N5 R1.4 Geometric Skills - Revision

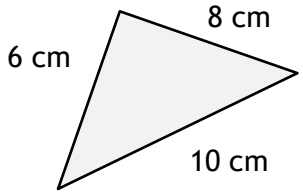
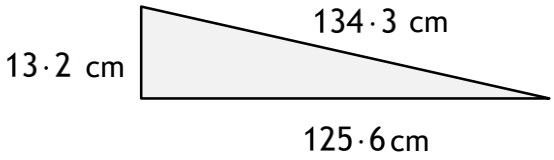
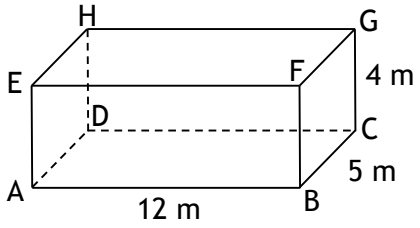
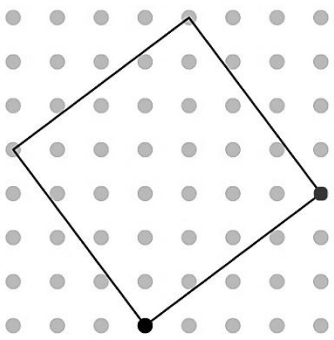
This revision pack covers the skills at Unit Assessment and exam level for Geometric Skills so you can evaluate your learning of this outcome. It is important that you prepare for Unit Assessments but you should also remember that the final exam is considerably more challenging, thus practice of exam content throughout the course is essential for success. The SQA does not currently allow for the creation of practice assessments that mirror the real assessments so you should make sure your knowledge covers the sub skills listed below in order to achieve success in assessments as **these revision packs will not cover every possible question that could arise in an assessment.**

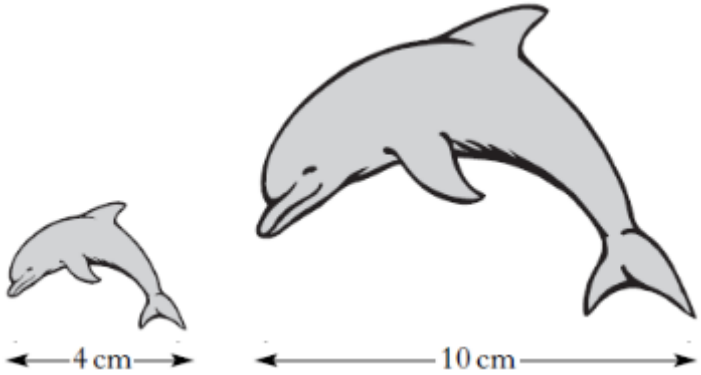
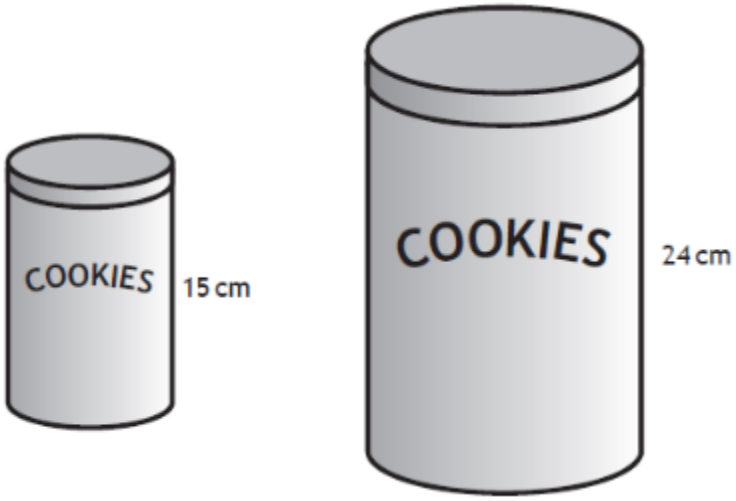
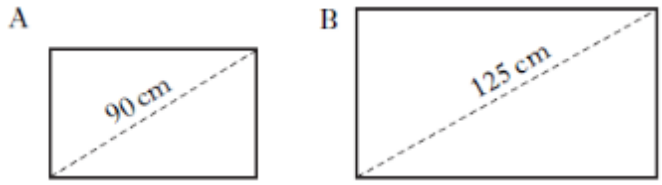
Topic	Unit	Sub skills	Questions
Pythagoras' Theorem	**R1.4**	♦ Using Pythagoras' theorem in complex situations, including converse and 3D.	1 – 5, 13
Similarity	**R1.4**	♦ Interrelationship of scale including linear, area and volume scale factors.	6 – 13
Angles	**R1.4**	♦ Angles in quadrilaterals, triangles, polygons and circles.	15 - 18
Circle geometry	-	➢ Use the relationship in a circle between the centre, chord and perpendicular bisector to evaluate missing sides or angles	20 - 23

