KING EDWARD VI
HANDSWORTH GRAMMAR
SCHOOL FOR BOYS

KING EDWARD VI
ACADEMY TRUST
BIRMINGHAM

Year 11

2026 Mathematics 2027

Unit 23 Booklet – Part 1

HGS Maths

Tasks

Dr Frost Course

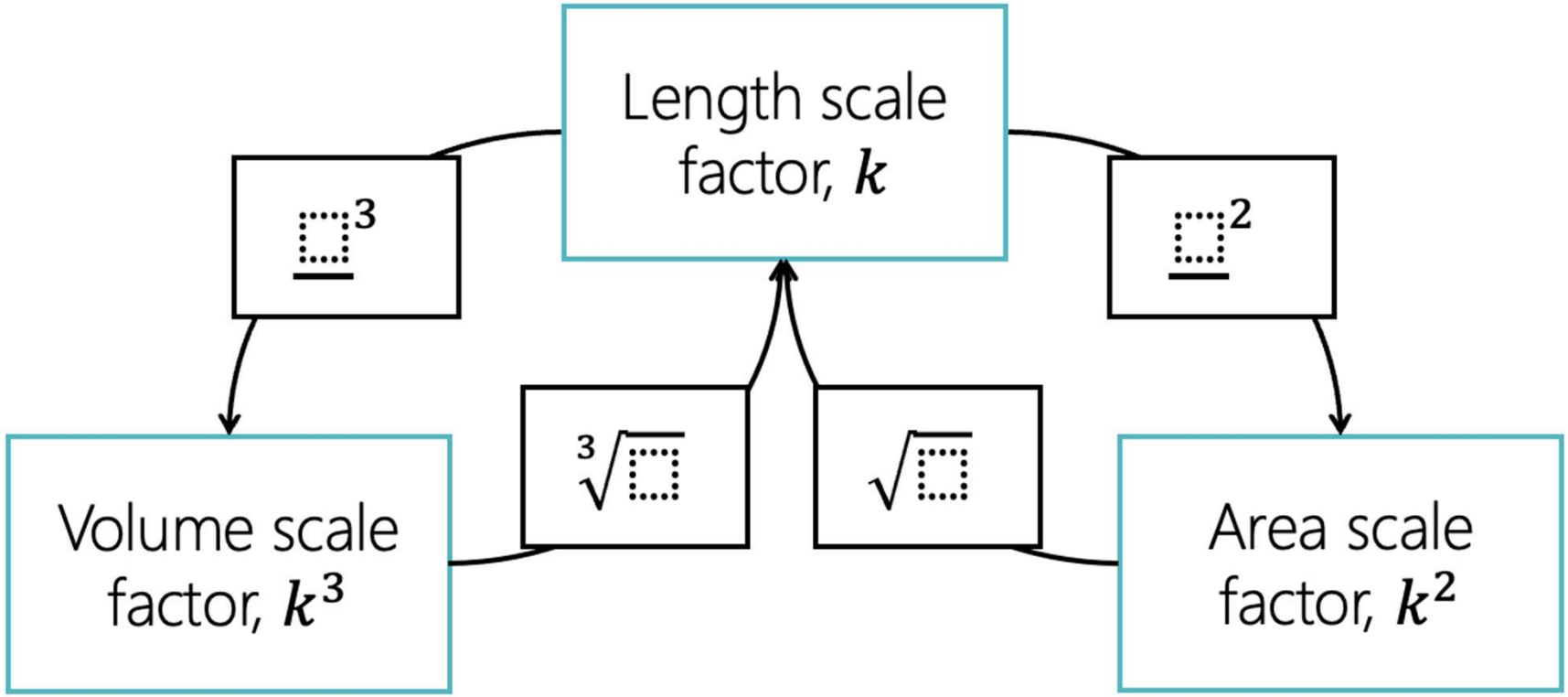
Name: _____

Class: _____

Contents

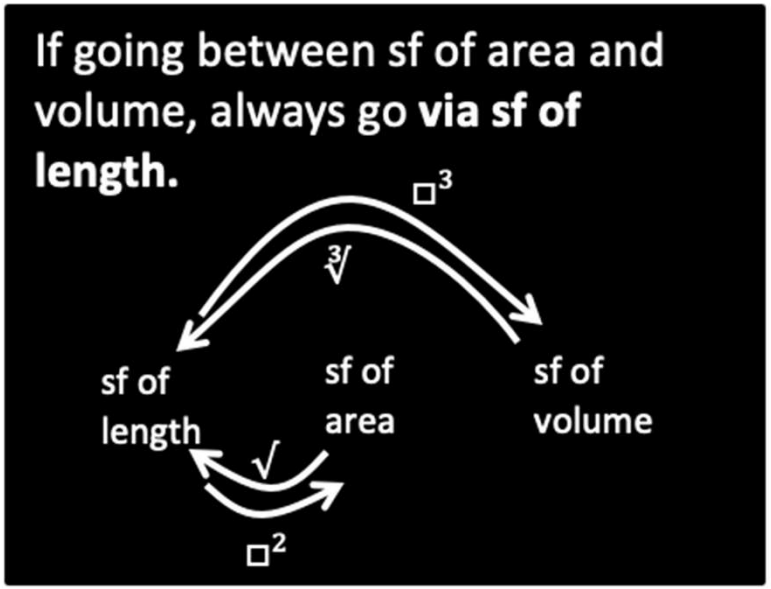
1 Similarity with Area and Volume

We can now see the relationship between length, area and volume scale factors.



Scale Factors

Length Scale Factor	Area Scale Factor	Volume Scale Factor
$\times\ 2$	$\times\ 4$	$\times\ 8$
$\times\ 3$	$\times\ 9$	$\times\ 27$
$\times\ 4$	$\times\ 16$	$\times\ 64$
…	…	…
$\times\ k$	$\times\ k^2$	$\times\ k^3$



Fill in the Gaps

	Length	Area	Volume
Scale Factor	2	4	8
Shape A	5 cm	30 cm^2	100 cm^3
Shape B	10 cm	120 cm^2	

	Length	Area	Volume
Scale Factor	3	9	27
Shape A	4 cm	16 cm^2	50 cm^3
Shape B	12 cm		

	Length	Area	Volume
Scale Factor	2		
Shape A	15 mm	35 mm^2	64 mm^3
Shape B	30 mm		

	Length	Area	Volume
Scale Factor			
Shape A	2 m	1.5 m^2	16 m^3
Shape B	5 m		

	Length	Area	Volume
Scale Factor			
Shape A	4 cm		
Shape B	12 cm	72 cm^2	540 cm^3

	Length	Area	Volume
Scale Factor			
Shape A	2.4 m		
Shape B	1.2 m	4 m^2	5.6 m^3

	Length	Area	Volume
Scale Factor	1.5		
Shape A			
Shape B	7.5 cm	45 cm^2	202.5 cm^3

	Length	Area	Volume
Scale Factor	$\frac{4}{3}$		
Shape A	1.8 cm		54 cm^3
Shape B		80 cm^2	

Fill in the Gaps

	Length	Area	Volume
Scale Factor		4	8
Shape A	3 cm	10 cm^2	25 cm^3
Shape B			

	Length	Area	Volume
Scale Factor		9	
Shape A	4 cm	20 cm^2	70 cm^3
Shape B			

	Length	Area	Volume
Scale Factor			125
Shape A	0.5 m	2 m^2	5 m^3
Shape B			

	Length	Area	Volume
Scale Factor			
Shape A	4.5 mm	20 mm^2	35 mm^3
Shape B		180 mm^2	

	Length	Area	Volume
Scale Factor			
Shape A	2.5 cm	8 cm^2	20 cm^3
Shape B			67.5 cm^3

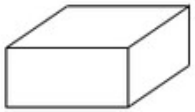
	Length	Area	Volume
Scale Factor			
Shape A	0.6 m	2.8 m^2	
Shape B		0.7 m^2	1.4 m^2

	Length	Area	Volume
Scale Factor			
Shape A		1.8 cm^2	
Shape B	2 cm	5 cm^2	25 cm^3

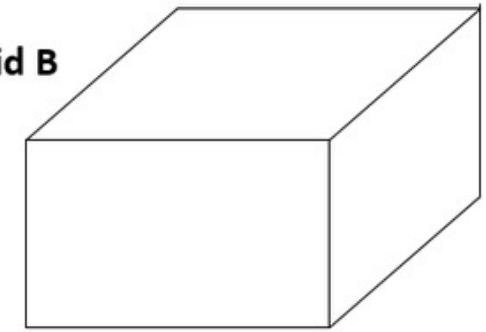
	Length	Area	Volume
Scale Factor			
Shape A	7.5 cm		135 cm^3
Shape B		22 cm^2	40 cm^3

Fill in the Gaps

Cuboid A



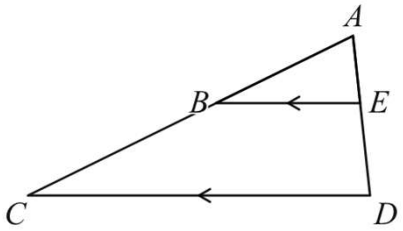
Cuboid B



Height of A (cm)	Height of B (cm)	Surface area of A (cm^2)	Surface area of B (cm^2)	Volume of A (cm^3)	Volume of B (cm^3)
15	45	120		60	
90	180	2000			12000
2	20		700		12000
18		70	1750	32	
	10	4.3	68.8	7.2	
6.8		12.5		6.6	178.2
	45		125	42	656.25
	11.36	15.2		54	221.184

Worked Example

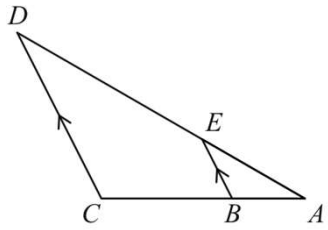
In the diagram ABC and AED are straight lines and BE is parallel to CD.



The length AB is 20 cm and the length BC is 27.5 cm.
The area of triangle ABE is 83.2 cm^2.
Work out the area of triangle ACD.

Your Turn

In the diagram ABC and AED are straight lines and BE is parallel to CD.



The length AB is 10.5 cm and the length BC is 18.9 cm.
The area of triangle ABE is 45 cm^2.
Work out the area of triangle ACD.

