4.

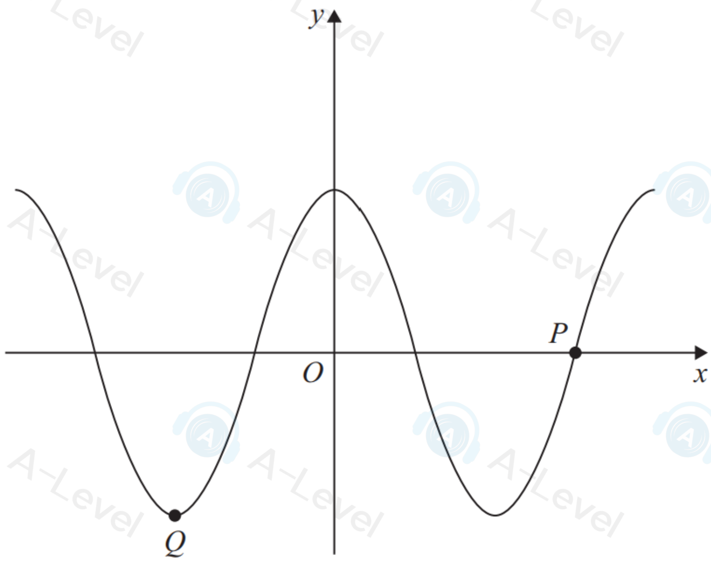

Figure 1

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)

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

The curve C has equation $y = \mathrm{f}(x), x > 0$

Given that

- the point $P\left(2, 8\sqrt{2}\right)$ lies on C
- $\mathrm{f}'(x) = 4\sqrt{x^3} + \dfrac{k}{x^2}$ where k is a constant
- $\mathrm{f}''(x) = 0$ at P

(a) find the exact value of k,

(4)

(b) find $\mathrm{f}(x)$, giving your answer in simplest form.

(4)

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

Solutions relying on calculator technology are not acceptable.

$$y = x^3 + 96\sqrt{x} + 5 \qquad x > 0$$

(a) Find $\dfrac{dy}{dx}$, giving each term in simplest form.

(3)

(b) Find the solution of the equation

$$\frac{d^2y}{dx^2} = 0$$

writing the answer in the form 2^k where k is a constant.

(3)

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

The curve C_1 has equation $y = (x + 5)(3x + 2)(2x - 5)$

The curve C_2 has equation $y = 3x^2 - 33x - 50$

Use algebra to find the x coordinates of the points of intersection of C_1 and C_2

(5)

9.

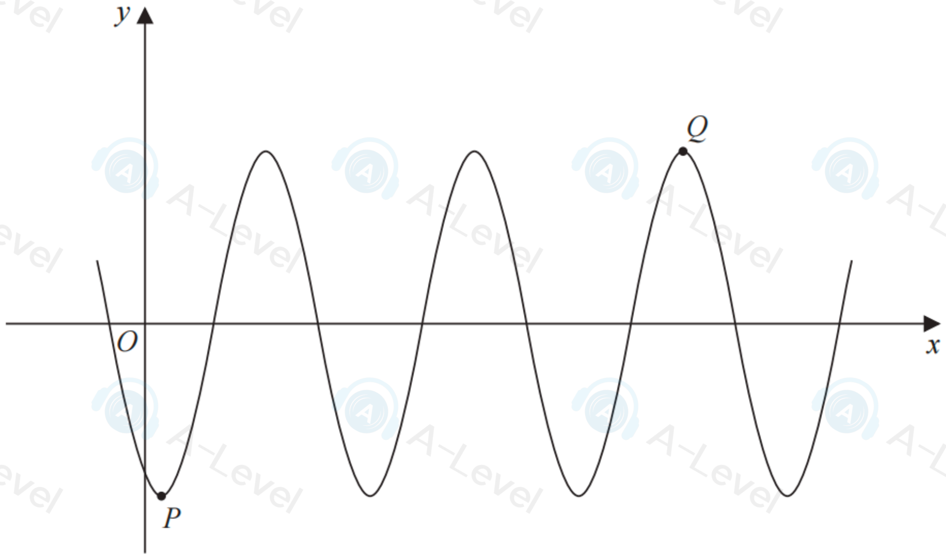

Figure 4

Figure 4 shows part of the curve with equation

$$y = A\cos(x - 30)°$$

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)

blank

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)

8.

