

4. A parallelogram $ABCD$ has area 40 cm^2

Given that AB has length 10 cm , BC has length 6 cm and angle DAB is obtuse, find

- (a) the size of angle DAB , in degrees, to 2 decimal places,

(3)

- (b) the length of diagonal BD , in cm , to one decimal place.

(2)

9.

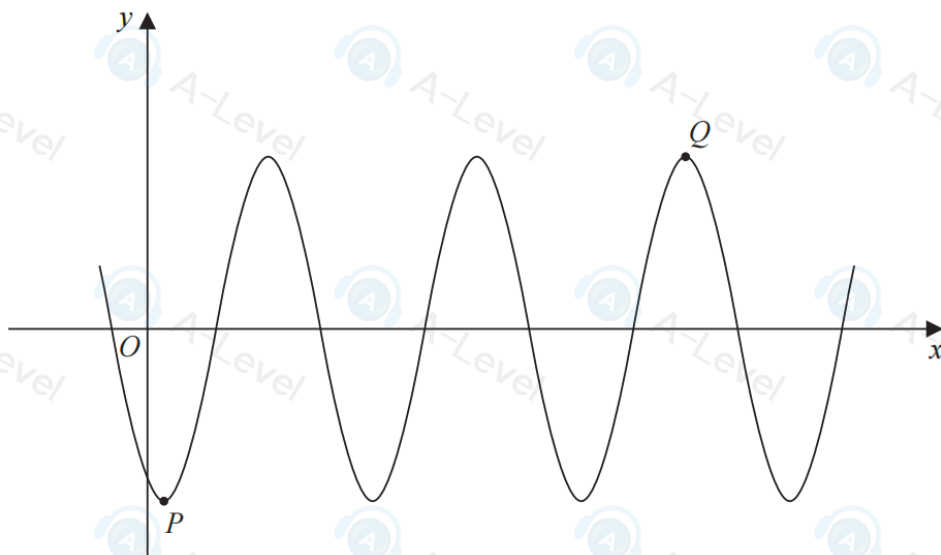


Figure 4

Figure 4 shows part of the curve with equation

$$y = A \cos(x - 30^\circ)$$

where A is a constant.

The point P is a minimum point on the curve and has coordinates $(30, -3)$ as shown in Figure 4.

- (a) Write down the value of A .

(1)

The point Q is shown in Figure 4 and is a maximum point.

- (b) Find the coordinates of Q .

(3)

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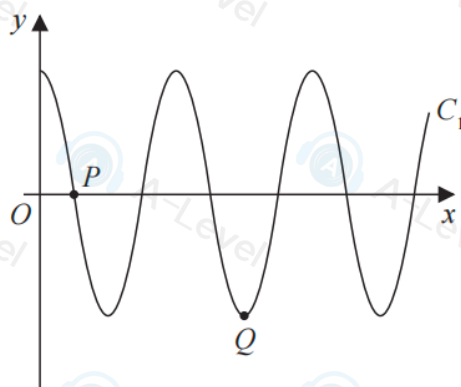
**Figure 4**

Figure 4 shows a sketch of part of the curve C_1 with equation

$$y = 3 \cos\left(\frac{x}{n}\right)^\circ \quad x \geq 0$$

where n is a constant.

The curve C_1 cuts the positive x -axis for the first time at point $P(270, 0)$, as shown in Figure 4.

(a) (i) State the value of n

(ii) State the period of C_1

(2)

The point Q , shown in Figure 4, is a minimum point of C_1

(b) State the coordinates of Q .

(2)

The curve C_2 has equation $y = 2 \sin x^\circ + k$, where k is a constant.

The point $R\left(a, \frac{12}{5}\right)$ and the point $S\left(-a, -\frac{3}{5}\right)$, both lie on C_2

Given that a is a constant less than 90

(c) find the value of k .

