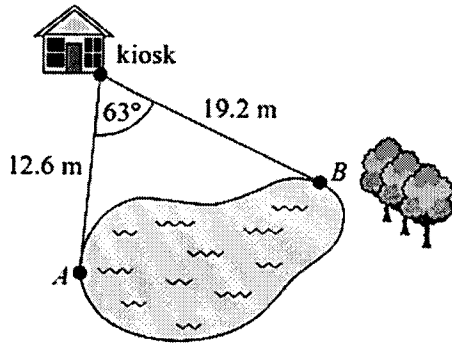


**Question 2**

The distances from a kiosk to points  $A$  and  $B$  on opposite sides of a pond are found to be 12.6 m and 19.2 m respectively.

The angle between the lines joining these points to the kiosk is  $63^\circ$ .



The distance, in m, across the pond between points  $A$  and  $B$  can be found by evaluating

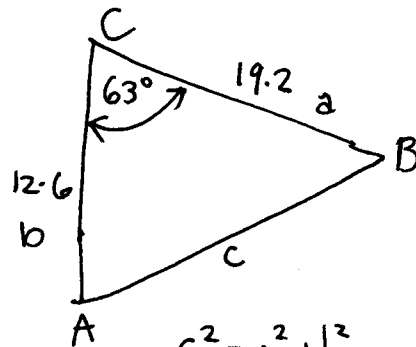
A.  $\frac{1}{2} \times 12.6 \times 19.2 \times \sin(63^\circ)$

B.  $\frac{19.2 \times \sin(63^\circ)}{12.6}$

C.  $\sqrt{12.6^2 + 19.2^2}$

**D.**  $\sqrt{12.6^2 + 19.2^2 - 2 \times 12.6 \times 19.2 \times \cos(63^\circ)}$

E.  $\sqrt{s(s-12.6)(s-19.2)(s-63)}$ , where  $s = \frac{1}{2}(12.6 + 19.2 + 63)$



$$c^2 = a^2 + b^2 - 2ab \cos(C)$$

$$c^2 = 19.2^2 + 12.6^2 - 2 \times 19.2 \times 12.6 \cos(63^\circ)$$

$$c = \sqrt{19.2^2 + 12.6^2 - 2 \times 19.2 \times 12.6 \cos(63^\circ)}$$

**Question 5**

The scale used on a map is 1:50 000.

On this map, a distance of 4 km would be represented by

A. 2.0 cm

B. 5.0 cm

**C.** 8.0 cm

D. 12.5 cm

E. 20.0 cm

Map distance

$$= \frac{4 \text{ km}}{50000}$$

$$= \frac{4000 \text{ m}}{50000}$$

$$= \frac{4}{50} \text{ m}$$

$$= \frac{4}{50} \times 100 \text{ cm}$$

$$= 8 \text{ cm}$$

**Question 8**

There are four telecommunications towers in a city. The towers are called Grey Tower, Black Tower, Silver Tower and White Tower.

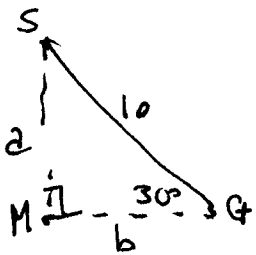
Grey Tower is 10 km due west of Black Tower.

Silver Tower is 10 km from Grey Tower on a bearing of  $300^\circ$ .

White Tower is 10 km due north of Silver Tower.

Correct to the nearest degree, the bearing of Black Tower from White Tower is

- A.  $051^\circ$
- B.  $129^\circ$**
- C.  $141^\circ$
- D.  $309^\circ$
- E.  $321^\circ$

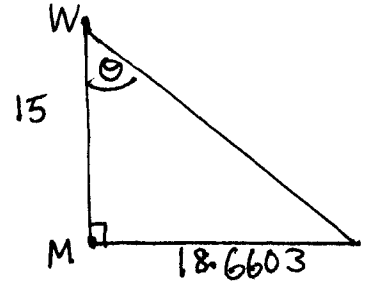
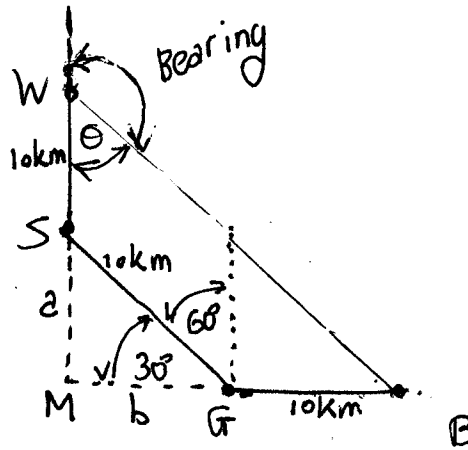


$$\sin(30^\circ) = \frac{a}{10}$$

$$a = 10 \sin(30^\circ) = 5$$

$$\cos(30^\circ) = \frac{b}{10}$$

$$b = 10 \cos(30^\circ) \approx 8.6603$$



$$\tan(\theta) = \frac{18.6603}{15}$$

$$\theta = \tan^{-1}\left(\frac{18.6603}{15}\right)$$

$$\theta \approx 51.2^\circ$$

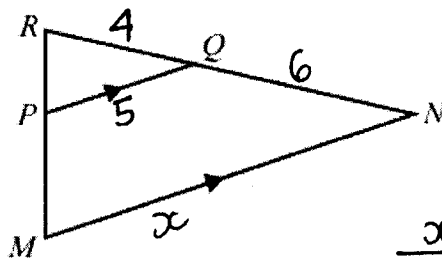
$$\therefore \text{Bearing} = 180^\circ - 51.2^\circ \approx 128.8^\circ$$

