

Solving Linear Inequalities

Solutions

For AQA GCSE Mathematics (8300) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (3 marks)

(a) Solve $x + 5 > 9$

Solve it like an equation, but keep the inequality sign.

Subtract 5 from both sides: $x > 9 - 5$

$$x > 4$$

Answer: $x > 4$

Tip: Your answer must be an inequality, $x > 4$. Writing $x = 4$ or just 4 loses the mark.

(b) Solve $3x \leq 21$

Divide both sides by 3: $x \leq 21 \div 3$

$$x \leq 7$$

Answer: $x \leq 7$

(c) Solve $\frac{x}{2} < 6$

Multiply both sides by 2: $x < 6 \times 2$

$$x < 12$$

Answer: $x < 12$

2 (2 marks)

Solve $3x - 4 \leq 11$

Add 4 to both sides: $3x \leq 15$

Divide both sides by 3: $x \leq 5$

Answer: $x \leq 5$

Marks: 1 mark for $3x \leq 15$. 1 mark for $x \leq 5$.

3 (2 marks)

Solve $5x + 2 > 17$

Subtract 2 from both sides: $5x > 15$

Divide both sides by 5: $x > 3$

Answer: $x > 3$

Marks: 1 mark for $5x > 15$. 1 mark for $x > 3$.

4 (1 mark)

Solve $2x - 7 < 3$

Circle your answer.

Options: $x < -2$, $x < 2$, $x < 5$, $x > 5$

Add 7 to both sides: $2x < 10$

Divide both sides by 2: $x < 5$

Answer: $x < 5$

5 (2 marks)

Solve $6x + 7 > 2x - 5$

Subtract $2x$ from both sides: $4x + 7 > -5$

Subtract 7 from both sides: $4x > -12$

Divide both sides by 4: $x > -3$

(Dividing by a positive number, 4, does not change the sign.)

Answer: $x > -3$

Tip: Move the x -terms to one side and the numbers to the other. Adding $2x$ to $6x$, or 7 to -5 , are common slips.

Marks: 1 mark for $4x > -12$ (or similar). 1 mark for $x > -3$.

6 (3 marks)

Solve $4(x - 3) \geq 2x + 6$

Expand the bracket: $4x - 12 \geq 2x + 6$

Subtract $2x$ from both sides: $2x - 12 \geq 6$

Add 12 to both sides: $2x \geq 18$

Divide both sides by 2: $x \geq 9$

Answer: $x \geq 9$

Tip: Keep the inequality sign on every line. Do not swap it for an equals sign part way through.

Marks: 1 mark for $4x - 12$. 1 mark for $2x \geq 18$. 1 mark for $x \geq 9$.

7 (3 marks)

(a) Solve $6x - 5 < 19$

Add 5 to both sides: $6x < 24$

Divide both sides by 6: $x < 4$

Answer: $x < 4$

Marks: 1 mark for $6x < 24$. 1 mark for $x < 4$.

- (b) Write down the largest integer that satisfies $6x - 5 < 19$

From part (a), $x < 4$.

4 is not included, because the sign is $<$.

So the largest integer is 3.

Answer: 3

Tip: $x < 4$ means x cannot be 4 itself. The answer is 3.

8 (2 marks)

n is an integer.

List all the values of n that satisfy $7 < 2n + 1 \leq 15$

Subtract 1 from all three parts: $6 < 2n \leq 14$

Divide all three parts by 2: $3 < n \leq 7$

n is bigger than 3, so 3 is not included.

n can equal 7, so 7 is included.

The integers are 4, 5, 6 and 7.

Answer: 4, 5, 6, 7

Tip: Look carefully at each end: $<$ means that number is not included, but $\leq$ means it is. Many students leave out 7 or wrongly include 3.

Marks: 1 mark for $3 < n \leq 7$ (or $6 < 2n \leq 14$). 1 mark for 4, 5, 6, 7.

9 (2 marks)

Solve $4y + 13 \geq 6$

Subtract 13 from both sides: $4y \geq 6 - 13$

$$4y \geq -7$$

Divide both sides by 4: $y \geq -\frac{7}{4}$

$$-\frac{7}{4} = -1.75$$

Answer: $y \geq -\frac{7}{4}$ (or $y \geq -1.75$)

Tip: You are dividing by +4, so the sign does **not** flip, even though -7 is negative. The sign only flips when you multiply or divide by a negative.

Marks: 1 mark for $4y \geq -7$ (or similar). 1 mark for $y \geq -\frac{7}{4}$ (or -1.75).

10 (4 marks)

(a) Solve $-3 < x + 2 \leq 5$

Subtract 2 from all three parts.

$$-3 - 2 = -5 \text{ and } 5 - 2 = 3$$

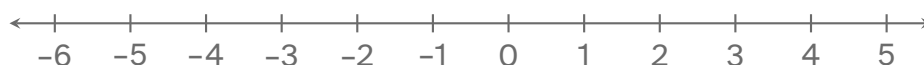
$$\text{So } -5 < x \leq 3$$

Answer: $-5 < x \leq 3$

Tip: Do the same thing to **all three** parts. Subtracting 2 from only one side is a common mistake.

Marks: 2 marks for $-5 < x \leq 3$. 1 mark if one end is correct.

(b) Show your answer to part (a) on the number line.

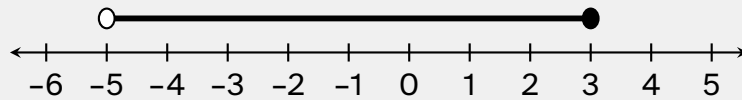


$-5 < x$: -5 is not included, so draw an open circle at -5 .

$x \leq 3$: 3 is included, so draw a filled circle at 3.

Join the two circles with a line.

Answer:



Marks: 2 marks for a fully correct diagram. 1 mark for one end correct (follow-through from your answer to part (a)).

11 (1 mark)

Sara solves $2x + 3 \geq 9$

$$2x \geq 12$$

$$x \geq 6$$

What mistake has Sara made?

To undo +3, Sara should **subtract** 3 from both sides.

She added 3 instead, getting $2x \geq 12$.

Correct: $2x \geq 9 - 3 = 6$

So $x \geq 3$.

Answer: She added 3 instead of subtracting 3. The answer is $x \geq 3$.

12 (3 marks)

A rectangle has length $(x + 8)$ cm and width x cm.

The perimeter of the rectangle must be less than 50 cm.

Work out the range of possible values of x .

Perimeter = two lengths + two widths

$$2(x + 8) + 2x = 2x + 16 + 2x = 4x + 16$$

The perimeter is less than 50: $4x + 16 < 50$

Subtract 16 from both sides: $4x < 34$

Divide both sides by 4: $x < 8.5$

Also, x is a length, so it must be more than 0.

So $0 < x < 8.5$

Answer: $0 < x < 8.5$ ($x < 8.5$ on its own is also accepted)

Marks: 1 mark for $4x + 16$. 1 mark for $4x + 16 < 50$. 1 mark for $x < 8.5$.