(2)

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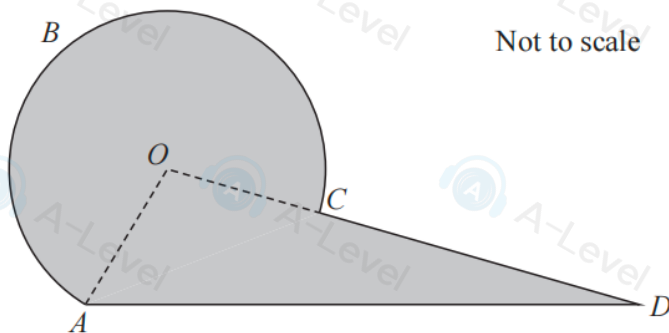
**Figure 3**

Figure 3 shows the plan view of a viewing platform at a tourist site.

The shape of the viewing platform consists of a sector $ABCOA$ of a circle, centre O , joined to a triangle AOD .

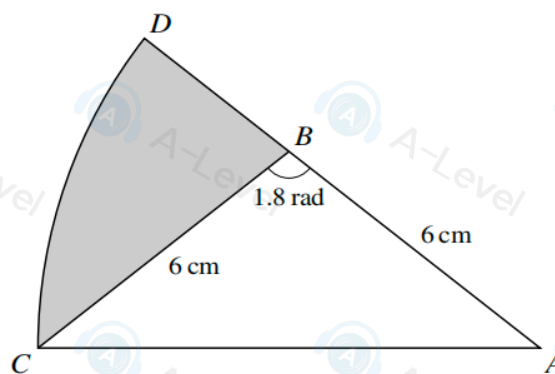
Given that

- $OA = OC = 6$ m
- $AD = 14$ m
- angle $ADC = 0.43$ radians
- angle AOD is an obtuse angle
- OCD is a straight line

find

- the size of angle AOD , in radians, to 3 decimal places, (3)
- the length of arc ABC , in metres, to one decimal place, (2)
- the total area of the viewing platform, in m^2 , to one decimal place. (4)

9



The diagram shows triangle ABC with $AB = BC = 6$ cm and angle $ABC = 1.8$ radians. The arc CD is part of a circle with centre A and ABD is a straight line.

- Find the perimeter of the shaded region. [5]
- Find the area of the shaded region. [3]

2. In the triangle ABC ,

- $AB = 21$ cm
- $BC = 13$ cm
- angle $BAC = 25^\circ$
- angle $ACB = x^\circ$

(a) Use the sine rule to find the value of $\sin x^\circ$, giving your answer to 4 decimal places. (2)

Given also that AB is the longest side of the triangle,

(b) find the value of x , giving your answer to 2 decimal places. (3)

The point Q lies on a different curve C_2

Given that point Q

- is a maximum point on the curve
- is the maximum point with the **smallest** x coordinate, $x > 0$

(b) find the coordinates of Q when

(i) C_2 has equation $y = 5 \cos x - 2$

(ii) C_2 has equation $y = -5 \cos x$ (4)

6.

