7.1 Applications of Differentiation

Question Paper

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

Time allowed: 40

Score: /34

Percentage: /100

Question 1

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

[5 marks]

Question 2

Show that the function $f(x) = 7x^2 - 2x(x^2 + 5)$ is decreasing for all $x \in \mathbb{R}$.

[3 marks]

Question 3

A curve has the equation $y = x(x + 6)^2 + 4(3x + 11)$.

The point $P(x, y)$ is the stationary point of the curve.
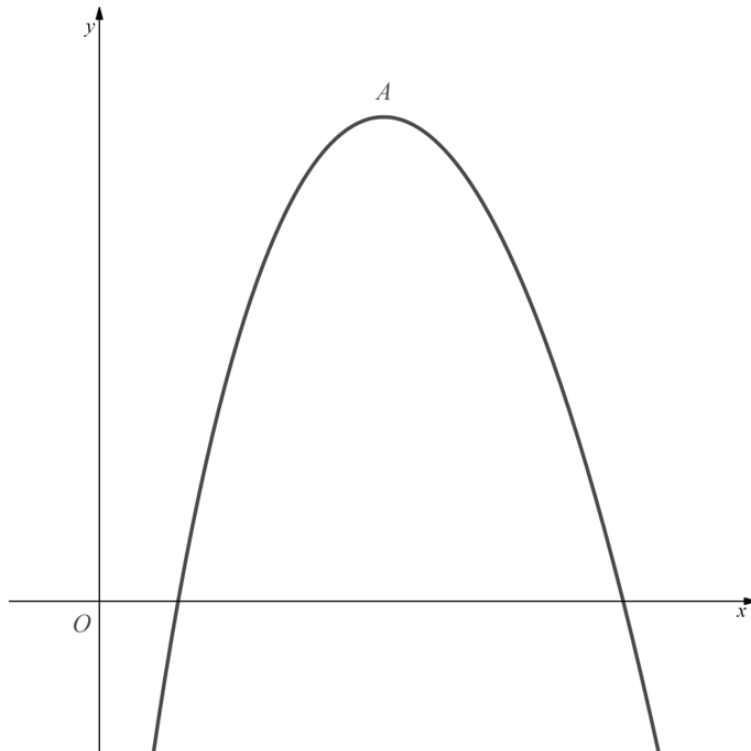
Find the coordinates of P and determine its nature.

[5 marks]

Question 4

The diagram below shows a part of the curve with equation $y = f(x)$, where

$$f(x) = 460 - \frac{x^3}{300} - \frac{8100}{x}, \qquad x > 0$$

Point A is the maximum point of the curve.
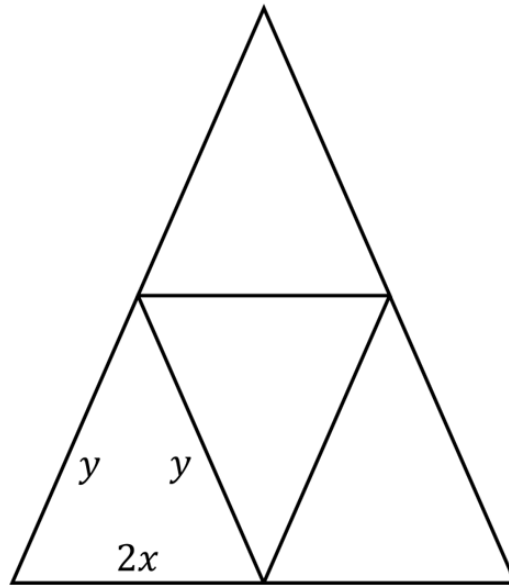

(a) Find $f'(x)$.

[3 marks]

Question 4

(b) Use your answer to part (a) to find the coordinates of point A.

[4 marks]

Question 5

A garden bed is to be divided by fencing into four identical isosceles triangles, arranged as shown in the diagram below:

The base of each triangle is $2x$ metres, and the equal sides are each y metres in length.

Although x and y can vary, the total amount of fencing to be used is fixed at P metres.

(a) Explain why $0 < x < \dfrac{P}{6}$.

[1 mark]

Question 5

(b) Show that
$$A^2 = \frac{4}{9}P^2x^2 - \frac{16}{3}Px^3$$
where A is the total area of the garden bed.

[4 marks]

Question 5

(c) Using your answer to (b) find, in terms of P, the maximum possible area of the garden bed.

[4 marks]

Question 5

(d) Describe the shape of the bed when the area has its maximum value.

[1 mark]

Question 6

Find the coordinates of the stationary points, and their nature, on the graph with equation $y = 4x - x^2 - 2x^3$.

[4 marks]