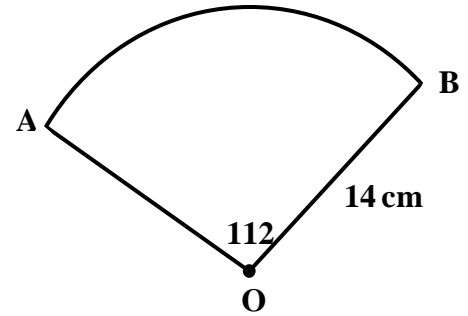# Nat 5 Circles, Solids and Similarity

1. The diagram below shows a sector of a circle, centre O.
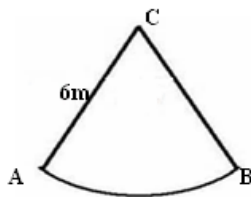
   Angle AOB $= 112°$ and the radius is 14 cm.

   Calculate the area of the sector AOB   **3**

2.

   The boat on a carnival ride travels along an arc of a circle, centre C.

   The boat is attached to C by a rod 6 metres long.
   The rod swings from position CA to position CB.

   The length of the arc AB is 7 metres.

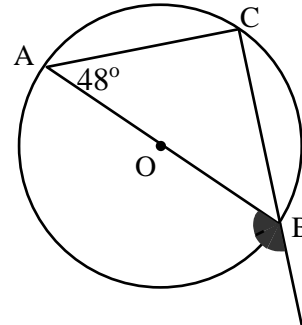   Find the angle through which the rod swings from position A to position B.   **4**

3. Two congruent circles overlap to form the symmetrical shape shown below. Each circle has a diameter of 12 cm and have centres at B and D.
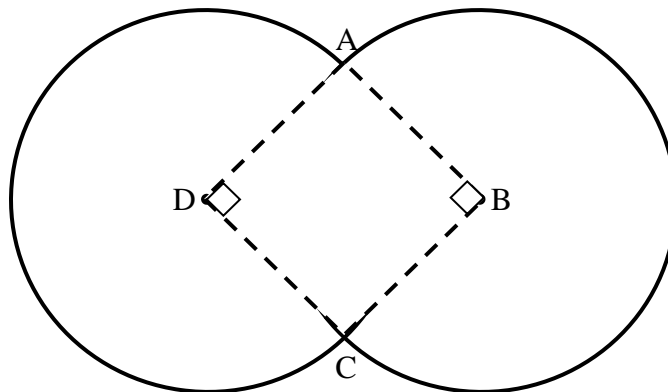
   Calculate the area of the shape.   **5**

4. The diagram shows a circle centre O. AB is a diameter and C is a point on the circumference of the circle.
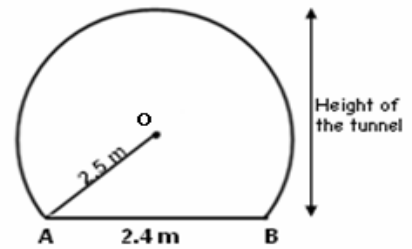
Calculate the size of the shaded angle.

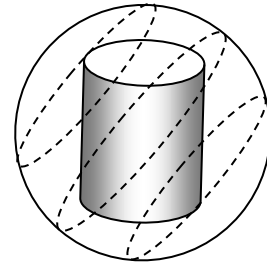5. This is the circular cross-section of a tunnel with a horizontal floor.

AB represents the floor.
AB is 2.4metres.

The radius, OA, of the cross-section is 2.5 metres.

Find the height of the tunnel.　　　**4**

6. A Christmas bauble is made from a sphere of perspex with a coloured cylinder in the middle.
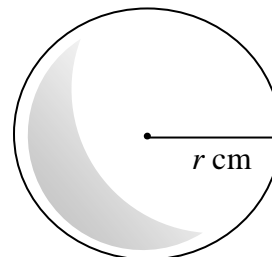
The volume round the cylinder is filled with a thick liquid.

The sphere has a diameter of 8 cm.
The cylinder has a radius of 2·6 cm with a height of 6 cm.

Calculate the volume of liquid needed to fill the sphere, giving your answer correct to 2 significant figures.　　　**5**

7 The volume of this sphere is 203cm^3.
Calculate its radius, r cm, correct to 3 significant figures.

　　　3

8. John is looking to buy a new rug for his main room.
The two rugs below are **mathematically similar** in shape.

8 ft

6 ft

7·2 ft
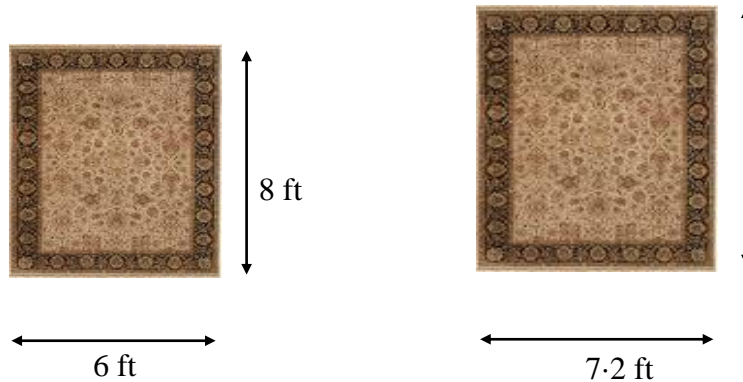
The smaller rug has an area of 48 square feet. John thinks that the area of the larger rug is at **least 72 square feet**. Is he correct? **4**

