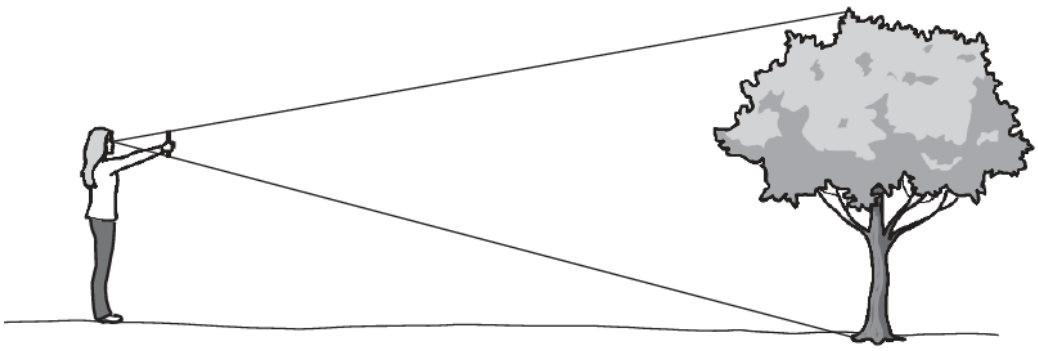
1(a). Anna estimates the height of a tree.



Anna holds a ruler vertically so the height of the tree is exactly covered by the ruler.
She is 20 metres from the tree.
The ruler is 30 cm long.
The horizontal distance from her eyes to the ruler is 60 cm.

Calculate an estimate of the height of the tree.

(a) _____ m [3]

(b). Give two reasons why this method may not be suitable to estimate the height of a very tall building.

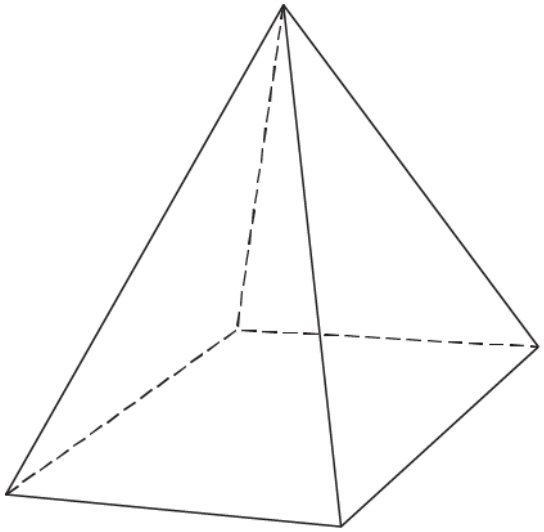
1

2

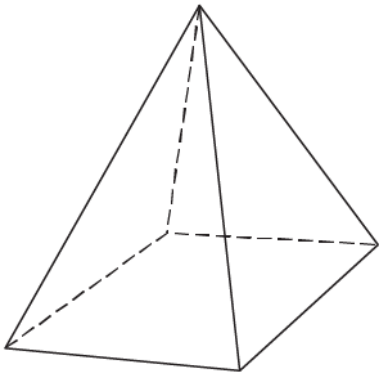
---

[2]

2. Two similar pyramids A and B have surface areas 180 cm^2 and 80 cm^2 respectively.



Pyramid A



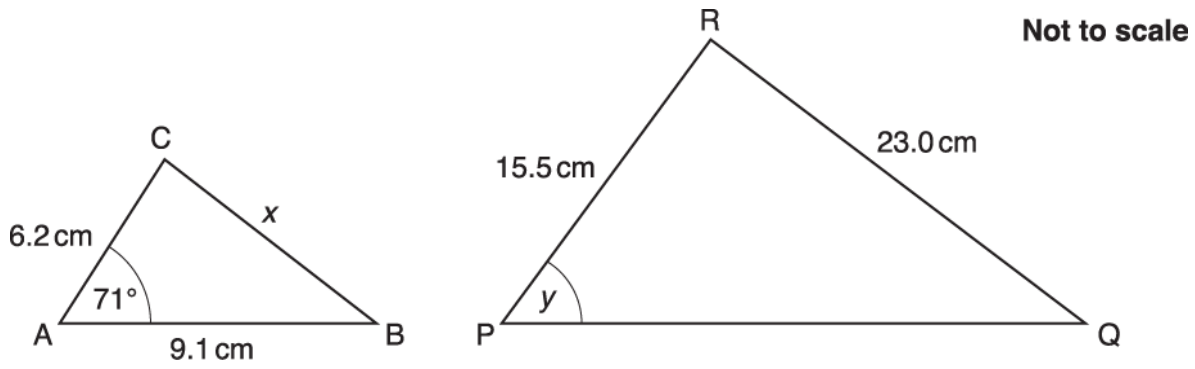
Pyramid B

The volume of pyramid A is 810 cm^3.