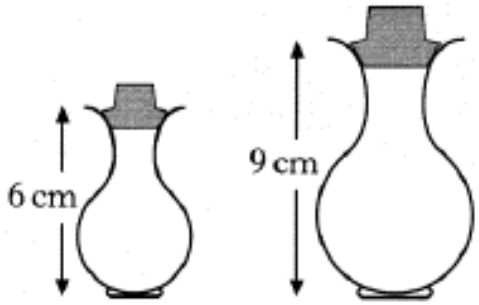
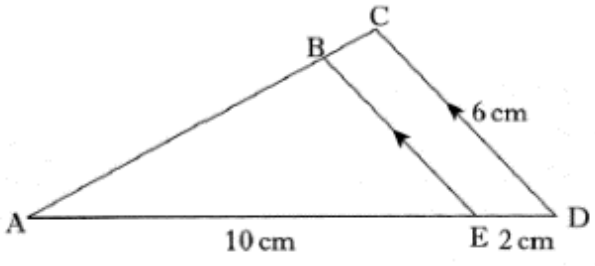
When attempting a question, this key will give you additional important information.

Key	Note
◆	Question is at unit assessment level, a similar question could appear in a unit assessment or an exam.
➢	Question is at exam level, a question of similar difficulty will only appear in an exam.
#	The question includes a reasoning element and typically makes a question more challenging. Both the Unit Assessment and exam will have reasoning questions.
*	If a star is placed beside one of the above symbols that indicates the question involves sub skills from previously learnt topics. If you struggle with this question you should go back and review that topic, reference to the topic will be in the marking scheme.
NC	Question should be completed without a calculator.
C	Question should be completed with a calculator.

Questions will be ordered by sub skill and typically will start of easier and then get more challenging. Some questions may also cover several sub skills from this outcome or even include sub skills from previously learnt topics (denoted with a *). Questions are gathered from multiple sources including ones we have created and from past papers. **Extra challenge** questions are for extension and are not essential for either Unit Assessment or exam preparation.

Q	Questions	Marks
1 ◆ **NC**	Determine whether the triangle opposite is right angled.  	**3**
2 ◆ # **C**	The diagram opposite shows the position of three towns. Lowtown is due west of Midtown The distance from • Lowtown to Midtown is 75 kilometres. • Midtown to Hightown is 110 kilometres. • Hightown to Lowtown is 85 kilometres. Is Hightown directly north of Lowtown? Justify your answer.  	**4**
3 ◆ # **C**	A wheel chair ramp must be righted angled to pass safety inspection. Opposite is the measurements that a safety inspector took of a ramp outside a shop. Will this ramp pass the safety inspection?  	**4**
4 ◆ # **C**	In the cuboid opposite, *(a)* Find the length of the face diagonal AC. *(b)* Find the length of the space diagonal HB.  	**2** **2**
5 ◆ # **NC**	In the diagram opposite is a square with each vertex lying on a dot. The vertical distance and horizontal distance between each dot are equal at a length of 1 centimetre. Calculate the area of the square. 	**3**

6 ◆ **C**	Two fridge magnets are mathematically similar. One magnet is 4 centimetres long and the other is 10 centimetres long.  The area of the smaller magnet is 18 square centimetres. Calculate the area of the larger magnet.	**3**
7 ◆ **C**	A supermarket sells cylindrical cookie jars which are mathematically similar.  The smaller jar has a height of 15 centimetres and a volume of 750 cubic centimetres. The larger jar has a height of 24 centimetres. Calculate the volume of the larger jar.	**3**
8 ◆ # **C**	Two rectangular solar panels, A and B, are mathematically similar. Panel A has a diagonal of 90 centimetres and an area of 4020 square centimetres  A salesman claims that panel B, with a diagonal of 125 centimetres, will be double the area of panel A. Is this claim justified? **Show all your working.**	**4**

