

EQUITY

LEARNING PLACE

Additional Math Topical (Quadratic Function)

Question 1:

Find the range of values of k for which $(k + 8)x^2 + 6x + k$ is always negative for all real values of x .

Question 2:

a) Solve $k^2 > 49$.

b) Show that the line $y = 4x + m$ meets the curve $y = mx^2 - 2x - 6$ for all real values of x .

Hence, state the value of m such that the line $y = 4x + m$ is a tangent to the curve.

Question 3:

Show that the equation $2x^2 + x(3x + h) = -3k$ has two real and distinct roots for all negative values of k .

Question 4:

Find the range of values of m , for which the line $2y = 2mx - 5$ intersects the curve $y^2 + 2y + 5 = 2x$

Question 5:

i) Find the range of values of k for which $4x^2 + (k + 1)x + 1$ is always positive for all values of x .

ii) Explain why it is not possible to find the range of values of k for which $4x^2 + (k + 1)x + 1$ is always negative for all values of x .

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Question 6:

Find the range of values of k for which $x^2 - 4x + 1 = k(x^2 + 2x + 1)$ has

- a) no real roots,
- b) distinct real roots.
- c) State the value of k for which the equation has equal roots.

Question 7:

- a) Find the range of values of x which satisfy the inequality, $(x - 3)(2x + 4) \leq x - 7$
- b) A curve has the equation $y = (k - 1)x^2 + 3kx + 5k$, where $k > 1$. Find the range of values of k for which the curve has real roots.

Question 8:

Find the range of values of x for which $x(2x - 7) < 4$

Question 9:

A piece of wire of length 36 cm is bent into a rectangle and the length of one side of the rectangle is x cm.

- a) Express the area of the rectangle in terms of x .
- b) Find the range of values of x for which the area of the rectangle is greater than 77 cm^2 .

Question 10:

Find the set of values of the constant k for which the line $y = k(x - 3)$ intersects the curve $y = x^2 + 5x + k$ at two distinct points.

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Question 11:

Find the maximum value of the curve $y = -2x^2 + x + 5$ and the value of x at which this occurs.

Question 12:

Find the range of values of m for which $3x^2 + (m - 2)x + 3 = 0$ has real and distinct roots for all values of x .

Question 13:

The equation of a curve is $y = 2x^2 - 2kx + k$, where k is a constant. Find the range of values of k for which the curve cuts the x -axis at two distinct points.

Question 14:

Given the line $3y = 4 - 2x$ and the curve $4x^2 + 3y^2 - n = 0$ do not meet, show that $n < 4$.

Question 15:

a) Find the values of p for which the line $y = 2x + 9$ is a tangent to the curve $y = x^2 + (p - 1)x + 2p$

b) Show that the equation $x^2 + (2 - m)x + m - 3 = 0$ has real roots for all values of m .

Question 16:

a) Show that $x^2 - 3x + 5 > 0$ for all real values of x .

b) Hence, solve the inequality $\frac{x}{x - 5} - \frac{1}{x - 2} < 0$.

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Question 17:

- a) Determine whether it is possible for $y = (k + 1)x^2 + (2k - 2)x + (1 - 2k)$ to lie entirely below the x -axis. If yes, state the corresponding range of values of k . If not, explain your answer.
- b) Find the value of a and of b for which $x < -7$ or $x > 3$ is the solution of $x^2 + ax > b$.

Question 18:

- a) If the line $y = mx - 8$ meets the curve at $y = x^2 - 5x + m$, find the range of values of m .
Hence, state the values of m for which the line is a tangent.
- b) Given that $px^2 + 5x - q$ is always negative, determine the conditions for p and q .

Question 19:

The equation of a curve is $y = x^2 - kx + 3 + k$, where k is a constant

- a) Find the range of values of k for which the curve has no real roots.
- b) In the case where $k = 2$, find the value of h for which the line $y = 2x - h$ is a tangent to the curve.

Question 20:

The equation of the curve is $y = x^2 - 5kx + 10k^2 + 2k - 3$, where k is a constant. Find the range of values of k for which the curve lies completely above the x -axis.

