CLASSIFIED

International Examinations Papers

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Pure Mathematics-1

TOPIC- Quadratics

Discriminants

1. The equation of a line is $2y + x = k$, where k is a constant, and the equation of a curve is $xy = 6$.

   (i) In the case where $k = 8$, the line intersects the curve at the points A and B. Find the equation of the perpendicular bisector of the line AB. [6]

   (ii) Find the set of values of k for which the line $2y + x = k$ intersects the curve $xy = 6$ at two distinct points. [3]

2 Find the set of values of m for which the line $y = mx + 4$ intersects the curve $y = 3x^2 - 4x + 7$ at two distinct points. [5]

3 The equation $x^2 + px + q = 0$, where p and q are constants, has roots -3 and 5.

   (i) Find the values of p and q. [2]

   **(ii)** Using these values of p and q, find the value of the constant r for which the equation $x^2 + px + q + r = 0$ has equal roots. [3]

4 Find the set of values of k for which the curve $y = kx^2 - 3x$ and the line $y = x - k$ do not meet. [3]

5 The function f is defined, for $x \in \mathbb{R}$, by $f : x \mapsto x^2 + ax + b$, where a and b are constants.

  (i) In the case where $a = 6$ and $b = -8$, find the range of f. [3]

  (ii) In the case where $a = 5$, the roots of the equation $f(x) = 0$ are k and $-2k$, where k is a constant. Find the values of b and k. [3]

  (iii) Show that if the equation $f(x + a) = a$ has no real roots, then $a^2 < 4(b - a)$. [3]
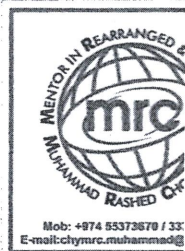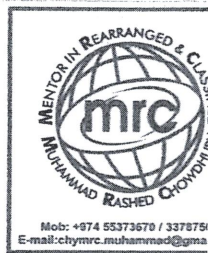
QUADRATICS-DISCRIMINENTS

(i) Express $2x^2 - 4x + 1$ in the form $a(x+b)^2 + c$ and hence state the coordinates of the minimum point, A, on the curve $y = 2x^2 - 4x + 1$. [4]

The line $x - y + 4 = 0$ intersects the curve $y = 2x^2 - 4x + 1$ at points P and Q. It is given that the coordinates of P are $(3, 7)$.

(ii) Find the coordinates of Q. [3]

(iii) Find the equation of the line joining Q to the mid-point of AP. [3]

A line has equation $y = 2x - 7$ and a curve has equation $y = x^2 - 4x + c$, where c is a constant. Find the set of possible values of c for which the line does not intersect the curve. [3]

8 **(i)** Express $2x^2 - 10x + 8$ in the form $a(x + b)^2 + c$, where a, b and c are constants, and use your answer to state the minimum value of $2x^2 - 10x + 8$. [4]

(ii) Find the set of values of k for which the equation $2x^2 - 10x + 8 = kx$ has no real roots. [4]

9   A line has equation $y = kx + 6$ and a curve has equation $y = x^2 + 3x + 2k$, where k is a constant.

   (i) For the case where $k = 2$, the line and the curve intersect at points A and B. Find the distance AB and the coordinates of the mid-point of AB.   [5]

   (ii) Find the two values of k for which the line is a tangent to the curve.   [4]

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

   (i) Find the set of values of x for which $y > 9$. [3]

   (ii) Express $2x^2 - 3x$ in the form $a(x + b)^2 + c$, where a, b and c are constants, and state the coordinates of the vertex of the curve. [4]
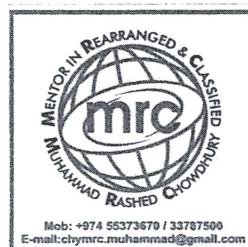
The functions f and g are defined for all real values of x by

$$f(x) = 2x^2 - 3x \quad \text{and} \quad g(x) = 3x + k,$$

where k is a constant.

   (iii) Find the value of k for which the equation $gf(x) = 0$ has equal roots. [3]

A curve has equation $y = kx^2 + 1$ and a line has equation $y = kx$, where k is a non-zero constant.

(i) Find the set of values of k for which the curve and the line have no common points. [3]

(ii) State the value of k for which the line is a tangent to the curve and, for this case, find the coordinates of the point where the line touches the curve. [4]