

Tangents, normals and stationary points

AS Pure Mathematics | Edexcel 8MA0 | 12 questions, 74 marks

A-level Maths topic practice



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Name: _____ **Date:** _____ **Score:** _____ / 74

1 The curve C has equation $y = x^3 - 4x + 1$

Find an equation of the tangent to C at the point where $x = 2$, giving your answer in the form $y = mx + c$

(4 marks)

Answer _____

2 The point $P(3, 6)$ lies on the curve with equation $y = 2x^2 - 5x + 3$

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

(4 marks)

Answer _____

3 $f(x) = x^3 + 3x^2 - 24x + 5$

Find the set of values of x for which $f(x)$ is a decreasing function.

(4 marks)

Answer _____

4

The curve C has equation $y = x^3 - 6x^2 + 9x + 2$

- Find the coordinates of the stationary points of C
- Determine the nature of each stationary point, giving a reason for your answer.

(6 marks)

Answer _____

5

A curve has equation $y = x^2 + \frac{16}{x}$, $x > 0$

a. Find (i) $\frac{dy}{dx}$ (ii) $\frac{d^2y}{dx^2}$

b. Verify that the curve has a stationary point when $x = 2$

c. Determine the nature of this stationary point, giving a reason for your answer.

(7 marks)

Answer _____

6

$f(x) = x^3 - 3x^2 + 5x - 7$

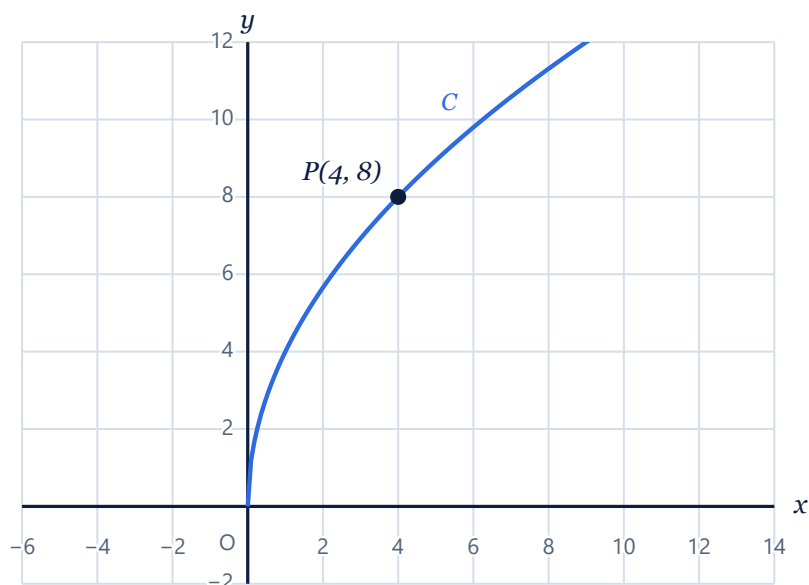
Prove that $f(x)$ is an increasing function for all real values of x

(4 marks)

Answer _____

7 The curve C has equation $y = 4\sqrt{x}$, $x > 0$. The point $P(4, 8)$ lies on C .

- Find an equation of the tangent to C at P
- Find an equation of the normal to C at P
- The tangent and the normal meet the x -axis at A and B . Find the area of triangle APB



(7 marks)

Answer _____

8 The curve C has equation $y = 2x^3 - 9x^2 + 12x - 1$

Find equations of the two tangents to C that are parallel to the line $y = 12x$

(5 marks)

Answer _____

9

The curve with equation $y = ax^3 + bx^2 - 4$, where a and b are constants, has a stationary point at $(2, -12)$

- Find the value of a and the value of b
- Find the coordinates of the other stationary point and determine the nature of both stationary points.

(7 marks)

Answer _____

10

A closed gift box is a cuboid with a square base of side x cm and a height of h cm. The volume of the box is 500 cm^3 .

- Show that the surface area, $A \text{ cm}^2$, of the box is given by $A = 2x^2 + \frac{2000}{x}$
- Use calculus to find the minimum value of A , giving your answer to 3 significant figures.
- Justify that the value you found is a minimum.

(9 marks)

Answer _____

11

An open box is made from a rectangular sheet of metal 24 cm by 15 cm. A square of side x cm is cut from each corner and the sides are folded up.

- Show that the volume, $V \text{ cm}^3$, of the box is $V = 4x^3 - 78x^2 + 360x$
- State the range of possible values of x
- Use calculus to find the maximum volume of the box, justifying that it is a maximum.

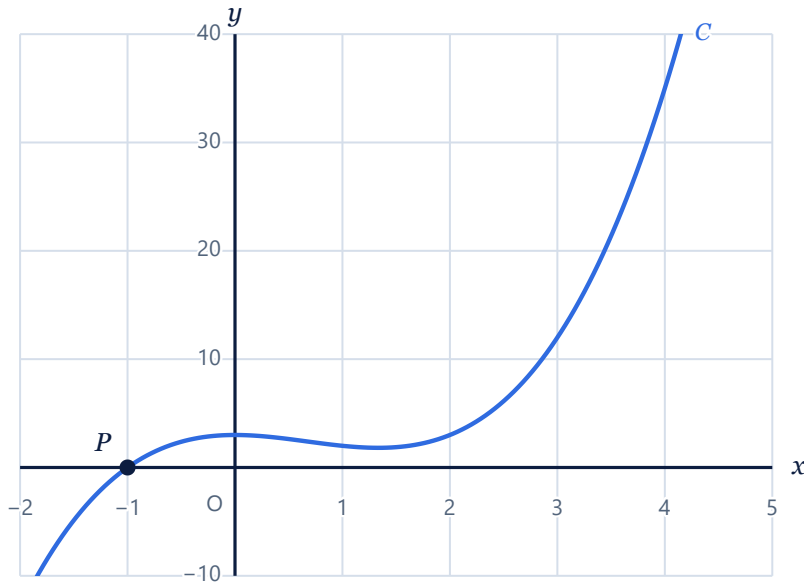
(8 marks)

Answer

12

The curve C has equation $y = x^3 - 2x^2 + 3$. The point P on C has x -coordinate -1

- Show that the tangent to C at P has equation $y = 7x + 7$
- The tangent meets C again at the point Q . Show that the x -coordinates of P and Q satisfy $x^3 - 2x^2 - 7x - 4 = 0$ and hence find the coordinates of Q
- Find the exact length of PQ , giving your answer as a simplified surd.



(9 marks)

Answer _____

End of questions | Total 74 marks