

Solving Linear Inequalities

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • 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 (2 marks)

(a) Solve $x - 4 \geq 3$

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

Add 4 to both sides: $x \geq 3 + 4$

$$x \geq 7$$

Answer: $x \geq 7$

Tip: Your answer must be an inequality, $x \geq 7$. Writing $x = 7$ or just 7 loses the mark.

(b) Solve $5x < 30$

Divide both sides by 5: $x < 30 \div 5$

$$x < 6$$

Answer: $x < 6$

2 (2 marks)

Solve $4x + 3 > 19$

Subtract 3 from both sides: $4x > 16$

Divide both sides by 4: $x > 4$

Answer: $x > 4$

Marks: 1 mark for $4x > 16$. 1 mark for $x > 4$.

3 (2 marks)

Solve $2x - 9 \leq 5$

Add 9 to both sides: $2x \leq 14$

Divide both sides by 2: $x \leq 7$

Answer: $x \leq 7$

Tip: Do not stop at $2x \leq 14$. Divide by 2 to get x on its own.

Marks: 1 mark for $2x \leq 14$. 1 mark for $x \leq 7$.

4 (3 marks)

(a) Solve $4p - 3 > 15$

Add 3 to both sides: $4p > 18$

Divide both sides by 4: $p > \frac{18}{4}$

$$\frac{18}{4} = 4.5$$

Answer: $p > 4.5$ (or $p > \frac{9}{2}$)

Marks: 1 mark for $4p > 18$. 1 mark for $p > 4.5$ (or $\frac{9}{2}$ or $4\frac{1}{2}$).

(b) p is an integer that satisfies $4p - 3 > 15$
Write down the smallest possible value of p .

From part (a), $p > 4.5$

The integers bigger than 4.5 are 5, 6, 7, ...

The smallest of these is 5.

Answer: 5

Tip: 4 is not bigger than 4.5, so 4 does not work. Check your answer: $4 \times 5 - 3 = 17$, which is bigger than 15.

5 (2 marks)

Solve $3x + 8 > x + 2$

Subtract x from both sides: $2x + 8 > 2$

Subtract 8 from both sides: $2x > -6$

Divide both sides by 2: $x > -3$

(Dividing by a positive number, 2, does not change the sign.)

Answer: $x > -3$

Tip: $2 - 8 = -6$, not 6. Take care with the negative.

Marks: 1 mark for $2x > -6$. 1 mark for $x > -3$.

6 (3 marks)

Solve $5(x + 1) \leq 2x + 17$

Expand the bracket: $5x + 5 \leq 2x + 17$

Subtract $2x$ from both sides: $3x + 5 \leq 17$

Subtract 5 from both sides: $3x \leq 12$

Divide both sides by 3: $x \leq 4$

Answer: $x \leq 4$

Marks: 1 mark for $5x + 5$. 1 mark for $3x \leq 12$. 1 mark for $x \leq 4$.

7 (2 marks)

Solve $\frac{x}{3} + 1 < 5$

Subtract 1 from both sides first: $\frac{x}{3} < 4$

Multiply both sides by 3: $x < 12$

Answer: $x < 12$

Tip: If you multiply by 3 first, multiply **every** term: $x + 3 < 15$, not $x + 1 < 15$.

Marks: 1 mark for $\frac{x}{3} < 4$. 1 mark for $x < 12$.

8 (4 marks)

(a) Solve $-4 < 2x \leq 6$

Divide all three parts by 2.

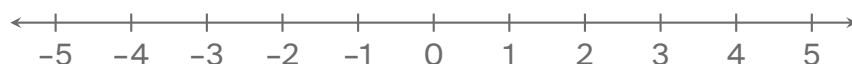
$$-4 \div 2 = -2 \text{ and } 6 \div 2 = 3$$

$$\text{So } -2 < x \leq 3$$

Answer: $-2 < x \leq 3$

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

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

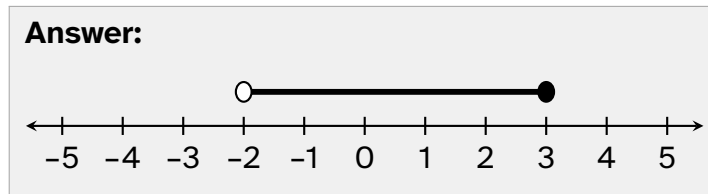


Use your answer to part (a): $-2 < x \leq 3$

-2 is not included, so draw an open circle at -2.

3 is included, so draw a filled circle at 3.

Join the two circles with a line.



Tip: Draw the values of x (-2 to 3), not the numbers in the question (-4 to 6).

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

9 (3 marks)

n is an integer.

$$-1 \leq 3n - 4 < 8$$

Write down all the possible values of n .

Add 4 to all three parts: $3 \leq 3n < 12$

Divide all three parts by 3: $1 \leq n < 4$

1 is included, 4 is not.

So $n = 1, 2, 3$

Answer: 1, 2, 3

Tip: Whatever you do to one part, do to all three parts. Add 4 first, then divide by 3.

Marks: 1 mark for $3 \leq 3n < 12$. 1 mark for $1 \leq n < 4$. 1 mark for 1, 2, 3.

10 (3 marks)

Tom has £20

He buys a magazine for £3.50 and some pens that cost £1.80 each.

Work out the greatest number of pens Tom can buy.

Let p be the number of pens.

The total cost must be £20 or less: $3.50 + 1.80p \leq 20$

Subtract 3.50 from both sides: $1.80p \leq 16.50$

Divide both sides by 1.80: $p \leq 9.16 \dots$

p must be a whole number, so the greatest number is 9.

Check: $3.50 + 9 \times 1.80 = 19.70$, which is less than 20 ✓

Answer: 9

Marks: 1 mark for $20 - 3.50 = 16.50$. 1 mark for $16.50 \div 1.80$. 1 mark for 9.