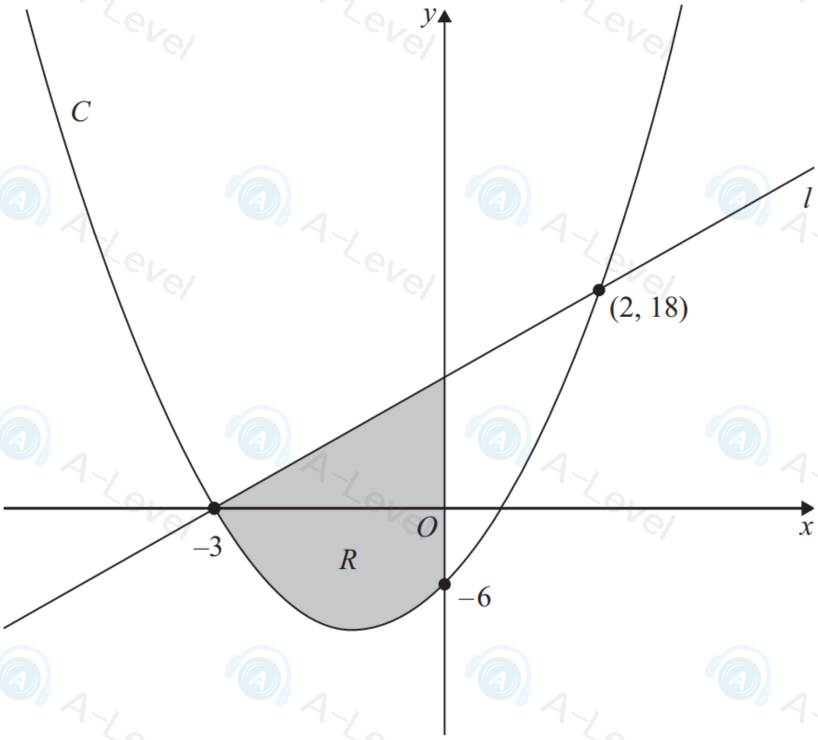

Figure 3

Figure 3 shows a sketch of a line l and a quadratic curve C.

Given that l passes through $(-3, 0)$ and $(2, 18)$

(a) find an equation for l in the form $y = mx + c$ where m and c are constants.

(3)

Given that

- C and l intersect at the points $(-3, 0)$ and $(2, 18)$
- C crosses the y-axis at $(0, -6)$

(b) find an equation for C.

(4)

The region R, shown shaded in Figure 3, is bounded by C, l and the y-axis.

(c) Use inequalities to define R.

(2)

11.

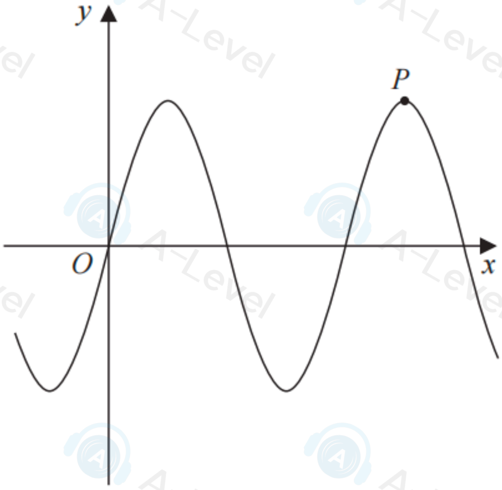

Figure 4

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

$$y = 12\sin x$$

where x is measured in radians.

The point P shown in Figure 4 is a maximum point on C_1

(a) Find the coordinates of P.

(2)

The curve C_2 has equation

$$y = 12\sin x + k$$

where k is a constant.

Given that the **maximum** value of y on C_2 is 3

(b) find the coordinates of the **minimum** point on C_2 which has the **smallest** positive x coordinate.

(2)

The curve C_3 has equation

$$y = 12\sin(x + B)$$

where B is a positive constant.

Given that $\left(\frac{\pi}{4}, A\right)$, where A is a constant, is the **minimum** point on C_3 which has the **smallest** positive x coordinate,

(c) find

(i) the value of A,

(ii) the smallest possible value of B.

(2)

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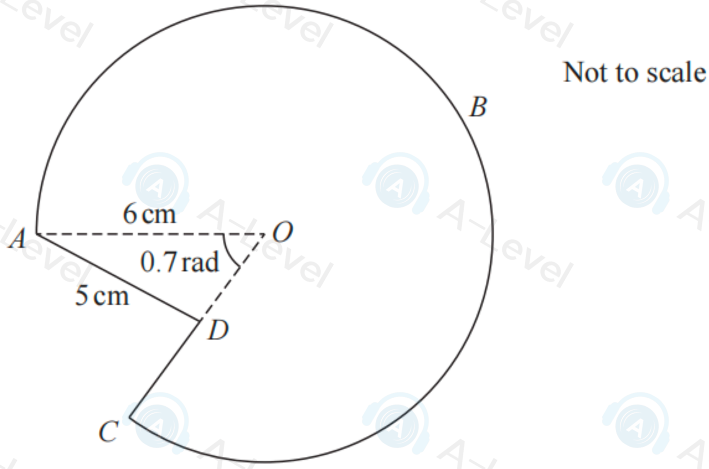

Figure 2

The shape $ABCDA$ consists of a sector $ABCOA$ of a circle, centre O, joined to a triangle AOD, as shown in Figure 2.