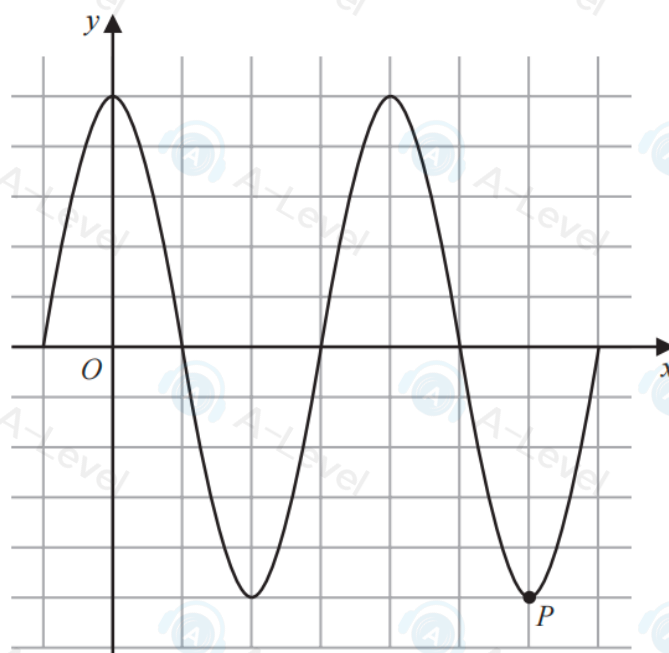
**Figure 2**

Figure 2 shows a plot of part of the curve C_1 with equation

$$y = 5 \cos x$$

with x being measured in degrees.

The point P , shown in Figure 2, is a minimum point on C_1

(a) State the coordinates of P

(2)

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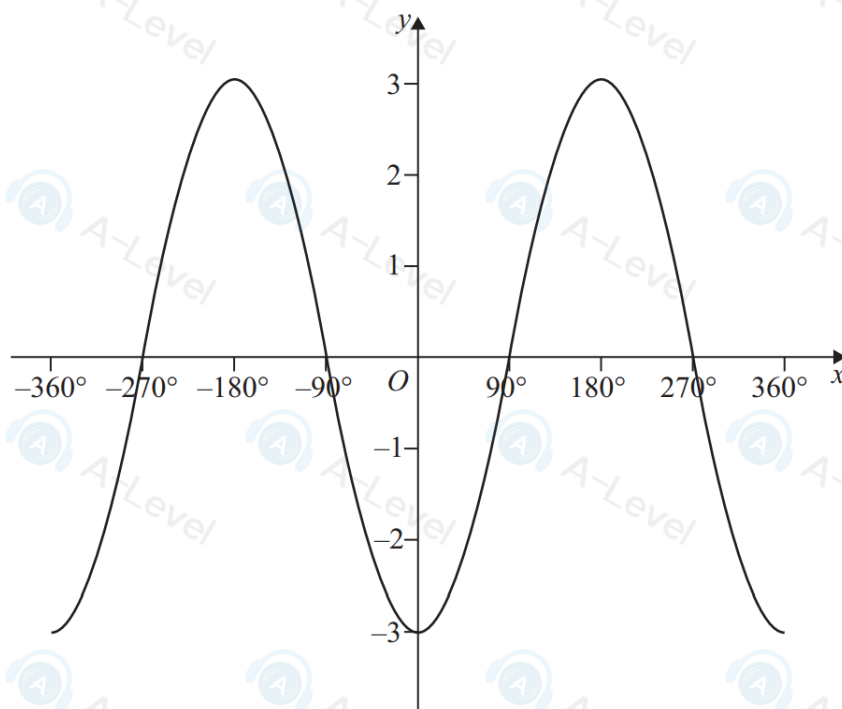
**Figure 2**

Figure 2 shows part of the graph of the trigonometric function with equation $y = f(x)$, where x is measured in degrees.

(a) Write down an expression for $f(x)$.

(2)

(b) State the number of solutions of the equation

(i) $f(x) = 2$ in the interval $-720^\circ \leq x \leq 720^\circ$

(ii) $f(x) = -3$ in the interval $-720^\circ \leq x \leq 720^\circ$

(2)

9.

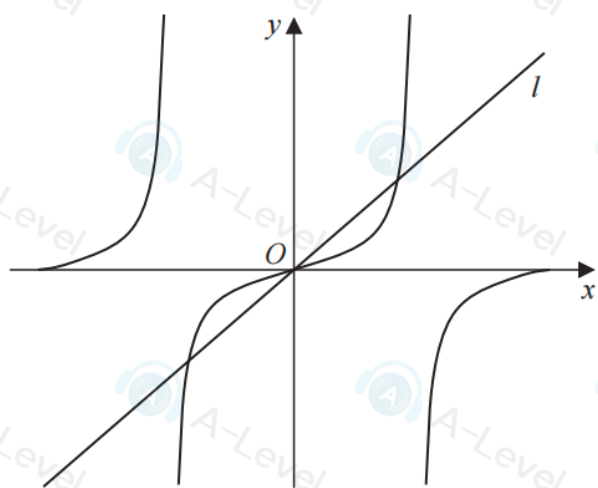
**Figure 3**

Figure 3 shows a sketch of

- the curve with equation $y = \tan x$
- the straight line l with equation $y = \pi x$

in the interval $-\pi < x < \pi$

(a) State the period of $\tan x$

(1)

