{140}$

2 Circles

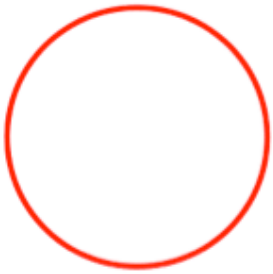
2.1 Parts of the Circle



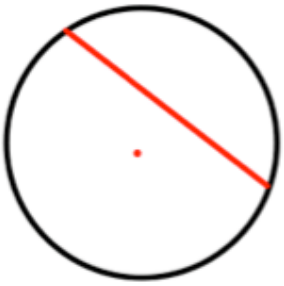
Radius



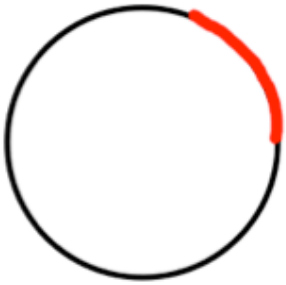
Diameter



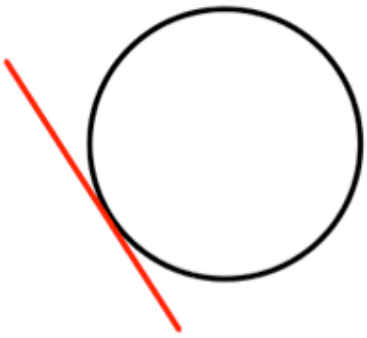
Circumference



Chord



Arc



Tangent

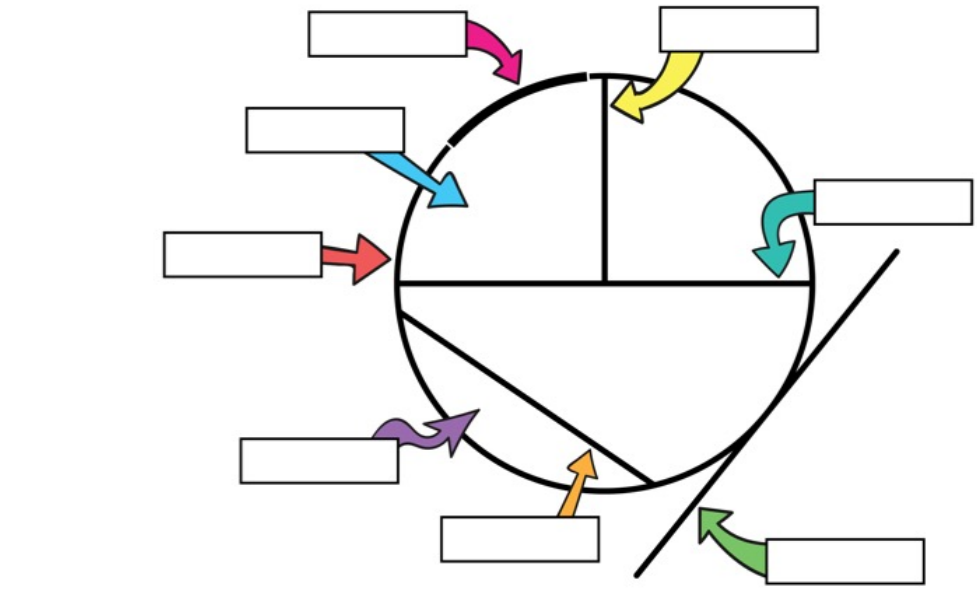
Segment

Sector

Fluency Practice

Labelling parts of a circle

Use the words below to label each part of the circle correctly



Arc | Chord | Circumference | Diameter | Radius | Sector | Segment | Tangent

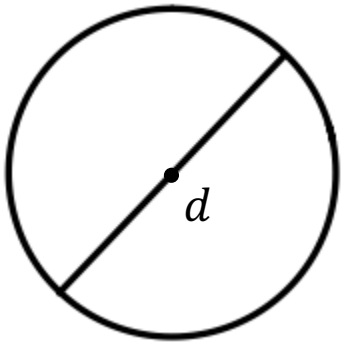
Circle Vocabulary: Match each word with its definition.

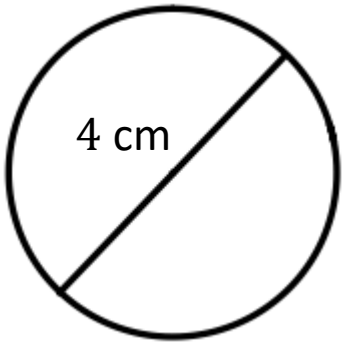
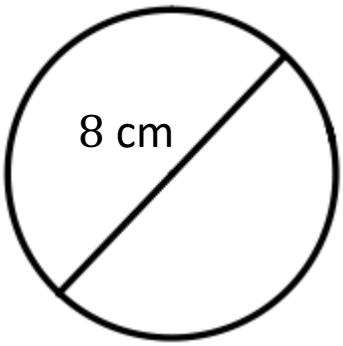
Arc	Line joining two points on a circumference.
Segment	Perimeter of a circle.
Chord	Part of a circle between a chord and an arc.
Radius	Line touching the circumference of a circle once.
Diameter	Distance from the centre of a circle to the edge.
Circumference	Part of the circumference of a circle.
Tangent	Part of a circle between two radii and an arc.
Sector	Width of a circle.

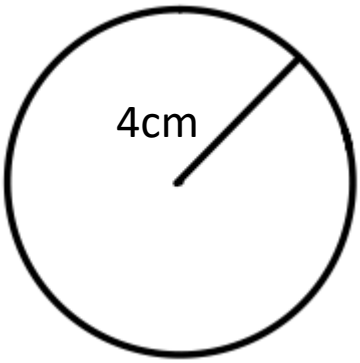
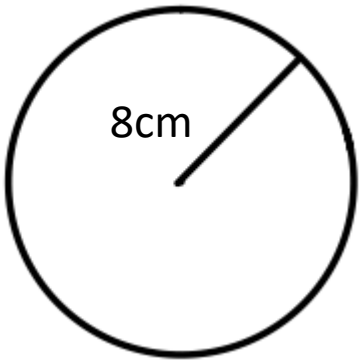
2.2 Circumference of Circles

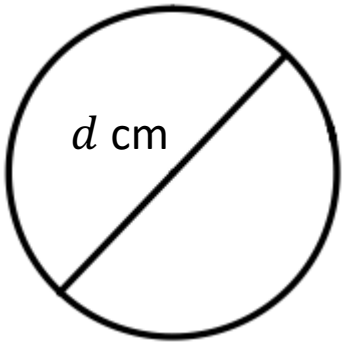
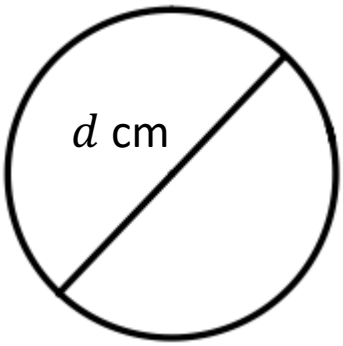
The circumference is the perimeter of a circle.

$$\text{Circumference} = \pi \times \text{diameter}$$
$$C = \pi \times d$$

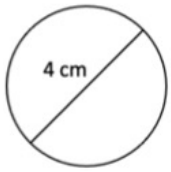
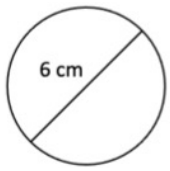
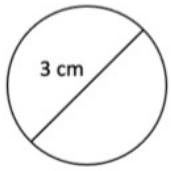
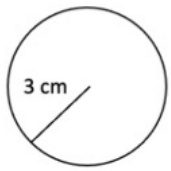
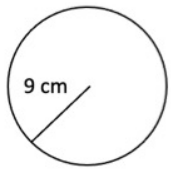


Worked Example	Your Turn
Calculate the circumference of the circle below. Give your answer in terms of π and to 1 decimal place.	Calculate the circumference of the circle below. Give your answer in terms of π and to 1 decimal place.
	

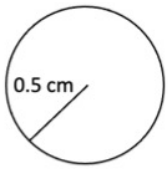
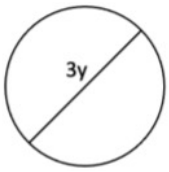
Worked Example	Your Turn
Calculate the circumference of the circle below. Give your answer in terms of π and to 1 decimal place.	Calculate the circumference of the circle below. Give your answer in terms of π and to 1 decimal place.
	

Worked Example	Your Turn
Calculate the diameter, d, of the circle below given that the circumference is 12.6 cm. Give your answer to 2 decimal places. 	Calculate the diameter, d, of the circle below given that the circumference is 25.1 cm. Give your answer to 2 decimal places. 

Fill in the Gaps

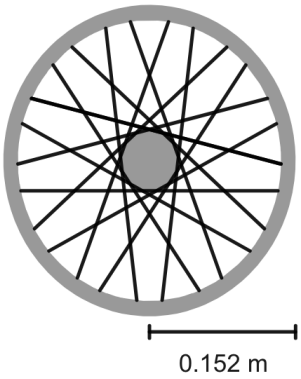
Diagram	Radius	Diameter	Calculation	Circumference (in terms of π)	Circumference (1 dp)
					
					
					
					
					
		12 mm			
	5 m				

Fill in the Gaps

Diagram	Radius	Diameter	Calculation	Circumference (in terms of π)	Circumference (1 dp)
				16π km	
					
					
	$5a$				

Worked Example

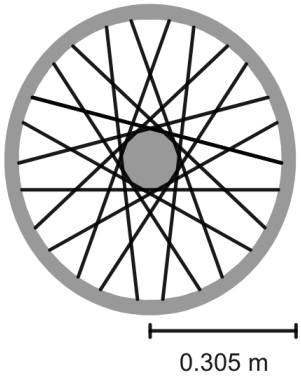
Omar has a bicycle with a wheel radius of 0.152 m.



He rides for 1600 metres.
Calculate how many full turns the wheel makes during his ride.

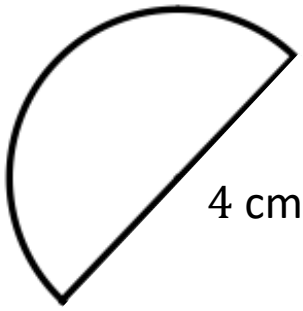
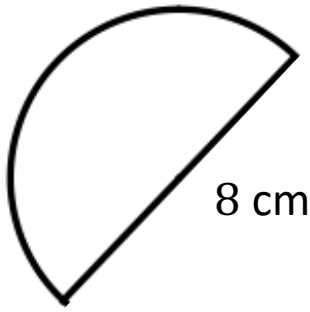
Your Turn

Connor has a bicycle with a wheel radius of 0.305 m.



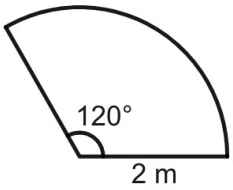
He rides for 1400 metres.
Work out how many full turns the wheel needs to make to cover the whole distance.

2.3 Perimeter of Fractions of Circles

Worked Example	Your Turn
Calculate the perimeter of the semi-circle below. Give your answer in terms of π and to 1 decimal place.  	Calculate the perimeter of the semi-circle below. Give your answer in terms of π and to 1 decimal place. 

Worked Example

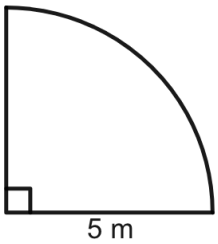
Calculate the perimeter of the shape drawn below.



Give your answer correct to 1 decimal place.

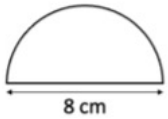
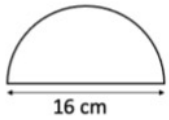
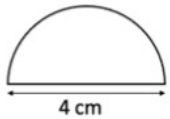
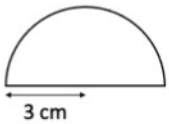
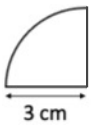
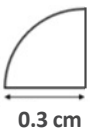
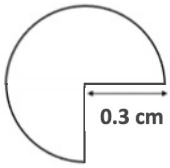
Your Turn

Work out the perimeter of the shape drawn below.



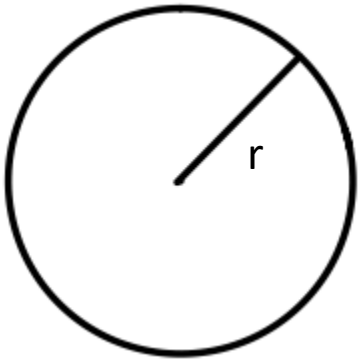
Give your answer correct to 1 decimal place.

Fill in the Gaps

Diagram	Radius	Diameter	Calculation	Perimeter (in terms of π)	Perimeter (1 dp)
					
					
					
					
					
					
					

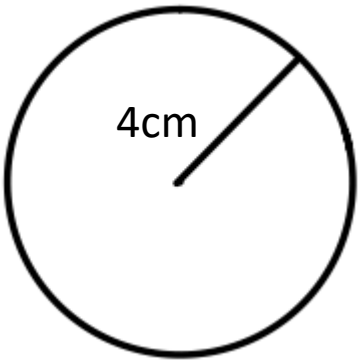
2.4 Area of Circles

$$\text{Area} = \pi \times \text{radius}^2$$
$$A = \pi \times r^2$$



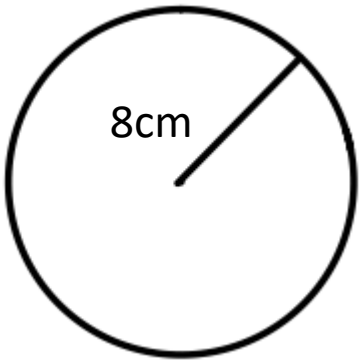
Worked Example

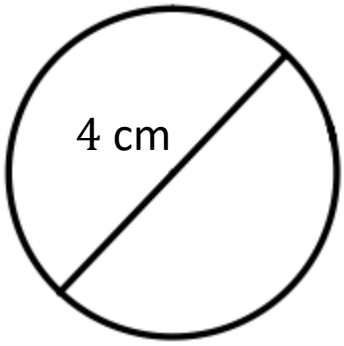
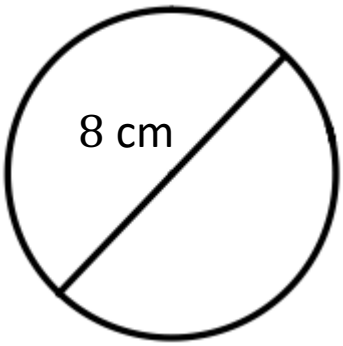
Calculate the area of the circle below. Give your answer in terms of π and to 1 decimal place.