**Question 6**

In triangle  $MNR$ , point  $P$  lies on side  $MR$  and point  $Q$  lies on side  $NR$ .

The lines  $PQ$  and  $MN$  are parallel.

The length of  $RQ$  is 4 cm, the length of  $QN$  is 6 cm and the length of  $PQ$  is 5 cm.



$$\frac{x}{5} = \frac{10}{4}$$

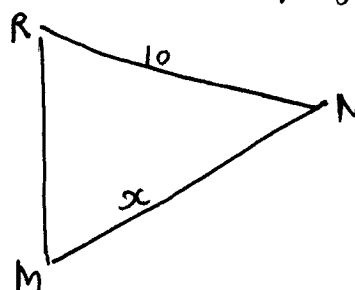
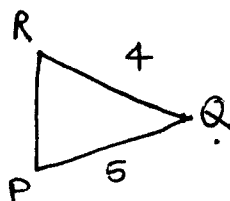
$$\frac{x}{5} = \frac{5}{2}$$

$$\therefore x = \frac{25}{2}$$

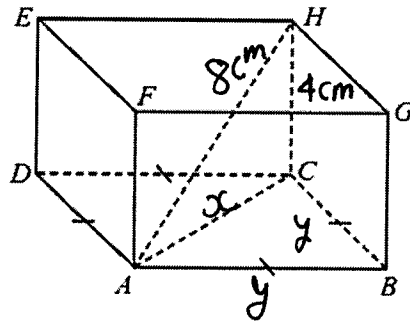
$$x = 12.5$$

The length of  $MN$ , in cm, is equal to

- A. 7.5
- B. 8.3
- C. 12.0
- D. 12.5**
- E. 15.0



Question 9



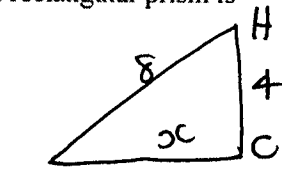
A rectangular prism with a square base,  $ABCD$ , is shown above.

The diagonal of the prism,  $AH$ , is 8 cm.

The height of the prism,  $HC$ , is 4 cm.

The volume of this rectangular prism is

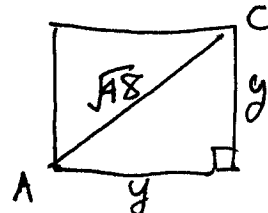
- A.  $64 \text{ cm}^3$
- B.  $96 \text{ cm}^3$**
- C.  $128 \text{ cm}^3$
- D.  $192 \text{ cm}^3$
- E.  $256 \text{ cm}^3$



$$x^2 = 8^2 - 4^2$$

$$x^2 = 64 - 16 = 48$$

$$\therefore x = \sqrt{48}$$



$$y^2 + y^2 = (\sqrt{48})^2$$

$$2y^2 = 48$$

$$y^2 = 24$$

$$\therefore V = A \cdot h$$

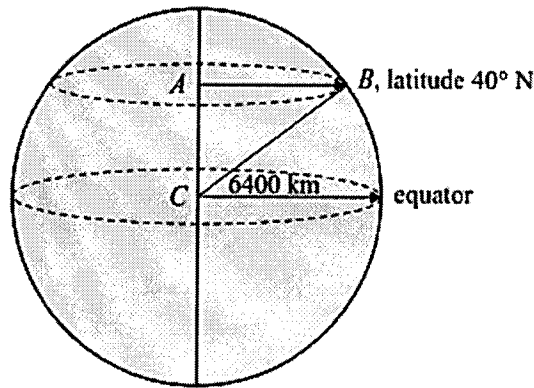
$$= y^2 \times h$$

$$= y^2 \times 4$$

$$= 24 \times 4$$

$$= 96 \text{ cm}^3$$

Question 7



Assume that the radius of Earth is 6400 km.

The diagram above shows a small circle of Earth, with centre at  $A$ , whose latitude is  $40^\circ \text{ N}$ .

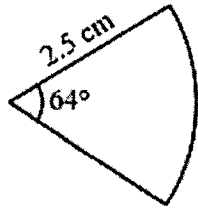
The radius of this small circle, in kilometres, is closest to

- A. 4114
- B. 4903**
- C. 5543
- D. 6400
- E. 7390

$$r = 6400 \cos(40^\circ)$$

$$\approx 4902.68 \text{ km}$$

Question 1



A sector of a circle of radius 2.5 cm subtends an angle of  $64^\circ$  at the centre of the circle.