Answers

1. Area = $\dfrac{112}{360}$ x π x 14² = **191.6 cm²**

2. $\dfrac{angle}{360}$ x π x 12 = 7, angle is **66.8º**

3. Shape is made up of two sectors with centre angle of 270°
   Area of these sectors are $2 \times \dfrac{270}{360} \times \pi \times 6^2 = 169{\cdot}646....$
   Area of central square is $6 \times 6 = 36$. Total area is **205·6 cm²**

4. angle ACB = 90º, angle ABC = 180 – (48 + 90) = 42º
   Shaded angle   180 – 42 = **138º**

5. Establish a right angled triangle and use Pythagoras   2.5² = 1.2² + b²,
   b = 2.2 m, height is **4.7 m**

6. $V_{sphere}= 4/3 \times \pi \times 4^3 = 268{\cdot}0825731$,
   $V_{cylinder} = \pi \times 2{\cdot}6^2 \times 6 = 127{\cdot}422998$
   Volume = 268.0825731 - 127.422998 = 140.6595751 = **140 cm³**

7. $203 = \frac{4}{3}\pi r^3$, $609 = 4\pi r^3$; $r = \sqrt[3]{\dfrac{609}{4\pi}}$, •³   **r = 3·65 cm**

8. L.S.F. = 7·2/6 = 1·2, A.S.F = 1·2²,
   Area of the larger rug is $48 \times 1.2^2 = 69.12$ square feet
   John is incorrect as area < 72 square feet

Vectors

9. Vectors **p** and **q** are shown on the diagram below
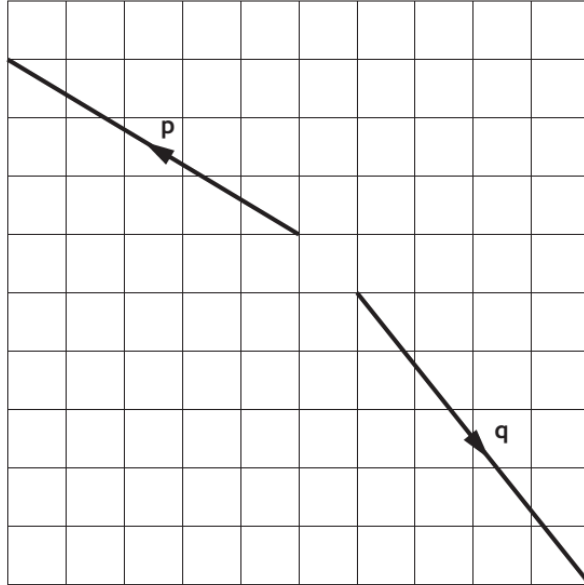
Find the vector **p** + **q**, express your answer in component form **3**

10. $\mathbf{a} = \begin{pmatrix} 1 \\ 4 \\ 0 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -2 \\ 4 \\ 10 \end{pmatrix}$, find **2a − b,**

express your answer in component form **2**

11. Find the magnitude of vector $\mathbf{q} = \begin{pmatrix} 3 \\ -1 \\ 2 \end{pmatrix}$ **2**

Answers

9. $\begin{pmatrix} -1 \\ -2 \end{pmatrix}$ 10. $\begin{pmatrix} 4 \\ 4 \\ -10 \end{pmatrix}$ 11. $|\mathbf{q}| = \sqrt{14}$

Extra help – Circles, Solids, Similarity and Vectors

	Examples to read	Questions to try
1	Arc Length and Sector Area Ex 9.1 & 9.2 Page 69	Q 1 Page 70
2	Find the sector angle Ex 9.5 Page 73	Q1 Page 74
3	Area of composite shapes	
4	Angle properties of circles Ex 21.1 - 21.3 Pages 221/3	Q 1-4 Page 224
5	Perpendicular bisectors Ex 21.5 & 21.66 Pages 229/30	Q1 Page 231, Q10 Page 232
6	Volume of composite solids Example 10.1 Page 76	Q 1,3,4 Page 83
7	Volume of solids Example 10.2 Page 77	Q3 Page 77, Q3 Page 81
8	Similarity Ex 22.2 & 22.33 Pages 242/3	Q1 Page 243, Q2 Page 244

Extra help –Vectors

	Examples to read	Questions to try
9	Adding Vectors Ex 28.2 - 28.4 Pages 314/5	Q1,2,4 Page 315
10	Adding Vectors in component form Ex 30.2 – 30.4 Page 322	Q2 Page 322, Q4 Page 323
11	Magnitude of vectors Ex 30.5 – 30.7 Pages 323/4	Q2 Page 325