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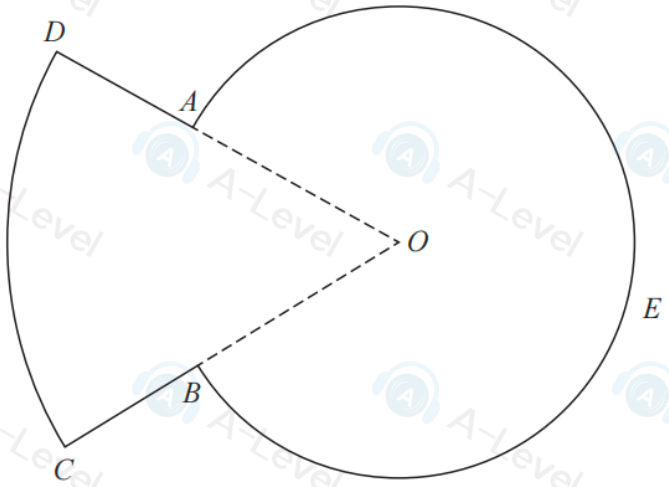

Figure 3

Figure 3 shows a sketch of the plan view of a platform.

The plan view of the platform consists of a sector DOC of a circle centre O joined to a sector $AOBEA$ of a different circle, also with centre O.

Given that

- angle $AOB = 0.8$ radians
- arc length $CD = 9\,\text{m}$
- $DA : AO = 3 : 5$

(a) show that $AO = 7.03\,\text{m}$ to 3 significant figures.

(3)

(b) Find the perimeter of the platform, in m, to 3 significant figures.

(3)

(c) Find the total area of the platform, giving your answer in m^2 to the nearest whole number.

(3)

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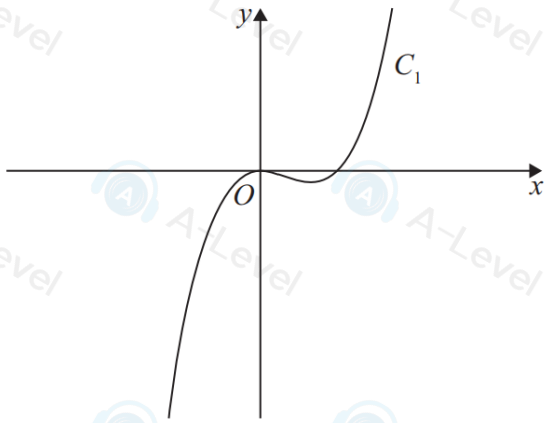

Figure 3

Figure 3 shows a sketch of part of the curve C_1

Given that C_1

- has equation $y = f(x)$ where $f(x)$ is a cubic function
- touches the x-axis at the origin and cuts the x-axis at $x = 4$
- passes through the point $(10, 120)$

(a) find $f(x)$

(3)

The curve C_2 has equation $y = 1.2x(8 - x)$

On the following page there is a copy of Figure 3 called Diagram 1.

(b) On Diagram 1 sketch a graph of the curve C_2

(2)

(c) Use algebra to find the coordinates of the points where C_1 and C_2 intersect. Show each stage of your working.

(5)

5.

$$y = \frac{1}{2}x^4 - 3 + \frac{10}{x^2} \qquad x \neq 0$$

(a) Find $\int y \, dx$ writing the answer in simplest form.

(3)

(b) (i) Find $\frac{dy}{dx}$ writing the answer in simplest form.

(3)

(ii) Hence find the exact solutions of the equation $\frac{dy}{dx} = 3$

(*Solutions relying on calculator technology are not acceptable.*)

(4)

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3.