The area of the sector, in square centimetres, is closest to

- A. 2.8
- B. 3.5**
- C. 7.0
- D. 88.4
- E. 110.5

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

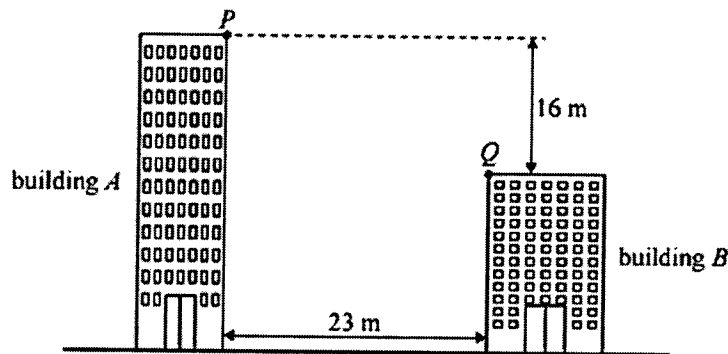
$$= \frac{\pi \times 2.5^2 \times 64}{360} \approx 3.49 \text{ cm}^2$$

Question 2

The city that is closest to the equator is

- A. Athens, latitude  $38.0^\circ \text{ N}$
- B. Belgrade, latitude  $44.8^\circ \text{ N}$
- C. Kingston, latitude  $45.3^\circ \text{ S}$
- D. Pretoria, latitude  $25.7^\circ \text{ S}$**
- E. Brisbane, latitude  $27.5^\circ \text{ S}$

Question 2



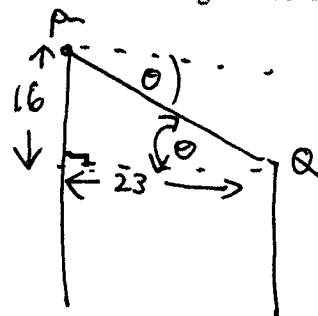
The point  $Q$  on building  $B$  is visible from the point  $P$  on building  $A$ , as shown in the diagram above.

Building  $A$  is 16 metres taller than building  $B$ .

The horizontal distance between point  $P$  and point  $Q$  is 23 metres.

The angle of depression of point  $Q$  from point  $P$  is closest to

- A.  $35^\circ$**
- B.  $41^\circ$
- C.  $44^\circ$
- D.  $46^\circ$
- E.  $55^\circ$



$$\tan(\theta) = \frac{16}{23}$$

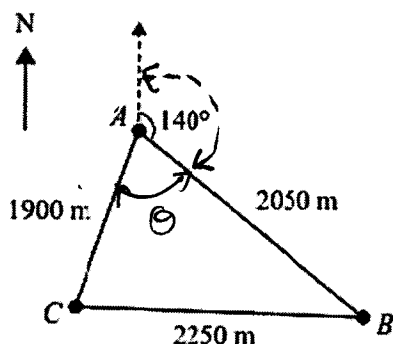
$$\theta = \tan^{-1}\left(\frac{16}{23}\right)$$

$$\theta = 34.8^\circ$$

Use the following information to answer Questions 5 and 6.

**Question 5**

A cross-country race is run on a triangular course. The points  $A$ ,  $B$  and  $C$  mark the corners of the course, as shown below.



The distance from  $A$  to  $B$  is 2050 m.

The distance from  $B$  to  $C$  is 2250 m.

The distance from  $A$  to  $C$  is 1900 m.

The bearing of  $B$  from  $A$  is  $140^\circ$ .

The bearing of  $C$  from  $A$  is closest to

- A.  $032^\circ$
- B.  $069^\circ$
- C.  $192^\circ$
- D.  $198^\circ$
- E.  $209^\circ$**

$$\cos(\theta) = \frac{2050^2 + 1900^2 - 2250^2}{2 \times 2050 \times 1900}$$

$$\theta = \cos^{-1} \left( \frac{2050^2 + 1900^2 - 2250^2}{2 \times 2050 \times 1900} \right)$$

$$\theta \approx 69.33^\circ$$

$$\text{Bearing} = 140^\circ + 69.33^\circ \approx 209^\circ \text{ T}$$

**Question 6**

The area within the triangular course  $ABC$ , in square metres, can be calculated by evaluating