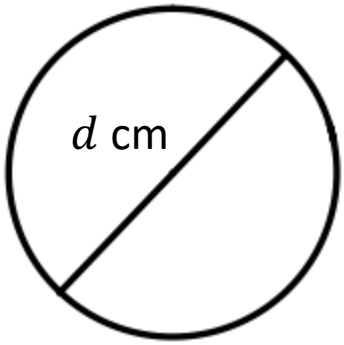
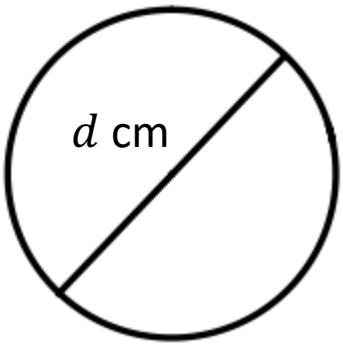


Your Turn

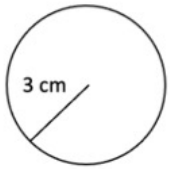
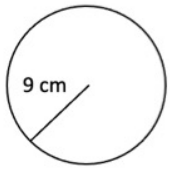
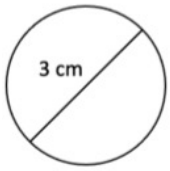
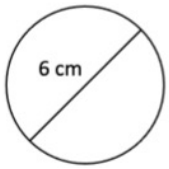
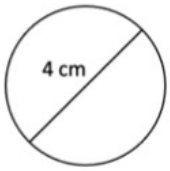
Calculate the area of the circle below. Give your answer in terms of π and to 1 decimal place.



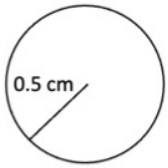
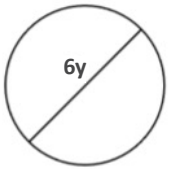
Worked Example	Your Turn
Calculate the area of the circle below. Give your answer in terms of π and to 1 decimal place.	Calculate the area of the circle below. Give your answer in terms of π and to 1 decimal place.
	

Worked Example	Your Turn
Calculate the diameter, d, of the circle below given that the area is $12.6\ cm^2$. Give your answer to 2 decimal places.  	Calculate the diameter, d, of the circle below given that the area is $50.3\ cm^2$. Give your answer to 2 decimal places. 

Fill in the Gaps

Diagram	Radius	Diameter	Calculation	Area (in terms of π)	Area (1 dp)
					
					
					
					
					
	6 mm				
		10 m			

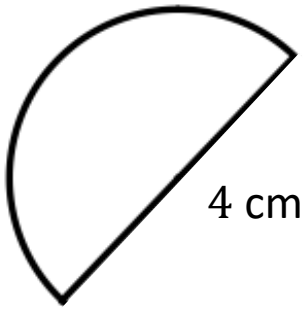
Fill in the Gaps

Diagram	Radius	Diameter	Calculation	Area (in terms of π)	Area (1 dp)
				16π km^2	
					
	$5a$				
					

2.5 Area of Fractions of Circles

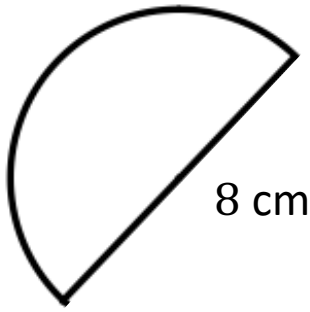
Worked Example

Calculate the area of the semi-circle below. Give your answer in terms of π and to 1 decimal place.



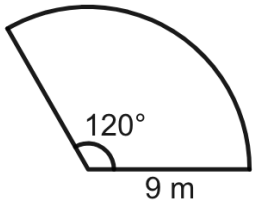
Your Turn

Calculate the area of the semi-circle below. Give your answer in terms of π and to 1 decimal place.



Worked Example

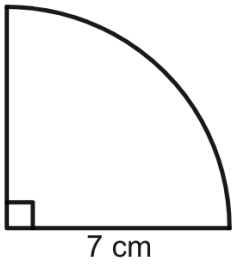
Calculate the area of the shape drawn below.



Give your answer correct to 1 decimal place.

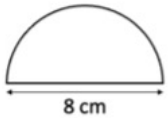
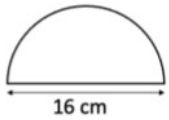
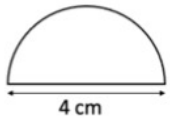
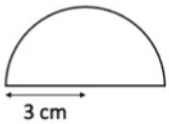
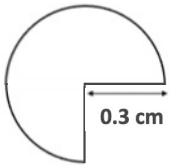
Your Turn

Work out the area of the shape drawn below.



Give your answer correct to 1 decimal place.

Fill in the Gaps

Diagram	Radius	Diameter	Calculation	Area (in terms of π)	Area (1 dp)
					
					
					
					
					
					
					

2.6 Area and Circumference of Circles

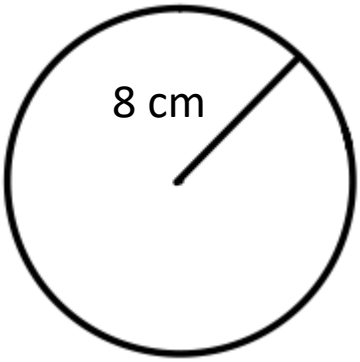
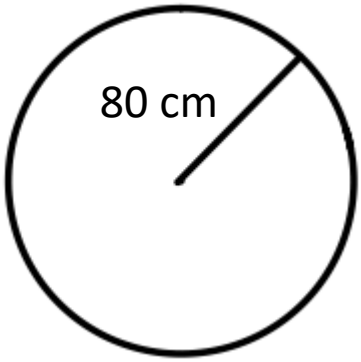
Fluency Practice

Which units should we use for the answer?

Question	Description	Units
1.	A circle has a radius of $10m$, what is the area?	
2.	A circle has a radius of $10cm$, what is the area?	
3.	A circle has a radius of $10cm$, what is the circumference?	
4.	A circle has a diameter of $10cm$, what is the circumference?	
5.	A circle has a circumference of $10cm$, what is the diameter?	
6.	A circle has an area of $10cm^2$, what is the diameter?	
7.	A circle has an area of $10cm^2$, what is the circumference?	
8.	A circle has an circumference of $10cm$, what is the area?	

9. Write a circles question where the units of the answer would be mm

10. Write a circles question where the units of the answer would be mm^2

Worked Example	Your Turn
	
Circumference =	Circumference =
Area =	Area =

Fill in the Gaps

Round all answers to 1 decimal place. Remember to give units.

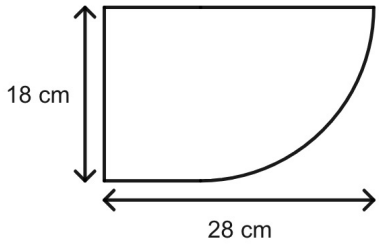
Radius	Diameter	Circumference	Area
$3\ cm$	$6\ cm$		$28.3\ cm^2$
$7\ cm$	$14\ cm$	$44.0\ cm$	
$5\ mm$			$78.5\ mm^2$
	$2.4\ m$	$7.5\ m$	
$4.5\ cm$	$9\ cm$		
$6\ cm$			
	$8\ cm$		
	$40\ mm$		
$0.7\ m$			
		$49.0\ cm$	$191.1\ cm^2$
		$100.5\ mm$	$804.2\ mm^2$
		$81.7\ m$	$530.9\ m^2$
		$11.3\ cm$	
		$147.0\ mm$	
			$38.5\ m^2$
			$498.8\ cm^2$

2.7 Area and Perimeter of Compound Shapes

Worked Example

Logan designs a new badge.

The design is based on a rectangle and a quadrant as shown in the diagram.



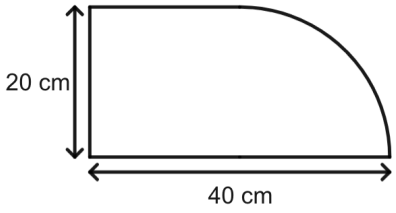
They decide to put silver thread around the badge.

Calculate the length of silver thread they need.
Give your answer to 2 decimal places.

Your Turn

John designs a new badge.

The design is based on a rectangle and a quadrant as shown in the diagram.

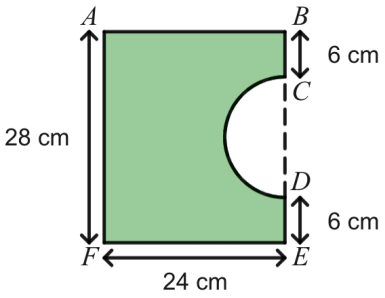


He decides to put silver thread around the badge.

Calculate the length of silver thread he needs.
Give your answer to 2 decimal places.

Worked Example

The shaded shape is made by cutting a semicircle from a rectangular piece of card, $ABEF$ as shown in the diagram.

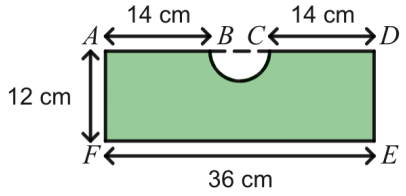


$BCDE$ is a straight line.
The centre of the semicircle lies on CD.
$AB = EF = 24$ cm
$AF = 28$ cm
$BC = DE = 6$ cm

Work out the perimeter of the shaded shape.
Give your answer to 2 decimal places.

Your Turn

The shaded shape is made by cutting a semicircle from a rectangular piece of card, $ADEF$ as shown in the diagram.

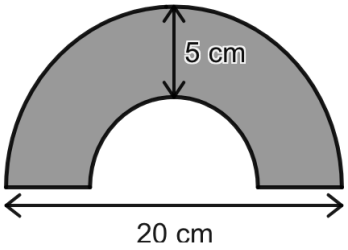


$ABCD$ is a straight line.
The centre of the semicircle lies on BC.
$AF = DE = 12$ cm
$EF = 36$ cm
$AB = CD = 14$ cm

Work out the perimeter of the shaded shape.
Give your answer to 2 decimal places.

Worked Example

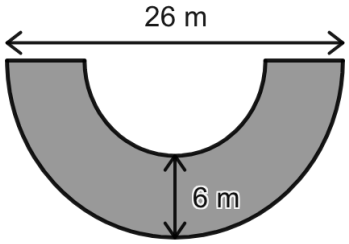
The diagram contains two concentric semi-circles.



Calculate the shaded area.
Give your answer to 1 decimal place.

Your Turn

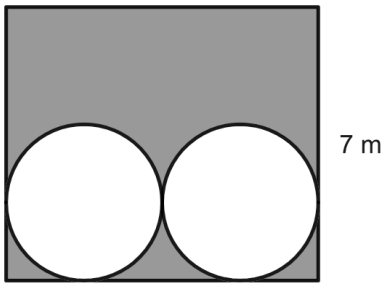
The diagram contains two concentric semi-circles.



Calculate the shaded area.
Give your answer to 1 decimal place.

Worked Example

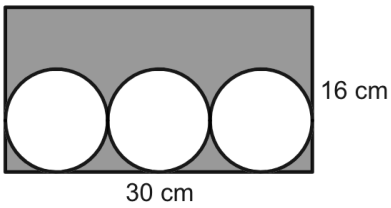
The diagram shows two circles enclosed in a rectangle.



Calculate the shaded area.
Give your answer correct to 1 decimal place.

Your Turn

The diagram shows three circles enclosed in a rectangle.



Calculate the shaded area.
Give your answer correct to 1 decimal place.

3 Angles in Parallel Lines

3.1 Transversals

Frayer Model – Transversal

Fluency Practice

The diagrams are not drawn accurately

Highlight any transversals

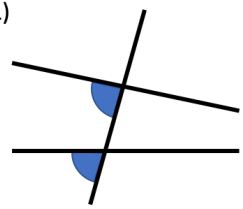
3.2 Corresponding Angles

Frayer Model – Corresponding Angles

Fluency Practice

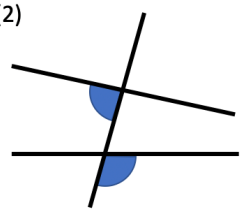
For each question, write either ***'corresponding'*** or ***'not corresponding'*** on the line.

(1)



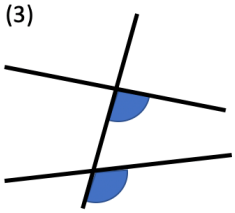
These angles are _____.

(2)



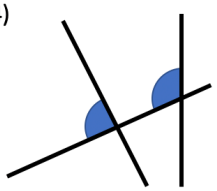
These angles are _____.

(3)



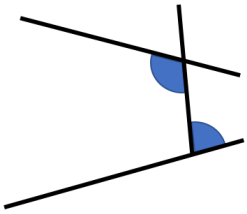
These angles are _____.

(4)



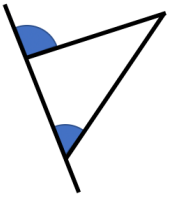
These angles are _____.

(5)



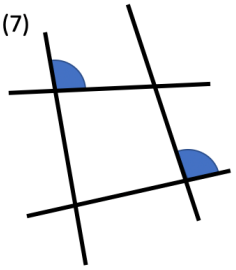
These angles are _____.

(6)



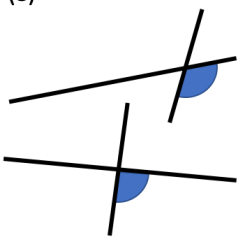
These angles are _____.

