

C2 Roots of Equation Questions

Specimen

4. Given that the equation

$$2kx^2 + 4x + k - 1 = 0$$

has two distinct real roots, show that

$$k^2 - k - 2 < 0.$$

Find the range of values of k satisfying this inequality. [6]

2005 Winter

6. The curve C has equation

$$y = 4x^2 - 7x + 11,$$

and the line L has equation

$$y = 5x + k,$$

where k is a constant. Given that L intersects C in two distinct points, show that $k > 2$. [6]

2005 Summer

7. The curve C has equation $y = x^3 - 3x^2$.

(a) Find the coordinates of the stationary points of C and determine the nature of each of these points. [7]

(b) Sketch C . [3]

(c) Find the range of values of k for which there are three real and distinct solutions of the equation $x^3 - 3x^2 = k$. [2]

2006 Winter

5. Given that the quadratic equation

$$(k + 2)x^2 + 4x + k + 5 = 0$$

has no real roots, show that

$$k^2 + 7k + 6 > 0.$$

Find the range of values of k satisfying this inequality. [7]

2006 Summer

4. (a) Given that the equation

$$kx^2 - 4x + k - 3 = 0$$

has equal roots, find the values of k . [5]

- (b) Express $x^2 + 8x + 2$ in the form $(x + a)^2 + b$. Hence write down the least value of $x^2 + 8x + 2$. [3]

2007 Winter

7. Given that the equation

$$kx^2 - 4x + (k - 3) = 0$$

has real roots, show that

$$k^2 - 3k - 4 \leq 0.$$

Find the range of values of k satisfying this inequality. [7]

2007 Summer

8. (a) Show that the equation

$$x^2 + (2k + 1)x + (k^2 + k + 1) = 0$$

has no real roots whatever the value of k . [4]

- (b) Find the range of values of x satisfying the inequality

$$2x^2 + 7x + 3 < 0. [3]$$

2008 Winter

5. (a) Find the range of values of k for which the quadratic equation

$$3x^2 + 2x - k = 0$$

has two distinct real roots. [4]

- (b) Solve the inequality $x^2 - 5x - 14 \leq 0$. [3]

2008 Summer

10. (a) Solve the inequality $2x^2 - 3x - 9 \geq 0$. [3]

(b) (i) Find the range of values of m for which the quadratic equation

$$3x^2 - 6x + m = 0$$

has no real roots.

(ii) The curve C has equation $y = 3x^2 - 4x + 7$. The line L has equation $y = 2x + k$, where k is a constant. Given that L and C do not intersect, find the range of possible values of k . [7]

(973-01)

2009 Winter

5. Given that the quadratic equation

$$(3k - 2)x^2 + 8x + k = 0$$

has no real roots, show that

$$3k^2 - 2k - 16 > 0.$$

Find the range of values of k satisfying this inequality. [7]

2009 Summer

6. (a) Given that $k \neq -1$, show that the quadratic equation

$$(k + 1)x^2 + 2kx + (k - 1) = 0$$

has two distinct real roots. [4]

(b) Find the range of values of x satisfying the inequality

$$5x^2 + 7x - 6 \leq 0.$$

(973-01) [3]

2010 Winter

5. (a) Find the range of values of k for which the quadratic equation

$$kx^2 + 3x - 5 = 0$$

has no real roots. [4]

(b) Solve the inequality $2x^2 - x - 6 > 0$. [3]

2010 Summer

6. (a) Find the range of values of k for which the quadratic equation

$$2x^2 + kx + 18 = 0$$

has no real roots.

[4]

- (b) Solve the inequality $10x^2 - x - 3 \geq 0$.

[3]

2011 Winter

3. Given that the quadratic equation

$$2x^2 + (3k - 1)x + (3k^2 - 1) = 0$$

has two distinct real roots, show that

$$5k^2 + 2k - 3 < 0.$$

Find the range of values of k satisfying this inequality.

[7]

2011 Summer

5. The curve C has equation

$$y = x^2 + (4k + 3)x + 7,$$

and the line L has equation

$$y = x + k,$$

where k is a constant.

Given that L and C intersect at two distinct points,

- (a) show that $4k^2 + 5k - 6 > 0$,

[6]

- (b) find the range of values of k satisfying this inequality.

[3]

2012 Winter

6. Given that the quadratic equation

$$(k + 6)x^2 + 4x + (k + 3) = 0$$

has no real roots, show that

$$k^2 + 9k + 14 > 0.$$

Find the range of values of k satisfying this inequality.

[7]

2012 Summer

6. (a) Show that the equation

$$x^2 + (2k - 1)x + (k^2 - k + 2) = 0$$

has no real roots, whatever the value of the constant k . [4]

- (b) Find the range of values of x satisfying the inequality

$$3x^2 + 16x - 12 > 0. [3]$$

2013 Winter

5. (a) Find the range of values of k for which the quadratic equation

$$5x^2 + 6x - 3k = 0$$

has two distinct real roots. [4]

- (b) Solve the inequality $2x^2 - 11x + 15 \leq 0$. [3]

2013 Summer

6. (a) (i) Assuming that the quadratic equation

$$(k + 1)x^2 + (4k + 1)x + (k - 5) = 0$$

has **two equal** roots, show that

$$4k^2 + 8k + 7 = 0.$$

- (ii) Hence show that there are **no real** values of k such that the quadratic equation

$$(k + 1)x^2 + (4k + 1)x + (k - 5) = 0$$

has two equal roots. [6]

- (b) Find the range of values of x satisfying the inequality

$$4x^2 - 9x - 9 \geq 0. [3]$$

2014 Winter

6. Given that the quadratic equation

$$(2k - 3)x^2 + 8x + (2k + 3) = 0$$

has no real roots, show that k satisfies an inequality of the form

$$m - nk^2 < 0,$$

where m, n are integers whose values are to be found.

Hence find the range of values of k such that the quadratic equation

$$(2k - 3)x^2 + 8x + (2k + 3) = 0$$

has no real roots.

[6]

2014 Summer

6. Given that the quadratic equation

$$(k - 1)x^2 + 2kx + (7k - 4) = 0$$

has no real roots, show that

$$6k^2 - 11k + 4 > 0.$$

Find the range of values of k satisfying this inequality.

[7]

2015

5. (a) Find the range of values of k for which the quadratic equation

$$kx^2 + (2k - 5)x + (k - 6) = 0$$

has **no real roots**.

[4]

- (b) Without carrying out any further calculation, write down the value of k for which the quadratic equation

$$kx^2 + (2k - 5)x + (k - 6) = 0$$

has **two equal roots**.

[1]

2016

6. (a) Find the range of values of k for which the quadratic equation

$$9x^2 + 8x - 2k = 0$$

has **two distinct real roots**.

[4]

- (b) Solve the inequality $x(5x - 7) \geq 6$.

[4]

2017

- (c) Given that the equation

$$x^3 - 9x^2 + 15x + 10 = k$$

has only one real root, find the range of possible values for k .

[2]



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