**A.**  $\sqrt{3100 \times 1200 \times 1050 \times 850}$

B.  $\sqrt{3100 \times 2250 \times 2050 \times 1900}$

C.  $\sqrt{6200 \times 4300 \times 4150 \times 3950}$

D.  $\frac{1}{2} \times 2050 \times 2250 \times \sin(140^\circ)$

E.  $\frac{1}{2} \times 2050 \times 2250 \times \sin(40^\circ)$

$$s = \frac{1900 + 2050 + 2250}{2}$$

$$= 3100$$

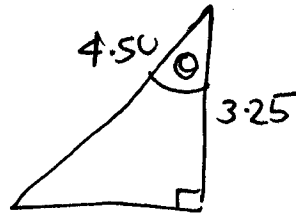
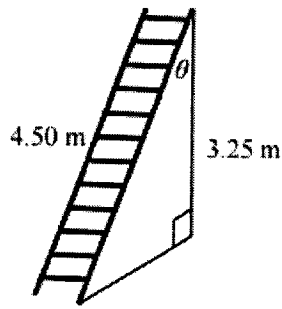
$$A = \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{3100(3100-1900)(3100-2050)(3100-2250)}$$

$$= \sqrt{3100 \times 1200 \times 1050 \times 850}$$

### Question 1

The top of a ladder that is 4.50 m long rests 3.25 m up a wall, as shown in the diagram below.



$$\cos(\theta) = \frac{3.25}{4.50}$$

$$\theta = \cos^{-1}\left(\frac{3.25}{4.50}\right)$$

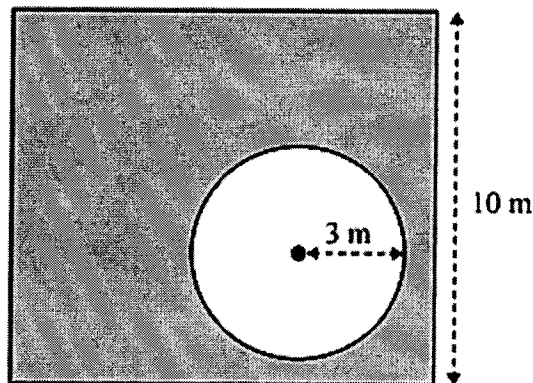
$$\theta = 43.8^\circ$$

The angle,  $\theta$ , that the ladder makes with the wall is closest to

- A.  $36^\circ$
- B.  $44^\circ$
- C.  $46^\circ$
- D.  $50^\circ$
- E.  $54^\circ$

### Question 2

A circular pool is located in a square lawn, as shown below.



The sides of the square lawn are 10 m in length.

The pool has a radius of 3 m.

The area of the lawn surrounding the pool, in square metres, is closest to

- A. 21
- B. 59
- C. 72
- D. 81
- E. 128

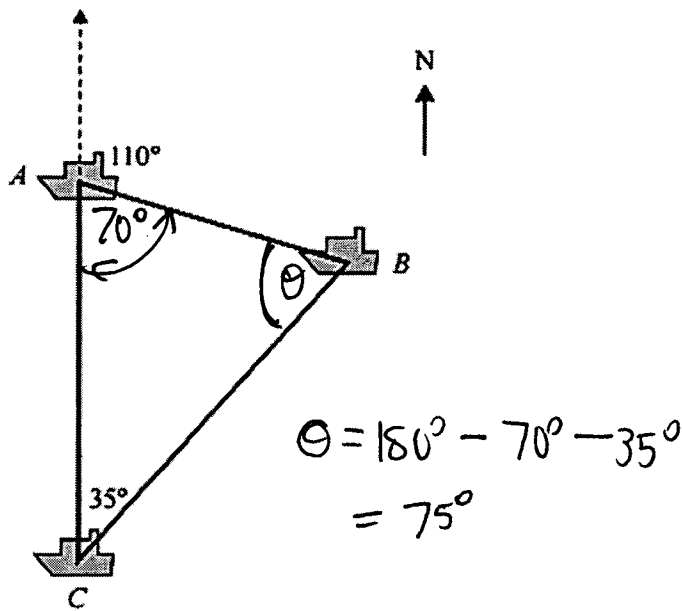
$$A = A_{\text{square}} - A_{\text{circle}}$$

$$A = 10^2 - \pi \times 3^2$$

$$\approx 71.73 \text{ m}^2$$

**Question 3**

The diagram below shows the location of three boats, *A*, *B* and *C*.

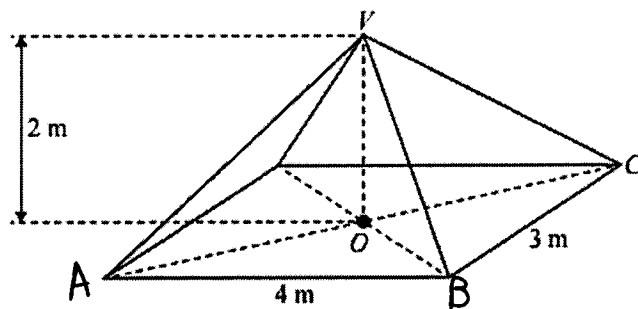


Boat *B* is on a bearing of  $110^\circ$  from boat *A*.  
 Boat *B* is also on a bearing of  $035^\circ$  from boat *C*.  
 Boat *A* is due north of boat *C*.  
 The angle *ABC* is

- A.  $35^\circ$
- B.  $65^\circ$
- C.  $70^\circ$
- D.  $75^\circ$**
- E.  $110^\circ$

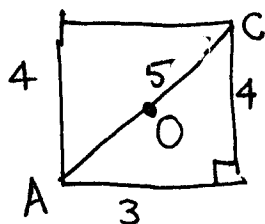
**Question 5**

A right pyramid, shown below, has a rectangular base with length 4 m and width 3 m. The height of the pyramid is 2 m.