(7)



These angles are _____.

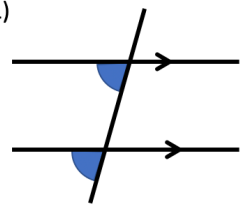
(8)



These angles are _____.

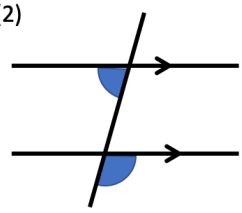
For each question, write either ***'corresponding'*** or ***'not corresponding'*** on the line.

(1)



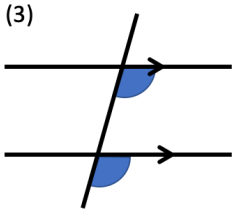
These angles are _____.

(2)



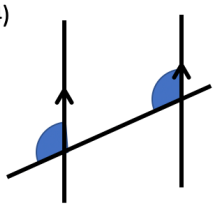
These angles are _____.

(3)



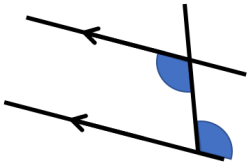
These angles are _____.

(4)



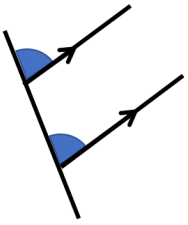
These angles are _____.

(5)



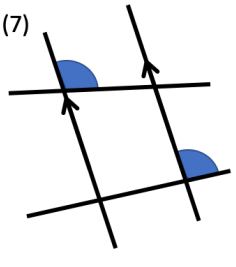
These angles are _____.

(6)



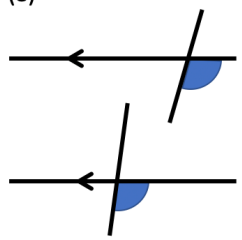
These angles are _____.

(7)



These angles are _____.

(8)

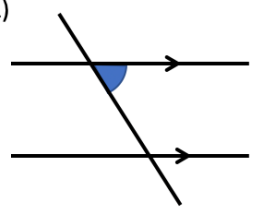


These angles are _____.

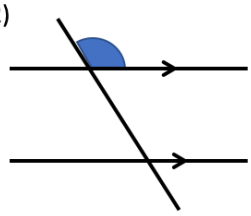
Fluency Practice

Each diagram has one angle shaded in.
Mark and shade in their corresponding angles.

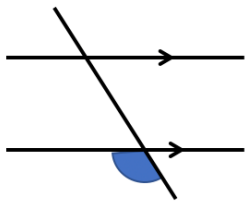
(1)



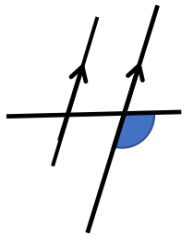
(2)



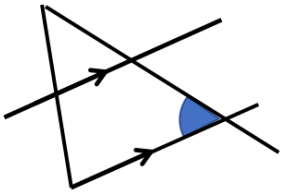
(3)



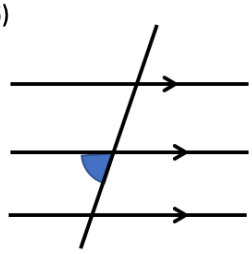
(4)



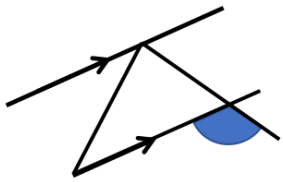
(5)



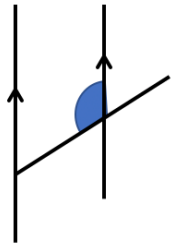
(6)



(7)

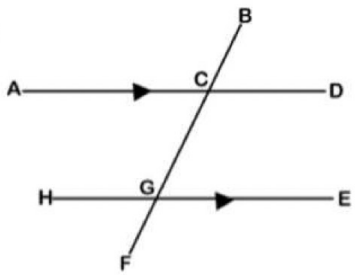


(8)

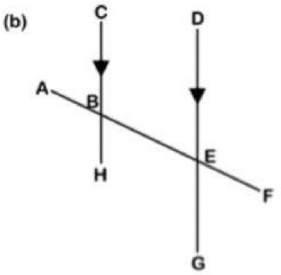


Find all the pairs of corresponding angles in each diagram.
Use three letter notation to identify the angles (e.g. "∠ACB and ∠HGC").

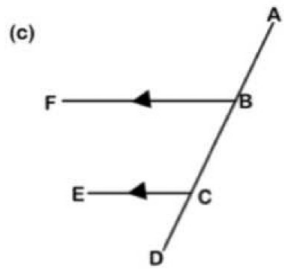
(a)



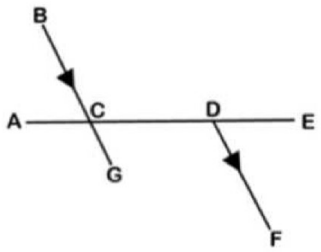
(b)



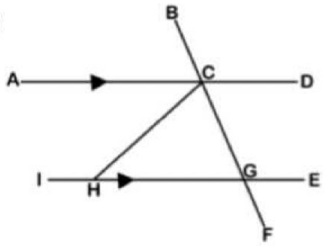
(c)



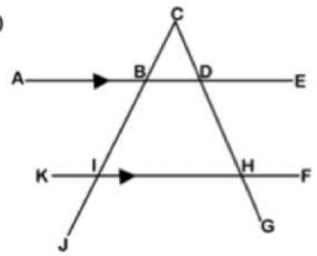
(d)



(e)

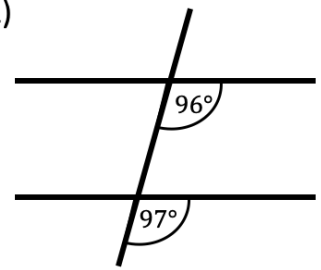


(f)

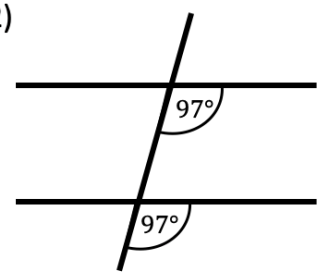


Use your knowledge of corresponding angles to decide which diagrams contain parallel lines. Explain how you made your decision for each question.

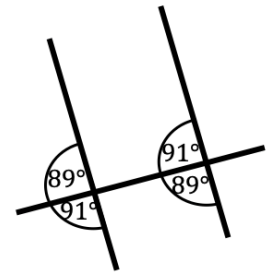
(1)



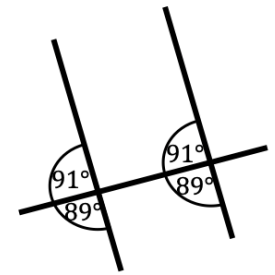
(2)



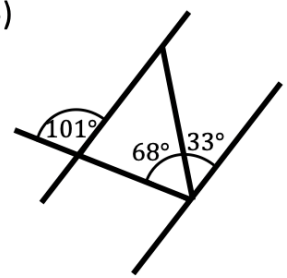
(3)



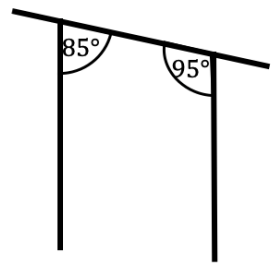
(4)



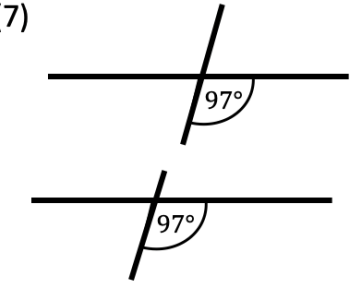
(5)



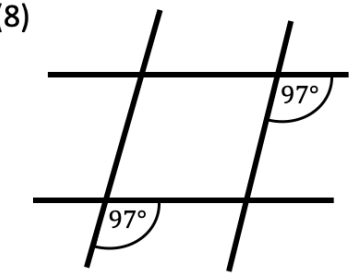
(6)



(7)

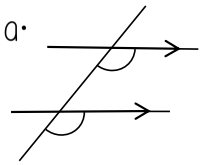


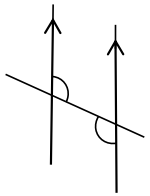
(8)

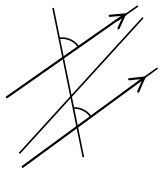


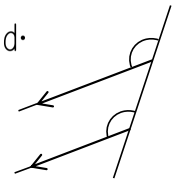
The diagrams are not drawn accurately

1. Do the diagrams show corresponding angles? Provide a reason for your answer.

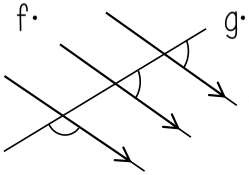
a. 

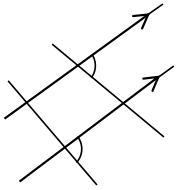
b. 

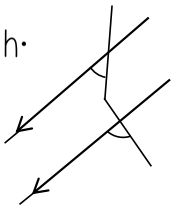
c. 

d. 

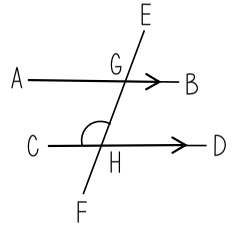
e. 

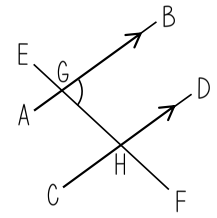
f. 

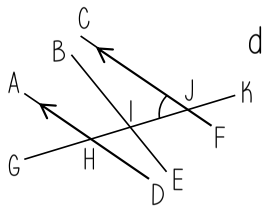
g. 

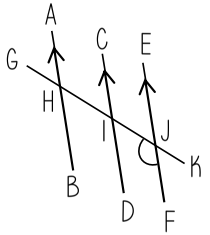
h. 

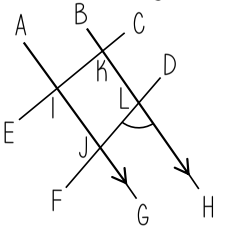
2. Write down the three letter notation for any corresponding angles to the one that is marked on the diagram.

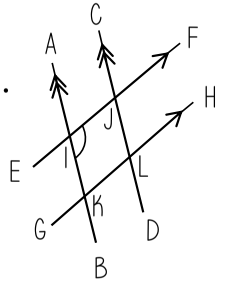
a. 

b. 

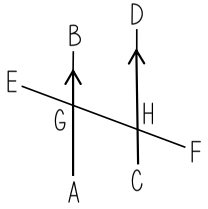
c. 

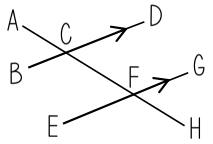
d. 

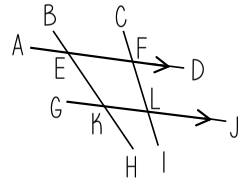
e. 

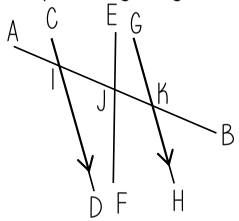
f. 

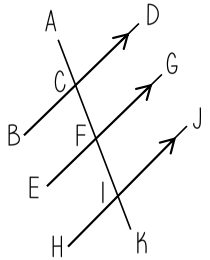
3. Write down the three letter notation for any pairs (or more) of corresponding angles.

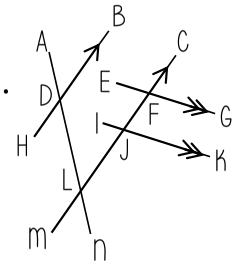
a. 

b. 

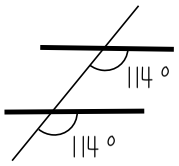
c. 

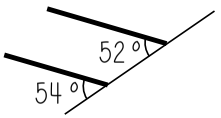
d. 

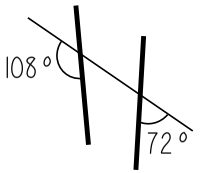
e. 

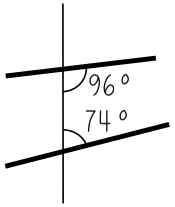
f. 

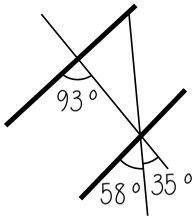
4. Are the bold lines parallel? Provide a reason for your answer.

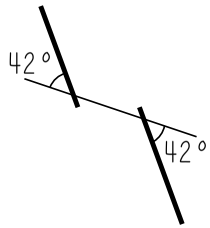
a. 

b. 

c. 

d. 

e. 

f. 

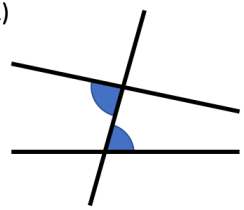
3.3 Alternate Angles

Frayer Model – Alternate Angles

Fluency Practice

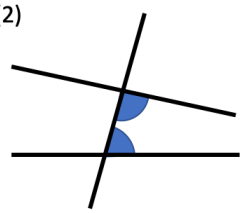
For each question, write either ***'alternate'*** or ***'not alternate'*** on the line.

(1)



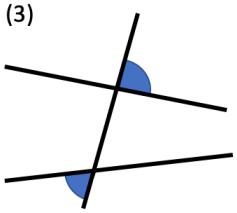
These angles are _____.

(2)



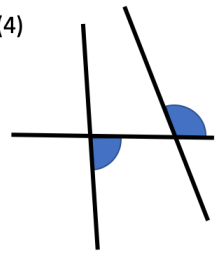
These angles are _____.

(3)



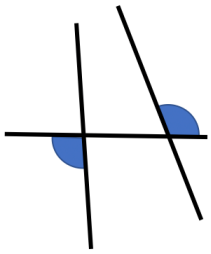
These angles are _____.

(4)



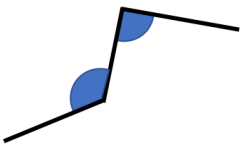
These angles are _____.