(b) Write down the number of roots of the equation

(i) $\tan x = (\pi + 2)x$ in the interval $-\pi < x < \pi$

(1)

(ii) $\tan x = \pi x$ in the interval $-2\pi < x < 2\pi$

(1)

(iii) $\tan x = \pi x$ in the interval $-100\pi < x < 100\pi$

(1)

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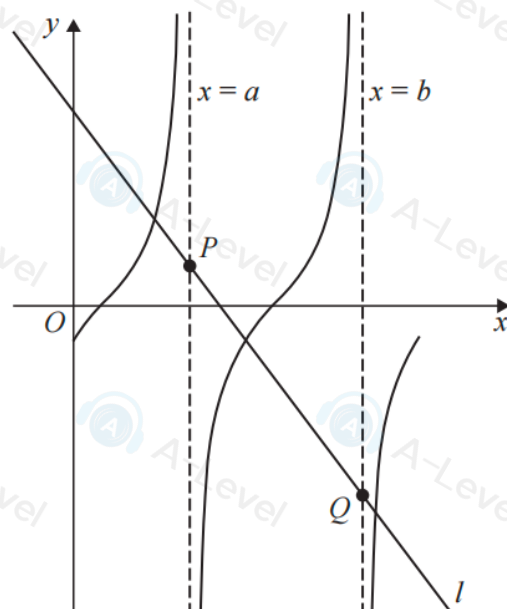


Figure 3

Figure 3 shows a sketch of

- the curve with equation $y = \tan\left(x - \frac{\pi}{6}\right)$ for $0 \leq x \leq 2\pi$
- part of the straight line l with equation $y = \pi - x$

(a) State the number of solutions of the equation

- $\tan\left(x - \frac{\pi}{6}\right) = \pi - x$ in the interval $0 \leq x \leq 2\pi$
- $\tan\left(x - \frac{\pi}{6}\right) = \pi - x$ in the interval $0 \leq x \leq 100\pi$
- $\tan\left(x - \frac{\pi}{6}\right) = \pi + x$ in the interval $0 \leq x \leq 2\pi$

(3)

The line with equation $x = a$, shown in Figure 3, is the asymptote to the curve with the smallest positive x coordinate.

(b) State the value of a

(1)

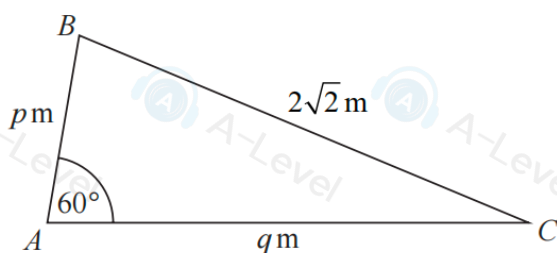
The line with equation $x = b$, also shown in Figure 3, is the asymptote to the curve with the second smallest positive x coordinate.

The line l meets $x = a$ at point P and meets $x = b$ at point Q as shown in Figure 3.

(c) Find the midpoint of the line segment PQ .

(4)

3. In this question you must show all stages of your working.
Solutions relying on calculator technology are not acceptable.