9 ◆ **NC**	Two drinks bottles are mathematically similar in shape. The smaller one is 6 centimetres high and holds 160 millilitres of juice.  The larger one is 9 centimetres high. What volume of juice will the larger one hold.	**4**
10 ➢ **NC**	Shampoo is available in travel size and salon size bottles. The two bottles are mathematically similar.  The travel size contains 200 millilitres and is 12 centimetres in height. The salon size contains 1600 millilitres. Calculate the height of the salon bottle.	**3**
11 ➢ **NC**	Triangle ABE and ACD with some measurements are shown opposite. Triangle ABE is mathematically similar to triangle ACD. Calculate the length of BE. **Do not use a scale drawing.**  	**3**

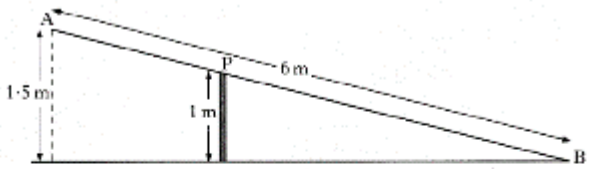
12 ➢ # **NC**

A metal beam, AB, is 6 metres long.

It is hinged at the top, P, of a vertical post 1 metre high.

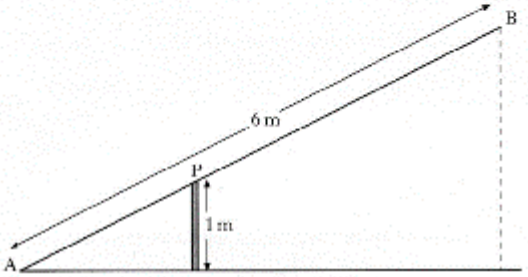
When B touches the ground, A is 1·5 metres above the ground, as shown in Figure 1.

Figure 1



When A comes down to the ground, B rises, as shown in Figure 2.
By calculating the length of AP, or otherwise, find the height of B above the ground.

Do not use a scale drawing.

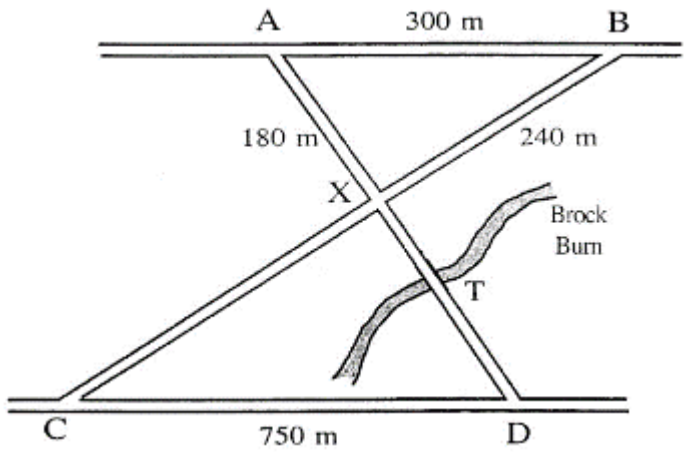


5

13 ➢ # **C**

The road joining A to B is parallel to the road joining C to D in the diagram opposite.

- AB = 300 metres
- AX = 180 metres
- BX = 240 metres
- CD = 750 metres

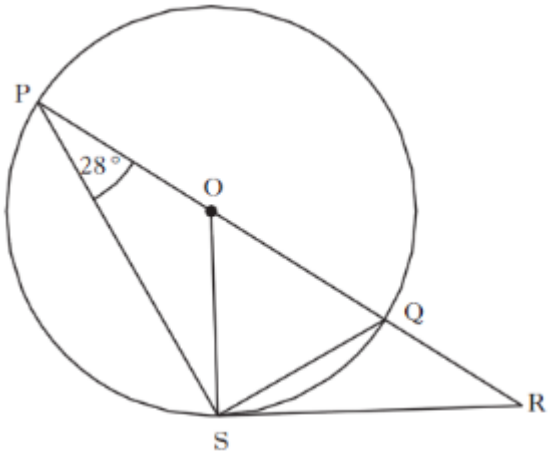
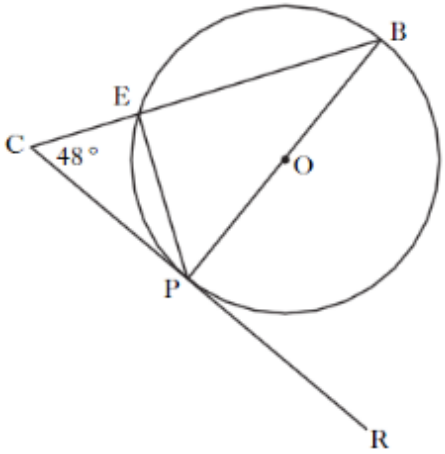
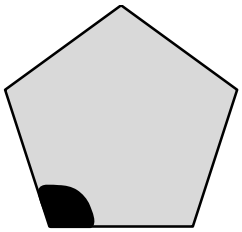
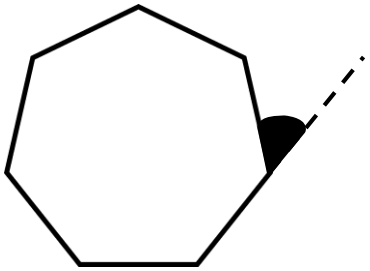
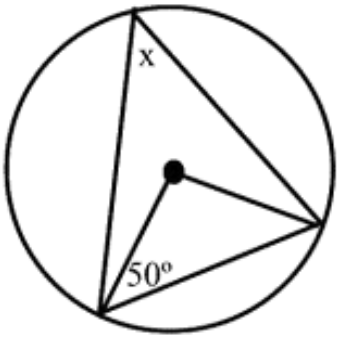