(5)



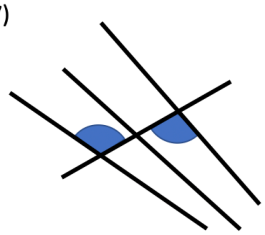
These angles are _____.

(6)



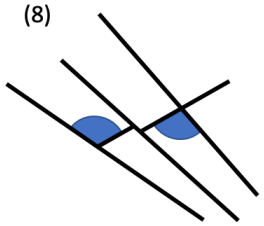
These angles are _____.

(7)



These angles are _____.

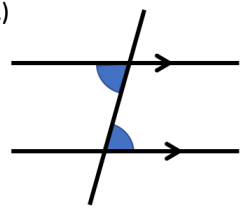
(8)



These angles are _____.

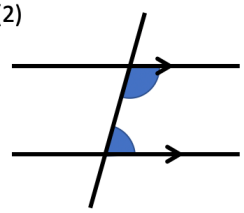
For each question, write either ***'alternate'*** or ***'not alternate'*** on the line.

(1)



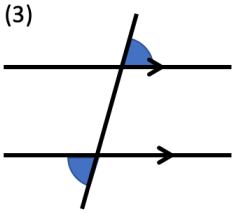
These angles are _____.

(2)



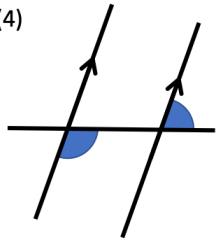
These angles are _____.

(3)



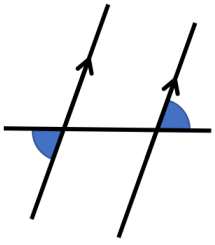
These angles are _____.

(4)



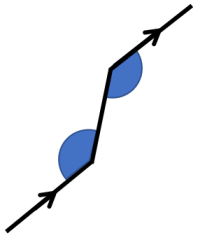
These angles are _____.

(5)



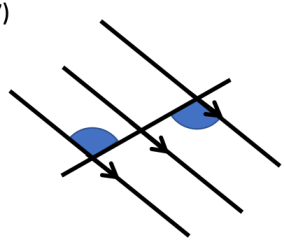
These angles are _____.

(6)



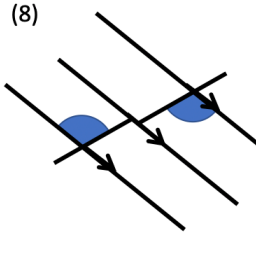
These angles are _____.

(7)



These angles are _____.

(8)

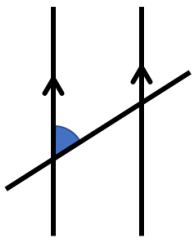


These angles are _____.

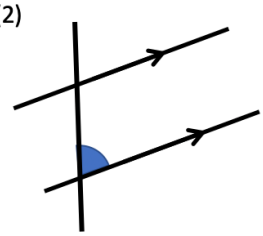
Fluency Practice

Each diagram has one angle shaded in.
Mark and shade in their alternate angles.

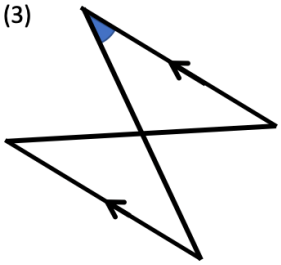
(1)



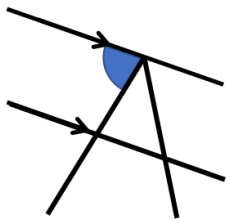
(2)



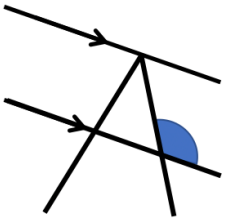
(3)



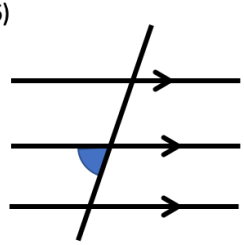
(4)



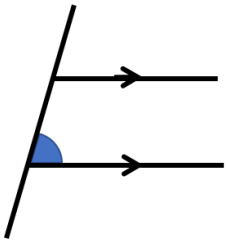
(5)



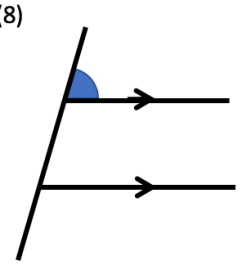
(6)



(7)

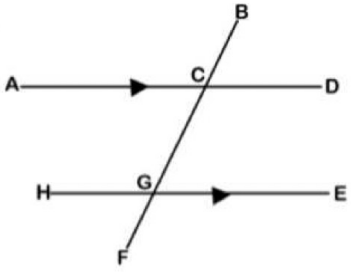


(8)

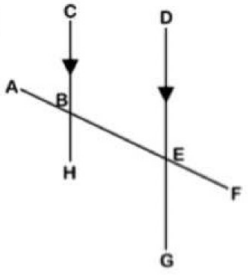


Find all the pairs of alternate angles in each diagram.
Use three letter notation to identify the angles (e.g. "∠DCG and ∠HGC").

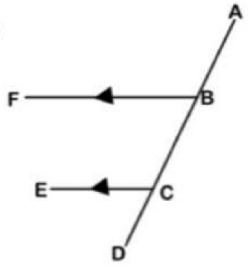
(a)



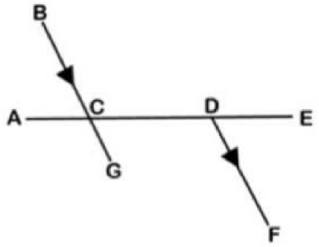
(b)



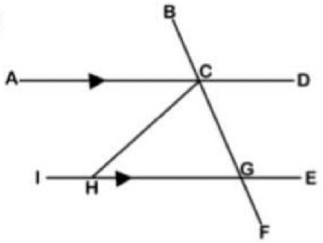
(c)



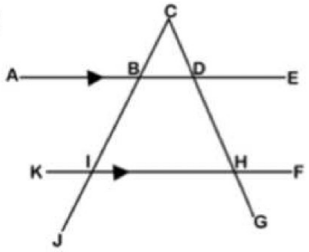
(d)



(e)

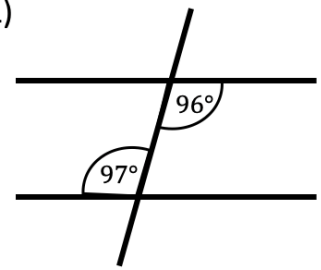


(f)

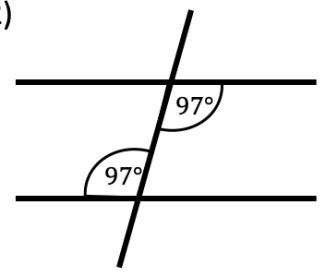


Use your knowledge of alternate angles to decide which diagrams contain parallel lines.
Explain how you made your decision for each question.

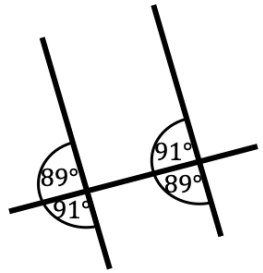
(1)



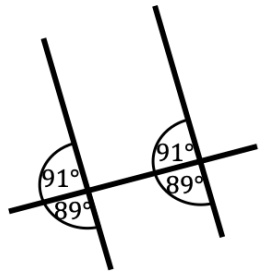
(2)



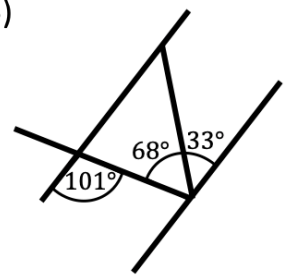
(3)



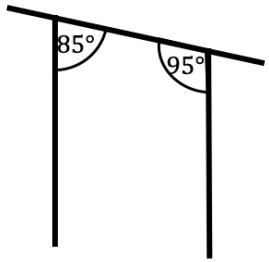
(4)



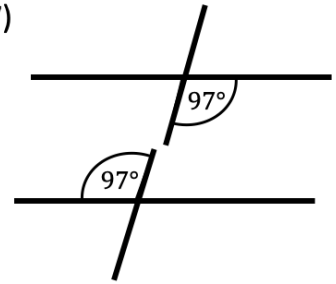
(5)



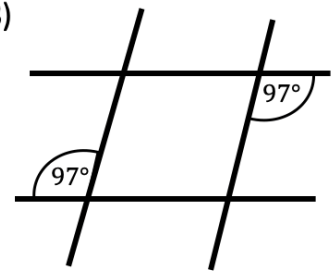
(6)



(7)

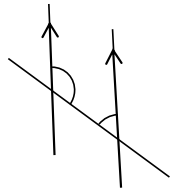


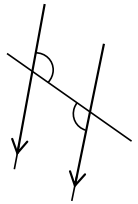
(8)

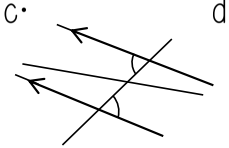


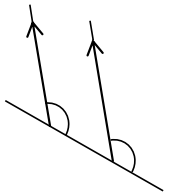
The diagrams are not drawn accurately

1. Do the diagrams show alternate angles? Provide a reason for your answer.

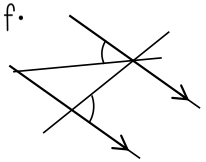
a. 

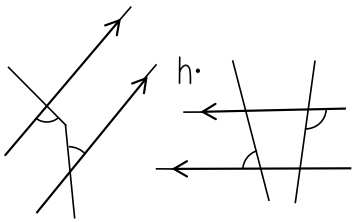
b. 

c. 

d. 

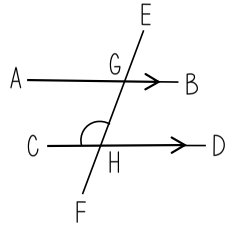
e. 

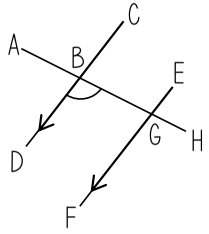
f. 

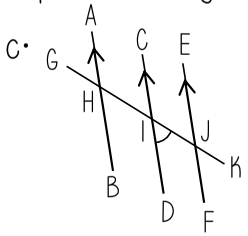
g. 

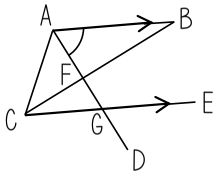
h.

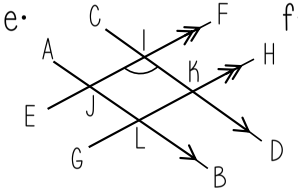
2. Write down the three letter notation for any alternate angles to the one that is marked on the diagram.

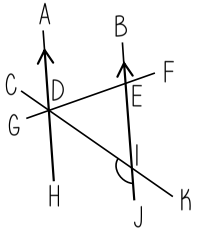
a. 

b. 

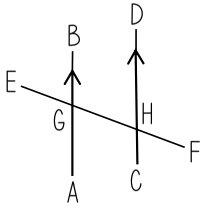
c. 

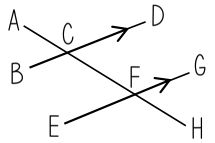
d. 

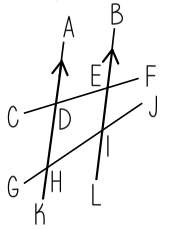
e. 

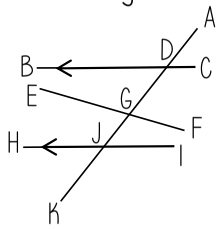
f. 

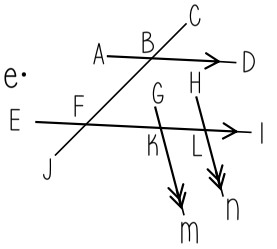
3. Write down the three letter notation for any pairs (or more) of alternate angles.

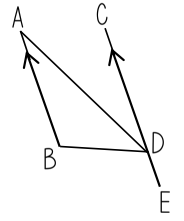
a. 

b. 

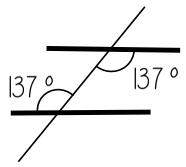
c. 

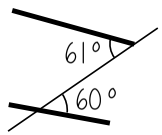
d. 

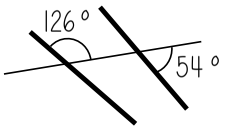
e. 

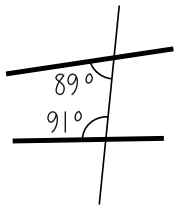
f. 

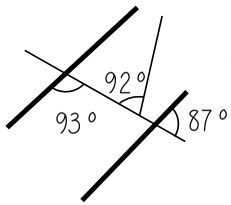
4. Are the bold lines parallel? Provide a reason for your answer.

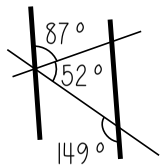
a. 

b. 

c. 

d. 

e. 

f. 

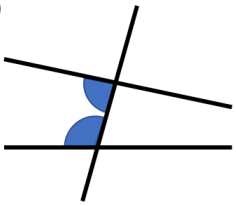
3.4 Co-Interior Angles

Frayer Model – Co-Interior Angles

Fluency Practice

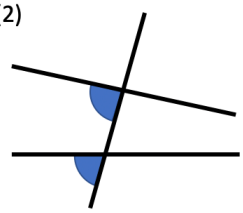
For each question, write either ***'co-interior'*** or ***'not co-interior'*** on the line.

(1)



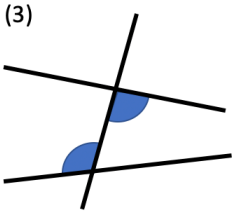
These angles are _____.

(2)



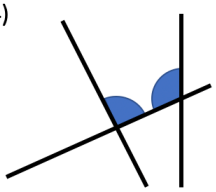
These angles are _____.

(3)



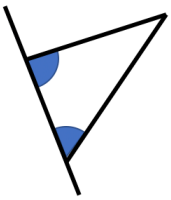
These angles are _____.

