

Stationary Points, Increasing and Decreasing Functions

For AQA Level 2 Certificate in Further Mathematics (8365)

Name _____

Total marks: **34**

Answer **all** questions in the spaces provided. Show your working: marks are given for correct method. You may use a calculator.

1 A curve has equation $y = x^2 + \frac{16}{x}$

(a) Show that the curve has a stationary point when $x = 2$

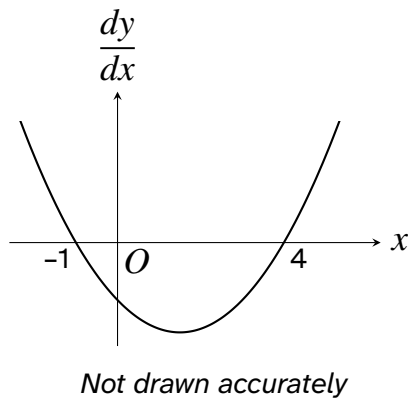
[2 marks]

(b) Use $\frac{d^2y}{dx^2}$ to determine the nature of this stationary point.
You must show your working.

[2 marks]

Answer _____

- 2 The sketch shows the graph of the gradient function $\frac{dy}{dx}$ for a curve $y = f(x)$



- (a) Write down the x -coordinates of the stationary points of the curve $y = f(x)$ [1 mark]

Answer _____

- (b) Which of these describes the curve $y = f(x)$ for $-1 < x < 4$?
Circle your answer.

[1 mark]

increasing

decreasing

increasing then decreasing

decreasing then increasing

- (c) Is the stationary point at $x = 4$ a maximum or a minimum? Tick one box.
Give a reason for your answer.

[1 mark]

☐

Maximum

☐

Minimum

- 3** The curve $y = 2x^3 + 9x^2 - 4$ has two stationary points.
Find both stationary points and determine the nature of each one.
You must show your working.

[5 marks]

Stationary point (_____ , _____) Nature _____

Stationary point (_____ , _____) Nature _____

- 4** $f(x) = x^3 - 6x^2 - 15x + 2$
For which values of x is $f(x)$ decreasing?
Give your answer as an inequality.

[3 marks]

Answer _____

5 f is a cubic function.

The curve $y = f(x)$ has a maximum point at $(-2, 6)$ and a minimum point at $(3, -4)$

Tick one box for each statement.

[2 marks]

$$\frac{dy}{dx} < 0 \text{ for } -2 < x < 3$$

The curve crosses the x -axis only once

The tangent at $(3, -4)$ is the line $y = -4$

$$\frac{d^2y}{dx^2} > 0 \text{ when } x = -2$$

True

False

☐☐☐☐☐☐☐☐

6 f is a cubic function.

The curve $y = f(x)$

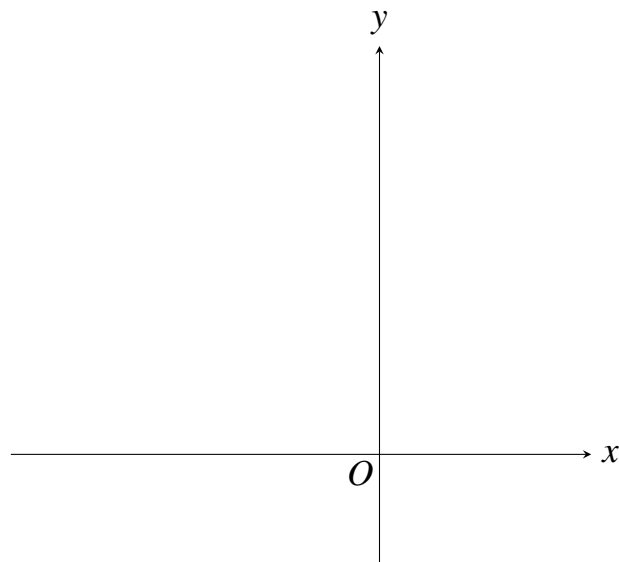
has a maximum point at $P(-3, 32)$

has a minimum point at $Q(1, 0)$

crosses the y -axis at $R(0, 5)$

On the axes, sketch the curve.

Label P , Q and R on your sketch.



[3 marks]

- 7 $f(x) = x^3 - 9x^2 + 30x + 7$
Show that $f(x)$ is increasing for every value of x .

[4 marks]

- 8 $g(x) = kx^3 - 6x^2 + 3x$, where k is a positive constant.
 $g(x)$ is increasing for every value of x .
Work out the range of values of k .
Give your answer as an inequality.

[4 marks]

Answer _____

9 The point $(2, -7)$ is a stationary point on the curve $y = x^3 + px^2 + qx + 1$

(a) Work out the values of p and q .

[4 marks]

Answer $p = \underline{\hspace{2cm}}$ $q = \underline{\hspace{2cm}}$

(b) Work out the x -coordinate of the other stationary point of the curve.

[2 marks]

Answer $\underline{\hspace{2cm}}$