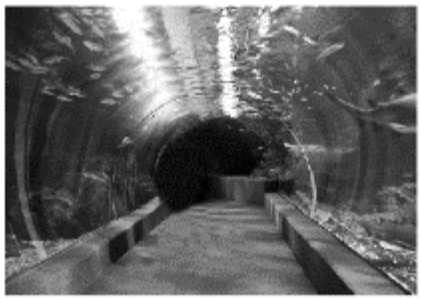
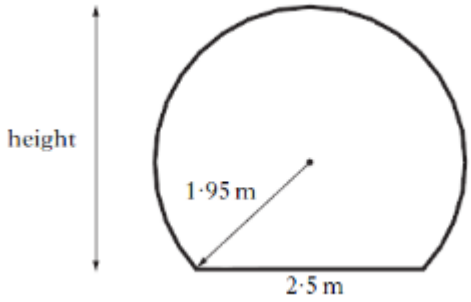
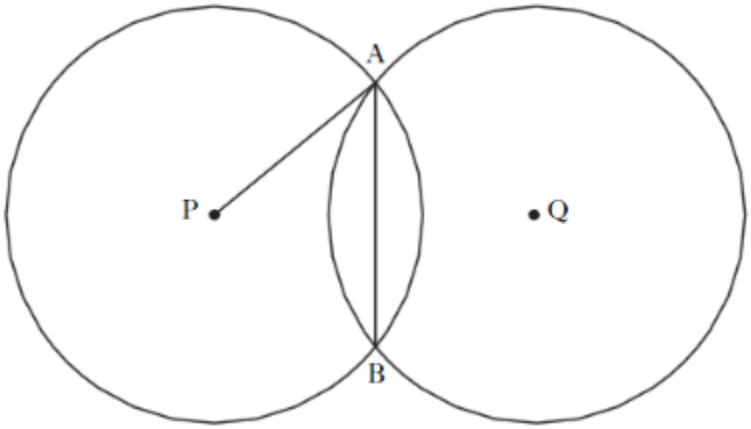
(a) Show that the roads AX and BX are perpendicular. **3**

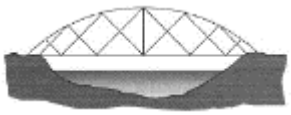
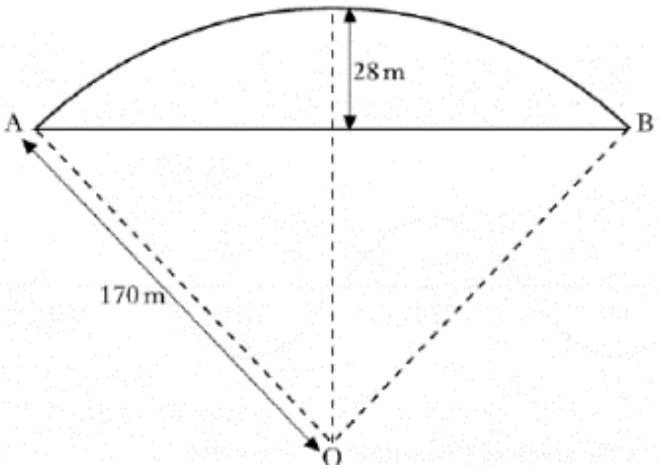
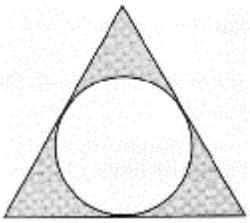
(b) The brock burn bursts its banks at T and the road becomes impassable.
An alternative route had to be found in order to travel from A to D.
Calculate the length of the shortest route. **4**

14 **C**

Extra Challenge:
Two shapes are mathematically similar. The volume of the larger shape is 400 cm^3 and the volume of the smaller shape is 150 cm^3. The area of the larger shape is 210 cm^2.
Calculate the area of the smaller shape.