The angle *VCO* that the sloping edge *VC* makes with the base of the pyramid, to the nearest degree, is

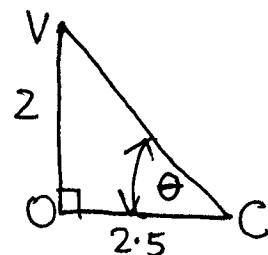
- A.  $22^\circ$
- B.  $27^\circ$
- C.  $34^\circ$
- D.  $39^\circ$**
- E.  $45^\circ$



$\overline{AC} = 5\text{ m}$   
 $\therefore \overline{OC} = 2.5\text{ m}$

$\tan(\theta) = \frac{2}{2.5}$

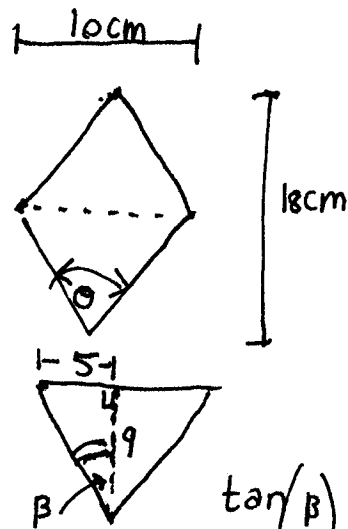
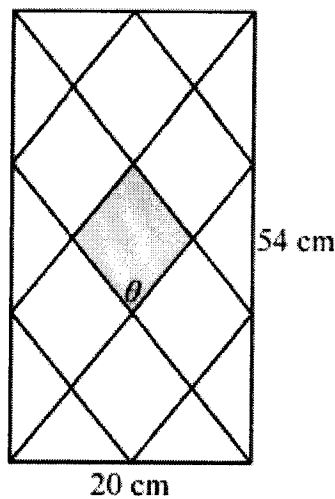
$\theta = \tan^{-1}\left(\frac{2}{2.5}\right) \approx 39^\circ$



**Question 5**

The rectangle shown below is 54 cm high and 20 cm wide.

The rhombuses drawn inside the rectangle are all the same size and shape.



$$\tan(\beta) = \frac{5}{9}$$

$$\beta = \tan^{-1}\left(\frac{5}{9}\right)$$

$$\beta = 29.05^\circ$$

$$\therefore \theta = 2 \times 29.05^\circ \approx 58^\circ$$

The size of the angle  $\theta$ , in the shaded rhombus, is closest to

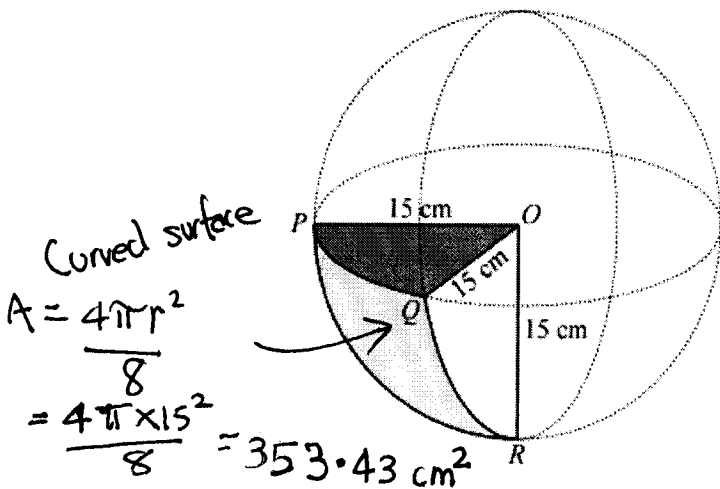
- A.  $34^\circ$
- B.  $45^\circ$
- C.  $56^\circ$
- D.  $58^\circ$**
- E.  $67^\circ$

**Question 9**

The solid  $OPQR$ , as shown below, is one-eighth of a sphere of radius 15 cm.

The point  $O$  is the centre of the sphere and the points  $P$ ,  $Q$  and  $R$  are on the surface of the sphere.

$$\angle POQ = \angle QOR = \angle ROP = 90^\circ$$

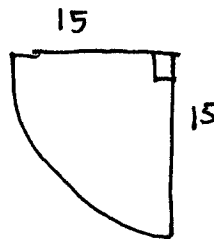


Curved surface

$$A = \frac{4\pi r^2}{8}$$

$$= \frac{4\pi \times 15^2}{8} = 353.43 \text{ cm}^2$$

T.S.A = 3rectas + curved surface



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

$$A = \frac{\pi \times 15^2 \times 90}{360}$$

$$A \approx 176.715 \text{ cm}^2$$

The total surface area of the solid  $OPQR$ , in  $\text{cm}^2$ , is closest to

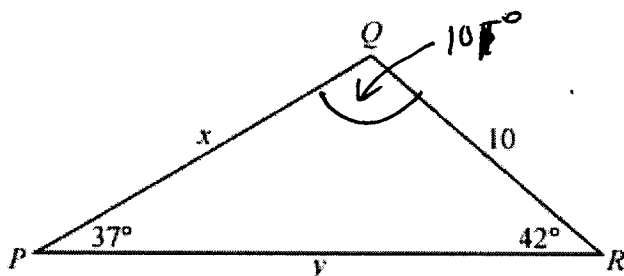
- A. 619
- B. 648
- C. 706
- D. 884**
- E. 1767

