3. The share price of a company is monitored.

Exactly 3 years after monitoring began, the share price was £1.05

Exactly 5 years after monitoring began, the share price was £1.65

The share price, £V, of the company is modelled by the equation

$$V = pt + q$$

where t is the number of years after monitoring began and p and q are constants.

(a) Find the value of p and the value of q.

(3)

Exactly T years after monitoring began, the share price was £2.50

(b) Find the value of T, according to the model, giving your answer to one decimal place.

(2)

blank

4.

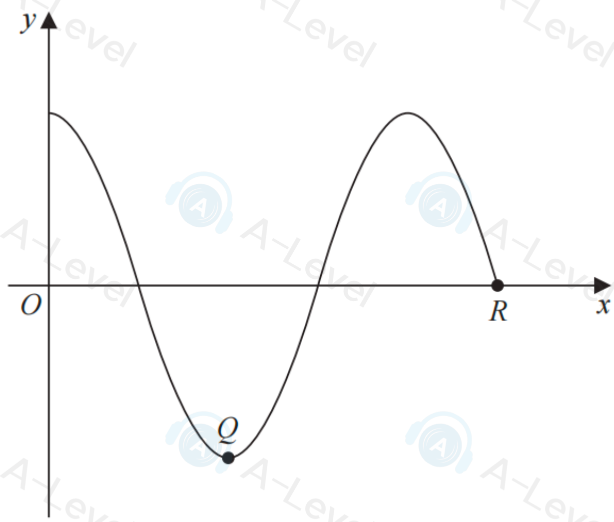

Figure 2

Figure 2 shows a sketch of the curve with equation $y = \mathrm{f}(x)$, where

$$\mathrm{f}(x) = \cos 2x^\circ \qquad 0 \leqslant x \leqslant k$$

The point Q and the point $R(k, 0)$ lie on the curve and are shown in Figure 2.

(a) State

(i) the coordinates of Q,

(ii) the value of k.

(3)

(b) Given that there are exactly two solutions to the equation

$$\cos 2x^\circ = p \qquad \text{in the region } 0 \leqslant x \leqslant k$$

find the range of possible values for p.

(2)

6.

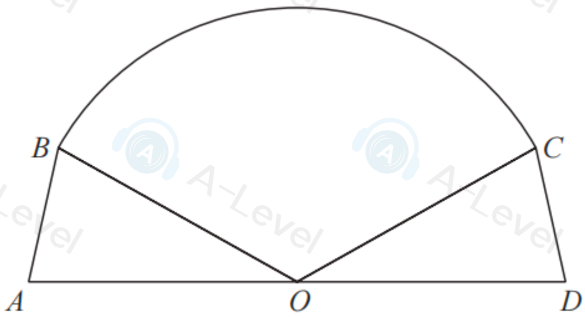

Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows the plan view for the design of a stage.

The design consists of a sector OBC of a circle, with centre O, joined to two congruent triangles OAB and ODC.

Given that

- angle $BOC = 2.4$ radians
- area of sector $BOC = 40\,\text{m}^2$
- AOD is a straight line of length 12.5 m

(a) find the radius of the sector, giving your answer, in m, to 2 decimal places, **(2)**

(b) find the size of angle AOB, in radians, to 2 decimal places. **(1)**

Hence find

(c) the total area of the stage, giving your answer, in m^2, to one decimal place, **(3)**

(d) the total perimeter of the stage, giving your answer, in m, to one decimal place. **(4)**

10.

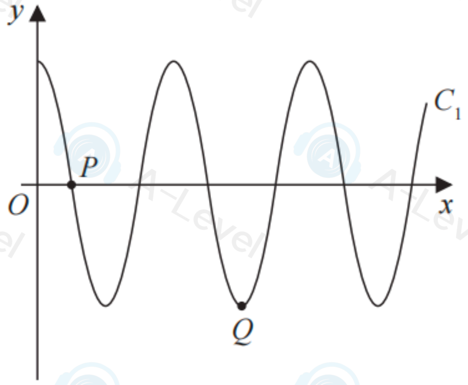

Figure 4

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

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

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)

10. **In this question you must show all stages of your working.**

Solutions relying on calculator technology are not acceptable.

The curve C has equation

$$y = \frac{2}{3}x^3 - 25x - \frac{56}{x} + \frac{194}{3} \qquad x > 0$$

The point P, which lies on C, has coordinates $(2, -8)$

(a) Show that an equation of the tangent to C at P is

$$y = -3x - 2$$

(5)

The point Q also lies on C.