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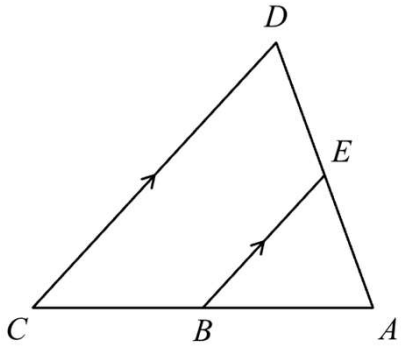
Worked Example

In the diagram ABC and AED are straight lines and BE is parallel to CD

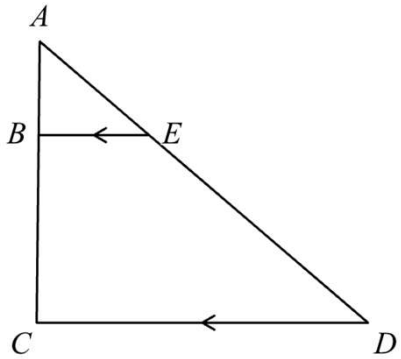


The length BE is 8 cm and the length CD is 16 cm
The area of triangle ABE is x cm^2
The area of quadrilateral $BCDE$ is y cm^2

Find an expression for y in terms of x

Your Turn

In the diagram ABC and AED are straight lines and BE is parallel to CD



The length AB is 8.5 cm and the length BC is 17 cm
The area of triangle ABE is x cm^2
The area of quadrilateral $BCDE$ is y cm^2

Find an expression for x in terms of y

Dr Frost 324p

Extra Notes

2 Arcs, Sectors and Segments

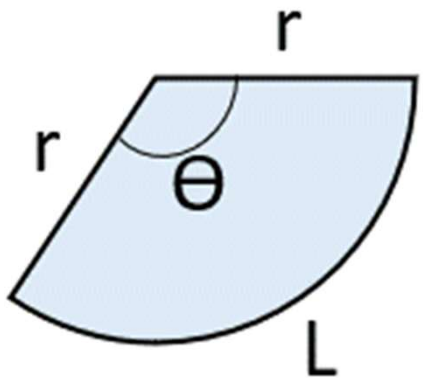
Arc Length and Perimeter of Sectors and Segments

Arc Length of a Sector $= \frac{\text{Angle}}{360} \times \pi \times \text{Diameter}$

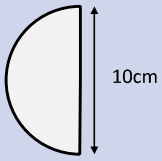
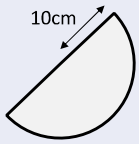
$L = \frac{\theta}{360} \times \pi d$

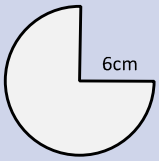
Perimeter of a Sector $= \frac{\text{Angle}}{360} \times \pi \times \text{Diameter} + 2 \times \text{Radius}$

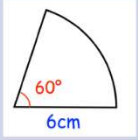
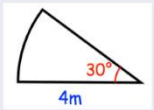
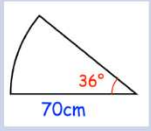
$P = \frac{\theta}{360} \times \pi d + 2r$



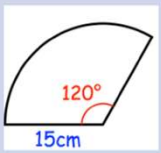
Radius	Angle	Arc Length	Perimeter
$8\ cm$	$90°$	$\frac{90}{360} \times \pi \times 2 \times 8 = 12.6\ cm$	$28.6\ cm$
$7\ cm$	$45°$	$\frac{45}{360} \times \pi \times 2 \times 7 = 5.5\ cm$	
$15\ mm$	$60°$	$\frac{60}{360} \times \pi \times 2 \times 15 = 15.7\ mm$	
$4\ cm$	$75°$		
$1.8\ m$	$130°$		
$82\ mm$	$335°$		
$11\ cm$	$275°$		
$9\ mm$	$32°$		
$10\ cm$		$\frac{\square}{360} \times \pi \times 2 \times 10 = 13.96\ cm$	
$25\ mm$		$\frac{\square}{360} \times \pi \times 2 \times 25 = 93.81\ mm$	
$2\ m$		$\frac{\square}{360} \times \pi \times 2 \times 2 = \square m$	$5.05\ m$
$8.9\ cm$		$\frac{\square}{360} \times \pi \times 2 \times 8.9 = \square cm$	$35.2\ m$
		$\frac{\square}{360} \times \pi \times 2 \times \square = 4.61\ cm$	$15.61\ cm$
		$\frac{\square}{360} \times \pi \times 2 \times \square = 55.29\ mm$	$99.29\ mm$

Sector.	Radius.	Diameter.	Fraction of the whole circle.	Arc length.	Length of straight sides.	Perimeter in terms of pi.	Perimeter to 1 decimal place.
	$5cm$	$10cm$	$\frac{1}{2}$	$5\pi = 15.7cm$	$10cm$	$(5\pi + 10)\ cm$	$25.7cm$
							
							

Sector.	Radius.	Diameter.	Fraction of the whole circle.	Arc length.	Length of straight sides.	Perimeter in terms of pi.	Perimeter to 1 decimal place.
							
		$4cm$	$\frac{1}{4}$				
	$3cm$		$\frac{1}{2}$				

Sector.	Radius.	Diameter.	Fraction of the whole circle.	Arc length.	Length of straight sides.	Perimeter in terms of pi.	Perimeter to 1 decimal place.
							
							
							

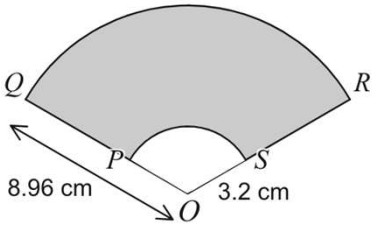
Fill in the Gaps

Sector.	Radius.	Diameter.	Fraction of the whole circle.	Arc length.	Length of straight sides.	Perimeter in terms of pi.	Perimeter to 1 decimal place.
							
		$10cm$	$\frac{1}{3}$				
	$10cm$		$\frac{1}{8}$				

Sector.	Radius.	Diameter.	Fraction of the whole circle.	Arc length.	Length of straight sides.	Perimeter in terms of pi.	Perimeter to 1 decimal place.
			$\frac{1}{2}$		$7cm$		
			$\frac{1}{3}$			$(4\pi + 12)\ cm$	
			$\frac{1}{10}$		$40cm$		$46.3cm$

Worked Example

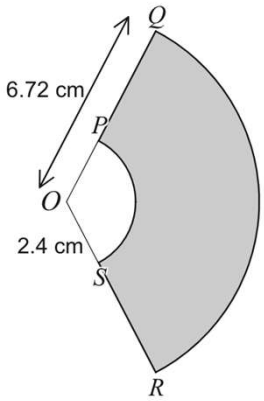
A shape is formed from the sectors of two circles with centre O.
OPQ and OSR are straight lines.



The length of OS is 3.2 cm.
The length of OQ is 8.96 cm.
Angle POS is $120°$.
Calculate the perimeter of the shaded region.
Give your answer to 1 decimal place.

Your Turn

A shape is formed from the sectors of two circles with centre O.
OPQ and OSR are straight lines.



The length of OS is 2.4 cm.
The length of OQ is 6.72 cm.
Angle POS is $125°$.
Calculate the perimeter of the shaded region.
Give your answer to 1 decimal place.

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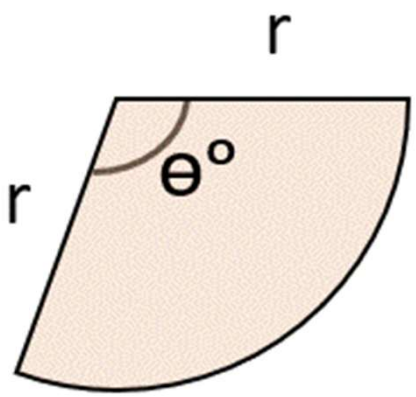
Area of Sectors and Segments

$$\text{Area of a Sector} = \frac{\text{Angle}}{360} \times \pi \times \text{Radius}^2$$

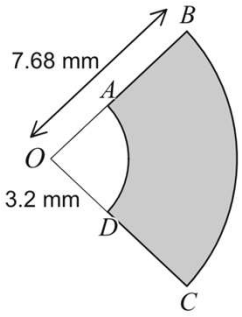
$$\mathbf{A = \frac{\theta}{360} \times \pi r^2}$$



Radius	Angle	Fraction	Area
$8\ cm$	$90°$	$\frac{90}{360} = \frac{1}{4}$	$\frac{90}{360} \times \pi \times 8^2 = 50.3\ cm^2$
$7\ cm$	$45°$	$\frac{45}{360} = \frac{1}{8}$	
$15\ mm$	$60°$		
$4\ cm$	$75°$		
$1.8\ m$	$130°$		
$82\ mm$	$335°$		
$11\ cm$	$275°$		
$9\ mm$		$\frac{\square}{360} = \frac{5}{36}$	
$10\ cm$		$\frac{\square}{360} = \frac{7}{9}$	
$25\ mm$			$\frac{\square}{360} \times \pi \times 25^2 = 327.2\ mm^2$
$2\ m$			$\frac{\square}{360} \times \pi \times 2^2 = 4.712\ m^2$
	$35°$		$\frac{35}{360} \times \pi \times \square^2 = 2.75\ cm^2$
	$315°$		$\frac{315}{360} \times \pi \times \square^2 = 464.6\ mm^2$
	$58°$		$\frac{58}{360} \times \pi \times \square^2 = 50.61\ cm^2$

Worked Example

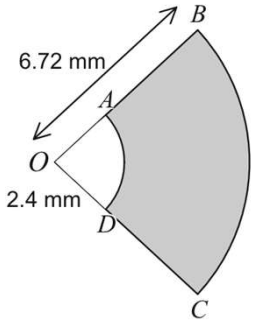
A metal component for a machine is formed from the sectors of two circles with centre O. The area of sector OAD is 7.7 mm^2.



OAB and ODC are straight lines.
The length of OD is 3.2 mm.
The length of OB is 7.68 mm.
Calculate the area of the shaded region.

Your Turn

A metal component for a machine is formed from the sectors of two circles with centre O. The area of sector OAD is 4.3 mm^2.



OAB and ODC are straight lines.
The length of OD is 2.4 mm.
The length of OB is 6.72 mm.
Calculate the area of the shaded region.

Dr Frost 319d

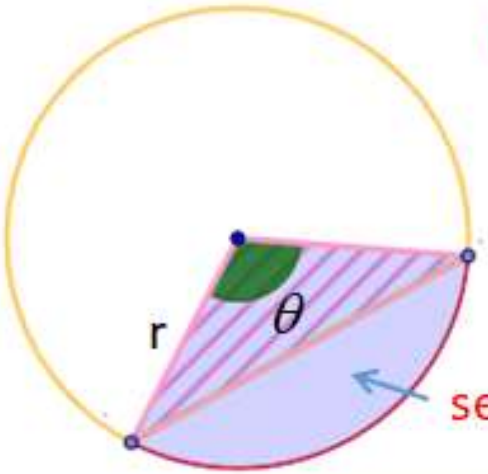
Fill in the Gaps

	Sketch	*Radius*	*Angle*	$\frac{Angle}{360}$ *(simplified)*	*Circumference of whole circle*	*Arc length*	*Area of whole circle*	*Area of shaded sector*
1		6	180^o	$\frac{1}{2}$	12π	6π		
2								
3			45^o		12π			
4		6		$\frac{3}{4}$				
5		6				2π		

Fill in the Gaps

	Sketch	*Radius*	*Angle*	$\frac{Angle}{360}$ *(simplified)*	*Circumference of whole circle*	*Arc length*	*Area of whole circle*	*Area of shaded sector*
6							36π	12π
7			330^o		12π			
8			330^o		24π			
9					24π	2π		
10						6π		36π