Show that the volume of pyramid B is 240 cm^3.

[5]

3(a). Triangles ABC and PQR are mathematically similar.



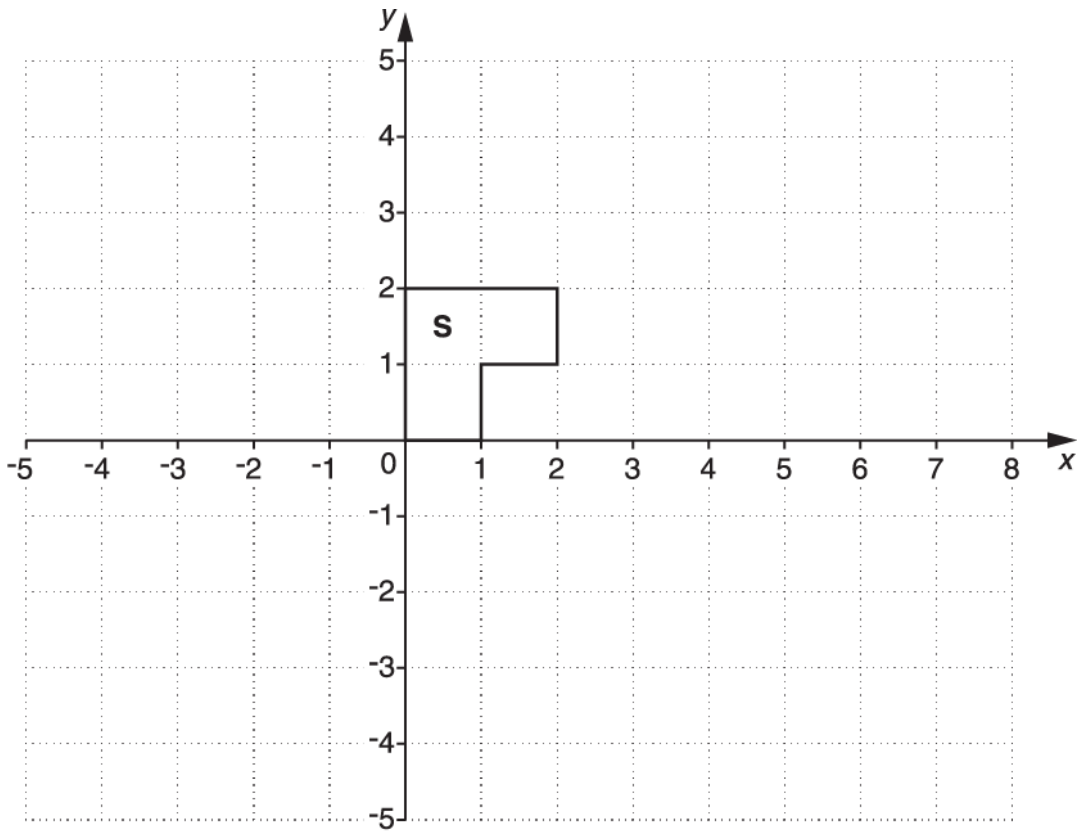
Calculate length *x*.

_____ cm **[3]**

(b). What is the size of angle *y*?