The point D lies on OC.

The radius of the circle is 6 cm, length AD is 5 cm and angle AOD is 0.7 radians.

(a) Find the area of the sector $ABCOA$, giving your answer to one decimal place.

(3)

Given angle ADO is obtuse,

(b) find the size of angle ADO, giving your answer to 3 decimal places.

(3)

(c) Hence find the perimeter of shape $ABCDA$, giving your answer to one decimal place.

(4)

4.

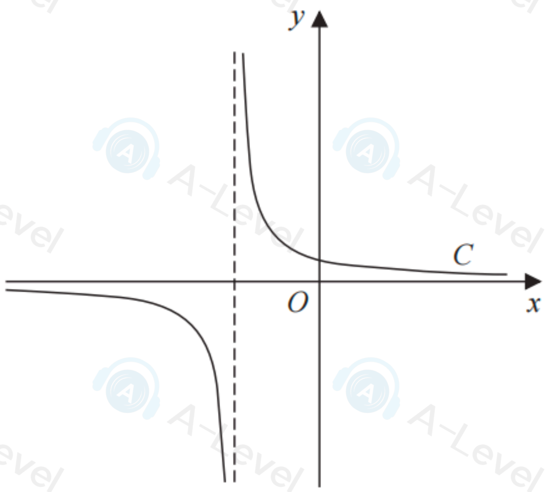

Figure 1

Figure 1 shows a sketch of part of the curve C with equation $y = \dfrac{1}{x+2}$

(a) State the equation of the asymptote of C that is parallel to the y-axis.

(1)

(b) Factorise fully $x^3 + 4x^2 + 4x$

(2)

A copy of Figure 1, labelled Diagram 1, is shown on the next page.

(c) On Diagram 1, add a sketch of the curve with equation

$$y = x^3 + 4x^2 + 4x$$

On your sketch, state clearly the coordinates of each point where this curve cuts or meets the coordinate axes.

(3)

(d) Hence state the number of real solutions of the equation

$$(x + 2)(x^3 + 4x^2 + 4x) = 1$$

giving a reason for your answer.

(1)

7.

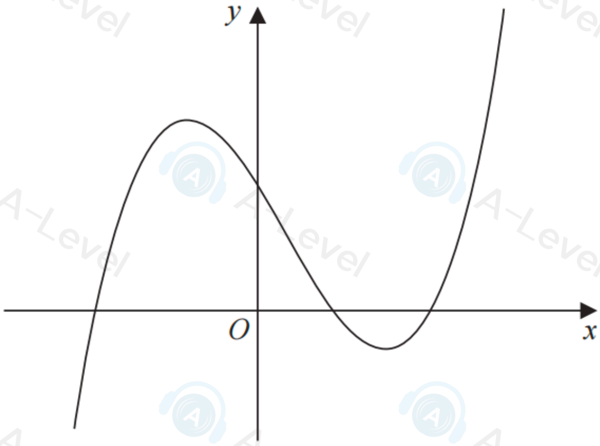

Figure 3

Figure 3 shows a sketch of part of the curve with equation $y = \mathrm{f}(x)$, where

$$\mathrm{f}(x) = (x + 4)(x - 2)(2x - 9)$$

Given that the curve with equation $y = \mathrm{f}(x) - p$ passes through the point with coordinates (0, 50)

(a) find the value of the constant p.

(2)

Given that the curve with equation $y = \mathrm{f}(x + q)$ passes through the origin,

(b) write down the possible values of the constant q.

(2)

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

(4)

(d) Hence find the range of values of x for which the gradient of the curve with equation $y = \mathrm{f}(x)$ is less than -18

(3)

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7 The first and second terms of an arithmetic progression are $\frac{1}{\cos^2\theta}$ and $-\frac{\tan^2\theta}{\cos^2\theta}$, respectively, where $0 < \theta < \frac{1}{2}\pi$.

(a) Show that the common difference is $-\frac{1}{\cos^4\theta}$. [4]

10. The curve C has equation $y = f(x)$.

Given that

- $f'(x) = \dfrac{k\sqrt{x}(x-3)}{5}$ where k is a constant
- the point P with x coordinate 4 lies on C
- the equation of the normal to C at P is $y = -\dfrac{5}{4}x + 2$

(a) find an equation of the tangent to C at P, giving your answer in the form $y = mx + c$, where m and c are constants,

(3)

(b) find the value of k,

(2)

(c) find $f(x)$, writing the answer in simplest form.

(5)