Question 21:

- a) Find the range of values of x for which $-2x^2 + 13x > 20$.
- b) Find the ranges of values of a for which $y = ax^2 + 5x + 2$ has real and distinct roots

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Question 22:

- a) Find algebraically the range of values of k for which the equation $(3-x)(x+1) = k$ has two real and distinct roots.
- b) By using your answer in part (a), or otherwise, find the range of values of k such that $(3-x)(x+1) = -k$ has two real and distinct roots.

Question 23:

Find the range of values of k such that $(k+4)x^2 - 6x + (k-4)$ is positive for all real values of x .

Question 24:

Give an example of a and of b such that the equation $ax^2 + bx + 2017 = 0$ has distinct roots which are perfect cubes.

Question 25:

- a) Express $3x^2 - 6x + 5$ in the form $a(x-h)^2 + k$.
- b) Hence sketch the parabola $y = 3x^2 - 6x + 5$, labelling the y -intercept and turning point clearly.
- c) Find the range of values of m for which the line $y = -mx - \frac{7}{4}$ will intersect the curve $y = 3x^2 - 6x + 5$ at two distinct points.

Question 26:

Determine the range of values of k for which the equation $k(2x - 5) = x^2 - 4$ has real and distinct roots. Hence, state what can be deduced about the curve $y = x^2 - 4$ and the line $y = 6x - 15$.

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Question 27:

Show that $my = x^2 - 4(x - 1)$ meets the curve $y = x^2 - 3x + 2$ at two distinct points for all real and non-zero values of m .

Question 28:

Find the value(s) of m for which the equation $mx^2 + x = -m(x + 1)$ has real and equal roots.

Question 29:

Find the range of values of x for which $15 + 7(x - 1) - 2(x - 1)^2 \geq 0$.

Question 30:

a) Find the range of values of q for which the expression $qx^2 - 4x + q(2x + 3) - 2$ is always positive for all real values of x .

b) Find the least positive integer value of m for which the line $y = -2 + mx$ intersects the curve

$\left(\frac{x}{2}\right)^2 = y - 3$ at two distinct points.

Question 31:

a) Find the range of values of x for which $(3x + 2)(1 - 4x) \geq x - 4$.

b) Show that the line $y = 2 - x$ will meet the curve $y = x^2 + mx + m$ at two distinct points for all real values of m .

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Question 32:

Find the range of values of k for which the line $y = kx + 3$ will intersect the curve $xy + 20 = 5y$ at two points.

Question 33:

- a) Express $y = -x^2 - 2x + 6$ in the form $y = -(x + p)^2 + q$, where p and q are constants.
- b) State the maximum point of $y = -x^2 - 2x + 6$.
- c) Sketch the graph of $y = -x^2 - 2x + 6$, showing clearly the coordinates of the maximum point and the intersections with the axes.

Question 34:

- a) Find the range of values of k for which the line $y = 3x + k$ will meet the curve $2x^2 - xy = 9$ at two real and distinct points.
- b) Find the value of m for which the line $2y + x = m$ is a tangent to the curve $y^2 + 4x = 20$.
- c) Given the line $3y = 4 - 2x$ and the curve $4x^2 + 3y^2 - n = 0$ do not meet, show that $n < 4$.

Question 35:

- a) Find the range of values of x for which $2x(2 - x) > 3(x - 2)$.
- b) Find the range of values of k for which $2y + x = k$ does not intersect the curve $y^2 + 4x = 20$. Hence, state the value of k for which the straight line is a **tangent** to the curve.

Question 36:

Find the values of k for which the line $y = 2x + k + 2$ cuts the curve $y = 2x^2 + (k + 2)x + 8$ at two distinct points.

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Question 37:

A function g is defined by $g(x) = 5x^2 + px + 72$, where p is a constant. The function can also be written as $g(x) = 5(x - 4)^2 + q$.

- Show that the value of p and of q are -40 and -8 respectively.
- Find the range of the function g .
- Sketch the graph of the function.