Area of Segment



Area of segment
= area of sector – area of triangle

area of triangle = $\frac{1}{2}r^2 \sin\theta$

If θ is in degrees then

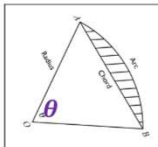
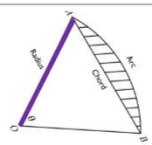
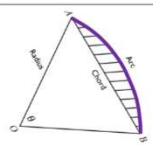
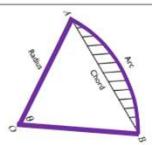
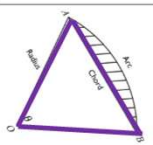
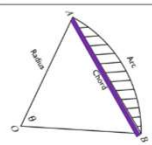
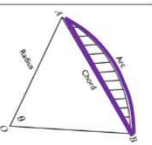
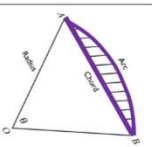
area of sector $= \frac{\theta}{360°}\pi r^2$

Area of segment

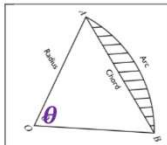
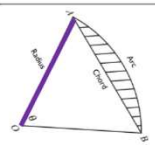
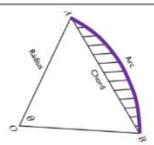
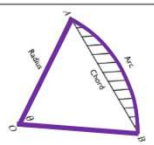
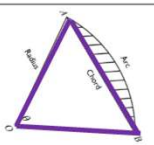
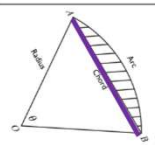
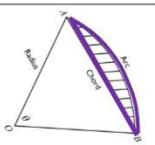
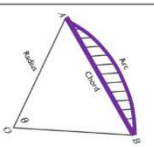
$$= \frac{\theta}{360}\pi r^2 - \frac{1}{2}r^2 \sin\theta$$

$$= r^2\left(\frac{\theta\pi}{360} - \frac{\sin\theta}{2}\right)$$

Fill in the Gaps

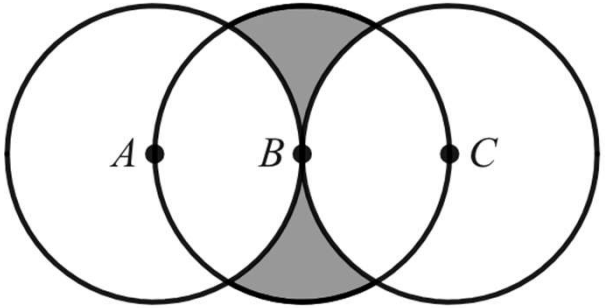
 Angle θ^c	 Radius $r\ cm$	 Arc Length	 Area of Sector	 Area of Triangle	 Length of Chord	 Area of Segment	 Perimeter of Segment
$\theta = 1.5^c$	$r = 10cm$	Arc Length $= r\theta$ $\rightarrow (10)(1.5)$ $= 15cm$	Sector Area $= \frac{1}{2}r^2\theta$ $\rightarrow \frac{1}{2}(10)^2(1.5)$ $= 75cm^2$	Triangle Area $= \frac{1}{2}ab\sin C$ $\rightarrow \frac{1}{2}(10)(10)\sin(1.5)$ $= 49.87cm^2$	Cosine Rule $a^2 = b^2 + c^2 - 2bc\cos A$ $a^2 = 10^2 + 10^2 - 2(10)(10)\cos(1.5)$ $a^2 = 185.853\ldots$ $a = 13.63cm$	Area = Sector – Triangle $\rightarrow 75 - 49.87$ $= 25.13cm^2$	Perimeter = Chord + Arc $\rightarrow 13.63 + 15$ $= 28.63cm$
1) 0.8^c	$7cm$						
2)	$20cm$	$60cm$					
3) 1.2^c			$21.6cm^2$				
4)		$6\pi\ cm$	$72\pi\ cm^2$				

Fill in the Gaps

 Angle θ^c	 Radius $r\ cm$	 Arc Length	 Area of Sector	 Area of Triangle	 Length of Chord	 Area of Segment	 Perimeter of Segment
$\theta = 1.5^c$	$r = 10cm$	Arc Length $= r\theta$ $\rightarrow (10)(1.5)$ $= 15cm$	Sector Area $= \frac{1}{2}r^2\theta$ $\rightarrow \frac{1}{2}(10)^2(1.5)$ $= 75cm^2$	Triangle Area $= \frac{1}{2}ab\sin C$ $\rightarrow \frac{1}{2}(10)(10)\sin(1.5)$ $= 49.87cm^2$	Cosine Rule $a^2 = b^2 + c^2 - 2bc\cos A$ $a^2 = 10^2 + 10^2 - 2(10)(10)\cos(1.5)$ $a^2 = 185.853\ldots$ $a = 13.63cm$	Area = Sector – Triangle $\rightarrow 75 - 49.87$ $= 25.13cm^2$	Perimeter = Chord + Arc $\rightarrow 13.63 + 15$ $= 28.63cm$
5)	$8cm$				$8cm$		
6)	$15cm$			$94.67cm^2$			
7)	$11cm$				$5.694cm$		
8) 2^c						$6.681cm^2$	

Worked Example

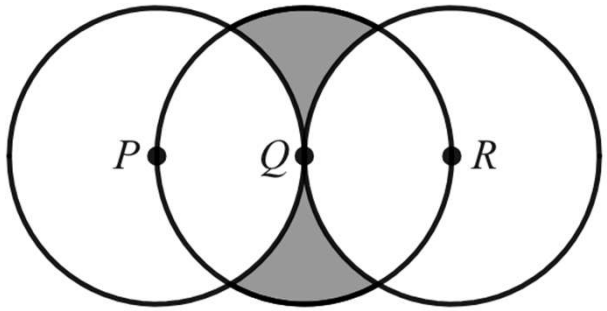
The diagram shows three circles, each of radius 9 cm.
The centres of the circles are A, B and C such that ABC is a straight line and $AB = BC = 9$ cm.



Work out the total area of the two shaded regions.
Give your answer in terms of π.

Your Turn

The diagram shows three circles, each of radius 6 cm.
The centres of the circles are P, Q and R such that PQR is a straight line and $PQ = QR = 6$ cm.



Work out the total area of the two shaded regions.
Give your answer in terms of π.

Dr Frost 467r

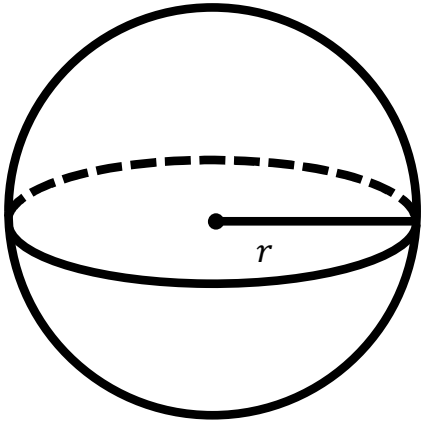
Extra Notes

3 Volume and Surface Area of Non-Prisms

Volume of Spheres

Volume of Sphere $= \frac{4}{3} \times \pi \times \text{Radius}^3$

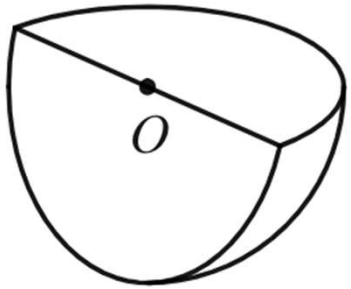
$V = \frac{4}{3}\pi r^3$



Worked Example	Your Turn
a) A sphere has a surface area of $36\pi\ cm^2$. Work out the volume of the sphere. Give your answer in terms of π and to 1 decimal place. b) A sphere has a volume of $36\pi\ cm^3$. Work out the surface area of the sphere. Give your answer in terms of π and to 1 decimal place.	a) A sphere has a surface area of $144\pi\ cm^2$. Work out the volume of the sphere. Give your answer in terms of π and to 1 decimal place. b) A sphere has a volume of $288\pi\ cm^3$. Work out the surface area of the sphere. Give your answer in terms of π and to 1 decimal place.

Worked Example

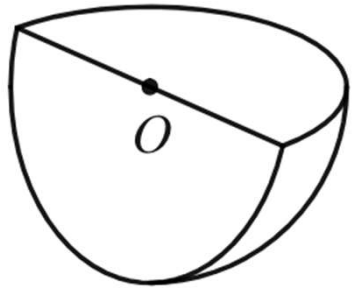
The diagram shows a solid quarter sphere, centre O.



The volume of the solid is 9750 cm^3.
Work out the surface area of the solid.
Give your answer to 1 decimal place.

Your Turn

The diagram shows a solid quarter sphere, centre O.

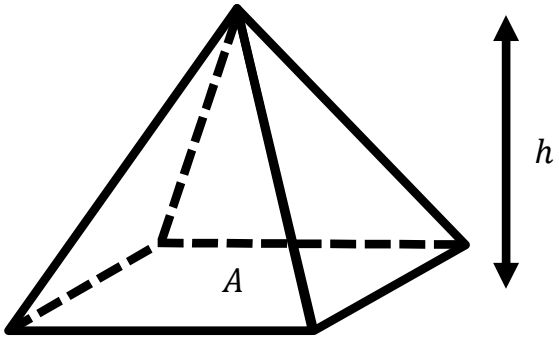


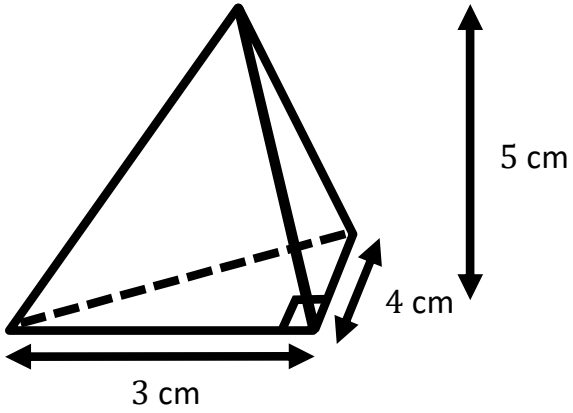
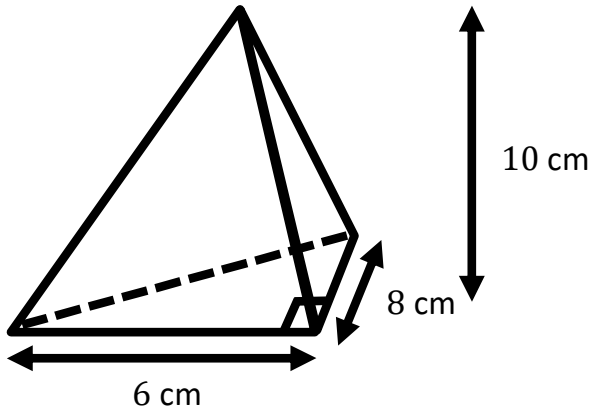
The volume of the solid is 3500 cm^3.
Work out the surface area of the solid.
Give your answer to 1 decimal place.

Volume of Pyramids

$$\text{Volume of Pyramid} = \frac{1}{3} \times \text{Area of Base} \times \text{Vertical Height}$$

$$V = \frac{1}{3}Ah$$

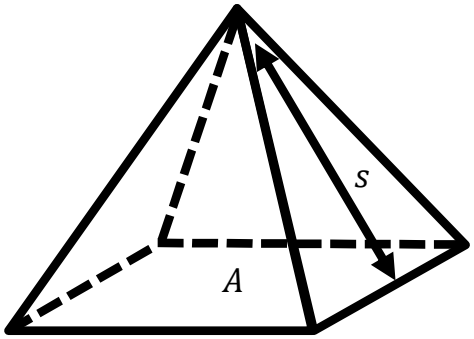


Worked Example	Your Turn
Calculate the volume of the following triangular-based pyramid.  	Calculate the volume of the following triangular-based pyramid. 

