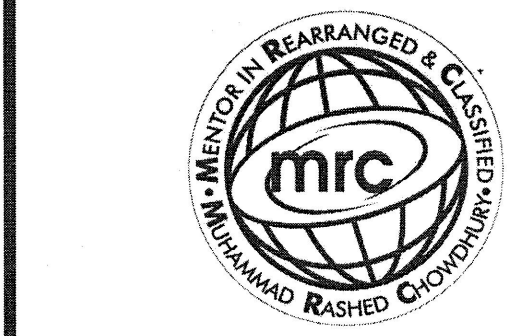

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International Examinations Papers
Mob: +974 55373670 / 33787500
E-mail:chymrc.muhammad@gmail.com

MODULAR MATHEMATICS/CORE-1

TOPIC-Differentiation Application

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6. The curve C has equation

$$y = \frac{(x+3)(x-8)}{x} \quad , \quad x > 0$$

(a) Find $\frac{dy}{dx}$ in its simplest form.

(4)

(b) Find an equation of the tangent to C at the point where $x = 2$

(4)

Ja-10

Leave blank

10. The curve C has equation

$$y = (x+1)(x+3)^2$$

(a) Sketch C, showing the coordinates of the points at which C meets the axes.

(4)

(b) Show that $\frac{dy}{dx} = 3x^2 + 14x + 15$.

(3)

The point A, with x-coordinate -5, lies on C.

(c) Find the equation of the tangent to C at A, giving your answer in the form $y = mx + c$, where m and c are constants.

(4)

Another point B also lies on C. The tangents to C at A and B are parallel.

(d) Find the x-coordinate of B.

Jan-11

(3)

Leave blank

6. The curve C has equation

$$y = \frac{(x^2 + 4)(x - 3)}{2x}, \quad x \neq 0$$

JN-15

(a) Find $\frac{dy}{dx}$ in its simplest form.

(5)

(b) Find an equation of the tangent to C at the point where $x = -1$

Give your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(5)

Leave blank

11. Given that

$$f(x) = 2x^2 + 8x + 3$$

(a) find the value of the discriminant of $f(x)$.

(2)

(b) Express $f(x)$ in the form $p(x + q)^2 + r$ where p, q and r are integers to be found.

(3)

The line $y = 4x + c$, where c is a constant, is a tangent to the curve with equation $y = f(x)$.

(c) Calculate the value of c.

JN-14

(5)

Leave blank

11. The curve C has equation

$$y = \frac{1}{2}x^3 - 9x^{\frac{3}{2}} + \frac{8}{x} + 30, \qquad x > 0$$

(a) Find $\frac{dy}{dx}$.

(4)

(b) Show that the point $P(4,-8)$ lies on C.

(2)

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

Ja-11

(6)

Leave blank

11. The curve C has equation $y = 2x^3 + kx^2 + 5x + 6$, where k is a constant.

(a) Find $\frac{dy}{dx}$

(2)

The point P, where $x = -2$, lies on C.

The tangent to C at the point P is parallel to the line with equation $2y - 17x - 1 = 0$

Find

(b) the value of k,

$\mathcal{J}_{\mathcal{N}} - 16$ **(4)**

(c) the value of the y coordinate of P,

(2)

(d) the equation of the tangent to C at P, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(2)

Leave blank

10. Given that

$$f(x) = x^2 - 6x + 18, \quad x \geqslant 0,$$

(a) express $f(x)$ in the form $(x - a)^2 + b$, where a and b are integers.

(3)

The curve C with equation $y = f(x)$, $x \geqslant 0$, meets the y-axis at P and has a minimum point at Q.

(b) In the space provided on page 19, sketch the graph of C, showing the coordinates of P and Q.

J6-05 **(4)**

The line $y = 41$ meets C at the point R.

(c) Find the x-coordinate of R, giving your answer in the form $p + q\sqrt{2}$, where p and q are integers.

(5)

Leave blank

9. The gradient of the curve C is given by

$$\frac{dy}{dx} = (3x-1)^2.$$

Jan-05

The point $P(1, 4)$ lies on C.

(a) Find an equation of the normal to C at P.

(4)

(b) Find an equation for the curve C in the form $y = f(x)$.

(5)

(c) Using $\frac{dy}{dx} = (3x-1)^2$, show that there is no point on C at which the tangent is parallel to the line $y = 1 - 2x$.

(2)

Leave blank

7. The curve C has equation $y = 4x^2 + \frac{5-x}{x}$, $x \neq 0$. The point P on C has x-coordinate 1.

(a) Show that the value of $\frac{dy}{dx}$ at P is 3.

(5)

(b) Find an equation of the tangent to C at P.

(3)

This tangent meets the x-axis at the point $(k, 0)$.

(c) Find the value of k.

(2)

Leave blank

8. The curve C has equation $y = 4x + 3x^{\frac{3}{2}} - 2x^2, \quad x > 0.$

(a) Find an expression for $\frac{dy}{dx}$.

(3)

(b) Show that the point P (4, 8) lies on C.

(1)

(c) Show that an equation of the normal to C at the point P is

$$3y = x + 20.$$

(4)

The normal to C at P cuts the x-axis at the point Q.

(d) Find the length PQ, giving your answer in a simplified surd form.

(3)

Leave blank

9. The curve C has equation $y = f(x)$, $x > 0$, and $f'(x) = 4x - 6\sqrt{x} + \frac{8}{x^2}$.

Given that the point $P(4, 1)$ lies on C,

(a) find $f(x)$ and simplify your answer.

(6)

(b) Find an equation of the normal to C at the point $P(4, 1)$.

Ja-08

(4)

Leave blank

5. (a) Write $\frac{2\sqrt{x}+3}{x}$ in the form $2x^p+3x^q$ where p and q are constants.

Ja-08 **(2)**

Given that $y = 5x - 7 + \frac{2\sqrt{x}+3}{x}$, $x > 0$,

(b) find $\frac{dy}{dx}$, simplifying the coefficient of each term.

(4)