$$\therefore \text{T.S.A} = 353.43 + 3 \times 176.71 \approx 884 \text{ cm}^2$$



**Question 7**

$PQR$  is a triangle with side lengths  $x$ ,  $10$  and  $y$ , as shown below.  
In this triangle, angle  $RPQ = 37^\circ$  and angle  $QRP = 42^\circ$ .



Which one of the following expressions is correct for triangle  $PQR$ ?

~~A~~  $x = \frac{10}{\sin 37^\circ}$

~~B~~  $y = \frac{10}{\tan 37^\circ}$

**C**  $x = 10 \times \frac{\sin 42^\circ}{\sin 37^\circ}$

D.  $y = 10 \times \frac{\sin 37^\circ}{\sin 101^\circ}$

E.  $10^2 = x^2 + y^2 - 2xy \cos 42^\circ$

$$\frac{y}{\sin(101^\circ)} = \frac{x}{\sin(42^\circ)}$$

OR  $\frac{y}{\sin(101^\circ)} = \frac{10}{\sin(37^\circ)}$   
 $y = \frac{10 \sin(101^\circ)}{\sin(37^\circ)}$

OR  $\frac{x}{\sin(42^\circ)} = \frac{10}{\sin(37^\circ)}$

**Question 8**

A triangular course for a yacht race has three stages.

Stage 1 is from the Start to Marker 1; a distance of  $3.5$  km on a bearing of  $055^\circ$ .

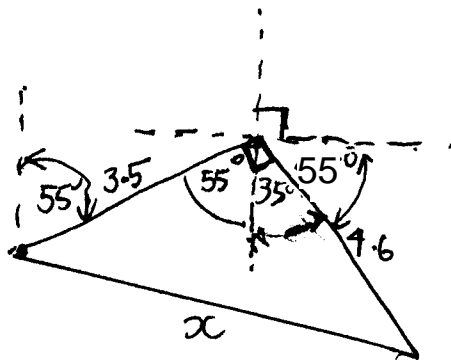
Stage 2 is from Marker 1 to Marker 2; a distance of  $4.6$  km on a bearing of  $145^\circ$ .

Stage 3 is from Marker 2 back to the Start.

The distance travelled on Stage 3, in km, is closest to

- A. 4.9
- B. 5.3
- C** 5.8
- D. 6.0
- E. 7.7

$$x = \frac{10 \sin(42^\circ)}{\sin(37^\circ)}$$



$$x^2 = 3.5^2 + 4.6^2$$

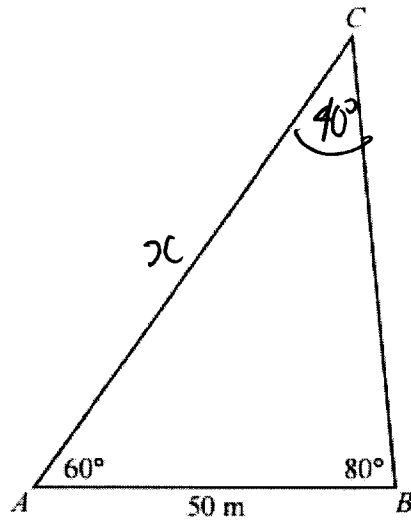
$$x = \sqrt{3.5^2 + 4.6^2}$$

$$x \approx 5.8 \text{ km}$$

**Question 4**

In triangle  $ACB$ ,  $\angle CAB = 60^\circ$  and  $\angle ABC = 80^\circ$

The length of side  $AB = 50$  m.



The length of side  $AC$  is closest to

- A. 57 m
- B. 67 m
- C. 77 m
- D. 81 m
- E. 100 m

$$\frac{x}{\sin(80^\circ)} = \frac{50}{\sin(40^\circ)}$$

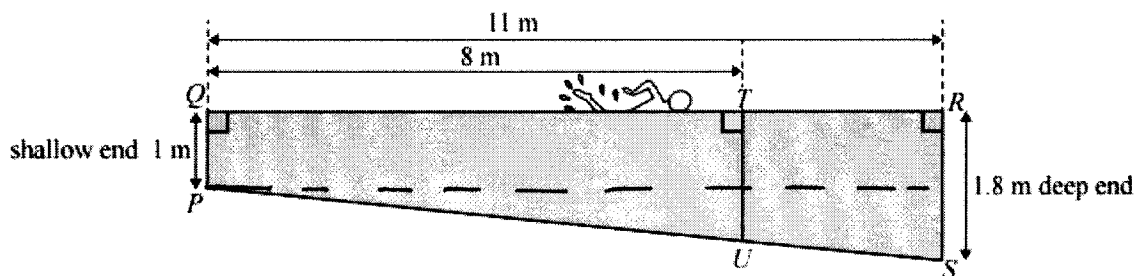
$$x = \frac{50 \sin(80^\circ)}{\sin(40^\circ)}$$

