

Question 1

A lighthouse has a lightroom, shown shaded in Figure 2 below.
The floor of the lightroom is in the shape of a regular octagon.
The longest distance across the floor is 4 metres.

The lightroom floor and $\angle POQ = \theta^\circ$ are shown in Figure 3 below.

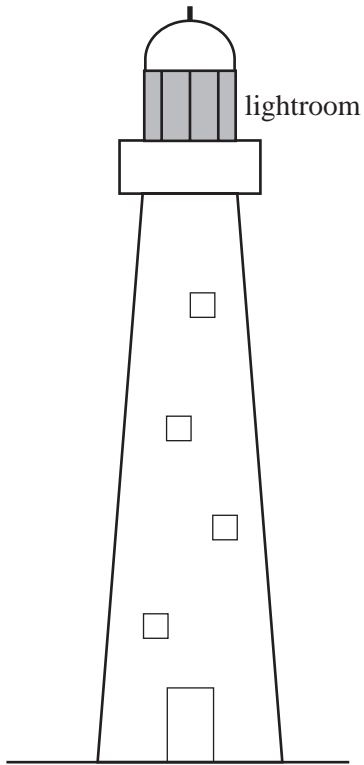


Figure 2

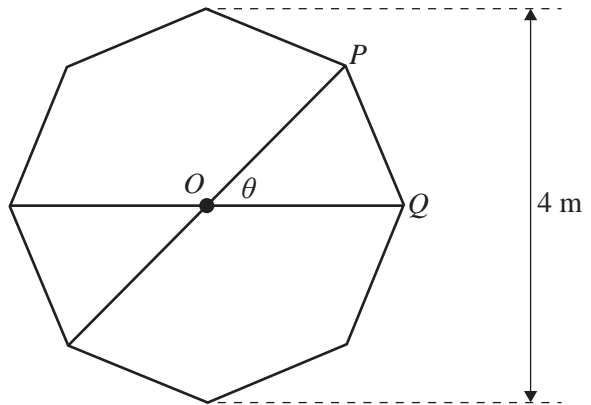


Figure 3

- a. Show that the size of the angle θ is 45° .

1 mark

- b. Determine the area of triangle POQ .
Write your answer in square metres correct to one decimal place.

1 mark

The lightroom is surrounded by a walkway of diameter 6.4 metres.
An outer circular wall surrounds the walkway.
The walkway is shown shaded in Figure 4 below.

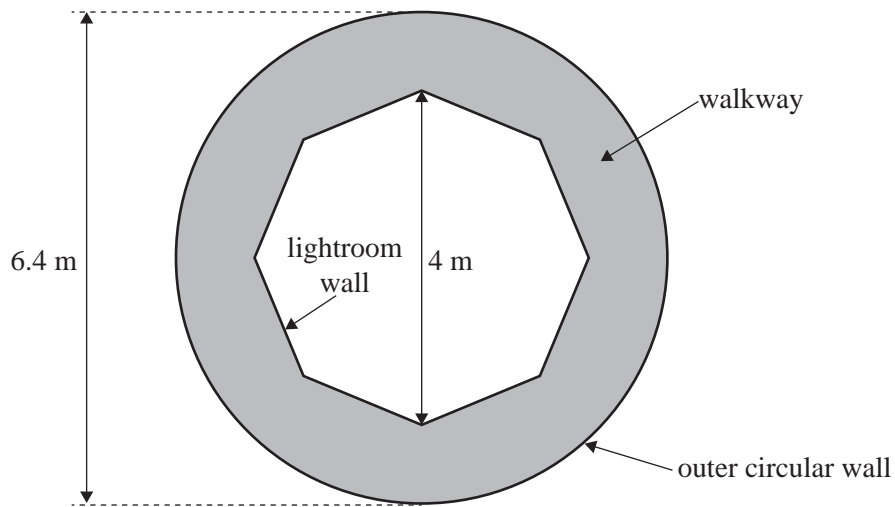


Figure 4

- c. Determine the minimum distance between the lightroom wall and the outer circular wall.

