C1 Differentiation

1. **June 2010 qu. 6**

Find the gradient of the curve $y = 2x + \dfrac{6}{\sqrt{x}}$ at the point where $x = 4$. [5]

2. **June 2010 qu. 10**

(i) Find the coordinates of the stationary points of the curve $y = 2x^3 + 5x^2 - 4x$. [6]

(ii) State the set of values for x for which $2x^3 + 5x^2 - 4x$ is a decreasing function. [2]

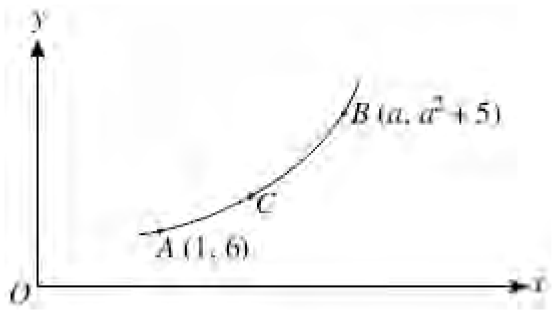
(iii) Show that the equation of the tangent to the curve at the point where $x = \dfrac{1}{2}$ is $10x - 4y - 7 = 0$. [4]

(iv) Hence, with the aid of a sketch, show that the equation $2x^3 + 5x^2 - 4x = \dfrac{5}{2}x - \dfrac{7}{4}$ has two distinct real roots. [2]

3. **Jan 2010 qu. 3**

Find the equation of the normal to the curve $y = x^3 - 4x^2 + 7$ at the point $(2, -1)$, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers. [7]

4. **Jan 2010 qu. 6**



Not to scale

The diagram shows part of the curve $y = x^2 + 5$. The point A has coordinates $(1, 6)$. The point B has coordinates $(a, a^2 + 5)$, where a is a constant greater than 1. The point C is on the curve between A and B.

(i) Find by differentiation the value of the gradient of the curve at the point A. [2]

(ii) The line segment joining the points A and B has gradient 2.3. Find the value of a. [4]

(iii) State a possible value for the gradient of the line segment joining the points A and C. [1]

5. **Jan 2010 qu. 9**

Given that $f(x) = \dfrac{1}{x} - \sqrt{x} + 3$,

(i) find $f'(x)$, [3]

(ii) find $f''(4)$. [5]

6. **June 2009 qu. 1**

Given that $y = x^5 + \dfrac{1}{x^2}$, find

(i) $\dfrac{dy}{dx}$, [3]

(ii) $\dfrac{d^2y}{dx^2}$. [2]

7. **June 2009 qu. 10**

(i) Solve the equation $9x^2 + 18x - 7 = 0$. [3]

(ii) Find the coordinates of the stationary point on the curve $y = 9x^2 + 18x - 7$. [4]

(iii) Sketch the curve $y = 9x^2 + 18x - 7$, giving the coordinates of all intercepts with the axes. [3]

(iv) For what values of x does $9x^2 + 18x - 7$ increase as x increases? [1]

8. June 2009 qu. 11

The point P on the curve $y = k\sqrt{x}$ has x-coordinate 4. The normal to the curve at P is parallel to the line $2x + 3y = 0$.

(i) Find the value of k. [6]

(ii) This normal meets the x-axis at the point Q. Calculate the area of the triangle OPQ, where O is the point (0, 0). [5]

9. Jan 2009 qu. 5

Find $\frac{dx}{dy}$ in each of the following cases:

(i) $y = 10x^{-5}$, [2]

(ii) $y = \sqrt[4]{x}$, [3]

(iii) $y = x(x + 3)(1 - 5x)$. [4]

10. Jan 2009 qu. 9

The curve $y = x^3 + px^2 + 2$ has a stationary point when $x = 4$. Find the value of the constant p and determine whether the stationary point is a maximum or minimum point. [7]

11. Jan 2009 qu. 10

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

(i) Find the gradient of the curve at the point for which $x = 2$. [2]

(ii) Find the equation of the normal to the curve at the point for which $x = 2$, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers. [4]

(iii) Find the values of k for which the line $y = kx - 4$ is a tangent to the curve. [6]

12. June 2008 qu. 5

Find the gradient of the curve $y = 8\sqrt{x} + x$ at the point whose x-coordinate is 9. [5]

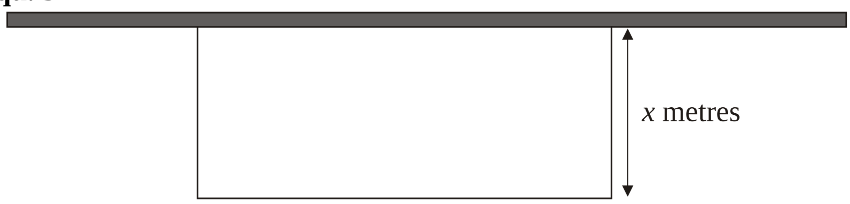
13. Jan 2008 qu. 8

(i) Find the coordinates of the stationary points on the curve $y = x^3 + x^2 - x + 3$. [6]

(ii) Determine whether each stationary point is a maximum point or a minimum point. [3]

(iii) For what values of x does $x^3 + x^2 - x + 3$ decrease as x increases? [2]

14. June 2007 qu. 5



The diagram shows a rectangular enclosure, with a wall forming one side. A rope, of length 20 metres, is used to form the remaining three sides. The width of the enclosure is x metres.

(i) Show that the enclosed area, A m^2, is given by

$$A = 20x - 2x^2.$$ [2]

(ii) Use differentiation to find the maximum value of A. [4]

15. **Jan 2007 qu. 7**

Find $\frac{dy}{dx}$ in each of the following cases.

(i) $y = 5x + 3$ [1]

(ii) $y = \frac{2}{x^2}$ [3]

(iii) $y = (2x + 1)(5x - 7)$ [4]

16. **June 2006 qu. 1**

The points A (1, 3) and B (4, 21) lie on the curve $y = x^2 + x + 1$.

(i) Find the gradient of the line AB. [2]

(ii) Find the gradient of the curve $y = x^2 + x + 1$ at the point where $x = 3$. [2]

17. **June 206 qu. 8**

A cuboid has a volume of 8 m^3. The base of the cuboid is square with sides of length x metres. The surface area of the cuboid is A m^2.

(i) Show that $A = 2x^2 + \frac{32}{x}$. [3]

(ii) Find $\frac{dA}{dx}$. [3]

(iii) Find the value of x which gives the smallest surface area of the cuboid, justifying your answer. [4]

18. **Jan 2006 qu. 6**

(i) Find the coordinates of the stationary points on the curve $y = x^3 - 3x^2 + 4$. [6]

(ii) Determine whether each stationary point is a maximum point or a minimum point. [3]

(iii) For what values of x does $x^3 - 3x^2 + 4$ increase as x increases? [2]

19. **June 2005 qu. 10**

(i) Given that $y = \frac{1}{3}x^3 - 9x$, find $\frac{dy}{dx}$. [2]

(ii) Find the coordinates of the stationary points on the curve $y = \frac{1}{3}x^3 - 9x$. [3]

(iii) Determine whether each stationary point is a maximum point or a minimum point. [3]

(iv) Given that $24x + 3y + 2 = 0$ is the equation of the tangent to the curve at the point (p, q), find p and q. [5]