(4)



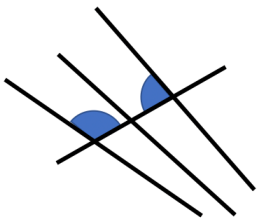
These angles are _____.

(5)



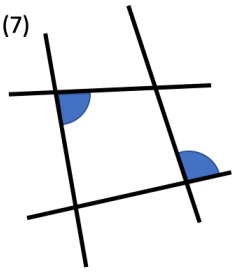
These angles are _____.

(6)



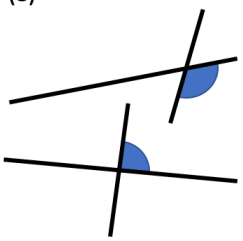
These angles are _____.

(7)



These angles are _____.

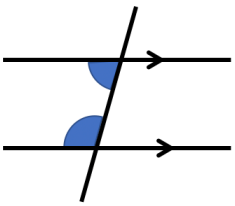
(8)



These angles are _____.

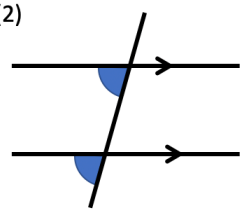
For each question, write either ***'co-interior'*** or ***'not co-interior'*** on the line.

(1)



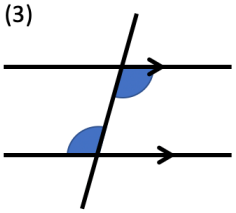
These angles are _____.

(2)



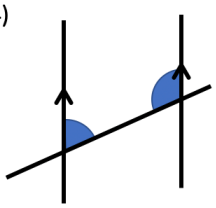
These angles are _____.

(3)



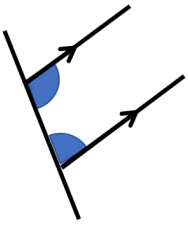
These angles are _____.

(4)



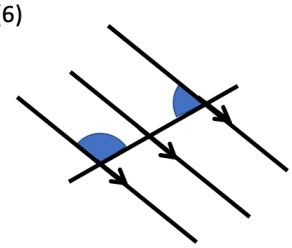
These angles are _____.

(5)



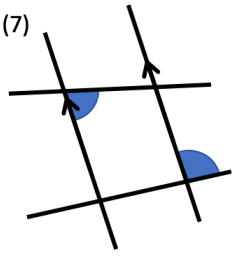
These angles are _____.

(6)



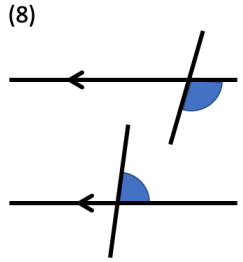
These angles are _____.

(7)



These angles are _____.

(8)

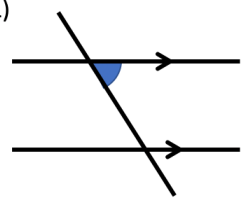


These angles are _____.

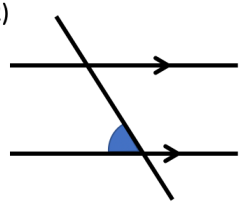
Fluency Practice

Each diagram has one angle shaded in.
Mark and shade in their co-interior angles.

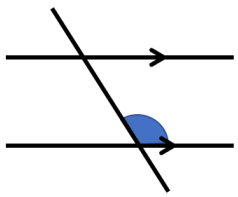
(1)



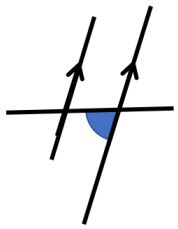
(2)



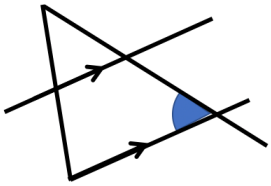
(3)



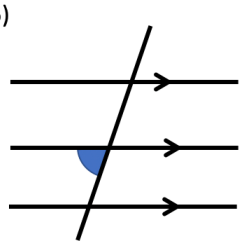
(4)



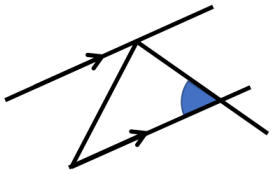
(5)



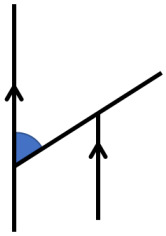
(6)



(7)

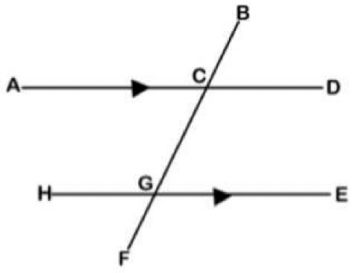


(8)

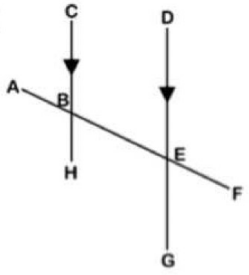


Find all the pairs of co-interior angles in each diagram.
Use three letter notation to identify the angles (e.g. "∠ACG and ∠HGC").

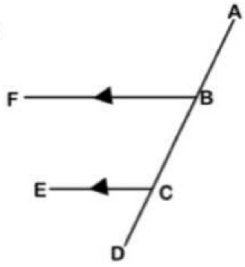
(a)



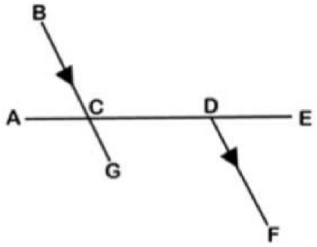
(b)



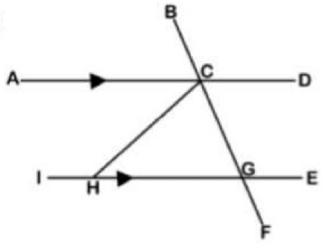
(c)



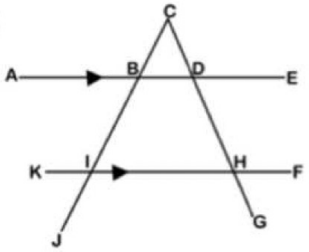
(d)



(e)

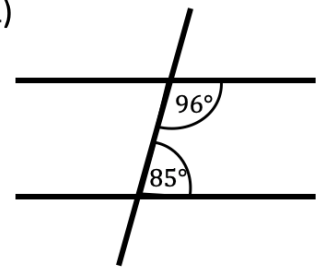


(f)

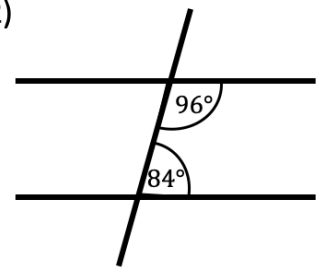


Use your knowledge of co-interior angles to decide which diagrams contain parallel lines.
Explain how you made your decision for each question.

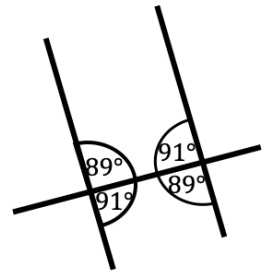
(1)



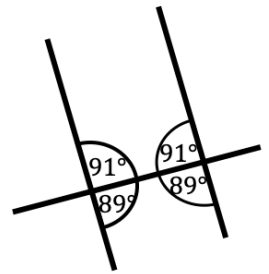
(2)



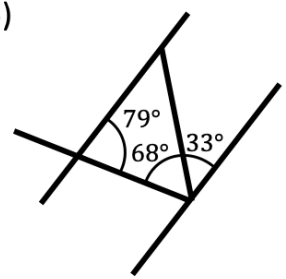
(3)



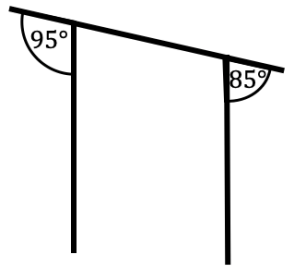
(4)



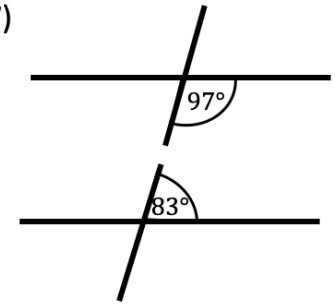
(5)



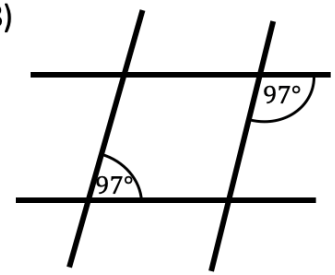
(6)



(7)

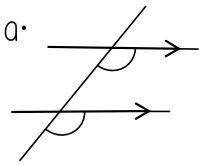


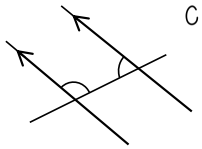
(8)

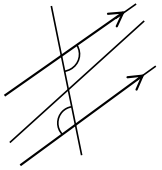


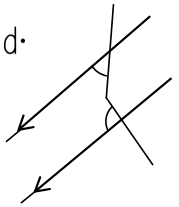
The diagrams are not drawn accurately

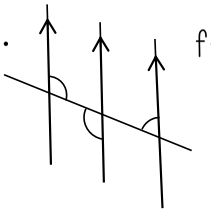
1. Do the diagrams show co-interior angles? Provide a reason for your answer.

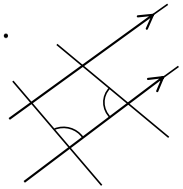
a. 

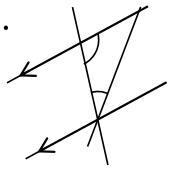
b. 

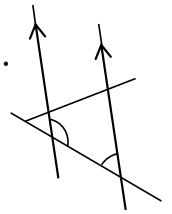
c. 

d. 

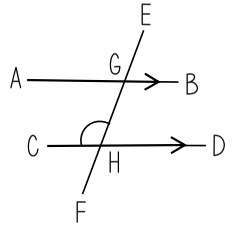
e. 

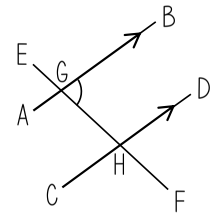
f. 

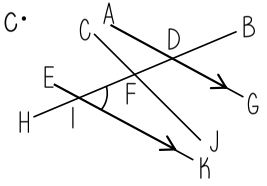
g. 

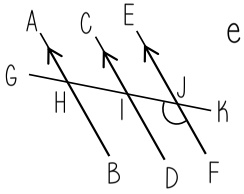
h. 

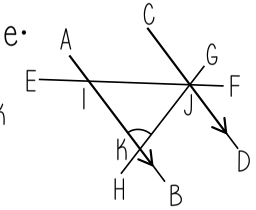
2. Write down the three letter notation for any co-interior angles to the one that is marked on the diagram.

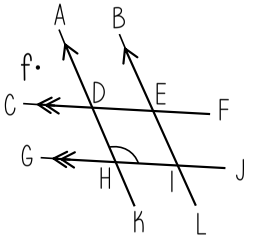
a. 

b. 

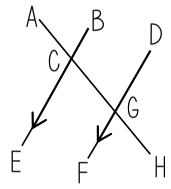
c. 

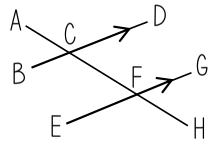
d. 

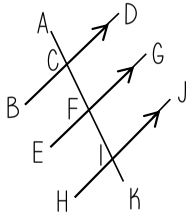
e. 

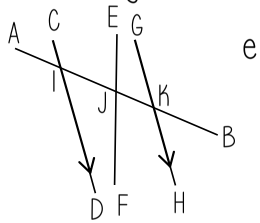
f. 

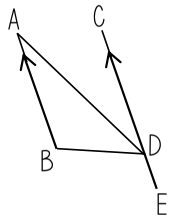
3. Write down the three letter notation for any pairs (or more) of co-interior angles.

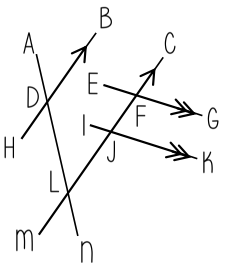
a. 

b. 

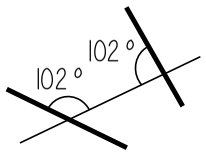
c. 

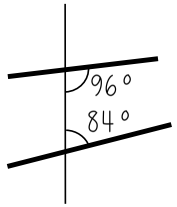
d. 

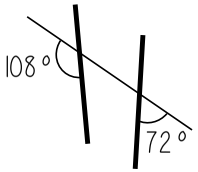
e. 

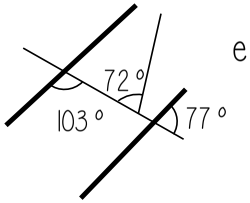
f. 

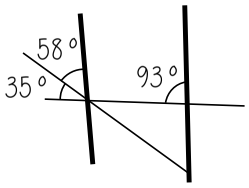
4. Are the bold lines parallel? Provide a reason for your answer.

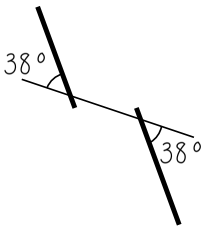
a. 

b. 

c. 

d. 

