HIGHER

# 2.9 Quadratic Inequalities: Solving and Graphing Regions: Test Pack

Total Marks

EDEXCEL 4MA1 · Calculator allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

**Answer ALL questions. Show all your working.**

**1** In the context of basic factorisation, solve the inequality $x^2 - 5x + 6 > 0$ for x on the real number line.

**(Total for Question 1 is 1 mark)**

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**2** x satisfies both $x^2 - 10x + 24 \leq 0$ and $x + 3 < 1$.
Find the set of possible values of x.

**(Total for Question 2 is 4 marks)**

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**3** Solve $x^2 - 3x - 4 \leq 0$

**(Total for Question 3 is 3 marks)**

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**4** For the parabola context $y = x^2 - x - 6$, find where $y \leq 0$. Give your answer in inequality form for x.

**(Total for Question 4 is 1 mark)**


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**5** Solve $x^2 > 6$

**(Total for Question 5 is 2 marks)**

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**6** The region R is defined by the inequalities
$y \geq (x - 2)^2 - 6$ and $y \leq 4$
Find the number of points with integer coordinates that lie in R (including points on the boundary where the inequality allows it).

**(Total for Question 6 is 4 marks)**

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**7** x satisfies both $x^2 + 11x + 30 < 0$ and $2x + 1 < 5$.
Find the set of possible values of x.

**(Total for Question 7 is 4 marks)**

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**8** Find all the integer values of x that satisfy $x^2 - 9 < 0$

**(Total for Question 8 is 4 marks)**


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**9** x satisfies both $x^2 - x - 30 < 0$ and $x + 2 \leq -4$.
Find the set of possible values of x.

**(Total for Question 9 is 4 marks)**

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**10** Solve $2x^2 - 21x + 49 \leq 0$

**(Total for Question 10 is 3 marks)**

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**11** The equation $kx^2 + 8x + 3 = 0$ has two distinct real roots.
Find the possible values of k.

**(Total for Question 11 is 4 marks)**


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**12** Sketch and shade the region on the xy-plane for the inequality $y > x^2 - 4x + 3$. Indicate clearly which side of the parabola is shaded and mark the critical points on the x-axis.

**(Total for Question 12 is 3 marks)**

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**13** Solve the inequality $3x^2 - 18x + 23 > 0$. The roots are not integers. Show your working including the critical values found using the quadratic formula, and give the final solution in inequality notation.

**(Total for Question 13 is 4 marks)**


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# Mark scheme · 2.9 Quadratic Inequalities: Solving and Graphing Regions: Test Pack

## Question 1

correct solution $x < 2$ or $x > 3$, in correct inequality notation **B1**

**Answer: $x < 2$ or $x > 3$**

## Question 2

factorises and finds the critical values of the quadratic inequality **M1**

$4 \leq x \leq 6$ **A1**

solves the linear inequality to get $x < -2$ **M1**

the two solution sets do not overlap: no values **A1**

**Answer: no values**

## Question 3

factorises (or uses the formula) to find the critical values **M1**

critical values $x = -1$ and $x = 4$ **A1**

$-1 \leq x \leq 4$ **A1**

**Answer: $-1 \leq x \leq 4$**

## Question 4

$-2 \leq x \leq 3$ cao **B1**

**Answer: $-2 \leq x \leq 3$**

## Question 5

critical values $x = \sqrt{6}$ and $x = -\sqrt{6}$ **M1**

$x < -\sqrt{6}$ or $x > \sqrt{6}$ **A1**

**Answer: $x < -\sqrt{6}$ or $x > \sqrt{6}$**

## Question 6

finds where the curve meets the line $y = 4$: $(x - 2)^2 = 10$ **M1**

finds the possible integer x values, from the largest and smallest x with the curve not above the line **M1**

counts the integer y values for each x: $x = -1$: 2, $x = 0$: 7, $x = 1$: 10, $x = 2$: 11, $x = 3$: 10, $x = 4$: 7, $x = 5$: 2 **M1**

total = 49 **A1**

**Answer: 49**

## Question 7

factorises and finds the critical values of the quadratic inequality **M1**

$-6 < x < -5$ **A1**

solves the linear inequality to get $x < 2$ **M1**

overlap of the two solution sets: $-6 < x < -5$ **A1**

**Answer: $-6 < x < -5$**

## Question 8

factorises to find the critical values **M1**

critical values $x = -3$ and $x = 3$ **A1**

writes the solution set $-3 < x < 3$ **M1**

integers: -2, -1, 0, 1, 2 **A1**

**Answer: -2, -1, 0, 1, 2**

## Question 9

factorises and finds the critical values of the quadratic inequality **M1**

$-5 < x < 6$ **A1**

solves the linear inequality to get $x \leq -6$ **M1**

the two solution sets do not overlap: no values **A1**

**Answer: no values**

## Question 10

factorises (or uses the formula) to find the critical values **M1**

critical values $x = 7/2$ and $x = 7$ **A1**

$7/2 \leq x \leq 7$ **A1**

**Answer: $7/2 \leq x \leq 7$**

## Question 11

uses the discriminant $b^2 - 4ac = 64 - 12k$ **M1**

sets $b^2 - 4ac > 0$ **M1**

$k < 16/3$ **A1**

$k \neq 0$ because the equation must remain quadratic **B1**

**Answer: $k < 16/3$ and $k \neq 0$**

## Question 12

identifies and plots the roots of $x^2 - 4x + 3 = 0$ as $x = 1$ and $x = 3$ or marks points (1,0) and (3,0) **M1**

sketches a correct upward-opening parabola passing through the roots **M1**

shades the region above the parabola ($y > x^2 - 4x + 3$) clearly **A1**

**Answer: Region above the parabola $y = x^2 - 4x + 3$, excluding the curve itself, with the curve crossing the x-axis at $x = 1$ and $x = 3$**

## Question 13

uses quadratic formula correctly and computes discriminant: $b^2 - 4ac = 324 - 276 = 48$ **M1**

finds critical values $x = (18 \pm \sqrt{48})/6$ and simplifies exactly to $x = (9 \pm 2\sqrt{3})/3$, oe **M1**

gives final solution in correct form: $x < (9 - 2\sqrt{3})/3$ or $x > (9 + 2\sqrt{3})/3$, cao **A1**

states approximate critical values, for example x approximately 1.845 and x approximately 4.155, supporting the correct inequality notation **A1**

**Answer: $x < (9 - 2\sqrt{3})/3$ or $x > (9 + 2\sqrt{3})/3$**


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