1 mark

- d. The walkway is the shaded area in Figure 4. Determine its area correct to the nearest square metre.

2 marks

Question 2

The lighthouse tower, shaded on Figure 5 below, is in the shape of a truncated cone.

It has circular cross-sections that decrease uniformly from a radius of 3.5 metres at ground level to a radius of 2 metres at the walkway.

The height of the lighthouse tower is 18 metres.

The angle marked α is the angle that the outer wall of the lighthouse tower makes with the horizontal at ground level.

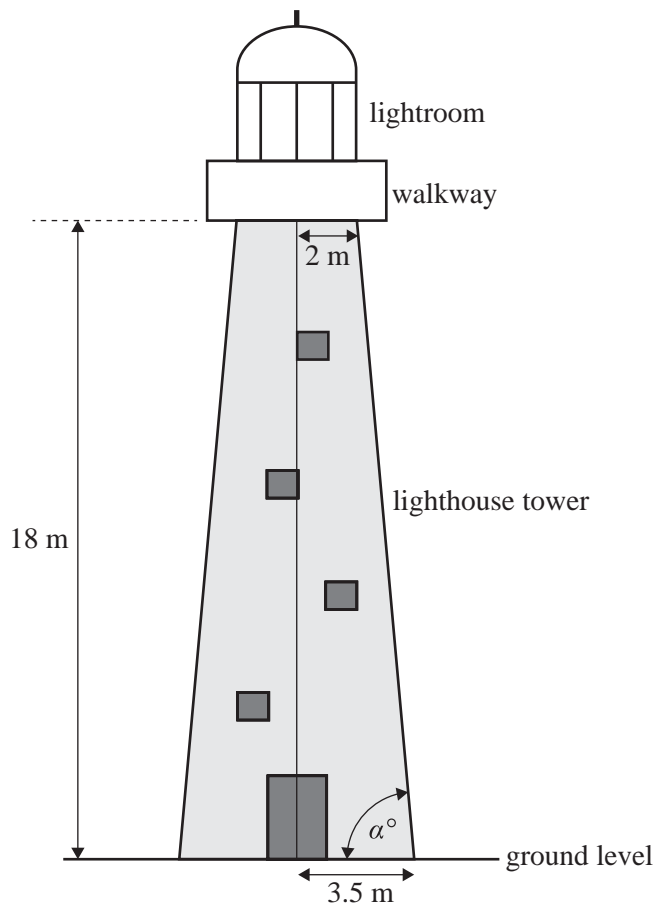


Figure 5

- a. Determine the size of the angle α .
Write your answer in degrees correct to one decimal place.

1 mark

The lighthouse tower is part of a cone. The height of this cone is h metres and the base radius is 3.5 metres, as shown in Figure 6.

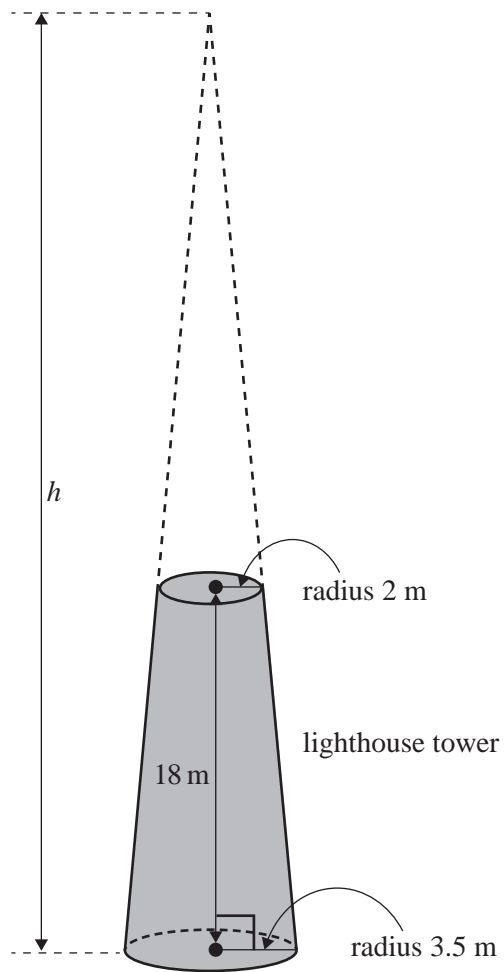


Figure 6

- b.** i. Determine h , the height of this cone, in metres.