_____ ° **[1]**

4. Shape **S** is shown on the grid.

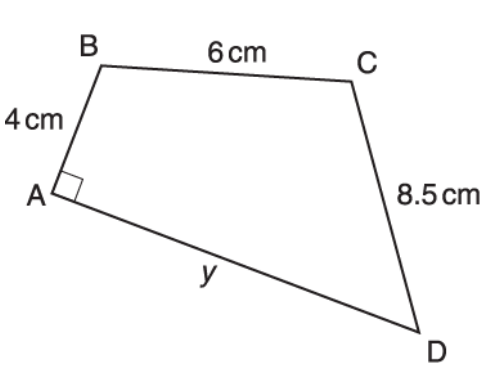


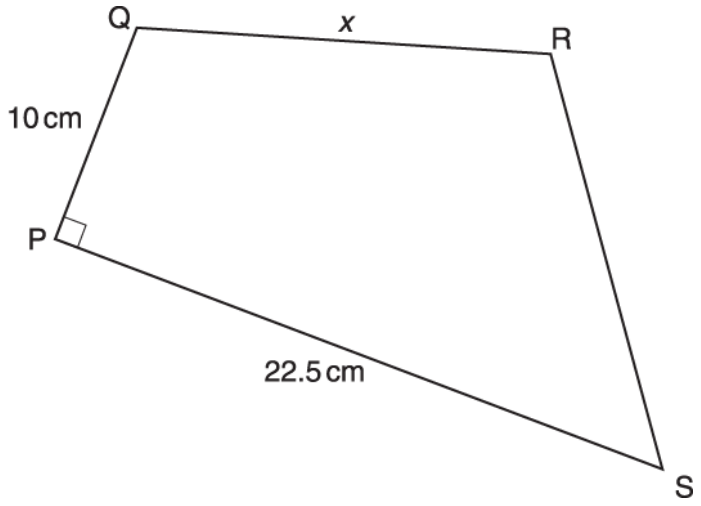
Enlarge shape **S** with scale factor $^{-}2$ and centre (0, 0).

Label your image **E**.

[2]