Given that the tangent to C at Q is parallel to the tangent to C at P,

(b) find, using algebra and showing your working, the exact x coordinate of Q.

(5)

2. **In this question you must show all stages of your working.**

Solutions relying entirely on calculator technology are not acceptable.

A rectangular sports pitch has length x metres and width y metres, where $x > y$

Given that the perimeter of the pitch is 350 m,

(a) write down an equation linking x and y

(1)

Given also that the area of the pitch is $7350\,\text{m}^2$

(b) write down a second equation linking x and y

(1)

(c) hence find the value of x and the value of y

(4)

blank

10. A curve has equation $y = \mathrm{f}(x)$, where

$$\mathrm{f}(x) = (x - 4)(2x + 1)^2$$

The curve touches the x-axis at the point P and crosses the x-axis at the point Q.

(a) State the coordinates of the point P.

(1)

(b) Find $\mathrm{f}'(x)$.

(4)

(c) Hence show that the equation of the tangent to the curve at the point where $x = \frac{5}{2}$ can be expressed in the form $y = k$, where k is a constant to be found.

(3)

The curve with equation $y = \mathrm{f}(x + a)$, where a is a constant, passes through the origin O.

(d) State the possible values of a.

(2)

DO NOT WRITE IN THIS AREA

DO NO

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3. The line l_1 has equation $3x + 5y - 7 = 0$

(a) Find the gradient of l_1

(2)

The line l_2 is perpendicular to l_1 and passes through the point $(6, -2)$.

(b) Find the equation of l_2 in the form $y = mx + c$, where m and c are constants.

(3)

DO NOT WRITE IN TH

9.

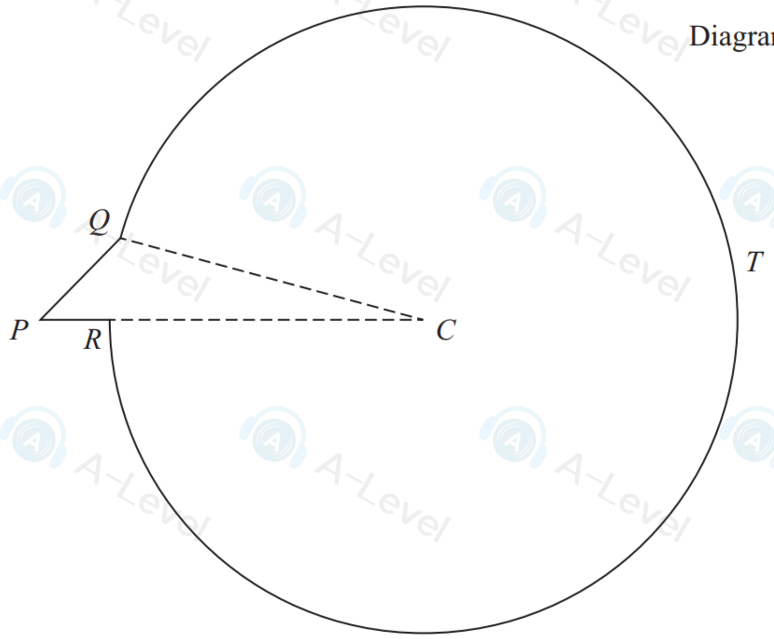

Figure 4

Figure 4 shows the outline of a sign that is used to advertise a bird sanctuary.

The sign is composed of a triangle CPQ joined to a sector $QCRTQ$ of a circle, centre C.

Given that

- angle $QPR = 0.8$ radians
- $PQ = 0.5\,\text{m}$
- $PC = 1.84\,\text{m}$
- PRC is a straight line

(a) find the radius, CQ, of the sector, in metres to 3 decimal places.

(2)

(b) Hence show that angle PCQ is 0.236 radians to 3 decimal places.

(2)

(c) Find the total area of the sign, giving your answer in m^2 to one decimal place.

(3)

(d) Find the total perimeter of the sign, giving your answer in metres to one decimal place.

(2)

4.