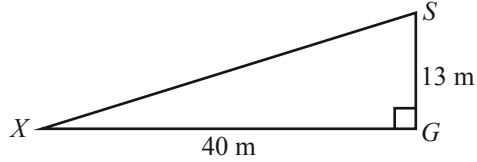
- ii. Determine the volume of the lighthouse tower.
Write your answer to the nearest cubic metre.

2 + 1 = 3 marks

Question 3 (4 marks)

A spectator, S , in the grandstand of an athletics ground is 13 m vertically above point G .

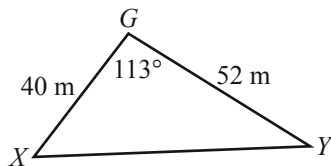
Competitor X , on the athletics ground, is at a horizontal distance of 40 m from G .



- a. Find the distance, SX , correct to the nearest metre. 1 mark

Competitor X is 40 m from G and competitor Y is 52 m from G .

The angle XGY is 113° .

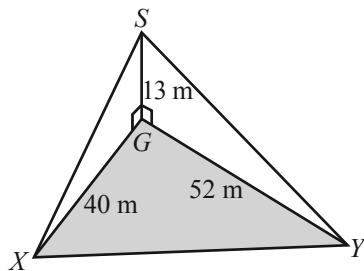


- b. i. Calculate the distance, XY , correct to the nearest metre. 1 mark

- ii. Find the area of triangle XGY , correct to the nearest square metre. 1 mark

- c. Determine the angle of elevation of spectator S from competitor Y , correct to the nearest degree.

Note that X , G and Y are on the same horizontal level. 1 mark



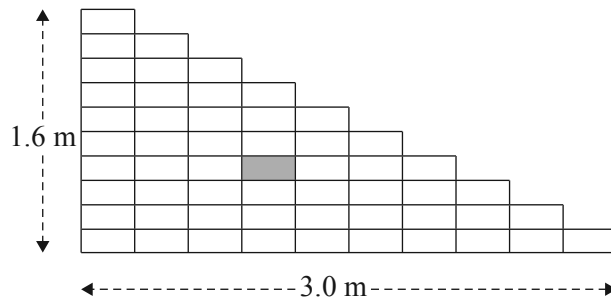
Question 4 (3 marks)

A concrete staircase leading up to the grandstand has 10 steps.

The staircase is 1.6 m high and 3.0 m deep.

Its cross-section comprises identical rectangles.

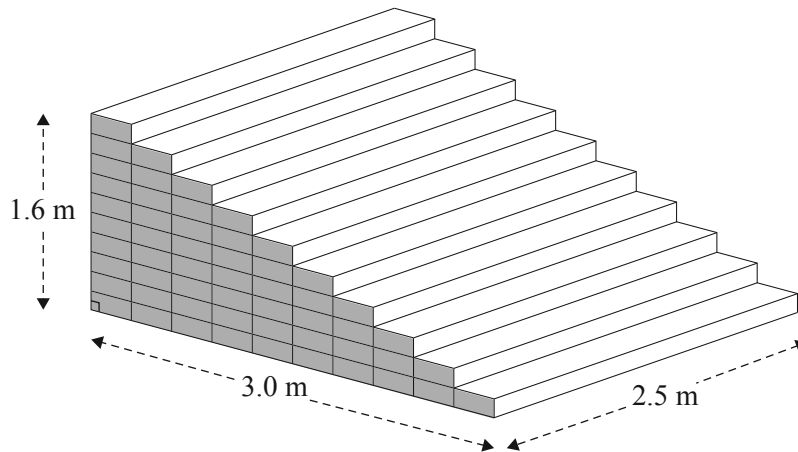
One of these rectangles is shaded in the diagram below.