Surface Area of Pyramids

$$\text{Total Surface Area of Pyramid} = \frac{1}{2} \times \text{Perimeter of Base} \times \text{Slant Height} + \text{Area of Base}$$

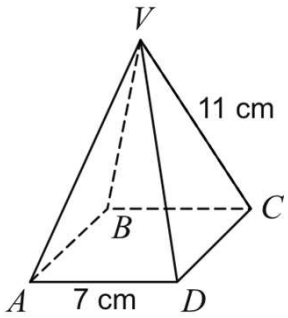
$$\text{TSA} = \frac{1}{2}\text{Ps} + \text{A}$$



Note: This formula only works for regular pyramids (e.g., pyramids with a square base). To find the surface area of other types of pyramids, you need to calculate the area of each face and the base separately, then add them together.

Worked Example

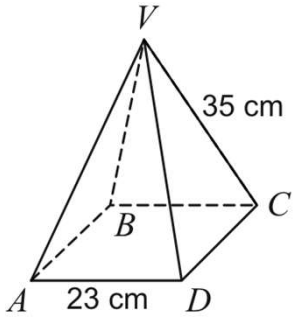
The diagram shows a square based pyramid $ABCDV$. The vertex, V, of the pyramid is directly above the centre of the square base.



The length of each side of the base is 7 cm. The length of each slanted edge is 11 cm. Find the total surface area of the pyramid. Give your answer to 1 decimal place.

Your Turn

The diagram shows a square based pyramid $ABCDV$. The vertex, V, of the pyramid is directly above the centre of the square base.



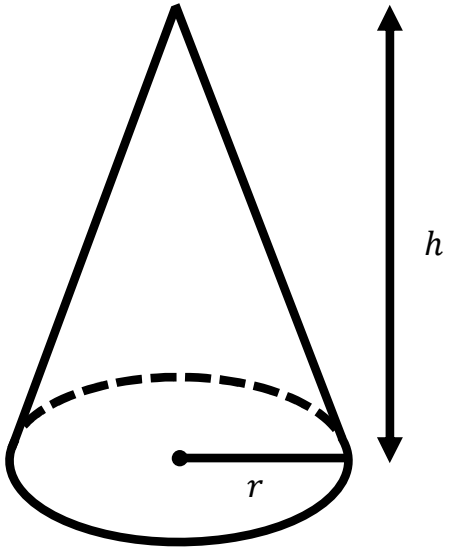
The length of each side of the base is 23 cm. The length of each slanted edge is 35 cm. Find the total surface area of the pyramid. Give your answer to 1 decimal place.

Dr Frost 406b

Volume of Cones

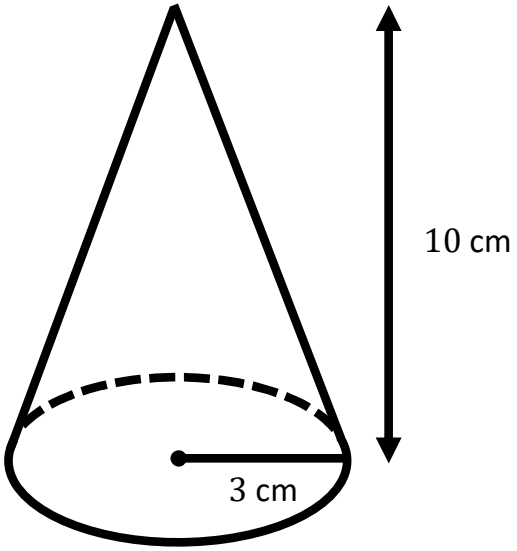
$$\text{Volume of Cone} = \frac{1}{3} \times \text{Area of Circle} \times \text{Height}$$

$$V = \frac{1}{3}\pi r^2 h$$



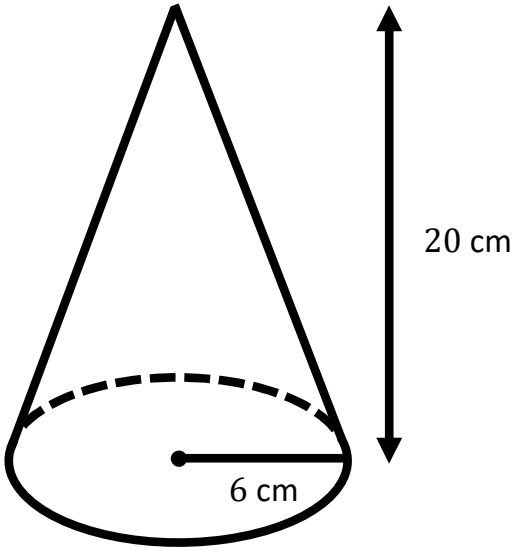
Worked Example

Calculate the volume of the following cone. Give your answer in terms of π and to 1 decimal place.



Your Turn

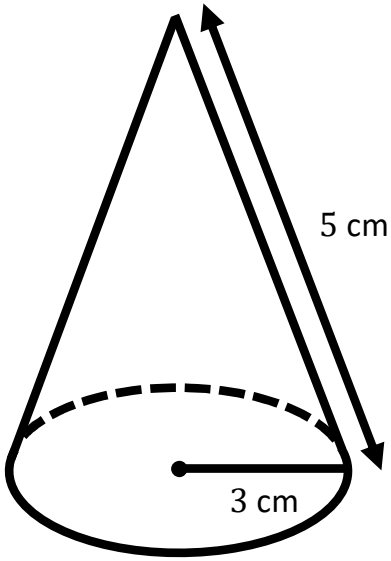
Calculate the volume of the following cone. Give your answer in terms of π and to 1 decimal place.



Dr Frost 405c

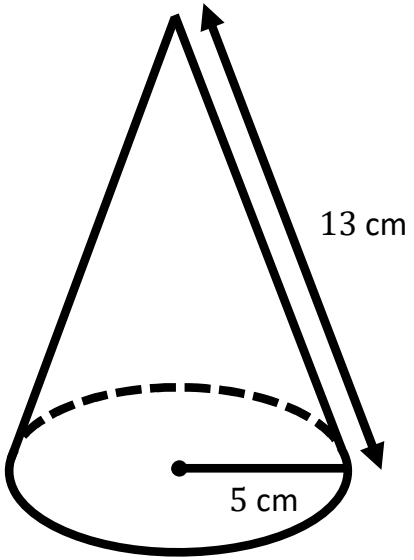
Worked Example

Calculate the volume of the following cone. Give your answer in terms of π and to 1 decimal place.



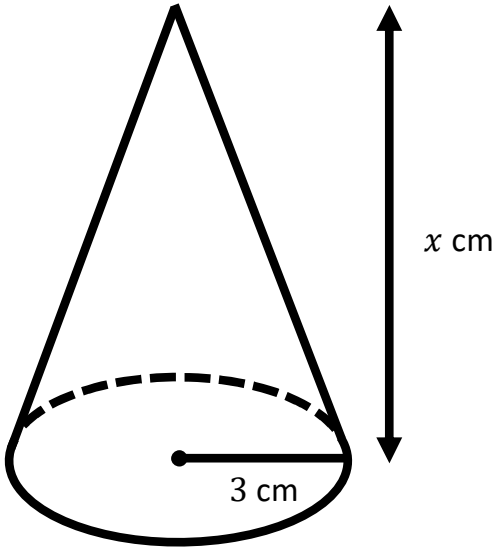
Your Turn

Calculate the volume of the following cone. Give your answer in terms of π and to 1 decimal place.



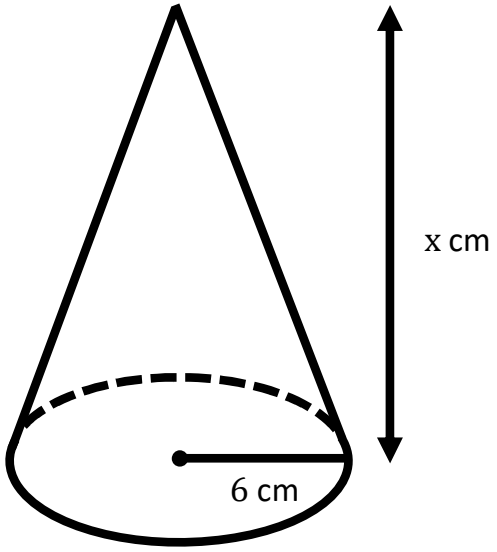
Worked Example

Find the height, x, given that the volume of the following cone is $94.2\ cm^3$. Give your answer to 1 decimal place.



Your Turn

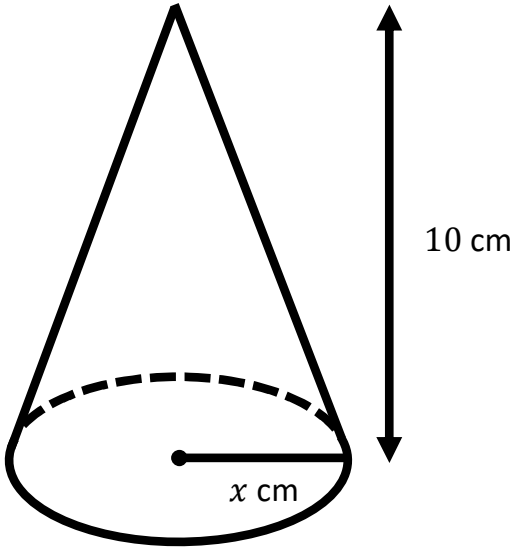
Find the height, x, given that the volume of the following cone is $754.0\ cm^3$. Give your answer to 1 decimal place.



Dr Frost 405d

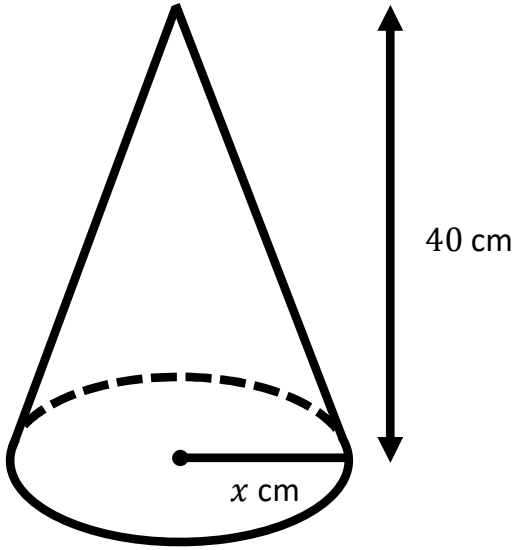
Worked Example

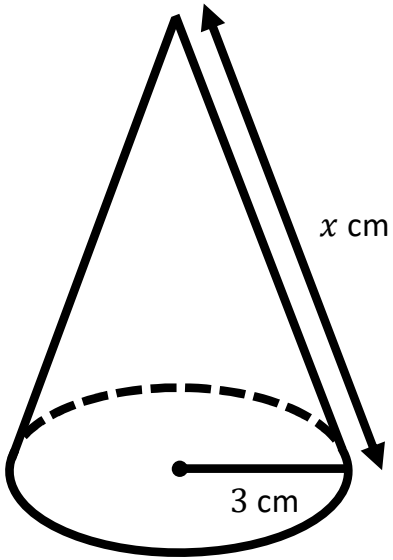
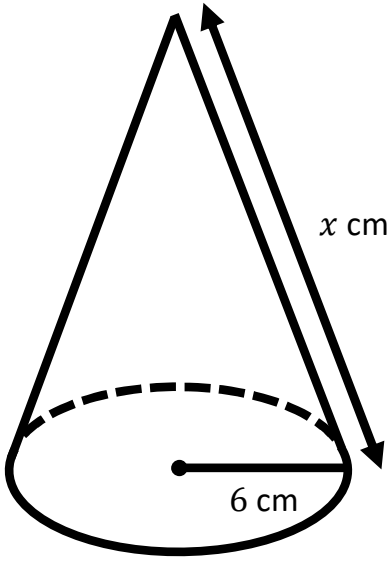
Find the radius, x, given that the volume of the following cone is $94.2\ cm^3$. Give your answer to 1 decimal place.