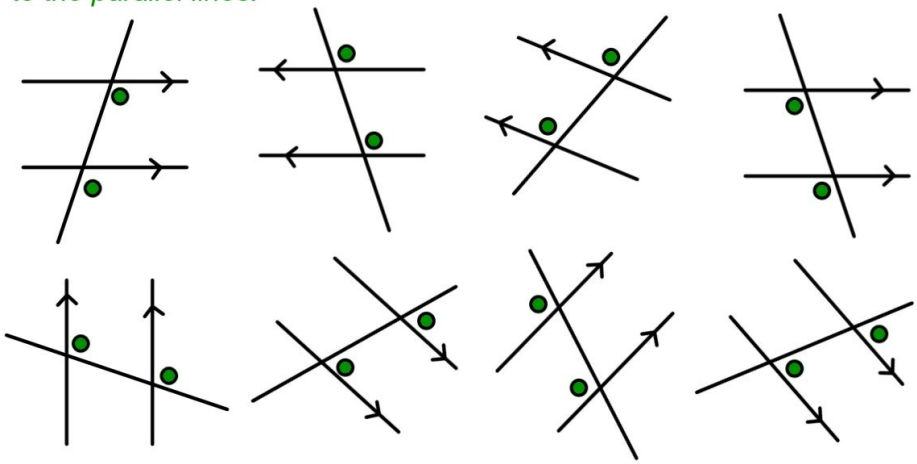
e. 

f. 

3.5 Mixed

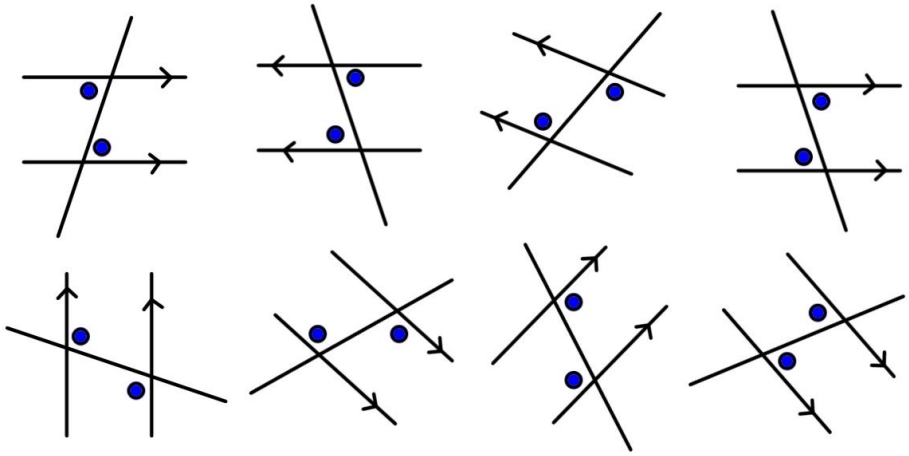
Angle Facts in Parallel Lines: *Corresponding angles are equal.*

On the same side of the transversal and in the same position in relation to the parallel lines.



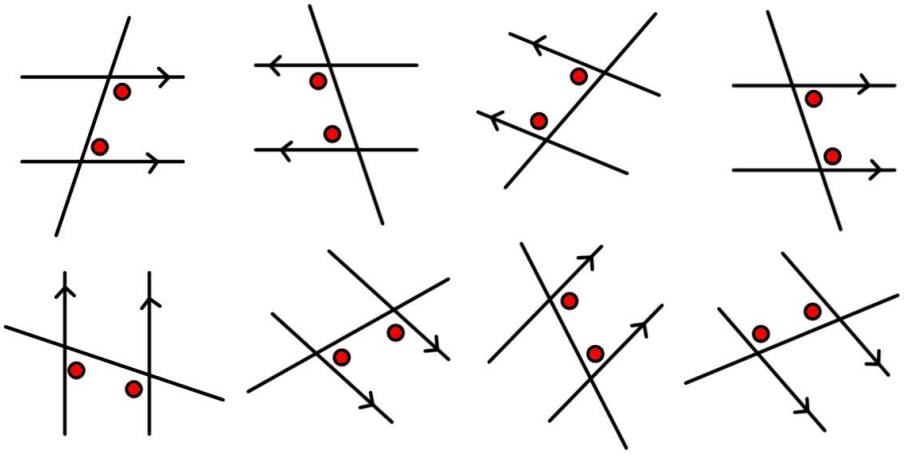
Angle Facts in Parallel Lines: *Alternate angles are equal.*

Between the parallel lines, on opposite sides of the transversal.



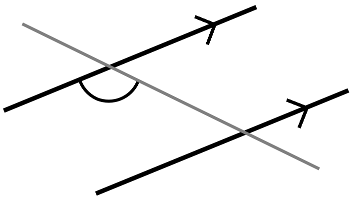
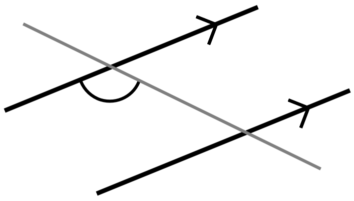
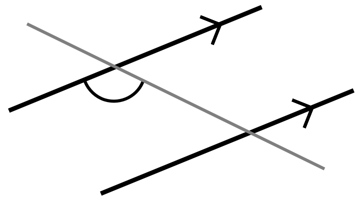
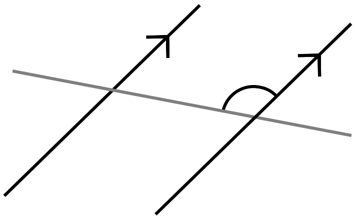
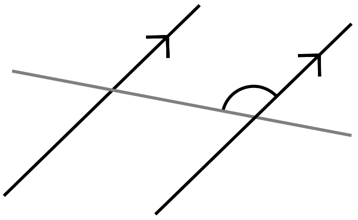
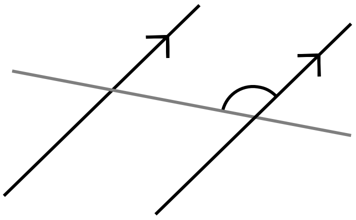
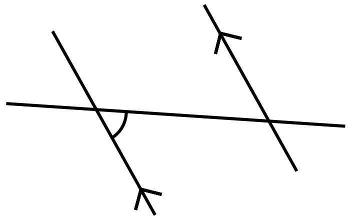
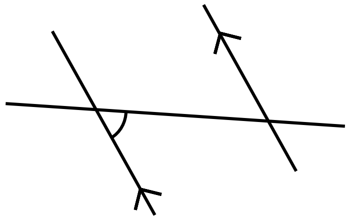
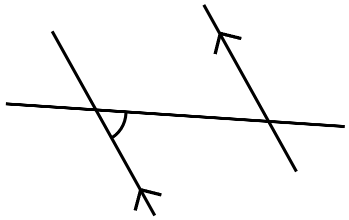
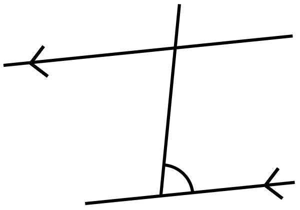
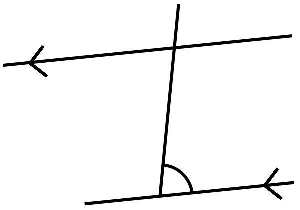
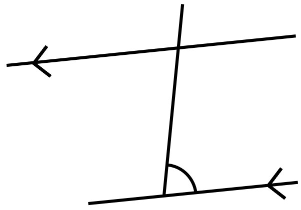
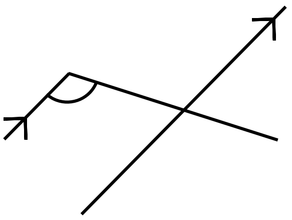
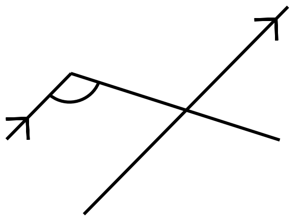
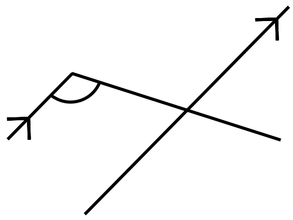
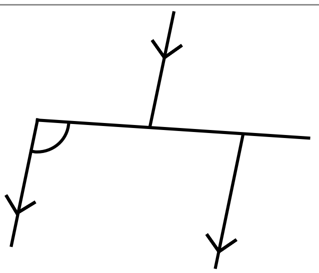
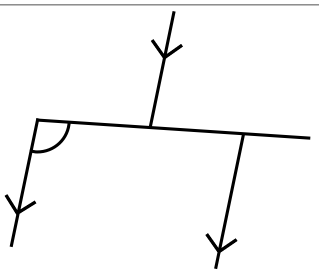
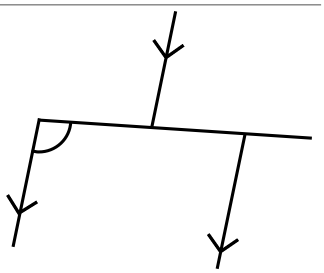
Angle Facts in Parallel Lines: *Co-interior angles add up to 180°.*

Between the parallel lines and on the same side of the transversal.



Fluency Practice

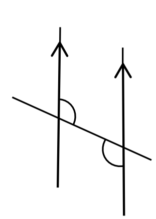
On each diagram, label an angle according to each rule.

Corresponding	Alternate	Co-Interior
		
		
		
		
		
		

Fluency Practice

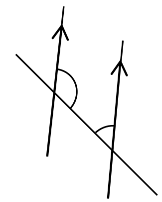
The diagrams are not drawn accurately

Decide whether the diagrams show corresponding, alternate or co-interior angles



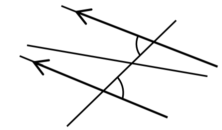
Corresponding	
Alternate	
Co-Interior	
None	

Explain how you know



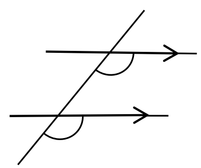
Corresponding	
Alternate	
Co-Interior	
None	

Explain how you know



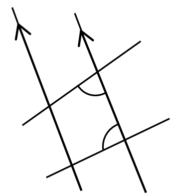
Corresponding	
Alternate	
Co-Interior	
None	

Explain how you know



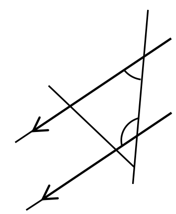
Corresponding	
Alternate	
Co-Interior	
None	

Explain how you know



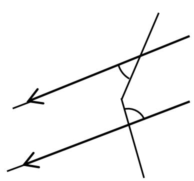
Corresponding	
Alternate	
Co-Interior	
None	

Explain how you know



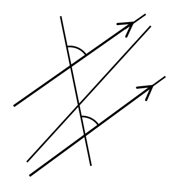
Corresponding	
Alternate	
Co-Interior	
None	

Explain how you know



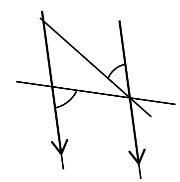
Corresponding	
Alternate	
Co-Interior	
None	

Explain how you know



Corresponding	
Alternate	
Co-Interior	
None	

Explain how you know

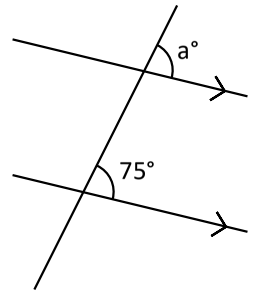


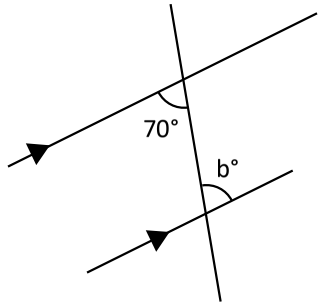
Corresponding	
Alternate	
Co-Interior	
None	

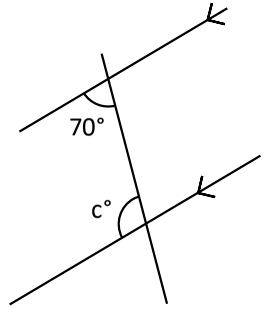
Explain how you know

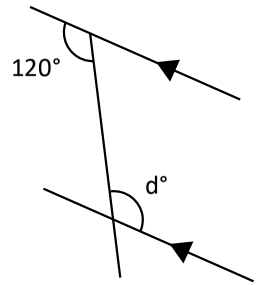
Finding Angles around Parallel Lines

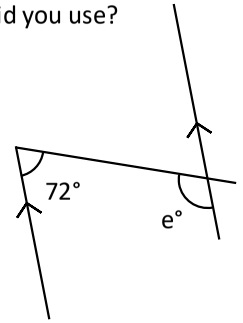
You must be able to explain to someone **why**… What angle rules did you use?