- a. Find the area of the shaded rectangle in square metres.

1 mark

The concrete staircase is 2.5 m wide.

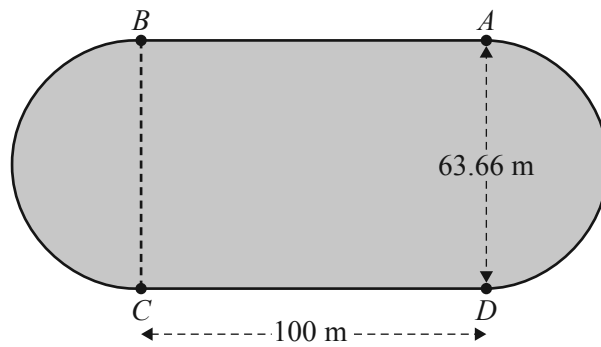


- b. Find the volume of the solid concrete staircase in cubic metres.

2 marks

Question 5 (4 marks)

A grassed region in the athletics ground is shown shaded in the diagram below.



The perimeter of the grassed region comprises two parallel lines, BA and CD , each 100 m in length, and two semi-circles, BC and AD .

In total, the perimeter of the grassed region is 400 m.

- a. The diameter of the semi-circle AD is 63.66 m, correct to two decimal places.

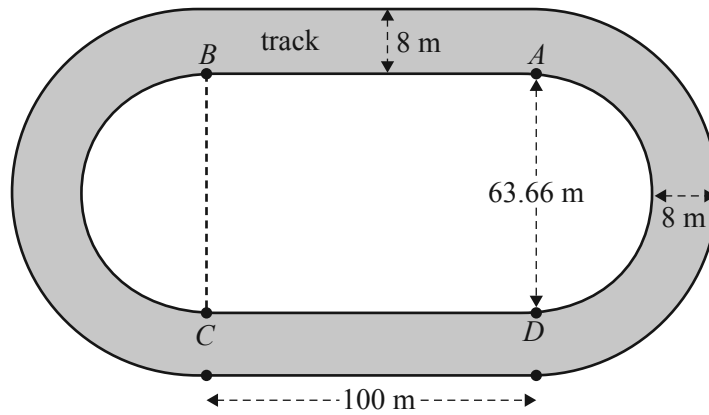
Show how this value could be obtained.

1 mark

- b. Determine the area of the grassed region, correct to the nearest square metre.

1 mark

A running track, shown shaded in the diagram below, surrounds the grassed region. This running track is 8 m wide at all points.



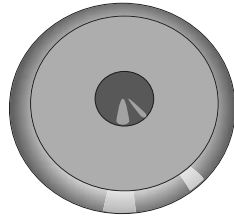
- c. The running track is to be resurfaced with special rubber material that is 0.1 m deep. Find the volume of rubber material that is needed to resurface the running track. Write your answer, correct to the nearest cubic metre.

2 marks

Question 6 (2 marks)

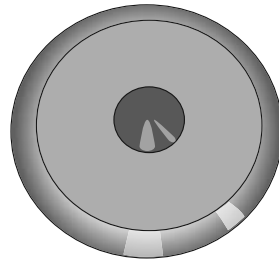
Competitors in the intermediate division of the discus use a smaller discus than the one used in the senior division, but of a similar shape. The total surface area of each discus is given below.

intermediate discus



total surface area 500 cm^2

senior discus



total surface area 720 cm^2

By what value can the volume of the intermediate discus be multiplied to give the volume of the senior discus?

Question 5 (2 marks)

Daniel threw a javelin a distance of 68.32 m on a bearing of 057° on his first throw.

On his second throw from the same point, he threw the javelin a distance of 72.51 m.

The second throw landed at a point on a bearing of 125° , measured from the point where the first throw landed.

Determine the distance between the point where Daniel's first throw landed and the point where his second throw landed.

Write your answer in metres, correct to one decimal place.