5. ABCD and PQRS are mathematically similar.



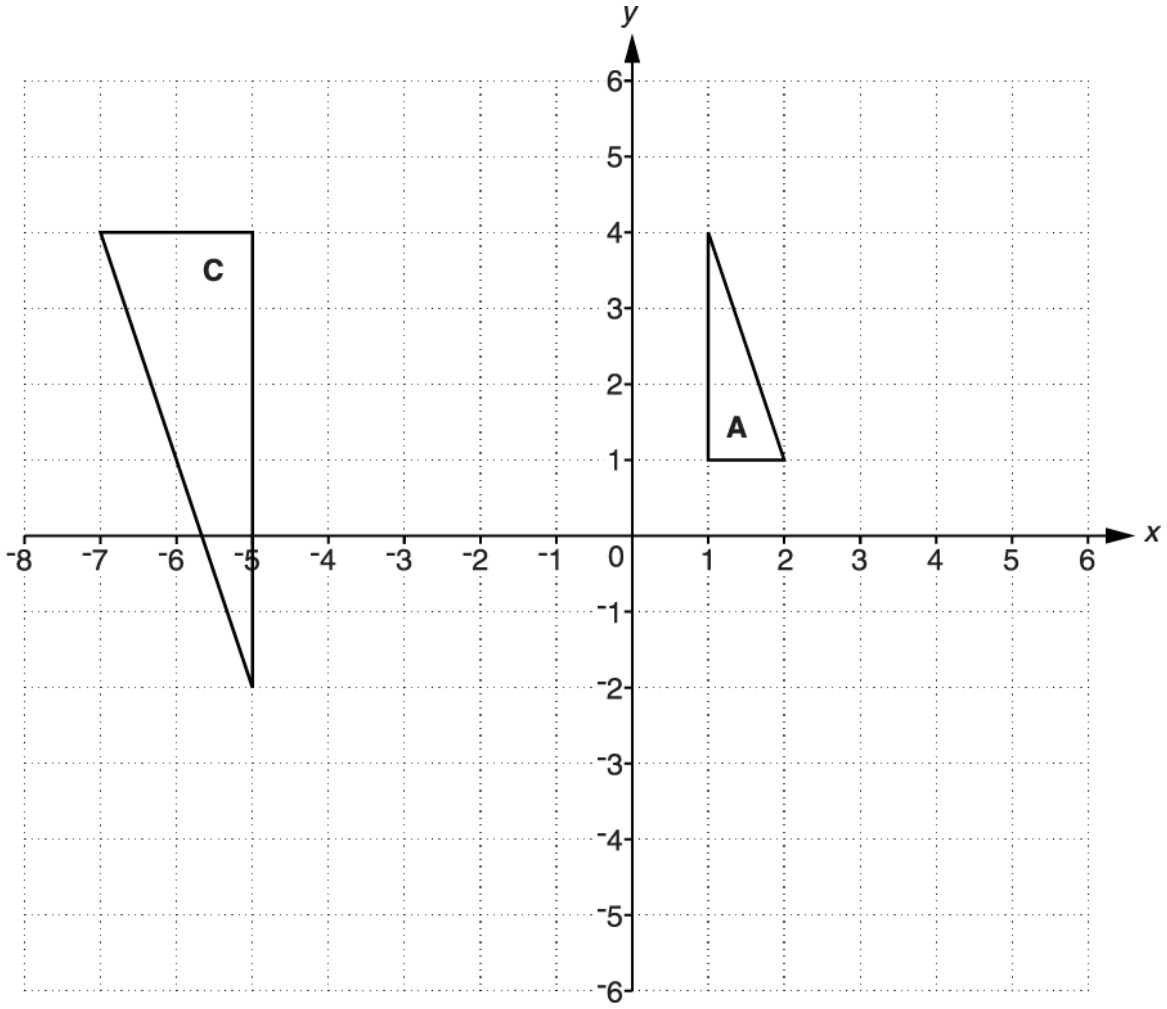


Not to scale

Calculate lengths *x* and *y.*

[5]

6. Triangles **A** and **C** are drawn on the grid below.



Triangle **C** is an enlargement of triangle **A**.

Describe the enlargement fully.

[2]

7. A shape **S** has perimeter 10 cm and area 6 cm^2.
The shape is enlarged with scale factor 4.

(i) Work out the perimeter of the enlarged shape.

(i) _____ cm **[1]**

(ii) Work out the area of the enlarged shape.

(ii) _____ cm^2 **[1]**

8.

Prism P and prism Q are similar.

The ratio of the surface area of prism P to the surface area of prism Q is 1 : 3.

(i) Jay says

The height of prism P is one third of the height of prism Q.

Explain why he is wrong.

---

[1]

(ii) The volume of prism Q is 86 cm^3.

Calculate the volume of prism P.

[3]

_____ cm^3

9(a). A model railway is built using the scale 1 : 87.

On the model railway, the distance between the rails is 16.5 mm.

Calculate, in metres, the distance between the rails for a full-size train.

---------- metres **[2]**

(b). The volume of a full-size train carriage is 220 m^3.

Trevor calculates the volume of a model train carriage to be 334 cm^3 correct to 3 significant figures.

Is Trevor's calculation correct?

Show how you decide.

---------- [3]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Part marks and guidance	
1	a		10 metres	3	**M1** for correct ratio $\frac{\text{height}}{20} = \frac{30}{60}$ **oe** **M1** rearrange Or **M1** for scale factor 0.5 **M1** for 20 × 0.5	
	b		2 valid reasons, e.g. She would have to be very far from the building. The estimate is likely to be inaccurate due to the scale factors at the distances involved.	2		
			Total	**5**		
2			The area scale factor is $\frac{80}{180} = \frac{4}{9}$ [So the length scale factor is $\sqrt{\frac{4}{9}} = \frac{2}{3}$] and the volume scale factor is $\left(\frac{2}{3}\right)^3 = \frac{8}{27}$ So the volume of B is $810 \times \frac{8}{27} = 240$	5	**M1** for finding area scale factor and **M1** for square root of area scale factor **soi** and **M1** for cubing length scale factor and **M1** for 810 × *their* volume scale factor	Allow any equivalent argument, for example by ratios
			Total	**5**		

Question			Answer/Indicative content	Marks	Part marks and guidance	
3	a		9.2	3	**M2** for $23 \times \frac{6.2}{15.5}$ oe **Or M1** for $\frac{6.2}{15.5}$ oe soi by 0.4 or 2.5 or $\frac{x}{6.2} = \frac{23[.0]}{15.5}$ oe	OR M1 $6.2^2 + 9.1^2 - 2 \times 6.2 \times 9.1 \times \cos 71$ A1 84.5… A1 9.19 to 9.2 **Examiner's Comments** The most common method employed was to use a scale factor. This was done very well. Some made it more difficult for themselves and used the cosine rule, though this was often done successfully. It was widely known that angles are unchanged in an enlargement.
	b		71	1		<u>Examiner's comments</u> Very few did not score the mark.
			Total	**4**		
4			Correct enlargement	2	**B1** for SF –2 wrong centre, or SF = 2 centre (0, 0) or other negative SF centre (0,0) or two correct vertices on correct enlargement attempt **Examiner's Comments** This was less well answered with many confusing the scale factor of –2 with a scale factor of ½. Those drawing rays to help often then got confused about which point was which, although these often got 1 mark for a shape with two correct vertices.	Orientation must be different and all in third quadrant
			Total	**2**		

