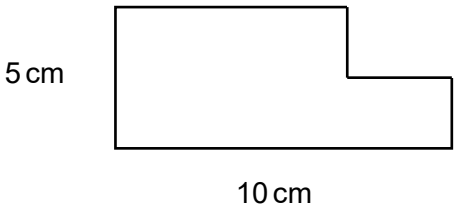
OCR 10 Mensuration (Higher)

1. Calculate the radius of a circle that has area π km^2.

2. Find the angle whose cosine is 0.8.

3. A skier weighs 750 N. His skis have a combined surface area of 0.25 m^2.
   How much pressure does the skier exert on the snow in N/m^2?

4. Find the perimeter of this shape.

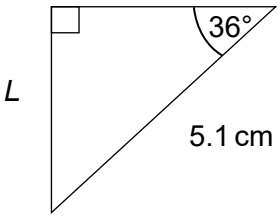


Not to scale

5. One face of a cube has area 200 cm^2.What is the surface area of the whole cube in m^2?

6. Sarah drives for 2 hours 20 minutes at an average speed of 42 miles per hour.
   How far does she drive?

7. Calculate *L*.



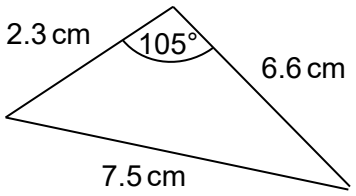
Not to scale

8. A map has a scale of 1 : 750 000. Two villages are 18 km apart.
   What will be the distance between the two villages on the map?
   Give your answer in mm.

9. The volume *V* of a sphere is given by the formula $V = \frac{4}{3}\pi r^3$, where *r* is the sphere's radius.

   Find the volume of a sphere with a diameter of $\frac{2}{7}$ m.

10. Calculate the area of this triangle.



Not to scale

11. Show that $\sin 60° \times \tan 30° = \frac{1}{2}$.

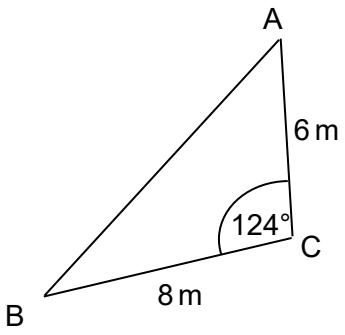
12. Show that if a circle has a circumference of 10 cm, it has an area of $\frac{25}{\pi}$ cm^2.

13. The density of water is 1 g per cm^3. Show that this is the same as 1000 kg per m^3.

14. Frank uses the cosine rule to find the length AB.
He does the following calculation.

$$\begin{aligned} AB^2 &= 6^2 + 8^2 - 2 \times 6 \times 8 \times \cos 124 \\ &= 36 + 64 - 96 \times \cos 124 \\ &= 100 - 53.6825 \\ &= 46.3175 \end{aligned}$$

$$\text{so } AB = \sqrt{46.3175} = 6.8 \text{ cm}$$



Not to scale

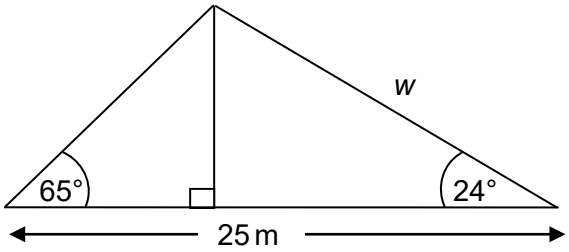
Identify the mistake Frank has made and show how to find the correct answer.

15. Charlotte runs for 30 seconds at a speed of u m/s. She then walks an equal distance at v m/s.
Show that the time Charlotte walks for can be expressed as $\frac{30u}{v}$ seconds.

16. In the isosceles triangle ABC, angle A = 90° and AB = 5 cm.
Calculate the length BC.

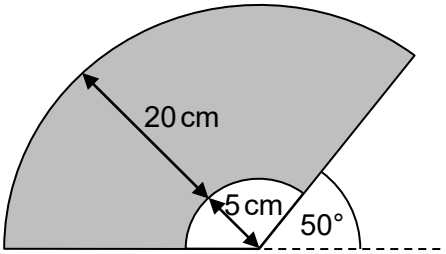
17. Town A is on a bearing of 150° from town B.
What is the bearing of town B from town A?

18. Two wires support a tall vertical pole. One wire forms an angle of 24° with the ground and the other wire forms an angle of 65° with the ground. The wires are 25 m apart at ground level.
The length of the longer wire is w m.
Find w.