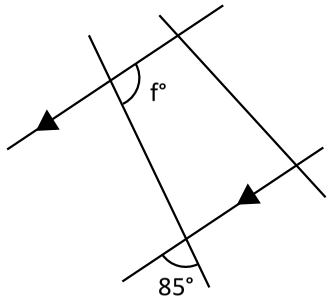


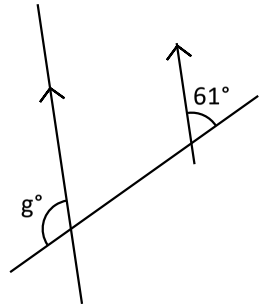


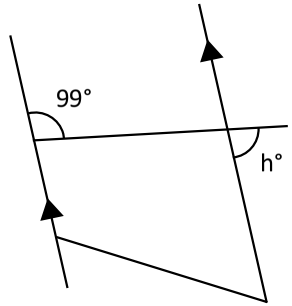


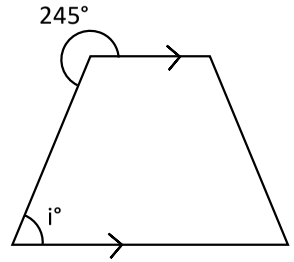


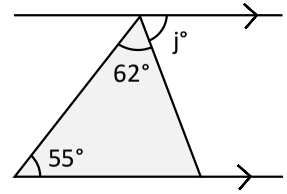


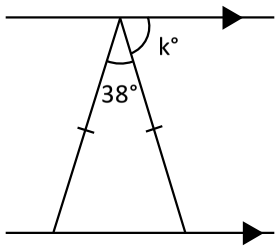


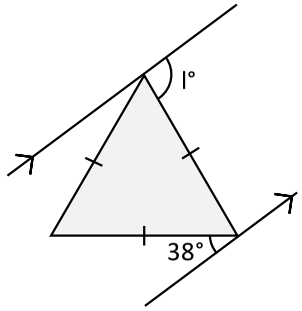


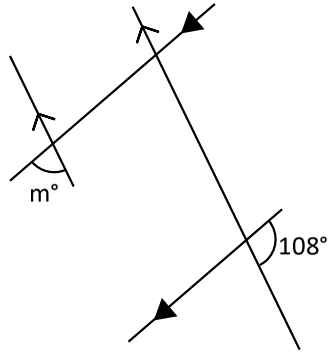


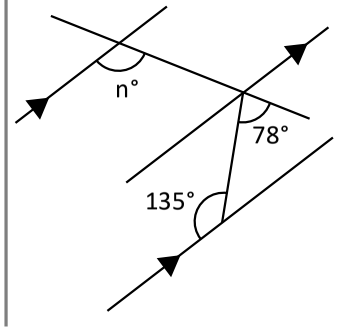


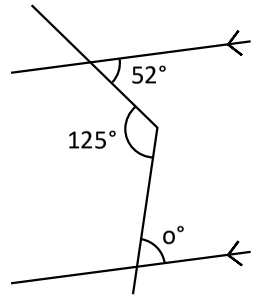








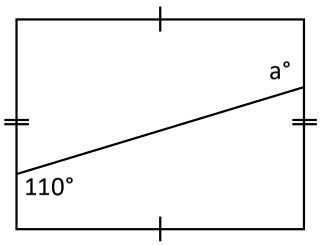


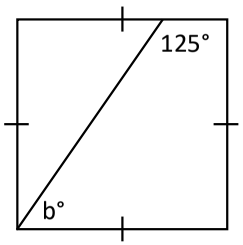


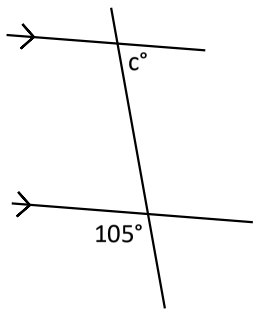
13 Answers	70	65	119	98	120	63	95
		110	71	108	81	75	72

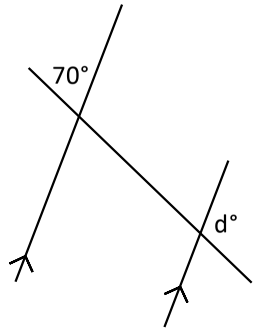
Angles Around Parallel Lines: With Angle Rules

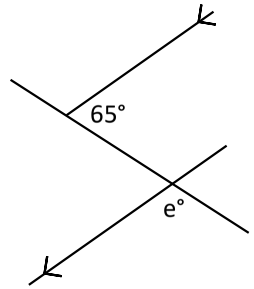
You **must** be able to state the angle rules you used to find each missing angle.

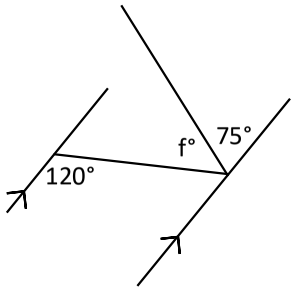


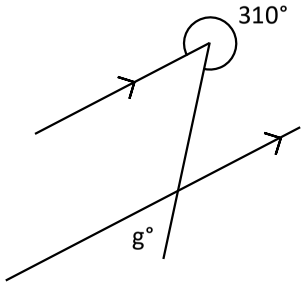


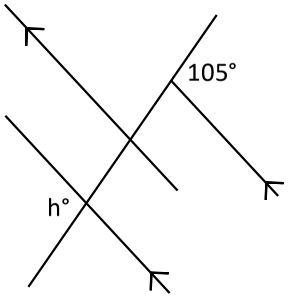


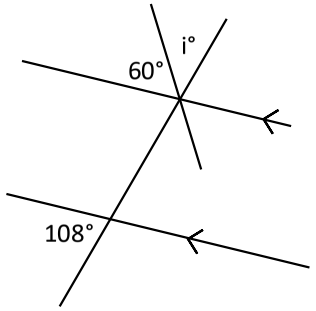


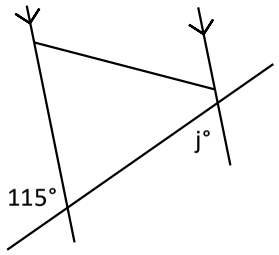


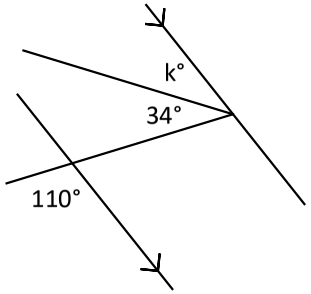


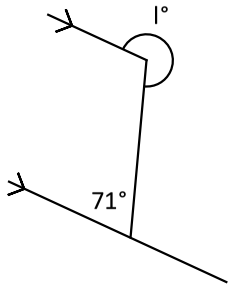


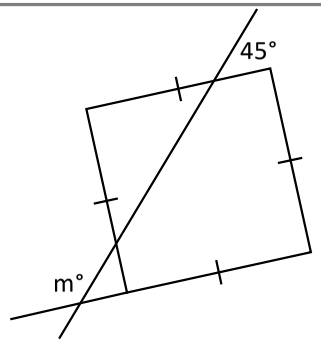


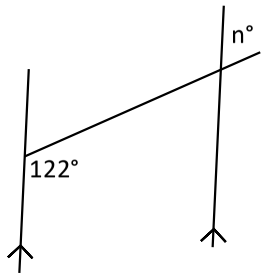


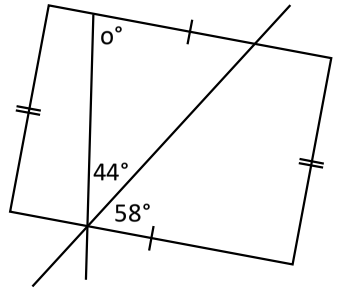












Angles around a point total 360°.
Angles on one side of a straight line total 180°.
Vertically opposite angles are equal.

Rectangles have parallel sides.
Rectangles have equal angles.

Alternate angles are equal.
Corresponding angles are equal.
Co-Interior angles total 180°.

some answers:

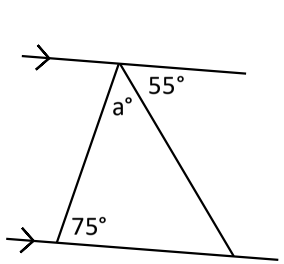
110	105	65	70	115	50
36	55	45	48	251	75

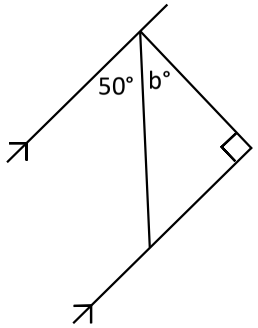
Fluency Practice

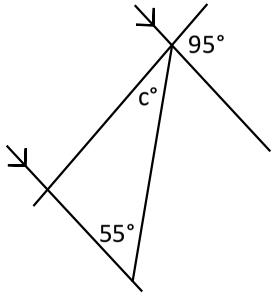
Angles Around Parallel Lines: With Triangles

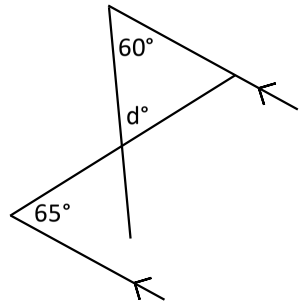
Are there multiple ways to find the missing angle?

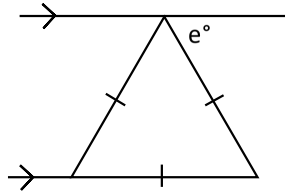
What other angle rules can or must we use?

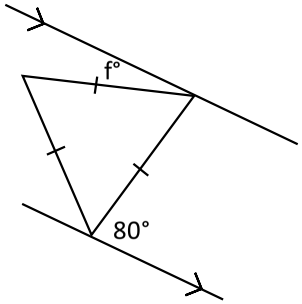


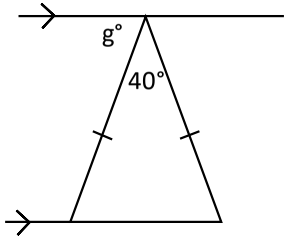


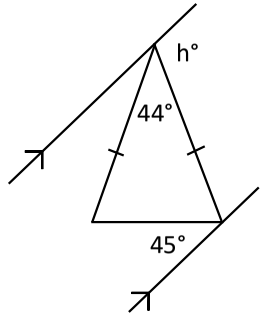


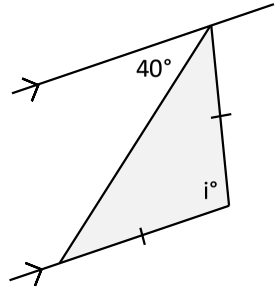


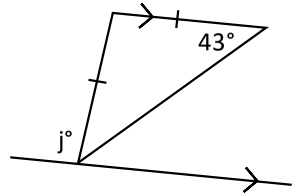


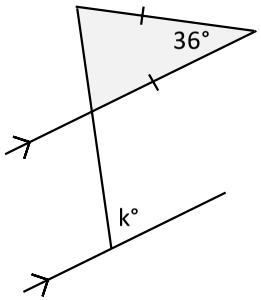


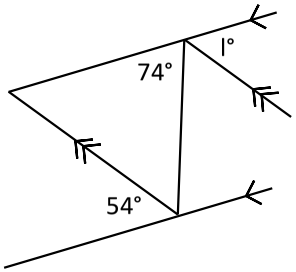


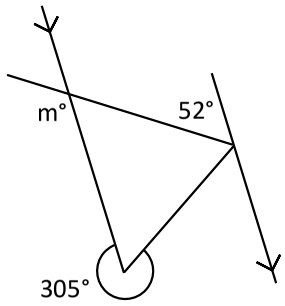


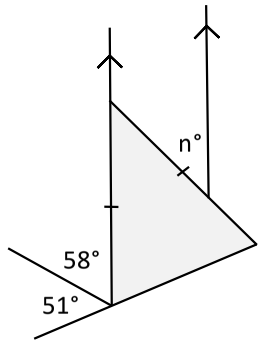


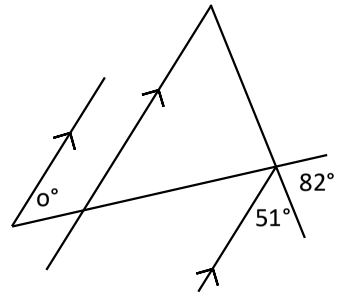












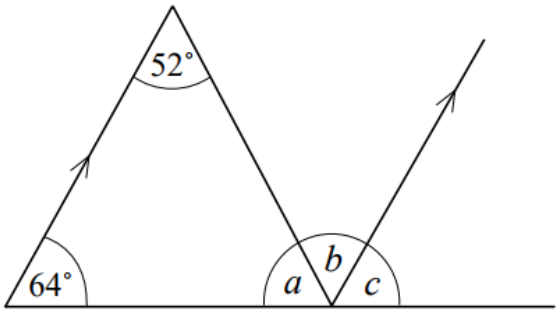
Interior angles of a triangle total 180°.
Base angles of an isosceles triangle are equal.
Equilateral triangles have equal interior angles.

70	40	20	100	60	72
55	94	54	50	113	30

Fluency Practice

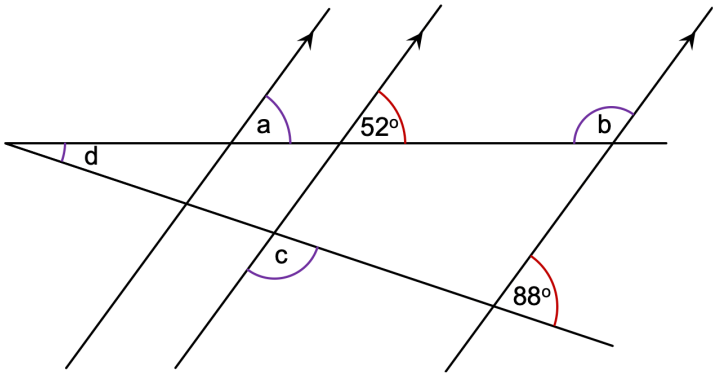
Worked Example

Work out the missing angles in the diagram below. Give reasons for your answer.



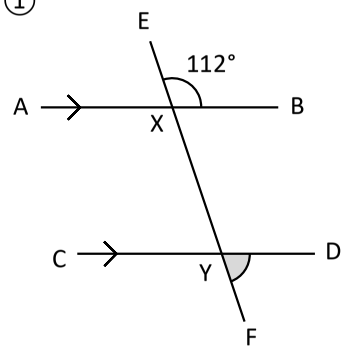
Your Turn

Work out the missing angles in the diagram below. Give reasons for your answer.