15 ◆ **NC**	In the diagram opposite, • O is the centre of the circle • PQ is a diameter of the circle • PQR is a straight line • RS is a tangent to the circle at S • Angle OPS is 28° Calculate the size of angle QRS.		**3**
16 ◆ **NC**	In the circle • PB is a diameter • CR is a tangent to the circle at point P • Angle BCP is 48° Calculate the size of angle EPR.		
17 ◆ # **NC**	Calculate the size of the interior angle of the regular pentagon opposite.		**2**
18 ◆ # **C**	Calculate the size of the exterior angle of the regular heptagon (a seven sided polygon) opposite.		**3**
19 **NC**	**Extra Challenge:** In the diagram opposite, the dot is the centre of the circle. Calculate the value of x.		

20 ➢ # **C**	Ocean World has an underwater viewing tunnel. The diagram below shows the cross-section of the tunnel. It consists of part of a circle with a horizontal base.   The radius of the circle is $1{\cdot}95$ metres and the width of the base is $2{\cdot}5$ metres. Calculate the height of the tunnel.	**4**
21 ➢ # **C**	Two identical circles, with centres P and Q, intersect at A and B as shown in the diagram.  The radius of each circle is 10 centimetres. The length of the common chord, AB is 12 centimetres. Calculate PQ, the distance between the centres of the two circles.	**5**

22 ➢ # **C**	Opposite is a picture of a road bridge.  The curved part of the bridge is formed from the arc of a circle, centre O, as shown opposite.  • OA and OB are radii of length 170 metres. • The height of the middle of the bridge above its ends is 28 metres Calculate the horizontal distance, AB.	**4**
23 ➢ # **C**	The diagram opposite shows the design of an earring.  The earring consists of a circle inside an equilateral triangle. The sides of the triangle are tangents to the circle. The radius of the circle is 8 mm. The distance from the centre of the circle to **each** vertex of the triangle is 17 mm. Calculate the perimeter of the triangle.	**4**

[END OF REVISION QUESTIONS]

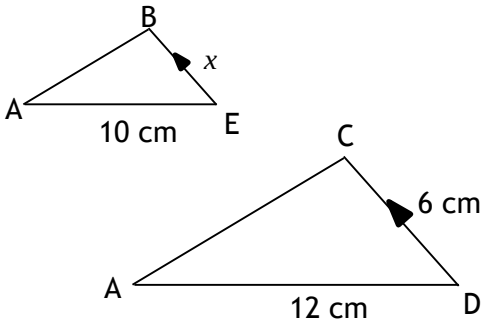
[Go to next page for the Marking Scheme]

Where suitable, you should always follow through an error as you may still gain partial credit. If you are unsure how to do this ask your teacher.

Q		Marking Scheme		
1 ◆ **NC**		$\bullet^1$ Valid strategy	$\bullet^1$	10^2 and 6^2+8^2
		$\bullet^2$ Calculation	$\bullet^2$	100 and 100
		$\bullet^3$ Statement	$\bullet^3$	$10^2=6^2+8^2$ so by the converse of Pythagoras the triangle is right angled
		Notes: 1. Final mark is only available if a comparison is made with all three sides and a reference to triangle being right angled. "yes" is not acceptable.		
2 ◆ # **C**		$\bullet^1$ Valid strategy	$\bullet^1$	110^2 and 85^2+75^2
		$\bullet^2$ Evaluation	$\bullet^2$	12 100 and 12 850
		$\bullet^3$ comparison	$\bullet^3$	$110^2 \neq 85^2+75^2$
		$\bullet^4$ Valid conclusion	$\bullet^4$	Therefore Hightown is not directly north from Lowtown since the triangle is not right angled.
		Notes: 1. $\bullet^3$ is only available if there is a direct numerical comparison between the longer side and shorter sides. 2. $\bullet^4$ is only available for a reference in the context of the question (eg "not directly North"). "no" or "not right angled" is not enough to gain this mark.		
3 ◆ # **C**		$\bullet^1$ Valid strategy	$\bullet^1$	$134\cdot3^2$ and $125\cdot6^2+13\cdot2^2$
		$\bullet^2$ Evaluation	$\bullet^2$	$18036\cdot49$ and $15949\cdot6$
		$\bullet^3$ comparison	$\bullet^3$	$134\cdot3^2 \neq 125\cdot6^2+13\cdot2^2$
		$\bullet^4$ Valid conclusion	$\bullet^4$	Therefore the ramp will not pass the safety inspection as the triangle is not right angled
		Notes: 1. $\bullet^3$ is only available if there is a direct numerical comparison between the longer side and shorter sides. 2. $\bullet^4$ is only available for a reference in the context of the question (eg "not pass safety inspection"). "no" or "not right angled" is not enough to gain this mark.		
4 ◆ # **C**	*(a)*	$\bullet^1$ Marshall facts and start Pythagoras	$\bullet^1$	$AC^2\left(=AB^2+BC^2\right)=12^2+5^2$
		$\bullet^2$ Complete Pythagoras	$\bullet^2$	$AC=13$ (m)
	(b)	$\bullet^3$ Know that DB (or HF) = AC	$\bullet^3$	$HB^2\left(=HD^2+DB^2\right)=4^2+13^2$
		$\bullet^4$ Complete Pythagoras	$\bullet^4$	$HB=13\cdot6$ (m)
		Notes: 1. Units not required		