Not drawn
to scale

Figure 1

Figure 1 shows the plan view of a flower bed.
The flowerbed is in the shape of a triangle ABC with

- $AB = p$ metres
- $AC = q$ metres
- $BC = 2\sqrt{2}$ metres
- angle $BAC = 60^\circ$

(a) Show that

$$p^2 + q^2 - pq = 8 \quad (2)$$

Given that side AC is 2 metres longer than side AB , use algebra to find

- (b) (i) the exact value of p ,
(ii) the exact value of q .

(5)

Using the answers to part (b),

(c) calculate the exact area of the flower bed.

(2)

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3.

Diagram not
drawn to scale

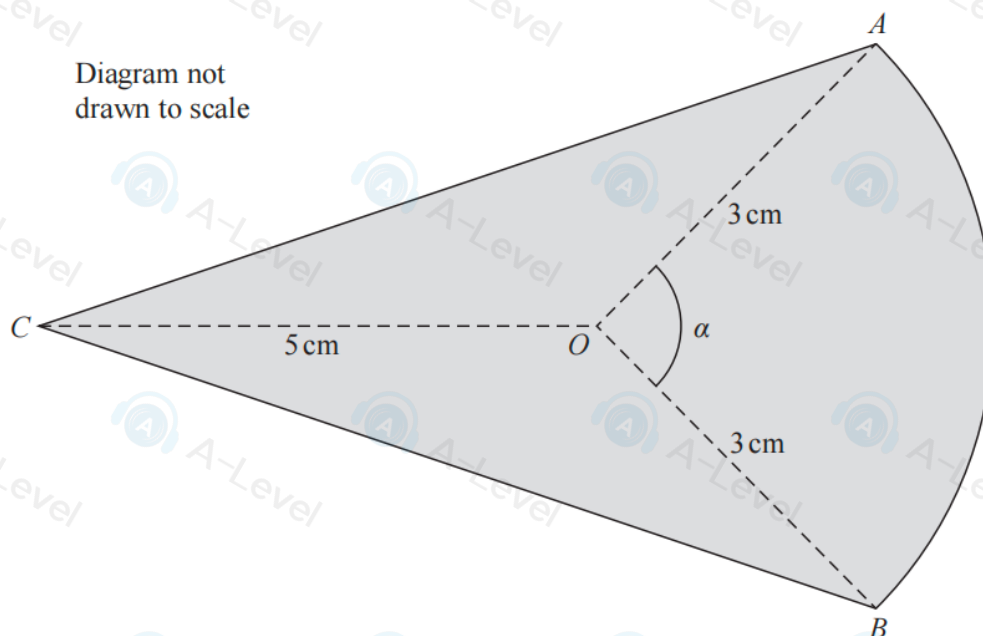


Figure 1

Figure 1 shows the design for a badge.

The design consists of two congruent triangles, AOC and BOC , joined to a sector AOB of a circle centre O .

- Angle $AOB = \alpha$
- $AO = OB = 3 \text{ cm}$
- $OC = 5 \text{ cm}$

Given that the area of sector AOB is 7.2 cm^2

(a) show that $\alpha = 1.6$ radians.

(2)

(b) Hence find

(i) the area of the badge, giving your answer in cm^2 to 2 significant figures,

(ii) the perimeter of the badge, giving your answer in cm to one decimal place.

(8)

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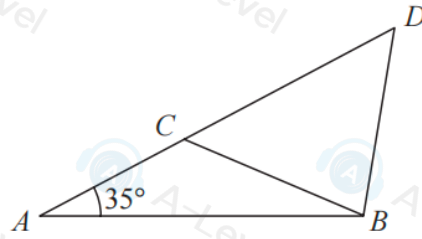


Figure 3

Not to scale

Figure 3 shows the design for a structure used to support a roof.

The structure consists of four wooden beams, AB , BD , BC and AD .

Given $AB = 6.5$ m, $BC = BD = 4.7$ m and angle $BAC = 35^\circ$

(a) find, to one decimal place, the size of angle ACB ,

(3)

(b) find, to the nearest metre, the total length of wood required to make this structure.

(3)