Question			Answer/Indicative content	Marks	Part marks and guidance	
5			Two correct answers with units and correct working, clearly laid out	5	SF = 10/4 oe or with 'internal' ratio eg 6/4 x = 6 × SF =15cm y = 22.5/SF = 9cm	
			As 5 marks but missing some working or units or with SF incorrectly evaluated and remainder of solution correct FT	4-3	For the lower mark two correct answers but missing working and units or one answer will be correct with working (with or without units) or SF incorrectly evaluated and remainder of solution correct FT for one answer or both with no units	
			SF correct 10/4 or 4/10 or 2 : 5 oe and attempt to use in an evaluated calculation or one correct answer with no working	2-1	For the lower mark there will be an attempt to find a SF	

Question			Answer/Indicative content	Marks	Part marks and guidance	
			No correct work seen	0	Examiner's Comments This question assessed the candidates' quality of written communication (QWC) and examiners commented on the high quality of many candidates' answers. It was pleasing to see that most candidates understood the necessity to show all steps of their working in order to achieve full marks. There were many very clear, precise solutions, showing all the relevant working and then giving the 2 answers with appropriate units. For those who correctly found the scale factor, the most common error was in trying to divide 22.5 by 2.5, with an answer of 8.10 being seen fairly often. The written communication required for this question was lacking for those few who simply quoted a number to multiply or divide by without showing that it came from the scale factors 10/4 or 4/10. A few responses were seen where +6 or –6 was used or other linear rules such as × 2 + 2 and there were, occasionally, attempts to use Pythagoras's Theorem.	
			Total	5		

Question			Answer/Indicative content	Marks	Part marks and guidance	
6			[Centre] (¯1, 2) and [scale factor] ¯2 with no other transformation	2	**B1** for (¯1, 2) Or **B1** for ¯2 **Examiner's Comments** The most common error was to give the scale factor as 2 rather than –2, although some gave the correct centre with this incorrect scale factor. Some failed to give a centre of enlargement with the scale factor; candidates should be aware that if a description is given 2 marks then it is likely that two things are required from them. Some candidates introduced a second transformation into their description, most commonly a 180° rotation.	Do not accept centre written as vector Condone e.g. 'negative enlargement of 2' for scale factor ¯2
			Total	2		

Question			Answer/Indicative content	Marks	Part marks and guidance	
7		i	40	1	Examiner's Comments Most candidates correctly found the perimeter of the enlarged shape. Candidates did not always understand the concept of the effect of enlargement on perimeter and did not simply multiply the original perimeter by the scale factor. It was common to see a rectangle with perimeter of 10, usually 2 by 3, which was scaled up in order to find the perimeter of the enlarged rectangle.	
		ii	96	1	Examiner's Comments In part (ii) correct answers were less common. Again the effect of enlargement on area was not understood and few candidates multiplied the area by the scale factor squared. Candidates who drew a rectangle and scaled it up were often successful. The most common incorrect answer in this part was 24 from multiplication of the area by the scale factor.	
			Total	2		

Question			Answer/Indicative content	Marks	Part marks and guidance		
8		i	Height factor is square root of area factor oe in words or figures	1 1 AO2.5a	Mark the best bit so long as no contradiction	Must include correct reference to square or square root	
		ii	16.5 to 16.6	3 2 AO1.3b 1 AO3.1b	B2 for $(\sqrt{3})^3$ oe or $\frac{1}{(\sqrt{3})^3}$ oe soi by 5.19 to 5.20 or 0.192 to 0.193 OR B1 for $\sqrt{3}$ or $\frac{1}{\sqrt{3}}$ oe soi by 1.73 [...] or 0.577[...]	Accept $\frac{86\sqrt{3}}{9}$ oe and Note that $\frac{1}{(\sqrt{3})^3} = \frac{\sqrt{3}}{9}$	
			Total	4			

Question			Answer/Indicative content	Marks	Part marks and guidance	
9	a		1.4355 or 1.436 or 1.44	2	**M1** for 16.5 × 87 possibly soi by figs 14355, 1436 or 144 Examiner's Comments Less than half of the candidates were able to use a scale to find the real length from that of the model. Many could not convert between mm and m correctly, whilst others divided instead of multiplying. Consequently, it was no surprise that only a very few candidates scored anything on the volume factor part.	
	b		Yes (Trevor is correct) because Eg $220 \div 87^3 \times 100^3 =$ 334.[….] or $334 \times 87^3 \div 100^3 = 219.9\ldots$ to 220	3	**M2** for $220 \div 87^3 \times 100^3$ or $334 \times 87^3 \div 100^3$ OR **B1** for 87^3 or 658503 or 100^3 or 1000000 soi	
			Total	5		