5 ◆ # **NC**		•1 Know to use Pythagoras to find distance between two vertices	•1 $D^2 = 4^2 + 3^2$
		•2 Complete Pythagoras	•2 $D = 5$
		•3 Find area of square	•3 $\text{Area} = 25\ \text{m}^2$
		Notes: 1. Units required for final mark	
6 ◆ **C**		•1 Linear scale factor	•1 $\frac{10}{4}$ or equivalent
		•2 Area scale factor	•2 $\left(\frac{10}{4}\right)^2$ or equivalent
		•3 Solution (using an area scale factor) with correct units	•3 $112 \cdot 5\ \text{cm}^2$
		Notes: 1. Units required for final mark 2. •3 is only available if an area scale factor is used. $\frac{10}{4} \times 18 = 45\ \text{cm}^2$ can only gain the first mark and no other	
7 ◆ **C**		•1 Linear scale factor	•1 $\frac{24}{15}$ or equivalent
		•2 Volume scale factor	•2 $\left(\frac{24}{15}\right)^3$ or equivalent
		•3 Solution (involving the use of the volume scale factor) with correct units	•3 $3072\ \text{cm}^3$
		Notes: 1. •3 is only available if a volume scale factor is used. $\frac{24}{15} \times 750 = 1200\ \text{cm}^3$ can only gain the first mark and no other	

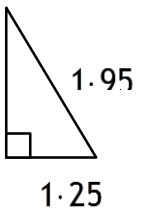
8 ◆ # **C**		$\bullet^1$ Linear scale factor	$\bullet^1$ $\frac{125}{90}$
		$\bullet^2$ Area scale factor	$\bullet^2$ $\left(\frac{125}{90}\right)^2$
		$\bullet^3$ Area of panel B (using an area scale factor)	$\bullet^3$ $\left(\frac{125}{90}\right)^2 \times 125 = 7754 \cdot 6$
		$\bullet^4$ Conclusion with explanation.	$\bullet^4$ No, the salesman's claim is not correct as $7754 \cdot 6 \neq 8040$
		Notes: 1. $\bullet^4$ is only available for a direct comparison between two numbers and reference to the context of the question. 8040 must appear in explanation and some reference to the claim not being correct. 2. $\bullet^3$ is only available if an area scale factor is used. $\frac{125}{90} \times 4020 = 5583 \cdot 3\,\text{cm}^2$ can only gain the first mark, however, $\bullet^4$ is still available if the conclusion has enough information detailed in note 1. 3. Units not required 4. An acceptable alternative is $\bullet^3 \left(\frac{125}{90}\right)^2 = 1 \cdot 929$ and $\bullet^4$ $1 \cdot 929 \neq 2$ so no …	
9 ◆ **NC**		$\bullet^1$ Linear scale factor	$\bullet^1$ $\frac{9}{6}$
		$\bullet^2$ Volume scale factor	$\bullet^2$ $\left(\frac{9}{6}\right)^3$
		$\bullet^3$ Evaluate volume scale factor without a calculator	$\bullet^3$ $\left(\frac{9}{6}\right)^3 = \left(\frac{3}{2}\right)^3 = \frac{3^3}{2^3} = \frac{27}{8}$ or equivalent
		$\bullet^4$ Find larger volume	$\bullet^4$ $\frac{27}{8} \times 160 = 27 \times 20 = 540$ (ml)
		Notes: 1. Some evidence of calculation is required for $\bullet^4$, at least one step of working. 2. For candidates who use linear scale factor, only $\bullet^1$ is available and no other mark (eg $\frac{9}{6} \times 160 = 240$ award 1/4) 3. Units not required	