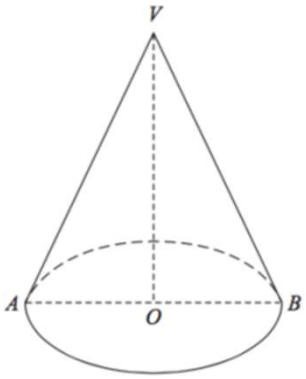
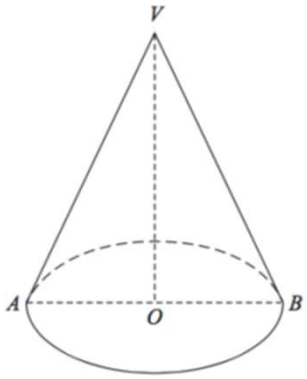


Your Turn

Find the radius, x, given that the volume of the following cone is $754.0\ cm^3$. Give your answer to 1 decimal place.

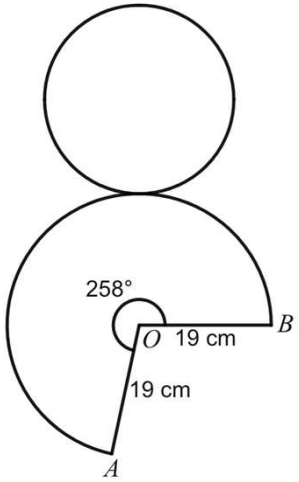


Worked Example	Your Turn
Find the slanted height, x, given that the volume of the following cone is $37.7\ cm^3$. Give your answer to 1 decimal place. 	Find the slanted height, x, given that the volume of the following cone is $500\ cm^3$. Give your answer to 1 decimal place. 

Worked Example	Your Turn
The diagram shows a solid cone. The base of the cone is a horizontal circle, centre O, with radius $9\ cm$. The curved surface area of the cone is $260\ cm^2$. Calculate the size of angle AVB. 	The diagram shows a solid cone. The base of the cone is a horizontal circle, centre O, with radius $4.5\ cm$. The curved surface area of the cone is $130\ cm^2$. Calculate the size of angle AVB. 

Worked Example

Here is the net of a cone.



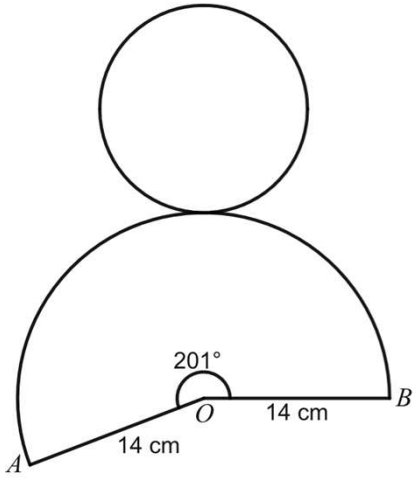
The net is formed from a sector of a circle, centre O, and radius 19 cm and an additional circle for the base.
Reflex angle $AOB = 258°$

The net makes a cone of slant height of 19 cm.

Calculate the volume of the cone.
Give your answer correct to 1 decimal place.

Your Turn

Here is the net of a cone.



The net is formed from a sector of a circle, centre O, and radius 14 cm and an additional circle for the base.
Reflex angle $AOB = 201°$

The net makes a cone of slant height of 14 cm.

Calculate the volume of the cone.
Give your answer correct to 1 decimal place.

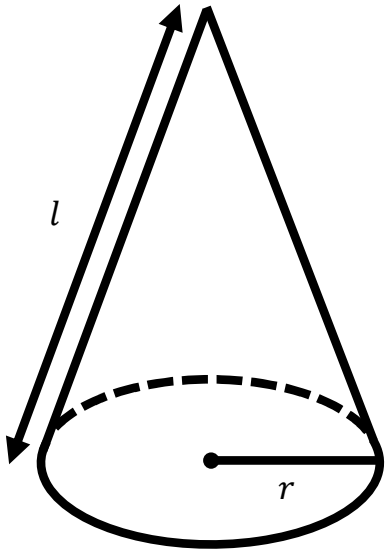
Surface Area of Cones

Curved Surface Area of Cone = π × Radius × Slanted Height

$CSA = \pi rl$

Total Surface Area of Cone = π × Radius × Slanted Height + π × Radius^2

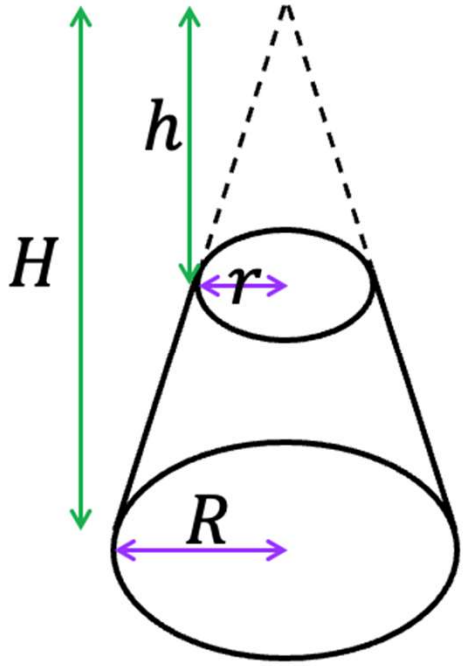
$TSA = \pi rl + \pi r^2$



Fill in the Gaps

Radius r	Vertical Height h	Slanted Height l	Volume in terms of π	Volume to 3 s.f.	Curved Surface Area in terms of π	Total Surface Area in terms of π	Volume : Total Surface Area
$5\ cm$	$12\ cm$	$13\ cm$	$100\pi\ cm^3$			$90\pi\ cm^2$	$10 : 9$
$6\ cm$	$8\ cm$	$10\ cm$			$60\pi\ cm^2$		
	$30\ mm$	$34\ mm$		$8040\ mm^3$			
$0.7\ m$	$2.4\ m$						
$9\ cm$		$15\ cm$					
$2\ m$			$\frac{14}{5}\pi\ cm^3$				
		$20\ mm$			$240\pi\ mm^2$		
					$15\pi\ cm^2$	$24\pi\ cm^2$	
		$17\ cm$	$320\pi\ cm^3$				$8 : 5$

Label the dimensions of each cone differently.



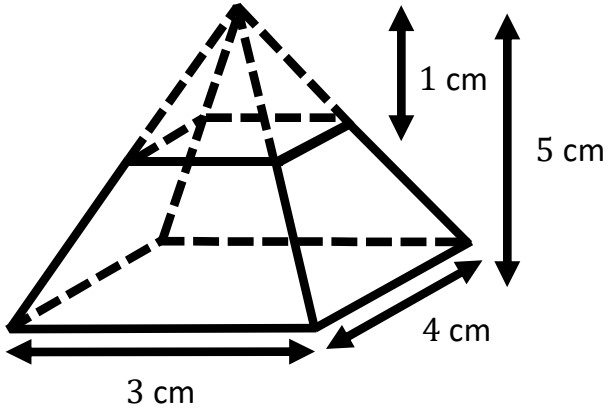
Volume of frustum =

volume of full cone −
volume of top-sliced cone

$$= \frac{1}{3}\pi R^2 H - \frac{1}{3}\pi r^2 h$$

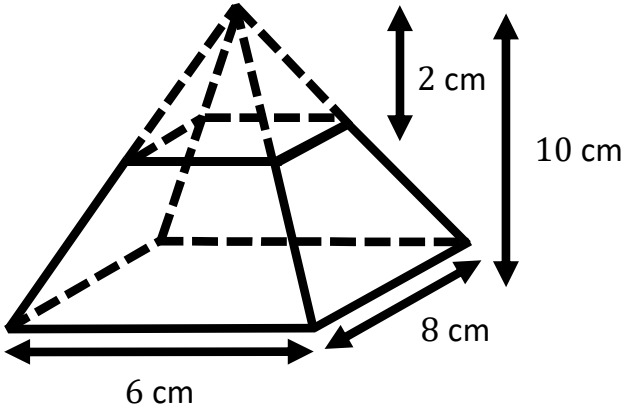
Worked Example

Calculate the volume of the following frustum.



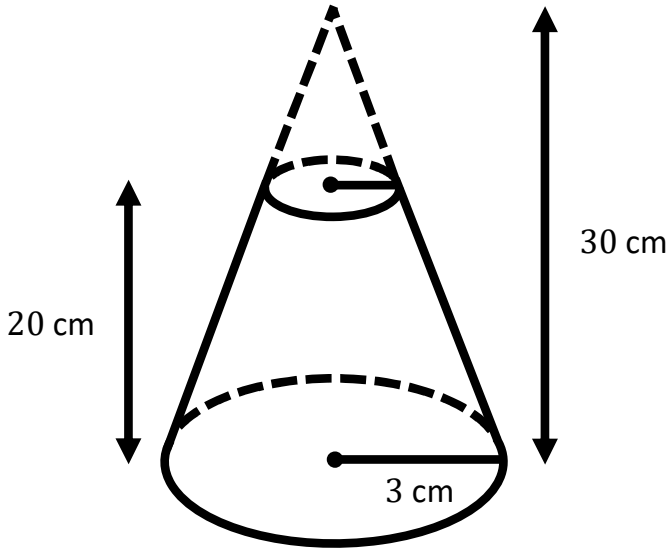
Your Turn

Calculate the volume of the following frustum.



