2.4 Quadratic Inequalities: 2-hour Pack

AQA 8365 · Calculator allowed · about 120 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Solve $2x^2 + x - 28 > 0$.

(Total for Question 1 is 3 marks)

2 Find the values of x that satisfy both $x^2 + 4x - 21 < 0$ and $x < -3$.

(Total for Question 2 is 4 marks)

3 Solve $x^2 - 8x + 7 \leq 0$.

(Total for Question 3 is 3 marks)

4 Solve $2x^2 \leq 16$. Give any surds in their simplest form.

(Total for Question 4 is 3 marks)

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5 Find the range of values of k for which $2x^2 + kx + 2 = 0$ has no real roots.

(Total for Question 5 is 3 marks)

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6 Solve $x^2 - 11x + 28 > 0$.

(Total for Question 6 is 3 marks)

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7 Solve the inequality $x^2 + 6 < 5x$.

(Total for Question 7 is 3 marks)

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8 Find the values of x that satisfy both $x^2 - x - 12 < 0$ and $x > 2$.

(Total for Question 8 is 4 marks)

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9 Solve $x^2 + 4x - 32 \geq 0$.

(Total for Question 9 is 3 marks)

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10 Solve $x^2 \leq 12$. Give any surds in their simplest form.

(Total for Question 10 is 2 marks)

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11 Find the values of x that satisfy both $x^2 - 16 < 0$ and $x < 0$.

(Total for Question 11 is 4 marks)

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12 n is an integer. Write down all the values of n for which $n^2 - 9 \leq 0$.

(Total for Question 12 is 3 marks)

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13 Solve $x^2 - 7x < -10$.

(Total for Question 13 is 3 marks)

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14 Find the values of x that satisfy both $x^2 - 7x + 6 < 0$ and $x > 4$.

(Total for Question 14 is 4 marks)

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15 Solve $x^2 \leq 20$. Give any surds in their simplest form.

(Total for Question 15 is 2 marks)

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16 n is an integer. Write down all the values of n for which $n^2 - 8n + 7 \leq 0$.

(Total for Question 16 is 3 marks)

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17 Solve $x^2 \leq 8$. Give any surds in their simplest form.

(Total for Question 17 is 2 marks)

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18 Find the values of x that satisfy both $x^2 - 2x - 35 < 0$ and $x > -1$.

(Total for Question 18 is 4 marks)

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19 Solve $x^2 + 3x > 4$.

(Total for Question 19 is 3 marks)

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20 Find the values of x that satisfy both $x^2 + 2x - 15 < 0$ and $x < -2$.

(Total for Question 20 is 4 marks)

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21 Solve the inequality $x^2 - 5x - 14 < 0$. Give your answer using set notation.

(Total for Question 21 is 3 marks)

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22 Solve the inequality $16 - x^2 < 0$.

(Total for Question 22 is 3 marks)

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23 Solve the inequality $20 - x - x^2 \leq 0$.

(Total for Question 23 is 2 marks)

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24 Solve the inequality $x^2 + 3 < 4x$.

(Total for Question 24 is 1 mark)

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25 Solve the inequality $x^2 \geq 121$. Give your answer using set notation with the union symbol.

(Total for Question 25 is 1 mark)

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26 Solve the inequality $9 - x^2 < 0$.

(Total for Question 26 is 1 mark)

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27 Solve the inequality $x^2 - 8x + 12 \leq 0$.

(Total for Question 27 is 2 marks)

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28 Solve the inequality $x^2 - x - 20 < 0$. Give your answer using set notation.

(Total for Question 28 is 2 marks)

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29 Solve the inequality $x^2 + 4x - 3 > 0$, giving your answer in surd form.

(Total for Question 29 is 4 marks)

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30 Solve the inequality $12 - 4x - x^2 < 0$.

(Total for Question 30 is 4 marks)

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31 Solve the inequality $x^2 + 2x - 1 > 0$, giving your answer in surd form.

(Total for Question 31 is 2 marks)

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32 Solve the inequality $2x^2 + 3x - 9 \geq 0$, giving your answer in set notation.

(Total for Question 32 is 3 marks)

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33 The function $f(x) = \sqrt{20 - x - x^2}$ is defined for real values of x. Find the set of values of x for which f(x) is defined.

(Total for Question 33 is 4 marks)

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34 The height, h metres, of a ball t seconds after being thrown is given by $h = 1 + 15t - 5t^2$. Find the values of t for which the ball is more than 11 metres above the ground.

(Total for Question 34 is 5 marks)

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35 The function $f(x) = \sqrt{15 - 2x - x^2}$ is defined for real values of x. Find the set of values of x for which f(x) is defined.

(Total for Question 35 is 3 marks)

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36 The equation $x^2 + kx + (k + 3) = 0$ has no real roots. Find the set of values of k.