$$x \approx 76.6$$

**Question 8**

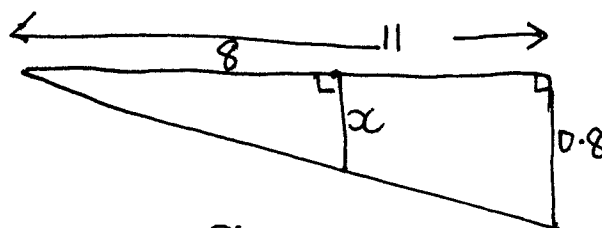
The diagram below shows a cross-section,  $PQRS$ , of a swimming pool.

The swimming pool is 11 metres long and the depth increases uniformly from 1 metre at the shallow end to 1.8 metres at the deep end.



The depth of the water at a point 8 metres from the shallow end, represented by  $TU$  on the diagram, is closest to

- A. 1.25 metres
- B. 1.31 metres
- C. 1.34 metres
- D. 1.58 metres
- E. 1.62 metres



$$\frac{x}{0.8} = \frac{8}{11}$$

$$\therefore TU = 1 + 0.58$$

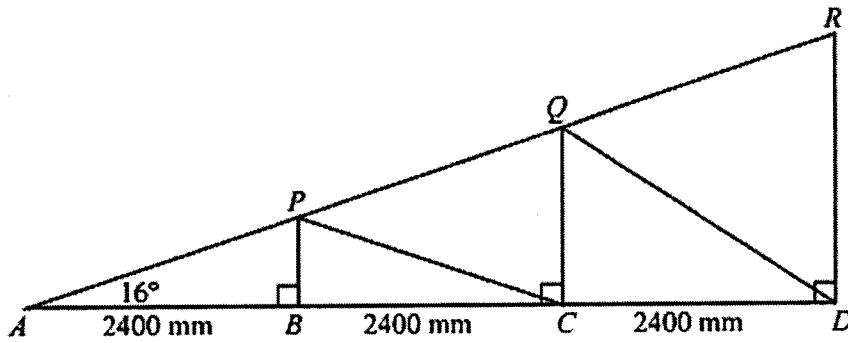
$$= 1.58 \text{ m}$$

$$x = \frac{8}{11} \times 0.8 \approx 0.58 \text{ m}$$

**Question 7**

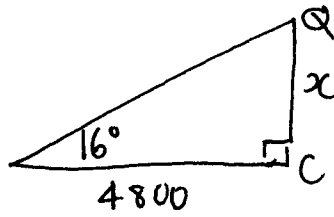
The structure of a roof frame is shown in the diagram below.

In this diagram,  $AB = BC = CD = 2400$  mm and  $\angle PAB = 16^\circ$ .



The length of  $QD$ , in mm, is closest to

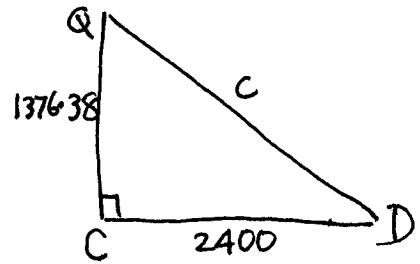
- A. 2741
- B. 2767**
- C. 2830
- D. 3394
- E. 5201



$$\tan(16^\circ) = \frac{x}{4800}$$

$$x = 4800 \tan(16^\circ)$$

$$x \approx 1376.38$$



$$c^2 = 2400^2 + 1376.38^2$$

$$c = \sqrt{2400^2 + 1376.38^2}$$

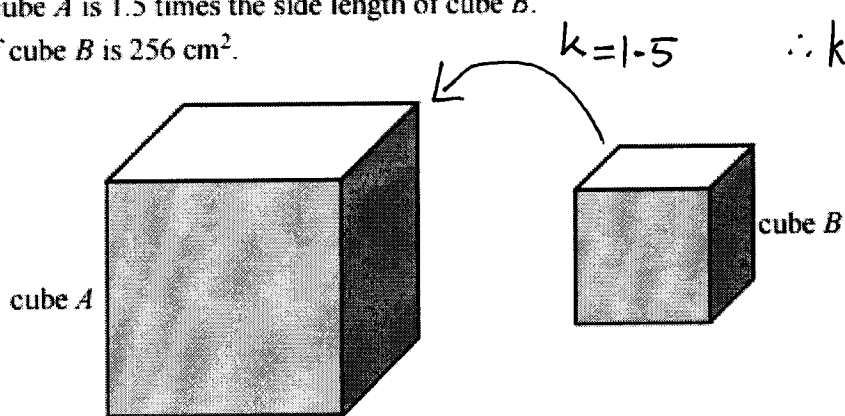
$$c = 2766.66 \text{ mm}$$

**Question 4**

Cube  $A$  and cube  $B$  are shown below.