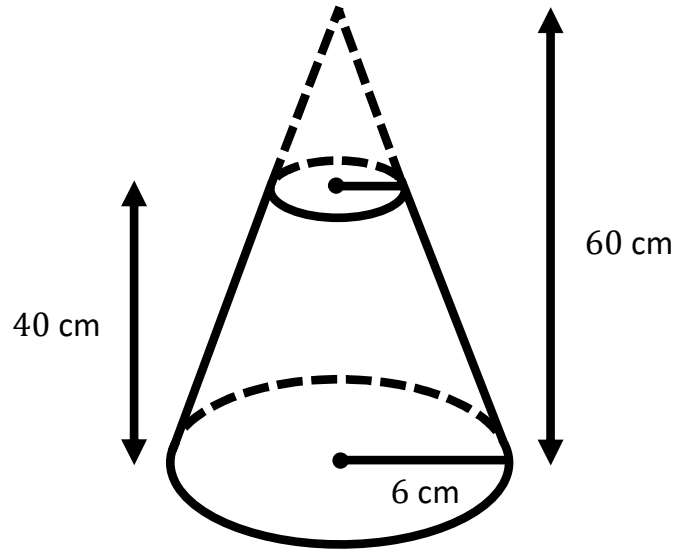
Worked Example

Calculate the volume of the following frustum. Give your answer in terms of π and to 1 decimal place.

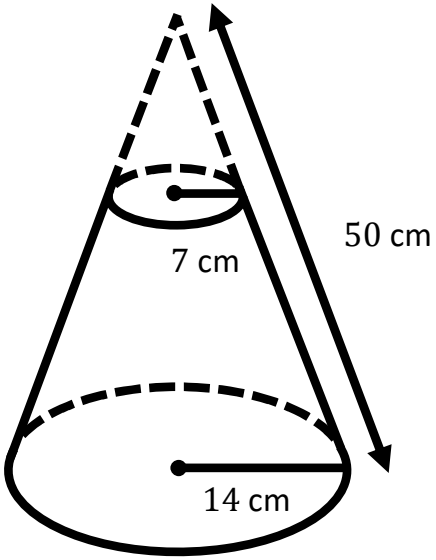
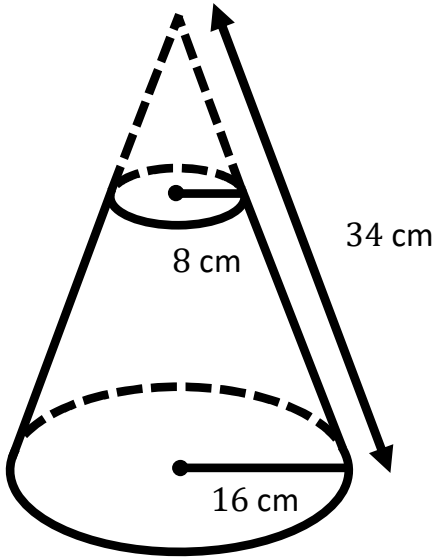


Your Turn

Calculate the volume of the following frustum. Give your answer in terms of π and to 1 decimal place.

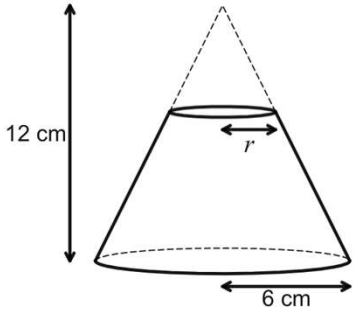


Dr Frost 407c

Worked Example	Your Turn
Calculate the volume of the following frustum. Give your answer in terms of π and to 1 decimal place.  	Calculate the volume of the following frustum. Give your answer in terms of π and to 1 decimal place. 

Worked Example

A cone of radius r cm is removed from a cone of radius 6 cm and height 12 cm to give a frustum.

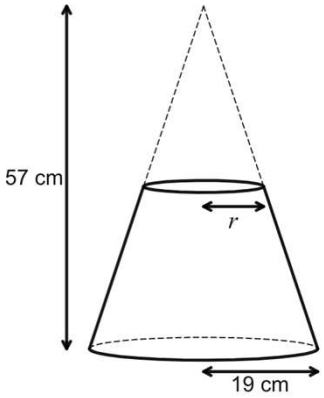


The volume of the frustum is 420 cm^3

Calculate the value of r
Give your answer correct to 1 decimal place

Your Turn

A cone of radius r cm is removed from a cone of radius 19 cm and height 57 cm to give a frustum.

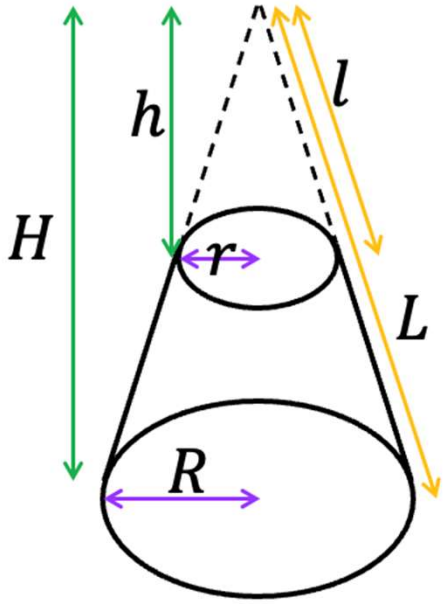


The volume of the frustum is 18407 cm^3

Calculate the value of r
Give your answer correct to 1 decimal place

Dr Frost 407h

Label the dimensions of each cone differently.



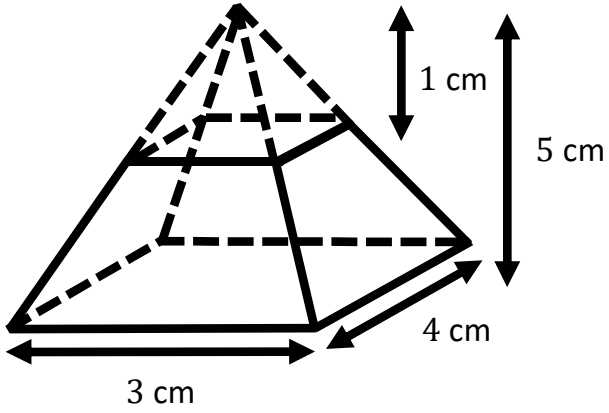
Surface area of frustum =

curved surface area of full cone −
curved surface area of top-sliced cone +
two circles (top and bottom)

$$= \pi RL - \pi rl + \pi R^2 + \pi r^2$$

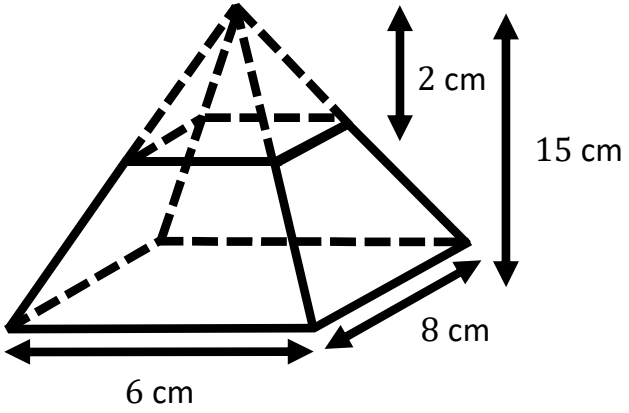
Worked Example

Calculate the total surface area of the following frustum.



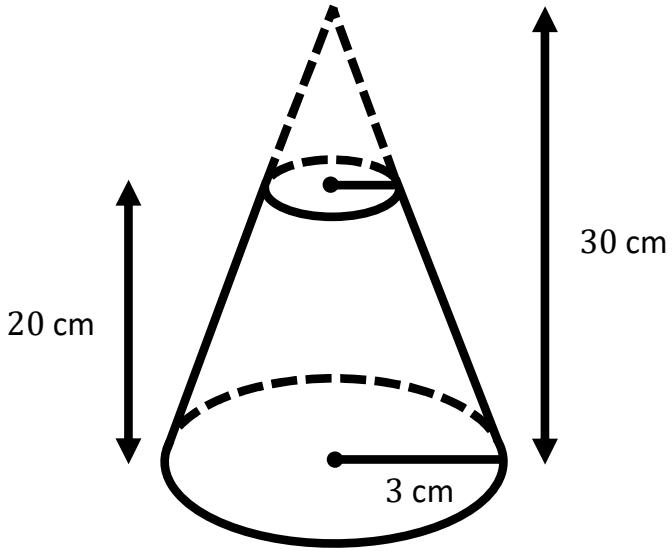
Your Turn

Calculate the total surface area of the following frustum.



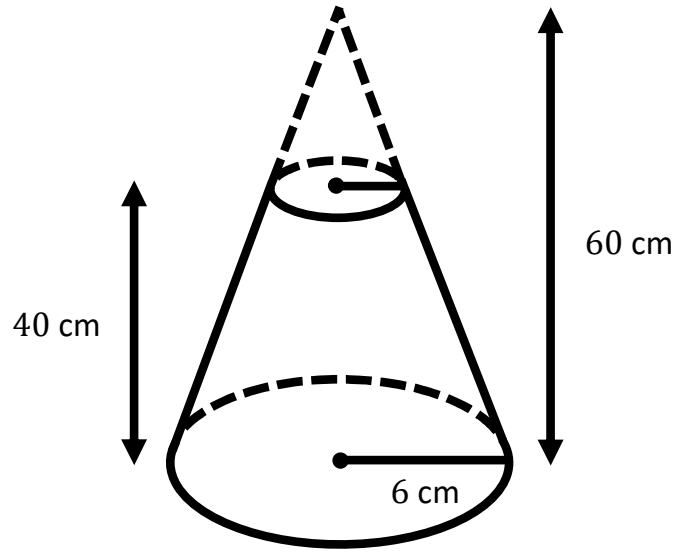
Worked Example

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



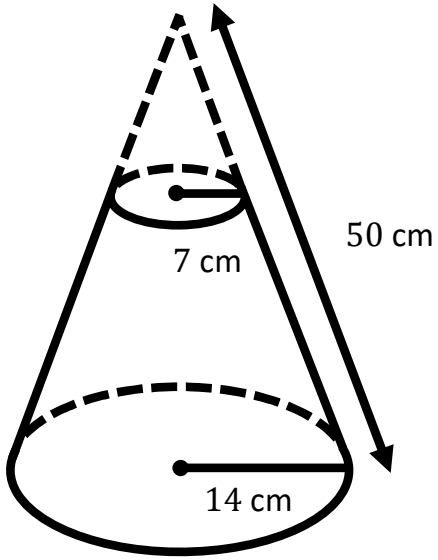
Your Turn

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



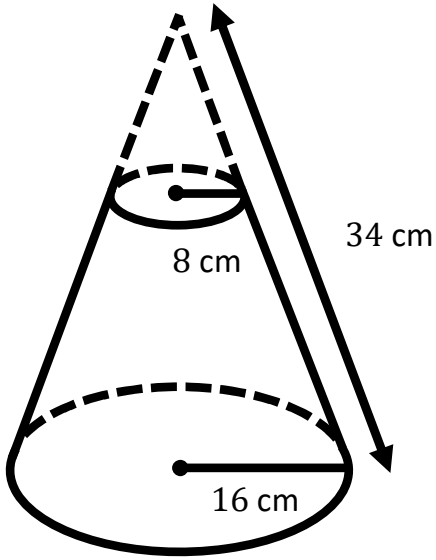
Worked Example

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



Your Turn

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



Extra Notes

4 Bearings

Can this be a Bearing?