(Total for Question 36 is 5 marks)

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Mark scheme · 2.4 Quadratic Inequalities: 2-hour Pack

Question 1

factorises or solves the related equation	**M1**
critical values -4 and 7/2	**A1**
x < -4 or x > 7/2 cao	**A1**

Answer: x < -4 or x > 7/2

Question 2

solves the quadratic inequality	**M1**
-7 < x < 3	**A1**
combines with the linear inequality (number line)	**M1**
-7 < x < -3 cao	**A1**

Answer: -7 < x < -3

Question 3

factorises or solves the equation correctly	**M1**
critical values 1 and 7	**A1**
1 ≤ x ≤ 7 cao	**A1**

Answer: 1 ≤ x ≤ 7

Question 4

divides by 2: $x^2 \leq 8$	**M1**
critical values $x = \pm \sqrt{8}$ found and simplified	**M1**
$-2\sqrt{2} \leq x \leq 2\sqrt{2}$ cao	**A1**

Answer: $-2\sqrt{2} \leq x \leq 2\sqrt{2}$

Question 5

$k^2 - 4(2)(2) < 0$	**M1**
critical values k = ±4	**M1**
-4 < k < 4 cao	**A1**

Answer: -4 < k < 4

Question 6

factorises or solves the equation correctly	**M1**
critical values 4 and 7	**A1**
x < 4 or x > 7 cao	**A1**

Answer: x < 4 or x > 7

Question 7

rearrange to $x^2 - 5x + 6 < 0$	**M1**
factorise to (x-2)(x-3)	**M1**
correct inequality 2 < x < 3 (oe)	**A1**

Answer: 2 < x < 3

Question 8

solves the quadratic inequality	**M1**
-3 < x < 4	**A1**
combines with the linear inequality (number line)	**M1**
2 < x < 4 cao	**A1**

Answer: 2 < x < 4

Question 9

factorises or solves the equation correctly	**M1**
critical values -8 and 4	**A1**
x ≤ -8 or x ≥ 4 cao	**A1**

Answer: x ≤ -8 or x ≥ 4

Question 10

critical values $x = \pm \sqrt{12}$ found and simplified	**M1**
$-2\sqrt{3} \leq x \leq 2\sqrt{3}$ cao	**A1**

Answer: $-2\sqrt{3} \leq x \leq 2\sqrt{3}$

Question 11

solves the quadratic inequality	**M1**
-4 < x < 4	**A1**
combines with the linear inequality (number line)	**M1**
-4 < x < 0 cao	**A1**

Answer: -4 < x < 0

Question 12

finds the critical values	**M1**
-3 ≤ n ≤ 3 seen	**A1**
integers -3, -2, -1, 0, 1, 2, 3 listed cao	**A1**

Answer: -3, -2, -1, 0, 1, 2, 3

Question 13

rearranges to $x^2 - 7x + 10 < 0$	**M1**
finds the critical values	**M1**
2 < x < 5 cao	**A1**

Answer: 2 < x < 5

Question 14

solves the quadratic inequality	**M1**
1 < x < 6	**A1**
combines with the linear inequality (number line)	**M1**
4 < x < 6 cao	**A1**

Answer: 4 < x < 6

Question 15

critical values $x = \pm \sqrt{20}$ found and simplified	**M1**
$-2\sqrt{5} \leq x \leq 2\sqrt{5}$ cao	**A1**

Answer: $-2\sqrt{5} \leq x \leq 2\sqrt{5}$

Question 16

finds the critical values	**M1**
1 ≤ n ≤ 7 seen	**A1**
integers 1, 2, 3, 4, 5, 6, 7 listed cao	**A1**

Answer: 1, 2, 3, 4, 5, 6, 7

Question 17

critical values $x = \pm \sqrt{8}$ found and simplified	**M1**
$-2\sqrt{2} \leq x \leq 2\sqrt{2}$ cao	**A1**

Answer: $-2\sqrt{2} \leq x \leq 2\sqrt{2}$

Question 18

solves the quadratic inequality	**M1**
-5 < x < 7	**A1**
combines with the linear inequality (number line)	**M1**
-1 < x < 7 cao	**A1**

Answer: -1 < x < 7

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Question 19

rearranges to $x^2 + 3x - 4 > 0$	**M1**
finds the critical values	**M1**
$x < -4$ or $x > 1$ cao	**A1**

Answer: $x < -4$ or $x > 1$

Question 20

solves the quadratic inequality	**M1**
$-5 < x < 3$	**A1**
combines with the linear inequality (number line)	**M1**
$-5 < x < -2$ cao	**A1**

Answer: $-5 < x < -2$

Question 21

factorise to $(x-7)(x+2)$	**M1**
correct critical values $x = -2$ and $x = 7$	**A1**
correct set notation $\{x : -2 < x < 7\}$ (oe)	**A1**