10 ➢ **NC**		•[1] Volume scale factor	•[1] $\frac{1600}{200}$
		•[2] Linear scale factor	•[2] $\sqrt[3]{\frac{1600}{200}} = \sqrt[3]{8} = 2$
		•[3] Calculate height	•[3] $12 \times 2 = 24$ cm
		Notes: 1. Units not required	
11 ➢ **NC**		•[1] Marshall facts (eg AD = 12cm)	•[1] 
		•[2] Linear scale factor	•[2] $\frac{10}{12}$
		•[3] Calculate BE	•[3] $\frac{10}{12} \times 6 = 5$ (cm)
		Notes: 1. Units not required 2. Minimum working for all 3 marks is $\frac{10}{12} \times 6 = 5$ 3. Note, these triangles are not right angled and therefore any attempt to use Pythgoras to find missing sides will gain 0 marks.	
12 ➢ # **NC**		•[1] Linear scale factor in Figure 1	•[1] $\frac{1}{1 \cdot 5}$
		•[2] Calculate length of PB	•[2] $\frac{1}{1 \cdot 5} \times 6 = 4$
		•[3] Calculate length of AP	•[3] $6 - 4 = 2$
		•[4] Linear scale factor in Figure 2	•[4] $\frac{6}{2}$
		•[5] Calculate height of B	•[5] $\frac{6}{2} \times 1 = 3$ (m)
		Notes: 1. Units not required	

13 ➢ # **C**	*(a)*	•[1]	Valid strategy	•[1]	300^2 and 180^2+240^2
		•[2]	Calculation	•[2]	90 000 and 90 000
		•[3]	Statement	•[3]	$300^2=180^2+240^2$ so by the converse of Pythagoras the roads are perpendicular at X.
	(b)	•[4]	Know that triangles are mathematically similar	•[4]	$\frac{AB}{CD}=\frac{BX}{CX}$ **stated or implied by** •[5]
		•[5]	Linear scale factor	•[5]	$\frac{750}{300}$
		•[6]	Calculate CX	•[6]	$\frac{750}{300}\times 240=600$
		•[7]	Find shortest distance	•[7]	$180+600+750=1530$ (m)
		Notes: 1. •[3] is only available if a comparison is made with all three sides and a reference to roads being perpendicular (or right angled). "yes" is not acceptable. 2. Units not required			
14 **C**		Volume scale factor = $\frac{150}{400}$, linear scale factor = $\sqrt[3]{\frac{3}{8}}$, area scale factor = $\left(\sqrt[3]{\frac{3}{8}}\right)^2$ Therefore area of smaller shape $=\left(\sqrt[3]{\frac{3}{8}}\right)^2\times 210=109\cdot 2\,\text{cm}^2$			
15 ◆ **NC**		•[1]	Angle OSR	•[1]	90°
		•[2]	Angle PSR	•[2]	118°
		•[3]	Angle QRS	•[3]	QRS $=34^\circ$
		Notes: 1. Answer must be clearly indicated either by being labelled or underlined. 2. For correct answer without working award 0/3 3. <u>Alternatives:</u> METHOD TWO (USING TRIANGLE ORS) •[1] angle OSR is 90° •[2] angle SOR is 56° •[3] angle QRS is 34° METHOD THREE (USING TRIANGLE QRS) •[1] angle OSR is 90° •[2] angle QSR and SQR is 28° and 118° •[3] angle QRS is 34°			