Angle Reasoning

①



Angle BXF =

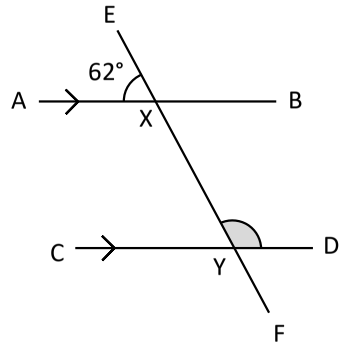
because…

Angle **DYF** =

because…

②

Here are two methods to find angle EYD:



Angle BXF =

because…

Angle **EYD** =

because…

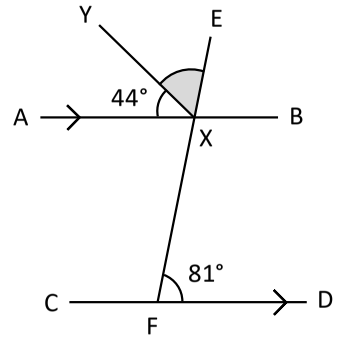
Angle AXF =

because…

Angle **EYD** =

because…

③



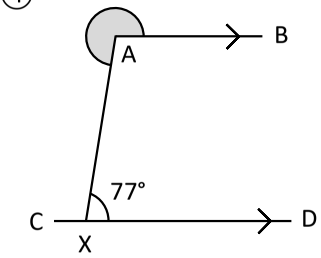
Angle EXB =

because…

Angle **EXY** =

because…

④



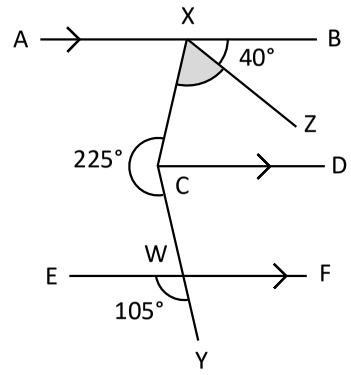
Obtuse Angle BAX =

because…

Reflex Angle **BAX** =

because…

⑤



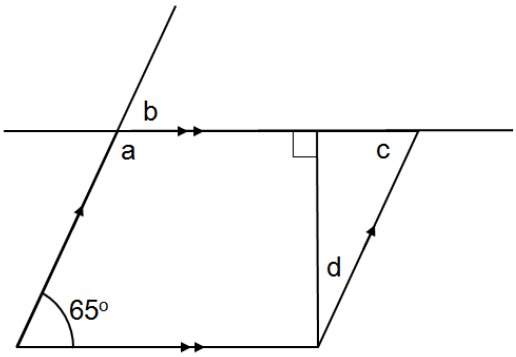
Angle **CXZ** =

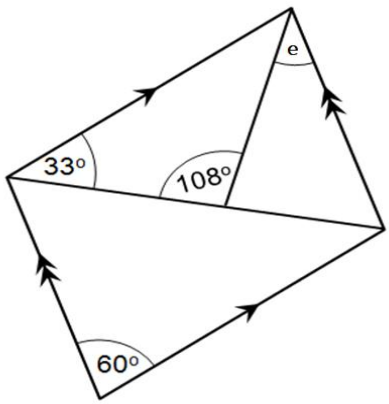
because…

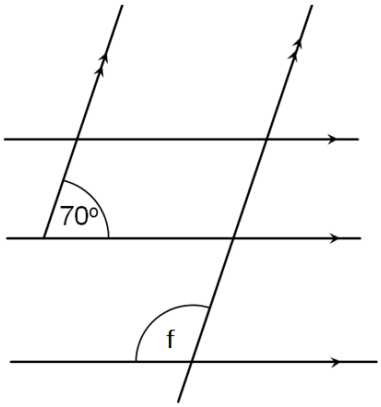
Fluency Practice

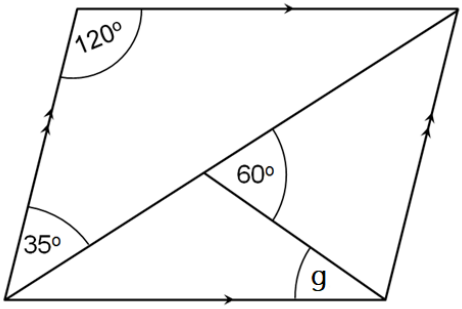
Write your answers in the grid and tick **all** the angle facts you used in each case.

Compare your grid to your partner's grid - did you use the same methods? If not, explain your methods and see if they can follow your thinking.







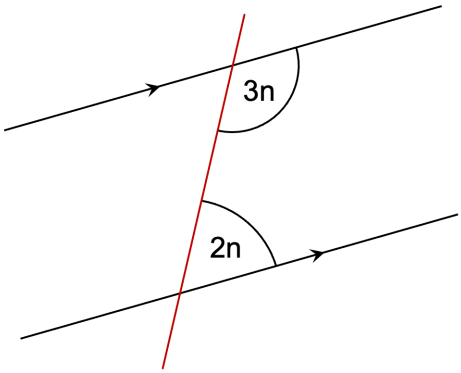


		Angle facts used							
Angle	Size	Alternate angles are equal	Corresponding angles are equal	Co-interior angles are supplementary	Vertically opposite angles are equal	Angles in a triangle sum to 180°	Adjacent angles on a straight line sum to 180°	Angles at a point sum to 360°	Opposite angles in a parallelogram are equal
a									
b									
c									
d									
e									
f									
g									

3.6 Angles in Parallel Lines with Equations

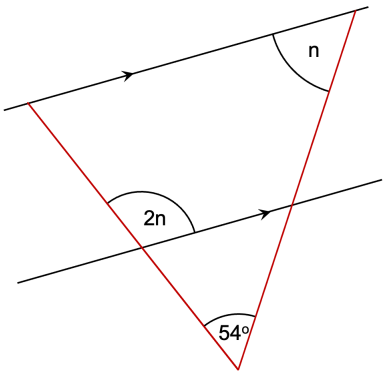
Worked Example

State what the angle n is, giving reasons for your answer.



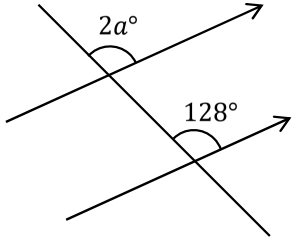
Your Turn

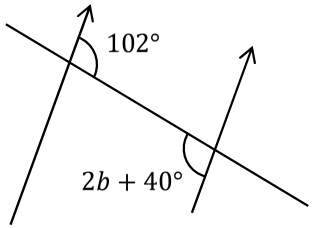
State what the angle n is, giving reasons for your answer.

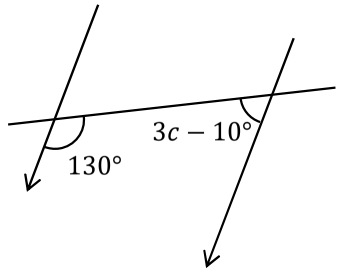


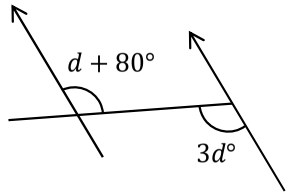
Equations & Parallel Lines

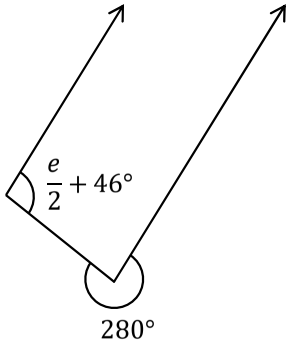
Use angle facts for parallel lines to find the value of the variables a to p.
For each question, state **all** the angle rules you have used.

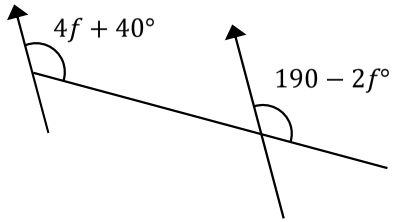


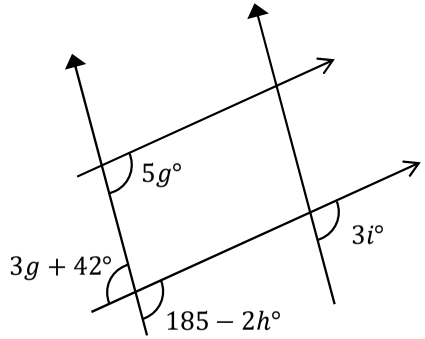


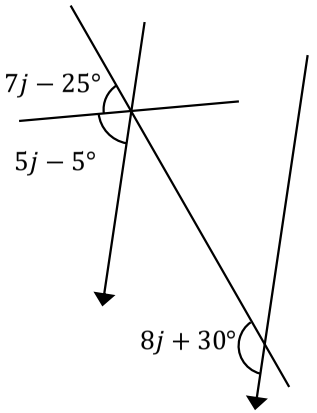


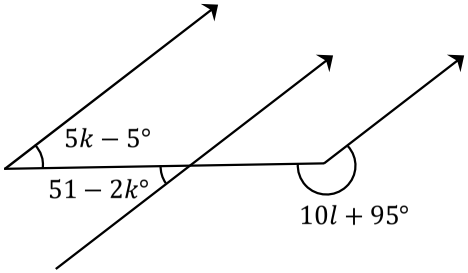


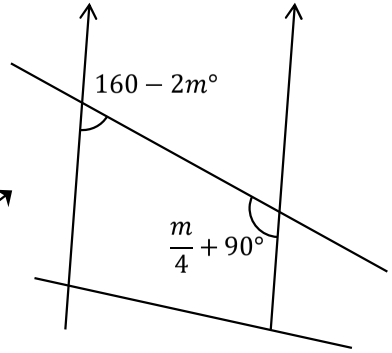


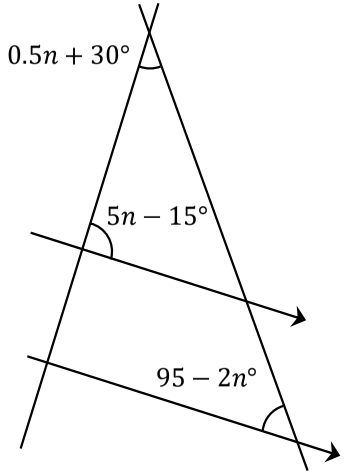


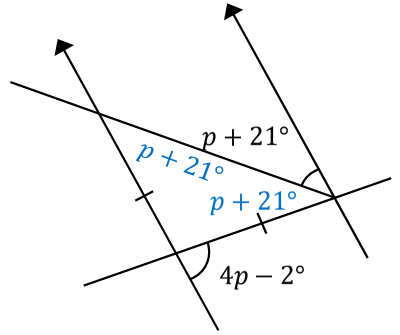






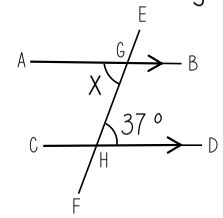


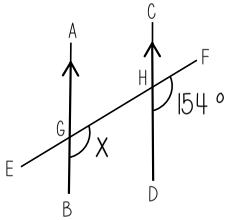


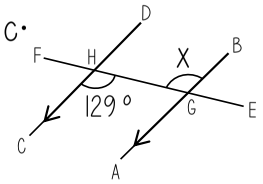


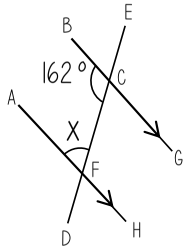
The diagrams are not drawn accurately

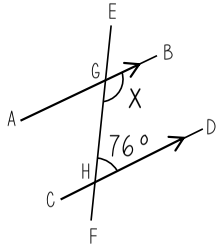
1. Find the missing angle and state what rule you used.

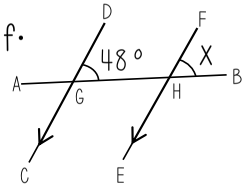
a. 

b. 

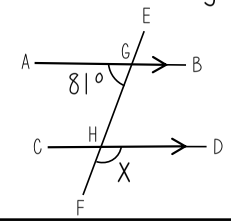
c. 

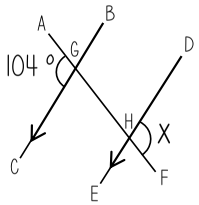
d. 

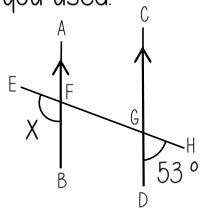
e. 

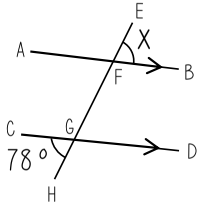
f. 

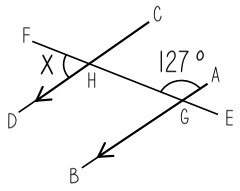
2. Find the missing angle and state what rules you used.

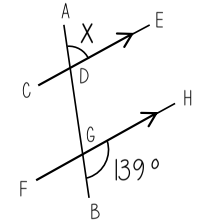
a. 

b. 

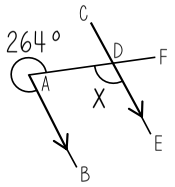
c. 

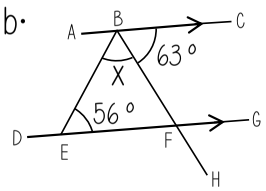
d. 

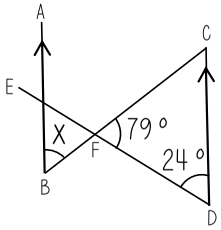
e. 

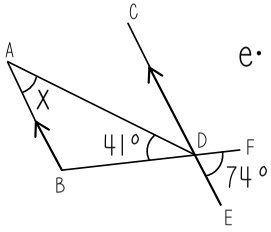
f. 

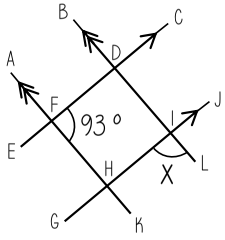
3. Find the missing angle and state what rules you used.

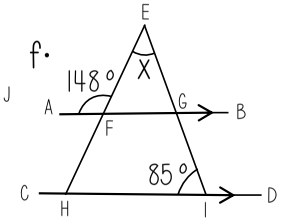
a. 

b. 

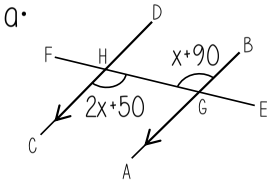
c. 

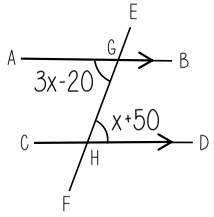
d. 

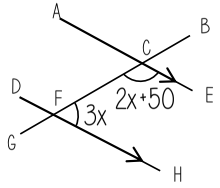
e. 

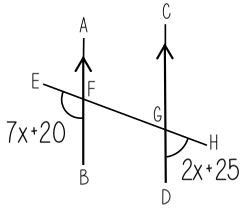
f. 

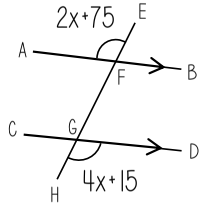
4. Find the value of x.

a. 

b. 

c. 

d. 

e. 

f.