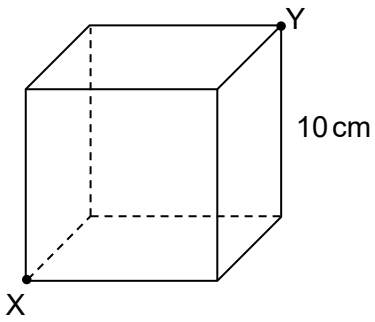
Not to scale

19. Calculate the shaded area of the diagram below.



Not to scale

20. A cube has side length 10 cm, shown below.
What is the direct distance from X to Y?



Answers

1. $\pi = \pi r^2$
   $r^2 = 1$
   so $r = 1$ km

2. 36.9°

3. 3000 N/m^2

4. 30 cm

5. $200 \times 6 = 1200$ cm^2
   $\frac{1200}{10000} = 0.12$ m^2

6. $d = st$ so distance is $42 \times \frac{7}{3} = 98$ miles

7. $5.1 \times \sin 36^\circ = 2.99...$ or 3.0 cm

8. $18 \div 750000 = 0.000024$ km
   $= 24$ mm

9. $\frac{4}{3} \times \pi \times \left(\frac{1}{7}\right)^3 = \frac{4}{1029}\pi$ or 0.012 m^3

10. $\frac{1}{2} \times 2.3 \times 6.6 \times \sin 105^\circ = 7.3$ cm^2

11. $\frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{3} = \frac{\sqrt{3} \times \sqrt{3}}{2 \times 3} = \frac{3}{6} = \frac{1}{2}$

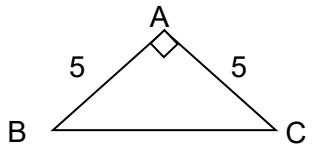
12. $2\pi r = 10$ so $r = \frac{5}{\pi}$ (or same from πd)
    $\pi r^2 = \pi\left(\frac{5}{\pi}\right)^2 = \frac{25\pi}{\pi^2} = \frac{25}{\pi}$ cm^2

13. 1 m^3 = 10^6 cm^3
    so 1 g per cm^3 is equivalent to 10^6 g per m^3.
    10^6 g = 1000 kg

14. $AB^2 = 100 + 53.68...$ in third line because $\cos 124^\circ$ is negative. The answer should be 12.4 cm.

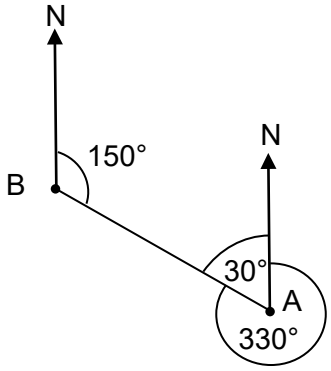
15. Runs $30u$ metres.
    $t = \frac{d}{s}$ so time walking is $\frac{30u}{v}$ seconds.

16.



$BC = \sqrt{5^2 + 5^2} = \sqrt{50}$ or 7.1 cm

17. 330°

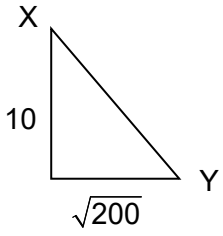


18. Third angle in triangle is 91°.

$$\frac{p}{\sin 65} = \frac{25}{\sin 91} \Rightarrow p = \frac{25 \times \sin 65}{\sin 91}$$
$$= 22.7 \text{ m}$$

19. $\frac{130}{360} \times \pi \times 40^2 = \frac{5000}{9}\pi$ or 1815.1 cm^2

20. Diagonal of bottom face $= \sqrt{10^2 + 10^2} = \sqrt{200}$



Distance from X to Y is $\sqrt{10^2 + \left(\sqrt{200}\right)^2} = \sqrt{300}$

$= 10\sqrt{3}$ or 17.3 cm

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GCSE (9–1)

MATHEMATICS

Section Check In

Assessment Objective	Qu.	Topic	R	A	G
AO1	1	Apply the formula for area of a circle			
AO1	2	Apply trigonometric ratios to find an angle			
AO1	3	Use compound units			
AO1	4	Calculate perimeter of a rectilinear shape			
AO1	5	Convert standard units of measure for area			
AO1	6	Know and apply speed = distance ÷ time			
AO1	7	Know and apply trigonometric ratios to find a length			
AO1	8	Use the scale of a map			
AO1	9	Calculate volume of a sphere			
AO1	10	Know and apply area $= \frac{1}{2}ab\sin C$			
AO2	11	Know and apply exact trigonometric ratios			
AO2	12	Know and apply formula for area of a circle			
AO2	13	Use and convert compound units			
AO2	14	Know and apply cosine rule to find a length			
AO2	15	Use compound units in an algebraic context			
AO3	16	Know and apply Pythagoras' theorem in 2D			
AO3	17	Work with bearings			
AO3	18	Use and apply sine rule to find a length			
AO3	19	Calculate area of a sector given angle and radius			
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