16 ◆ **NC**		$\bullet^1$ Angle BEP	$\bullet^1$ 90°
		$\bullet^2$ Angle EPC or EPB	$\bullet^2$ 42° or 48°
		$\bullet^3$ Angle EPR	$\bullet^3$ EPR $= 138^\circ$
		Notes: 1. Answer must be clearly indicated either by being labelled or underlined. 2. For correct answer without working award 0/3 3. Before awarding 2nd mark, is should be clear that 42° and 48° refer to angles EPC and EPB respectively.	
17 ◆ # **NC**		$\bullet^1$ Valid strategy (eg splitting shape into triangles and working out centre angle)	$\bullet^1$ $\frac{360}{5} = 72$
		$\bullet^2$ Calculate answer	$\bullet^2$ 108°
		Notes: 1.	
18 ◆ # **C**		$\bullet^1$ Valid strategy (eg splitting shape into triangles and working out centre angle)	$\bullet^1$ $\frac{360}{7} = 51 \cdot 4\ldots$
		$\bullet^2$ Valid strategy (eg calculate interior angle	$\bullet^2$ $128 \cdot 5\ldots$
		$\bullet^3$ Calculate answer	$\bullet^3$ $51 \cdot 4^\circ$
		Notes: 1. Ignore units and rounding 2. It should be clear that an attempt is made to work out exterior angle. For correct answer with no working, award 0/3	
19 **C**		x = 40° (look up "proof of angle at the centre theorem")	

20 ➢ # **C**

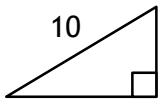
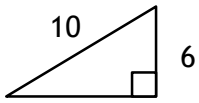
$\bullet^1$	Marshall facts and recognise right-angle	$\bullet^1$ 
$\bullet^2$	Use Pythagoras	$\bullet^2$ $x^2 = 1\cdot95^2 - 1\cdot25^2$
$\bullet^3$	Calculate third side correctly	$\bullet^3$ $1\cdot496$
$\bullet^4$	State height	$\bullet^4$ $1\cdot496 + 1\cdot95 = 3\cdot45$ (m)

Notes:

1. Mark $\bullet^4$ is for adding $1\cdot95$ to a value which has been calculated using Pythagoras' Theorem.
2. SOME COMMON ANSWERS (with working):

$\sqrt{1\cdot95^2 + 1\cdot25^2} + 1\cdot95 = 4\cdot27$	award 3/4
$\sqrt{1\cdot95^2 + 2\cdot5^2} + 1\cdot95 = 5\cdot12$	award 2/4
$\sqrt{2\cdot5^2 - 1\cdot95^2} + 1\cdot95 = 3\cdot51$	award 2/4
$\sqrt{3\cdot9^2 - 2\cdot5^2} = 2\cdot99$	award 1/4

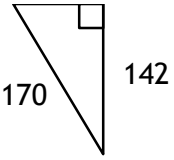
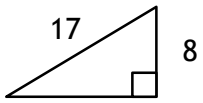
21 ➢ # **C**

$\bullet^1$	Marshall facts and know to use right angled triangle	$\bullet^1$ 
$\bullet^2$	Know that PQ bisects AB	$\bullet^2$ 
$\bullet^3$	Use Pythagoras' Theorem	$\bullet^3$ $x^2 = 10^2 - 6^2$
$\bullet^4$	Calculate length of third side	$\bullet^4$ 8
$\bullet^5$	Calculate PQ	$\bullet^5$ 16 (cm)

Notes:

1. For correct answer without working — award 0/5
2. SOME COMMON ANSWERS (with working):

$2\times\sqrt{10^2 + 6^2} = 23\cdot32$	award 4/5
$\sqrt{10^2 + 6^2} = 11\cdot66$	award 3/5
$2\times\sqrt{12^2 - 10^2} = 13\cdot27$	award 3/5
$\sqrt{12^2 - 10^2} = 6\cdot33$	award 2/5
$\sqrt{12^2 + 10^2} = 15\cdot62$	award 2/5
$\sqrt{10^2 + 10^2} = 14\cdot14$	award 2/5

22 ➢ # **C**		$\bullet^1$	Marshall facts and recognise right-angle	$\bullet^1$	
		$\bullet^2$	Use Pythagoras	$\bullet^2$	$x^2 = 170^2 - 142^2$
		$\bullet^3$	Calculate third side correctly	$\bullet^3$	$93 \cdot 466\ldots$
		$\bullet^4$	Find length AB	$\bullet^4$	$93 \cdot 466 \times 2 = 186 \cdot 9$ (m)
		Notes: 1. For correct answer without working			award 0/4
23 ➢ # **C**		$\bullet^1$	Marshall facts and recognise right-angle	$\bullet^1$	
		$\bullet^2$	Use Pythagoras	$\bullet^2$	$x^2 = 17^2 - 8^2$
		$\bullet^3$	Calculate third side correctly	$\bullet^3$	15
		$\bullet^4$	Find the perimeter	$\bullet^4$	$15 \times 6 = 90$ (mm)
		Notes: 1. For correct answer without working			award 0/4

[END OF MARKING SCHEME]