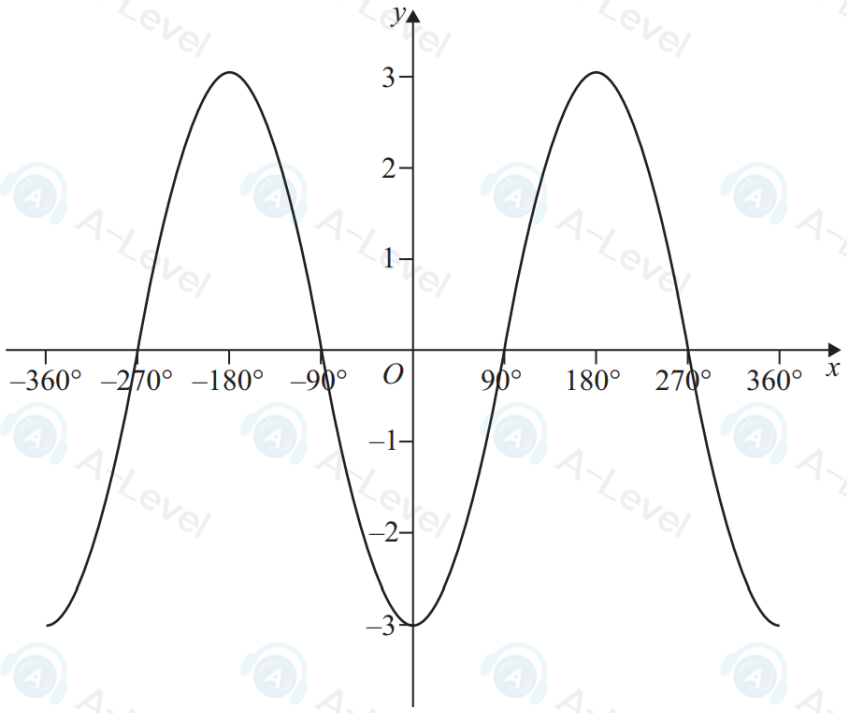

Figure 2

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 $-720° \leqslant x \leqslant 720°$

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

(2)

1. A curve has equation

$$y = 2x^3 - 5x^2 - \frac{3}{2x} + 7 \qquad x > 0$$

(a) Find, in simplest form, $\frac{dy}{dx}$

(3)

The point P lies on the curve and has x coordinate $\frac{1}{2}$

(b) Find an equation of the normal to the curve at P, writing your answer in the form $ax + by + c = 0$, where a, b and c are integers to be found.

(5)

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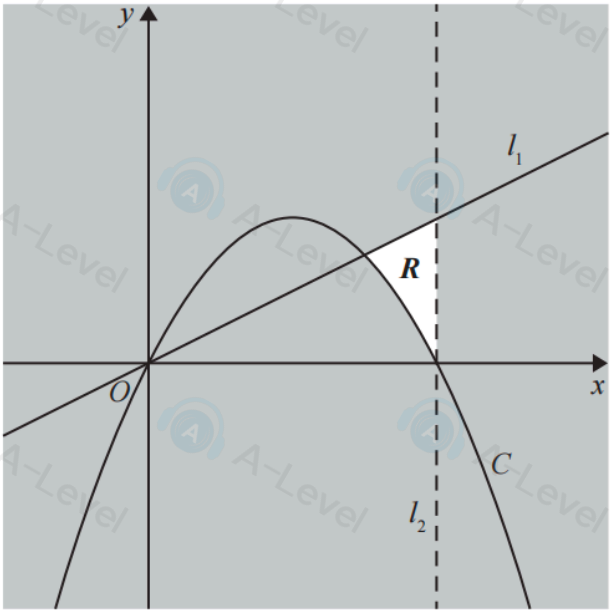

Figure 1

Figure 1 shows a line l_1 with equation $2y = x$ and a curve C with equation $y = 2x - \frac{1}{8}x^2$

The region R, shown unshaded in Figure 1, is bounded by the line l_1, the curve C and a line l_2

Given that l_2 is parallel to the y-axis and passes through the intercept of C with the positive x-axis, identify the inequalities that define R.

(3)

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1.

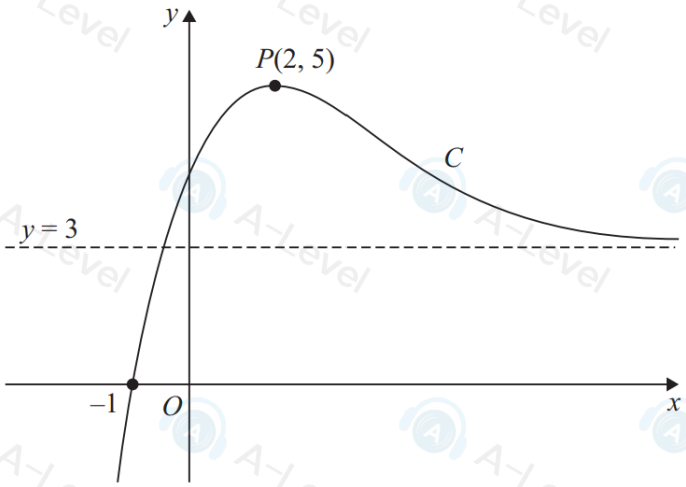

Figure 1

The curve C, shown in Figure 1,

- has equation $y = f(x), x \in \mathbb{R}$
- cuts the x-axis at -1
- has a maximum turning point at $P(2, 5)$
- has a horizontal asymptote with equation $y = 3$

The curve C has no other turning points or asymptotes.

(a) Find the coordinates of the point to which P is transformed when the curve with equation $y = f(x)$ is transformed to the curve with equation

(i) $y = f(x) + 7$

(ii) $y = 3f(x)$

(2)

Given that the line with equation $y = k$, where k is a constant, cuts or meets C exactly once,

(b) state the range of possible values of k.

(2)

(c) Write down the solution of the equation

$$f(x + 4) = 0$$

(1)

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