040	Yes / No
90	Yes / No
90.5	Yes / No
158.50	Yes / No
58.5	Yes / No

Intelligent Practice

1) 045 Yes / No
2) 090 Yes / No
3) 45 Yes / No
4) 360 Yes / No
5) 361 Yes / No
6) 450 Yes / No
7) 30 Yes / No
8) 030 Yes / No
9) -145 Yes / No
10) 260 Yes / No
11) 365 Yes / No
12) 180 Yes / No
13) 27 Yes / No
14) -049 Yes / No
15) 049.5 Yes / No
16) 0180 Yes / No
17) 045 Yes / No
18) 145 Yes / No
19) -260 Yes / No
20) 0100 Yes / No
21) 80 Yes / No
22) 080 Yes / No
23) 0005 Yes / No
24) 000.5 Yes / No
25) 100.005 Yes / No

Bearings

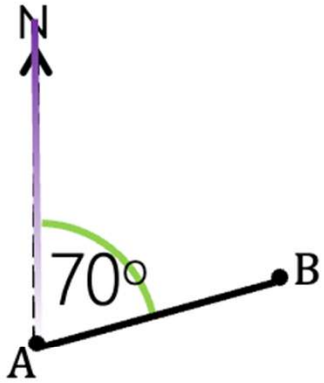
We talk about the bearing *of* an end point *from* a start point.

Here are two points, **A** and **B**.

To get from **A** to **B** we move like this.

To find the bearing of **B** from **A**,
draw a North line at **A**.

Turn clockwise from North
until we hit the line from **A** to **B**.



The bearing *of* **B** *from* **A** is 070°.

Bearings

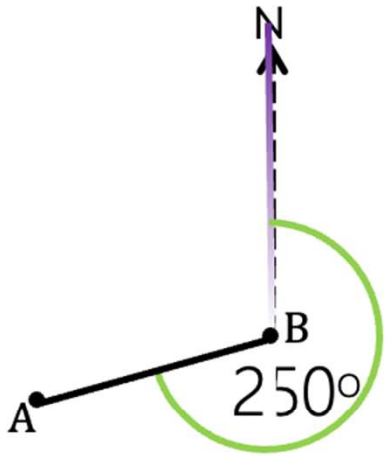
We talk about the bearing *of* an end point *from* a start point.

Here are two points, **A** and **B**.

To get from **B** to **A** we move like this.

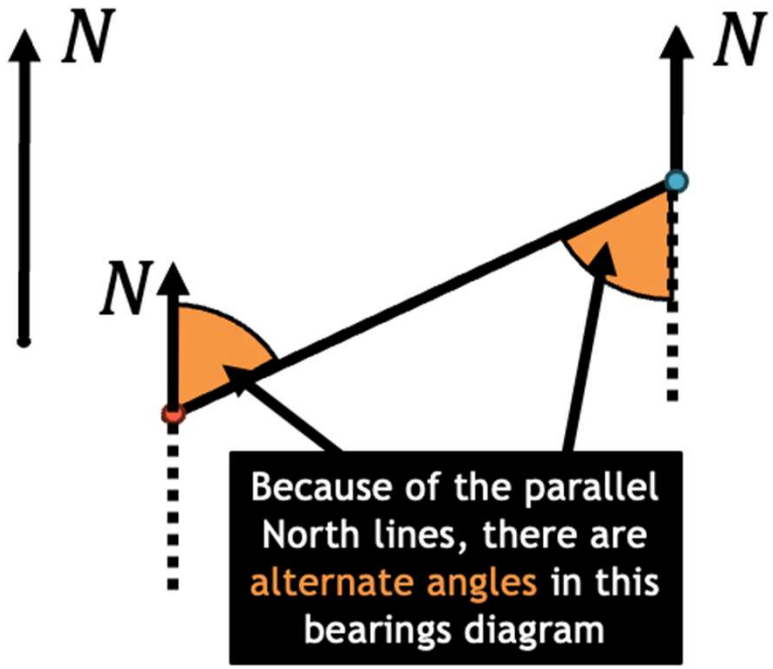
To find the bearing of **A** from **B**,
draw a North line at **B**.

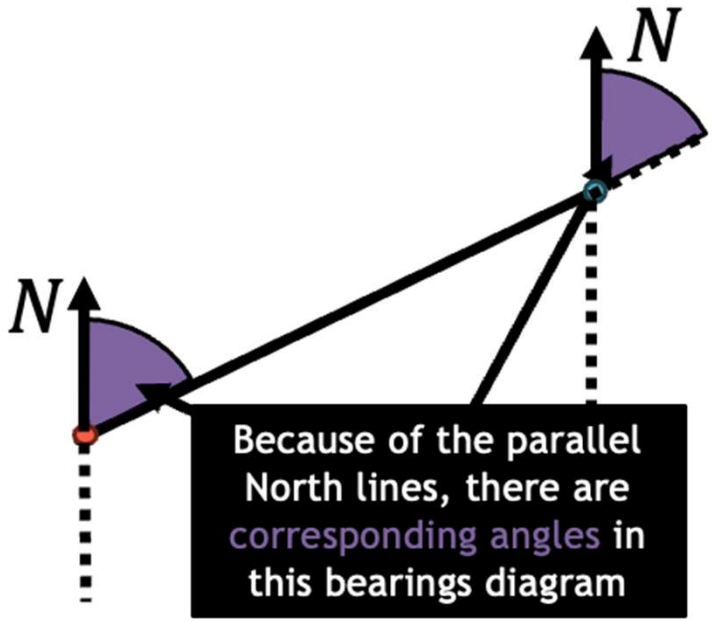
Turn clockwise from North
until we hit the line from **B** to **A**.

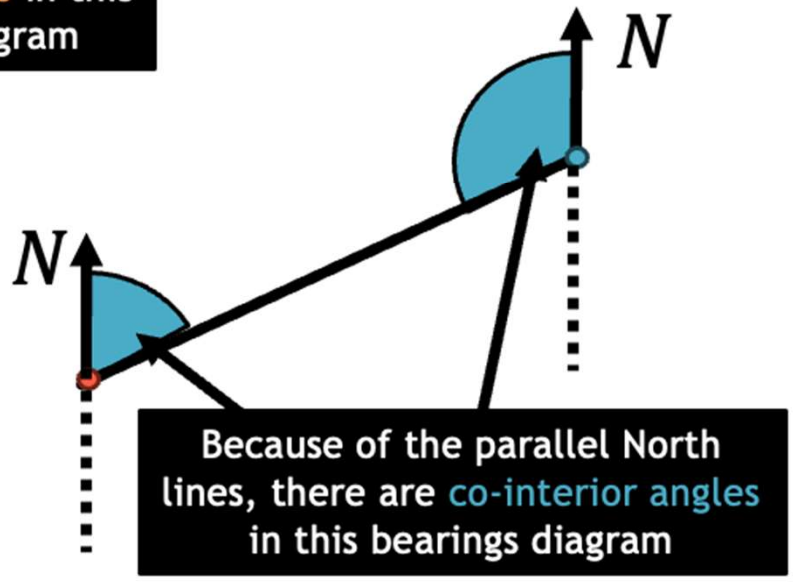


The bearing *of* **A** *from* **B** is 250°.

Bearings and Parallel Lines Summary

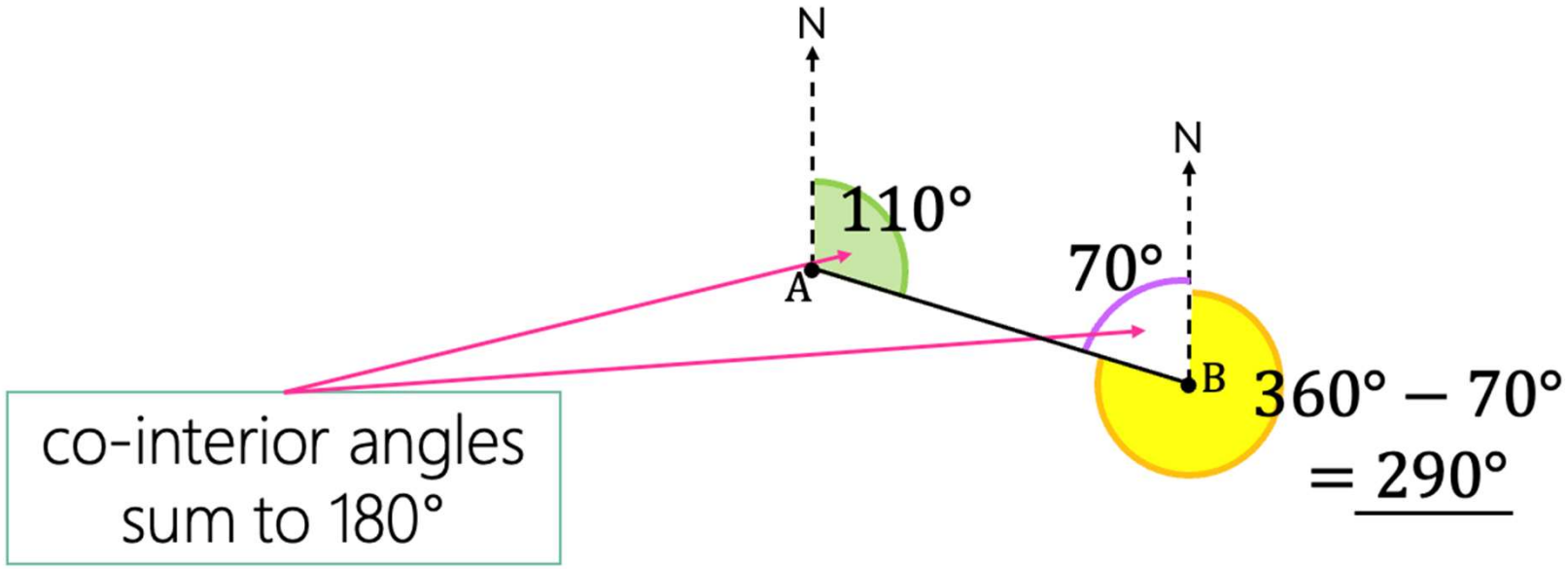


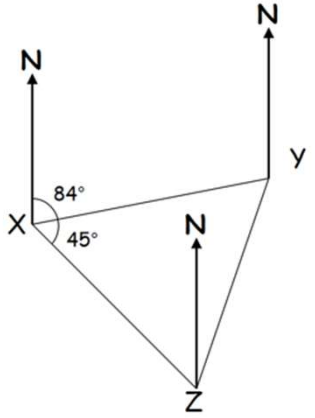
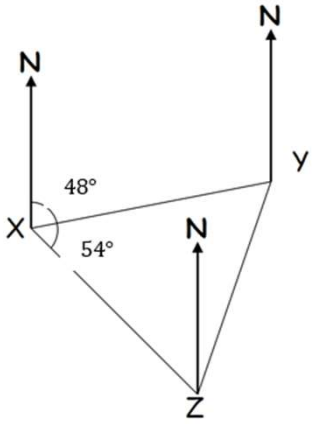




We can solve some bearings problems using facts about angles in parallel lines.

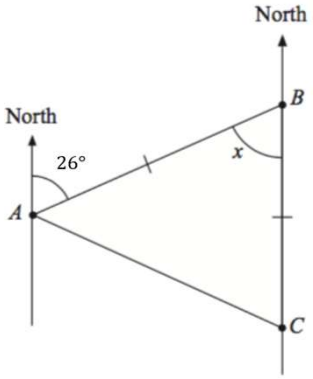
The bearing of **B** from **A** is 110°.
Work out the bearing of **A** from **B**.