The side length of cube  $A$  is 1.5 times the side length of cube  $B$ .

The surface area of cube  $B$  is  $256 \text{ cm}^2$ .



The surface area of cube  $A$  is

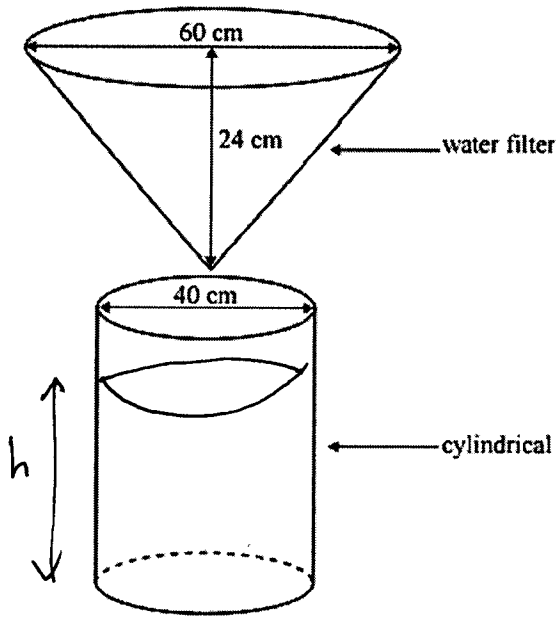
- A.  $114 \text{ cm}^2$
- B.  $256 \text{ cm}^2$
- C.  $384 \text{ cm}^2$
- D.  $576 \text{ cm}^2$**
- E.  $864 \text{ cm}^2$

$$A = 1.5^2 \times 256$$

$$= 576 \text{ cm}^2$$

**Question 9**

A conical water filter has a diameter of 60 cm and a depth of 24 cm. It is filled to the top with water. The water filter sits above an empty cylindrical container which has a diameter of 40 cm. The water is allowed to flow from the water filter into the cylindrical container.



$$V_{\text{cone}} = \frac{\pi r^2 h}{3}$$

$$= \frac{\pi \times 30^2 \times 24}{3}$$

$$V_{\text{water in cylinder}} = \pi r^2 h$$

$$= \pi \times 20^2 h$$

When the water filter is empty, the depth of water in the cylindrical container will be

- A. 8 cm
- B. 18 cm**
- C. 24 cm
- D. 32 cm
- E. 96 cm

$$\frac{\pi \times 30^2 \times 24}{3} = \pi \times 20^2 h$$

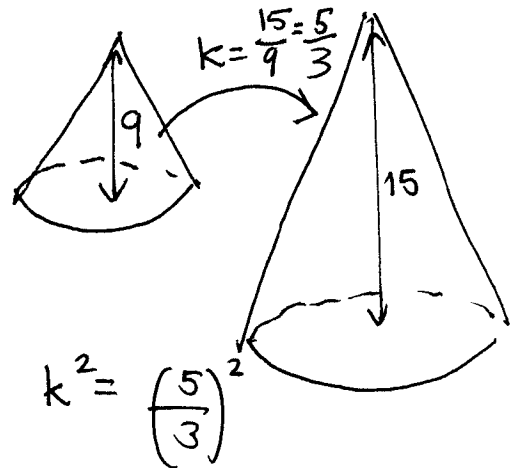
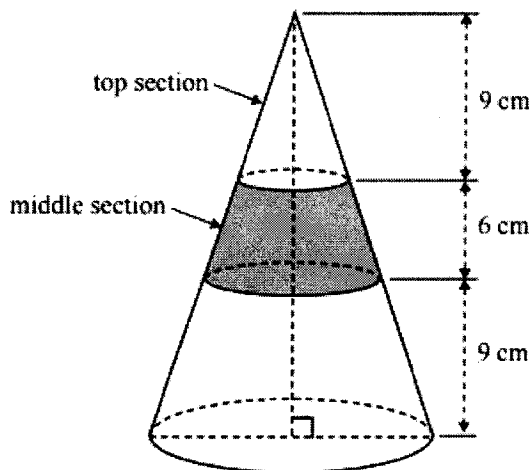
$$\therefore \frac{30^2 \times 24}{3} = 400h$$

$$7200 = 400h$$

$$h = 18$$

**Question 9**

The middle section of a cone is shaded, as shown in the diagram below.



$$k^2 = \left(\frac{5}{3}\right)^2$$

The surface area of the unshaded top section of the cone is 180 cm<sup>2</sup>.

The surface area of the middle section of the cone, in square centimetres, is

- A. 80
- B. 120
- C. 300
- D. 320**
- E. 500

Area of shaded section

$$= 500 - 180$$

$$= 320 \text{ cm}^2$$

∴ Area of large cone

$$= 180 \times \left(\frac{5}{3}\right)^2$$

$$= 500 \text{ cm}^2$$