7.1 Applications of Differentiation

Question Paper

Course	Edexcel IAL Maths: Pure 2
Section	7. Differentiation
Topic	7.1 Applications of Differentiation
Difficulty	Medium

Time allowed: 40

Score: /30

Percentage: /100

Question 1

Find the values of x for which $f(x) = -9x^2 + 5x - 3$ is an increasing function.

[3 marks]

Question 2

Show that the function $f(x) = x^3 - 3x^2 + 6x - 7$ is increasing for all $x \in \mathbb{R}$.

[3 marks]

Question 3

A curve has the equation $y = x^3 - 12x + 7$.

(a) Find expressions for $\dfrac{dy}{dx}$ and $\dfrac{d^2y}{dx^2}$.
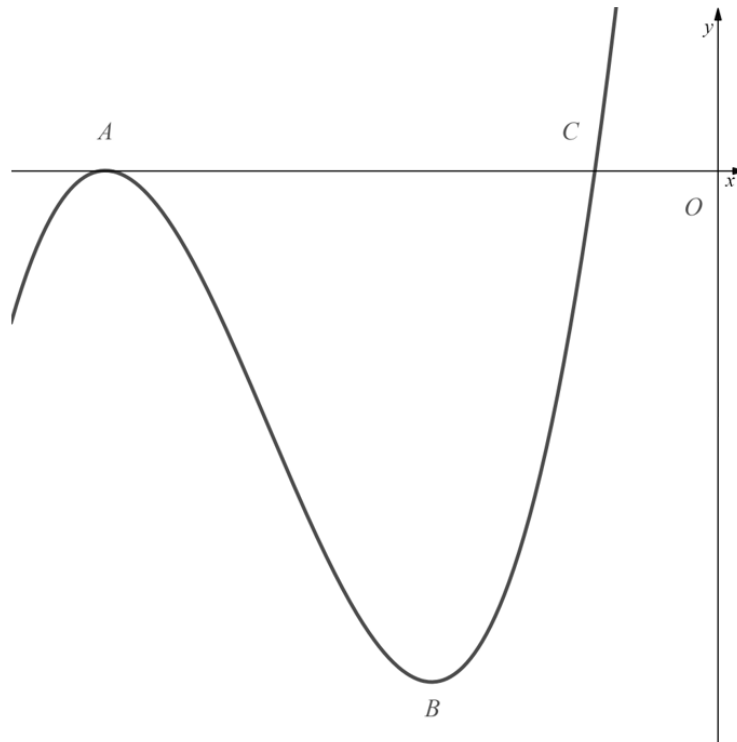
[3 marks]

Question 3

(b) Determine the coordinates of the local minimum of the curve.

[3 marks]

Question 4

The diagram below shows part of the curve with equation $y = x^3 + 11x^2 + 35x + 25$. The curve touches the x-axis at A and cuts the x-axis at C. The points A and B are stationary points on the curve.

(a) Using calculus, and showing all your working, find the coordinates of A and B.

[5 marks]

Question 4

(b) Show that $(-1, 0)$ is a point on the curve and explain why those must be the coordinates of point C.

[2 marks]

Question 5

A company manufactures food tins in the shape of cylinders which must have a constant volume of 150π cm^3. To lessen material costs the company would like to minimise the surface area of the tins.

(a) By first expressing the height h of the tin in terms of its radius r, show that the surface area of the cylinder is given by $S = 2\pi r^2 + \dfrac{300\pi}{r}$.

[2 marks]

Question 5

(b) Use calculus to find the minimum value for the surface area of the tins. Give your answer correct to 2 decimal places.

[4 marks]

Question 6

(a) Find the x-coordinates of the stationary points on the graph with equation $y = x^3 - 6x^2 + 9x - 1$.

[3 marks]

Question 6

(b) Find the nature of the stationary points found in part (a).

[2 marks]