Answer: $\{x : -2 < x < 7\}$

Question 22

rearrange to $x^2 > 16$, correctly reversing the inequality	**M1**
correct critical values $x = -4$ and $x = 4$	**A1**
correct inequality $x < -4$ or $x > 4$ (oe)	**A1**

Answer: $x < -4$ or $x > 4$

Question 23

rearrange (e.g. multiply by -1, reversing the inequality) to $x^2+x-20 \geq 0$ and factorise to $(x+5)(x-4)$	**M1**
$x \leq -5$ or $x \geq 4$ (oe)	**A1**

Answer: $x \leq -5$ or $x \geq 4$

Question 24

$1 < x < 3$ (oe) cao	**B1**

Answer: $1 < x < 3$

Question 25

$\{x : x \leq -11\} \cup \{x : x \geq 11\}$ (oe) cao	**B1**

Answer: $\{x : x \leq -11\} \cup \{x : x \geq 11\}$

Question 26

$x < -3$ or $x > 3$ (oe) cao	**B1**

Answer: $x < -3$ or $x > 3$

Question 27

factorise to $(x-2)(x-6)$	**M1**
$2 \leq x \leq 6$ (oe) cao	**A1**

Answer: $2 \leq x \leq 6$

Question 28

factorise to $(x-5)(x+4)$ and identify critical values $x = -4$ and $x = 5$	**M1**
correct set notation $\{x : -4 < x < 5\}$ (oe)	**A1**

Answer: $\{x : -4 < x < 5\}$

Question 29

apply the quadratic formula with $a=1$, $b=4$, $c=-3$	**M1**
correct roots $x = -2 - \sqrt{7}$ and $x = -2 + \sqrt{7}$ simplified	**A1**
identify correct inequality structure (outside the roots) using sign reasoning	**M1**
fully correct answer $x < -2 - \sqrt{7}$ or $x > -2 + \sqrt{7}$ (oe)	**A1**

Answer: $x < -2 - \sqrt{7}$ or $x > -2 + \sqrt{7}$

Question 30

rearrange (e.g. multiply by -1, reversing the inequality) to $x^2+4x-12>0$	**M1**
factorise to $(x+6)(x-2)$	**M1**
correct critical values $x = -6$ and $x = 2$	**A1**
correct inequality $x < -6$ or $x > 2$ (oe)	**A1**

Answer: $x < -6$ or $x > 2$

Question 31

apply the quadratic formula with $a=1$, $b=2$, $c=-1$ to find roots $x = -1 - \sqrt{2}$ and $x = -1 + \sqrt{2}$	**M1**
$x < -1 - \sqrt{2}$ or $x > -1 + \sqrt{2}$ (oe)	**A1**

Answer: $x < -1 - \sqrt{2}$ or $x > -1 + \sqrt{2}$

Question 32

factorise to $(2x-3)(x+3)$	**M1**
correct critical values $x = -3$ and $x = 3/2$	**A1**
correct set notation $\{x : x \leq -3\} \cup \{x : x \geq 3/2\}$ (oe)	**A1**

Answer: $\{x : x \leq -3\} \cup \{x : x \geq 3/2\}$

Question 33

set up condition $20-x-x^2 \geq 0$ for the square root to be defined	**M1**
rearrange (e.g. multiply by -1) and factorise to $(x+5)(x-4) \leq 0$	**M1**
correct critical values $x = -5$ and $x = 4$	**A1**
correct final domain $-5 \leq x \leq 4$ (oe)	**A1**

Answer: $-5 \leq x \leq 4$

Question 34

form inequality $1+15t-5t^2>11$	**M1**
rearrange and simplify (e.g. divide by -5, reversing) to $t^2-3t+2<0$	**M1**
factorise to $(t-1)(t-2)$	**M1**
correct critical values $t = 1$ and $t = 2$	**A1**
correct final answer $1 < t < 2$ (seconds) (oe)	**A1**

Answer: $1 < t < 2$ (seconds)

Question 35

set up condition $15-2x-x^2 \geq 0$ for the square root to be defined	**M1**
rearrange (e.g. multiply by -1) and factorise to $(x+5)(x-3) \leq 0$	**M1**
correct final domain $-5 \leq x \leq 3$ (oe)	**A1**

Answer: $-5 \leq x \leq 3$

Question 36

write discriminant $b^2-4ac = k^2-4(k+3)$	**M1**
simplify to $k^2-4k-12$ (<0)	**M1**
factorise to $(k-6)(k+2)$	**M1**
correct critical values $k = -2$ and $k = 6$	**A1**
correct final answer $-2 < k < 6$ (oe)	**A1**

Answer: $-2 < k < 6$

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