Worked Example	Your Turn
Find the bearing of:  Y from X X from Y Z from X X from Z	Find the bearing of:  Y from X X from Y Z from X X from Z

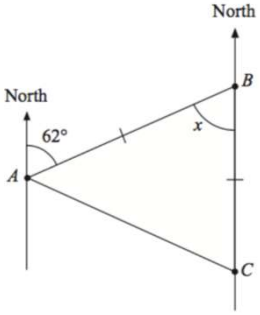
Worked Example

Calculate the bearing of C from A



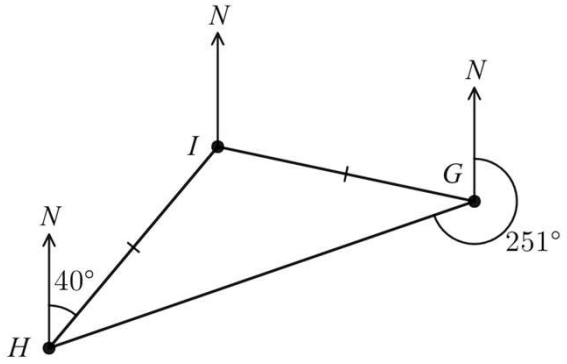
Your Turn

Calculate the bearing of C from A



Worked Example

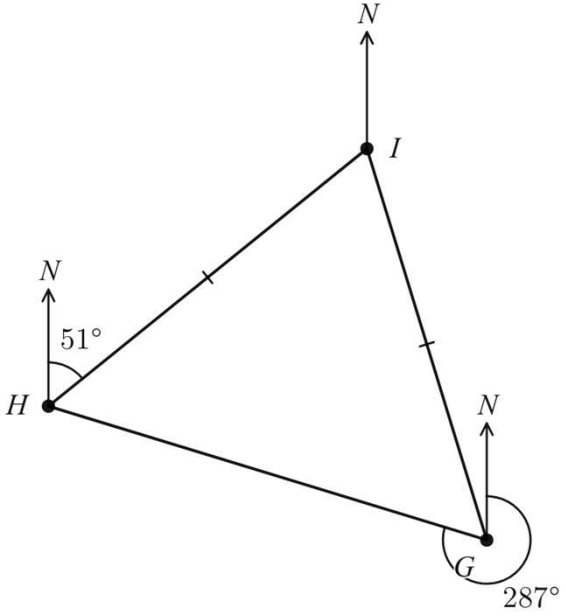
The diagram shows three points, G, H and I.
The bearing of H from G is $251°$.
The bearing of I from H is $040°$.
$HI = IG$



Find the bearing of I from G.

Your Turn

The diagram shows three points, G, H and I.
The bearing of I from H is $051°$.
The bearing of H from G is $287°$.
$HI = IG$



Find the bearing of I from G.

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Question 1: Write down the bearing of B from A in each of the following.
Give each answer as a three figure bearing.

(a)

(b)

(c)

(d)

(e)

(f)

Question 2: Write down the bearing of the boat from the lighthouse in each of the following. Give each answer as a three figure bearing.

(a)

(b)

(c)

(d)

(e)

(f)

Question 3: There are eight airplanes in the airspace above a radar.
Put an x in the middle of your page to represent the radar.
Letting 1cm = 1mile, mark the position of each airplane.

(a) Airplane 1 is 6 miles from the radar on a bearing of 025°
(b) Airplane 2 is 4 miles from the radar on a bearing of 075°
(c) Airplane 3 is 5 miles from the radar on a bearing of 125°
(d) Airplane 4 is 8 miles from the radar on a bearing of 150°
(e) Airplane 5 is 4 miles from the radar on a bearing of 190°
(f) Airplane 6 is 3 miles from the radar on a bearing of 250°
(g) Airplane 7 is 6.5 miles from the radar on a bearing of 310°
(h) Airplane 8 is 9 miles from the radar on a bearing of 351°

Question 4: There are eight boats in the sea around an island.
Put an x in the middle of your page to represent the island.
Letting 1cm = 1km, mark the position of each boat.

(a) Boat 1 is 4 km from the island on a bearing of 080°
(b) Boat 2 is 3 km from the island on a bearing of 016°
(c) Boat 3 is 5 km from the island on a bearing of 111°
(d) Boat 4 is 5.5 km from the island on a bearing of 308°
(e) Boat 5 is 3.5 km from the island on a bearing of 055°
(f) Boat 6 is 6 km from the island on a bearing of 214°
(g) Boat 7 is 6 km from the island on a bearing of 199°
(h) Boat 8 is 5 km from the island on a bearing of 154°

Question 5: Give these directions of travel as three figure bearings

(a) North	(b) South-east	(c) West	(d) North-east
(e) East	(f) South-west	(g) South	(h) North-west

Question 6: A dolphin is on a bearing of 100° from the island.
The same dolphin is on a bearing of 015° from the lighthouse.
On a sketch of the diagram below, mark the location of the dolphin.

Question 7: A hot-air balloon is on a bearing of 140° from the radar A.
The same hot-air balloon is on a bearing of 065° from the radar B.
On a sketch of the diagram below, mark the location of the hot-air balloon.

Question 8: A UFO is on a bearing of 015° from the radar A.
The same UFO is on a bearing of 315° from the radar B.
On a sketch of the diagram below, mark the location of the UFO.

Question 9:

(a) The bearing of A from B is 025°, find the bearing of B from A.
(b) The bearing of A from B is 061°, find the bearing of B from A.
(c) The bearing of A from B is 098°, find the bearing of B from A.
(d) The bearing of A from B is 102°, find the bearing of B from A.
(e) The bearing of A from B is 193°, find the bearing of B from A.
(f) The bearing of A from B is 222°, find the bearing of B from A.
(g) The bearing of A from B is 315°, find the bearing of B from A.

Question 10: Make a copy of the diagram below into your book.

(a) Find the bearing of B from A.
(b) Find the bearing of A from B.

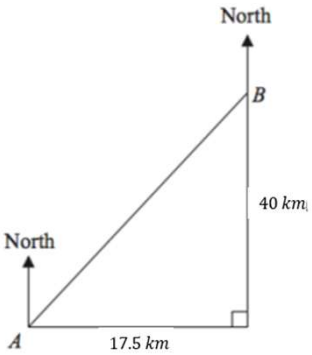
Use the scale 1cm represents 20miles.

(c) From your diagram, work out the real distance between A and B.

C is 140 miles from B on a bearing of 110°.

(d) On your diagram, mark C with a cross.

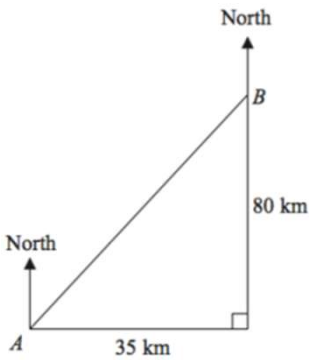
Worked Example



a) Work out the bearing of town A from town B

b) Work out the bearing of town B from town A

Your Turn

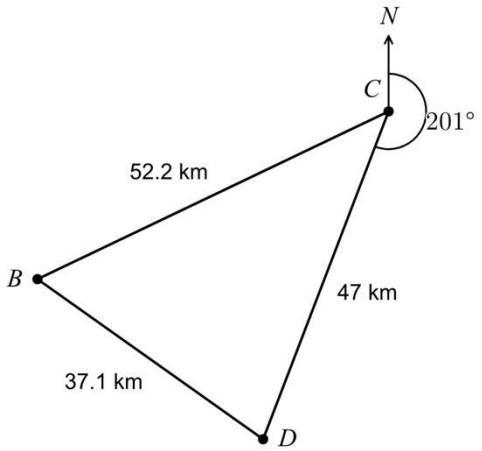


a) Work out the bearing of town A from town B

b) Work out the bearing of town B from town A

Worked Example

The diagram shows the position of three towns B, C and D



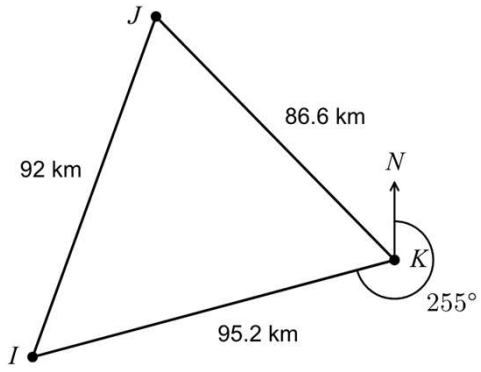
The distance between C and D is 47 km
The distance between C and B is 52.2 km
The distance between D and B is 37.1 km

The bearing of D from C is $201°$

Find the bearing of B from C
Give your answer correct to the nearest degree.

Your Turn

The diagram shows the position of three towns I, J and K



The distance between K and I is 95.2 km
The distance between K and J is 86.6 km
The distance between I and J is 92 km

The bearing of I from K is $255°$

Find the bearing of J from K
Give your answer correct to the nearest degree.

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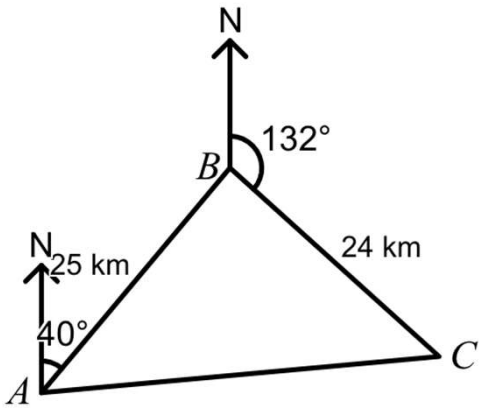
Worked Example

In the diagram, the three towns Abbotsley, Bowden and Cowbridge are represented by the letters A, B and C

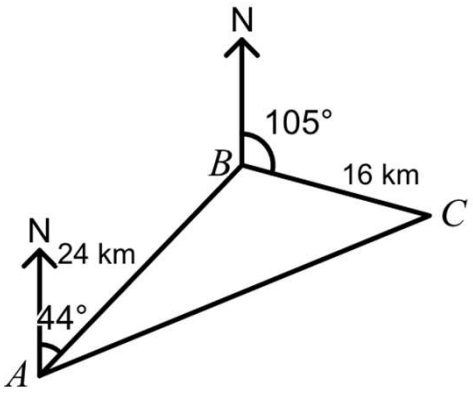


A plane flies from Abbotsley for 25 km on a bearing of $040°$ to Bowden.
It then flies from Bowden for 24 km on a bearing of $132°$ to Cowbridge.
The plane then returns directly to Abbotsley.

Find the total distance travelled by the plane.

Your Turn

In the diagram, the three towns Abercarn, Bagham and Caldmore are represented by the letters A, B and C



A helicopter flies from Abercarn for 24 km on a bearing of $044°$ to Bagham.
It then flies from Bagham for 16 km on a bearing of $105°$ to Caldmore.
The helicopter then returns directly to Abercarn.

Find the total distance travelled by the helicopter.

Dr Frost 469b

Extra Notes