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Additional Math with Ali Hashir
Quadratic Inequalities
Worksheet

CIE O Level Additional Mathematics 4037 • Total: 70 marks

Answer all questions. To solve a quadratic inequality, rearrange so that one side is zero, factorise to find the two critical values, then sketch the parabola and read off the required region: for $a > 0$, the expression $a(x - \alpha)(x - \beta)$ is negative *between* the roots and positive *outside* them. Never divide an inequality by an unknown, and reverse the inequality sign when multiplying or dividing by a negative number. Several questions produce an inequality in a *parameter* rather than in x — the method is identical. Give all answers as exact values.

Q1

Solve each of the following inequalities.

(a) $x^2 - 5x + 6 > 0$ (b) $2x^2 + 5x - 3 \leq 0$ (c) $9 - x^2 < 0$ [6]

Q2

There is no real value of x for which $mx^2 + 8x + m = 6$. Find m . [5]

Q3

The equation $2x^2 + 4x + 2 = p(x + 3)$ has two distinct real roots. Find the range of values of p . [5]

Q4

If the equation $(p + 2)x^2 - 12x + 2(p - 1) = 0$ has real and distinct roots, find the set of values of p . [6]

Q5

Find the set of values of m for the equation $2x^2 + 4x + 2 + m(x + 2) = 0$ to have real roots. [5]

Q6

The roots of the equation $3kx^2 + (k - 5)x = 5x^2 + 2$ are not real. Find the set of values of k . [5]

Q7

If the equation $px^2 - p + 10 = 2(p + 2)x$ has real solution(s), show that p cannot lie between 1 and 2. [6]

Q8

Given that the line $y = c - 3x$ does not intersect the curve $xy = 3$, find the range of values of c . [5]

Q9

The curve $x^2 - xy + y^2 = 1$ cuts the line $2x - y = k$ in two distinct points. Find the set of values of k . [6]

Q10

The curve $y = (k - 6)x^2 - 8x + k$ cuts the x -axis at two points and has a minimum point. Find the range of values of k . [6]

Challenge 1

Given that $y = 2x^2 + px + 16$ and that $y < 0$ only when $2 < x < k$, find the value of p and of k . [7]

Challenge 2

The equation $m^2x^2 - (m + n)x + n = 0$ has two equal real roots.

(i) Show that $n^2 + 2(m - 2m^2)n + m^2 = 0$. [3]

(ii) Given that n is real, find the range of values of m . [5]

Answers available at the website.

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