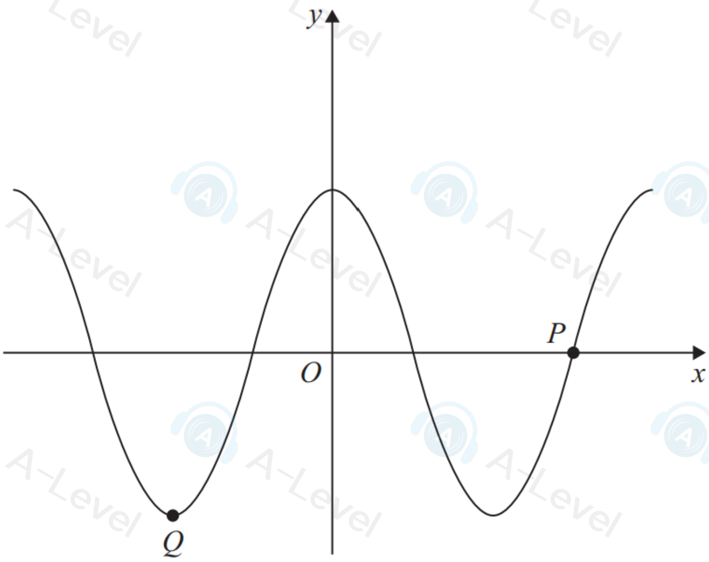

Figure 1

Figure 1 shows a sketch of part of the curve with equation

$$y = 4\cos x$$

where x is measured in degrees.

The points P and Q lie on the curve and are shown in Figure 1.

(a) State the coordinates of P.

(1)

(b) State the coordinates of Q.

(2)

(c) State the **number** of solutions of the equation

(i) $4\cos x = 3$ in the interval $0 < x \leqslant 18\,000°$

(ii) $5 + 4\cos x = 1$ in the interval $-720° < x \leqslant 720°$

(iii) $4\cos x - 3 = 1$ in the interval $-1080° \leqslant x \leqslant 1080°$

(3)

1. Given that

$$p = \frac{1}{16}x^4 \qquad q = \frac{40}{x^3}$$

express each of the following in the form kx^n where k and n are fully simplified constants.

(a) $p^{\frac{1}{2}}$

(1)

(b) $(pq)^{-1}$

(2)

(c) pq^2

(2)

3.

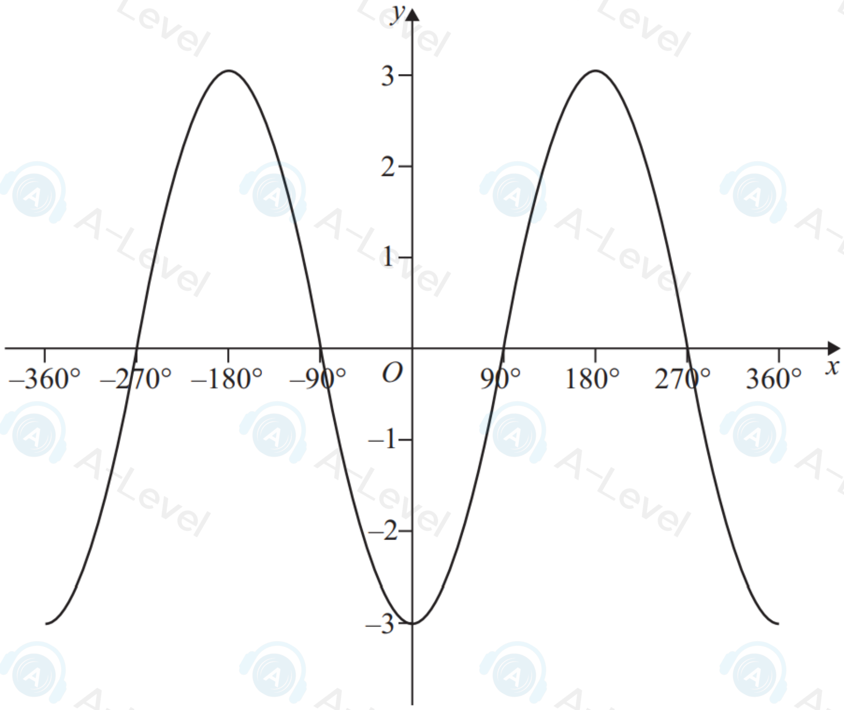

Figure 2

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

(a) Write down an expression for $\mathrm{f}(x)$.

(2)

(b) State the number of solutions of the equation

(i) $\mathrm{f}(x) = 2$ in the interval $-720° \leqslant x \leqslant 720°$

(ii) $\mathrm{f}(x) = -3$ in the interval $-720° \leqslant x \leqslant 720°$

(2)

Leave blank

8. The straight line l has equation $y = k(2x - 1)$, where k is a constant.

The curve C has equation $y = x^2 + 2x + 11$

Find the set of values of k for which l does not cross or touch C.

(6)