

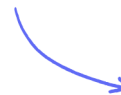
Calculator Questions

Differentiation

Differentiation / Finding Stationary Points & Turning Points / Classifying Stationary Points / Problem Solving with Differentiation

Medium (3 questions)	/12
Hard (4 questions)	/35
Very Hard (3 questions)	/19
Total Marks	/66

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Medium Questions

1 $y = 2x^k + ux^7$ and $\frac{dy}{dx} = 18x^{k-1} + 21x^6$

Find the value of k and the value of u .

$$k = \dots\dots\dots$$

$$u = \dots\dots\dots$$

(2 marks)

2 Calculate the gradient of $y = 24 + 5x - x^2$ at $x = -1.5$.

(3 marks)

3 (a) A curve has equation $y = x^3 + \frac{7}{2}x^2 - 2x + 9$

Find $\frac{dy}{dx}$.

(2 marks)

(b) Find the gradient of the curve at the point where:

(i) $x = -3$

[2]

(ii) $x = \frac{2}{3}$

[2]

(4 marks)

(c) What can you say about the tangents to the curves at these two points?

(1 mark)

Hard Questions

1 (a) A curve has the equation $y = x^3 + 8x^2 + 5x$.

Work out the coordinates of the two turning points.

(..... ,) and (..... ,)

(9 marks)

(b) Determine whether each of the turning points is a maximum or a minimum. Give reasons for your answers.

(3 marks)

2 A curve has equation $y = 4x^3 - 3x + 3$.

i) Find the coordinates of the two stationary points.

(..... ,) and (..... ,) [5]

ii) Determine whether each of the stationary points is a maximum or a minimum. Give reasons for your answers.

[3]

(8 marks)

3 (a) A curve has equation $y = x^3 - 6x^2 + 16$.

Find the coordinates of the two turning points.

(..... ,) and (..... ,)

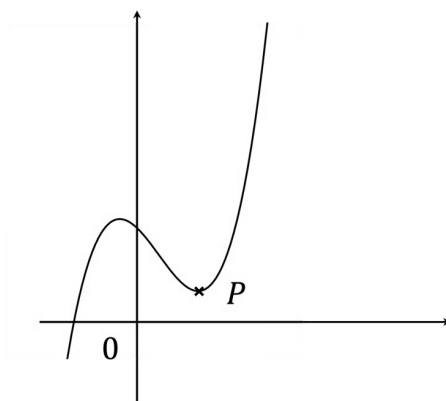
(6 marks)

(b) Determine whether each of the turning points is a maximum or a minimum.

Give reasons for your answers.

(3 marks)

4 (a)



The diagram above shows a sketch of a curve with equation $y = 2x^3 - 2x^2 - 3x + 5$.

The point P is the turning point of the curve. The x -coordinate of P is positive.

Find the x -coordinate of the point P .

(4 marks)

(b) Using the second derivative, show that the point P is a local minimum.

(2 marks)

Very Hard Questions

- 1 The curve **C** has equation $y = ax^3 + bx^2 - 12x + 6$ where a and b are constants.

The point **A** with coordinates $(2, -6)$ lies on **C**.

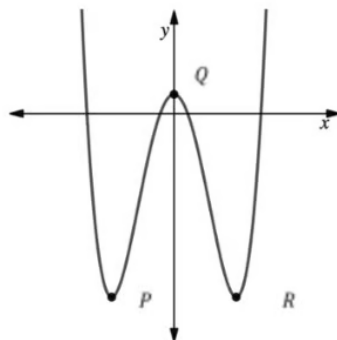
The gradient of the curve at **A** is 16.

Find the y coordinate of the point on the curve whose x coordinate is 3.

Show clear algebraic working.

(6 marks)

- 2 Part of the graph with equation $y = 2x^4 - 16x^2 + 3$ is shown below.



The graph has three stationary points, indicated on the graph by points P, Q and R. Find the area of the triangle PQR .

(7 marks)

3 (a) The curve **C** has equation $y = 5x^3 - x^2 - 6x + 4$.

Find $\frac{dy}{dx}$.

$$\frac{dy}{dx} = \dots\dots\dots$$

(2 marks)

(b) There are two points on the curve **C** at which the gradient of the curve is 2.

Find the x coordinate of each of these two points. Show clear algebraic working.

(4 marks)