

GCSE MATHS

Inequality regions

Worked Solutions

Q1

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$$5 > 2(2) = 4$$

Substitute both coordinates.

Q2

*

$$-1 + 2 = 1 > 0$$

The point fails the inequality.

Q3

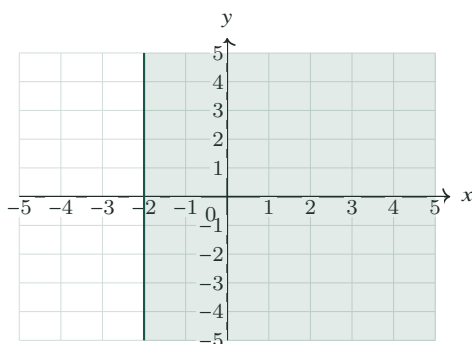
**

$$x = -2$$

The boundary is vertical and included.

$$x \geq -2$$

Larger x -values lie to the right.



Q4

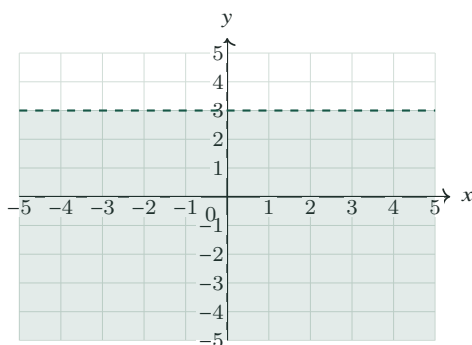
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$$y = 3$$

The inequality uses $<$ or $>$, so the boundary is not included.

$$y < 3$$

Shade below the line.



Q5

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$$y = 0 \Rightarrow x = 6$$

Find the x -intercept.

$$x = 0 \Rightarrow y = 3$$

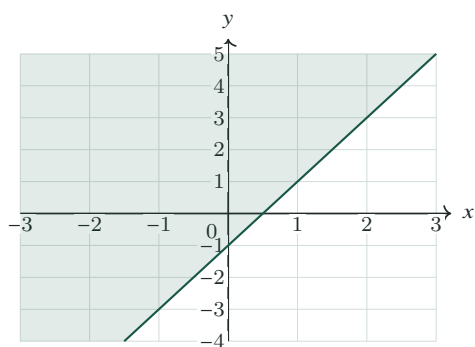
Find the y -intercept.**Q6**

$$(0, -1), (1, 1)$$

Plot two points on the boundary.

$$0 \geq -1$$

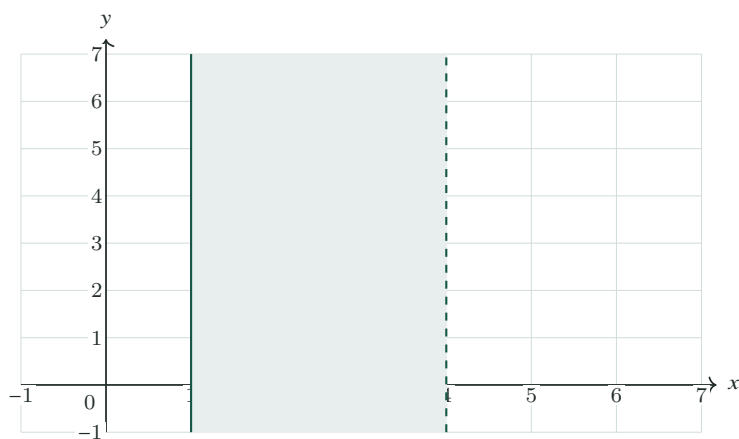
The origin satisfies the inequality, so shade its side.

**Q7**

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$$1 \leq x < 4$$

Shade the vertical strip between the two boundaries.



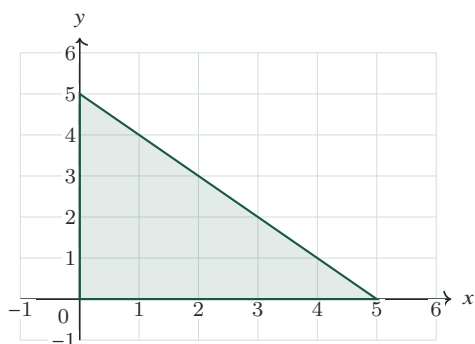
Q8

$$x + y = 5 \Rightarrow (5, 0), (0, 5)$$

Use the axis intercepts.

Triangle with $(0, 0)$

The origin satisfies all three conditions.



Q9

$$x = 1, y = 2 \Rightarrow (1, 2)$$

Intersect the horizontal and vertical boundaries.

$$y = 2 \Rightarrow x = 4$$

Meet the diagonal.

$$x = 1 \Rightarrow y = 5$$

Find the other diagonal endpoint.

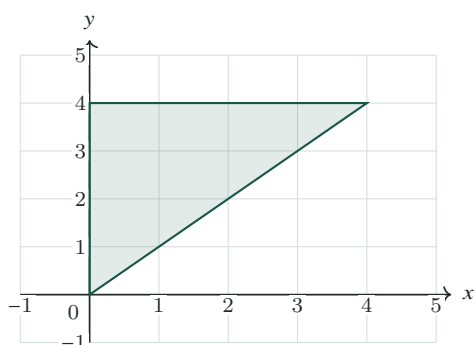
Q10

$$(0, 0), (0, 4), (4, 4)$$

Intersect each pair of boundary lines.

All edges included

All three inequalities include equality, so include the boundary lines.



Q11

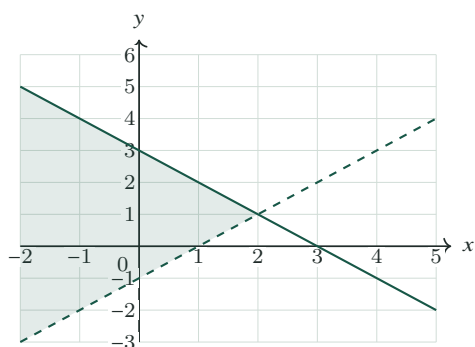
$1 > 2 - 1$ is false

$$y > x - 1$$

$$y \leq -x + 3$$

The point $(2, 1)$ lies on the dashed boundary, so it is not included.

Shade above the dashed first line and below the solid second line.



Q12

$$x = 0$$

$$y = 1$$

$$x + y = 5$$

$$x \geq 0$$

$$y \geq 1$$

$$x + y \leq 5$$

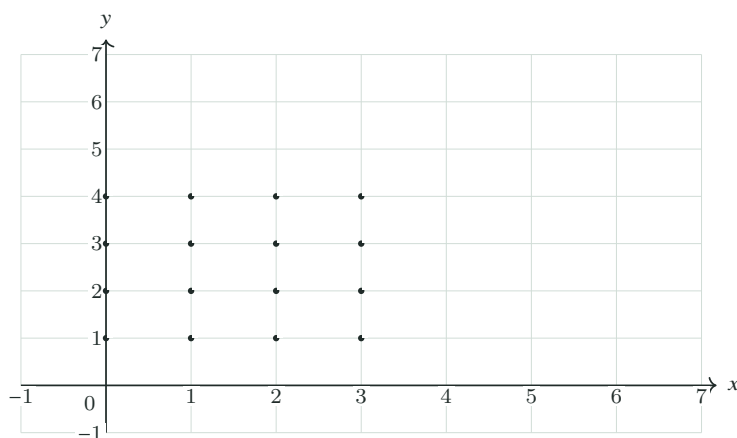
Identify the three boundaries.

Choose the sides containing the shaded triangle.

Q13

$$4 \times 4 = 16$$

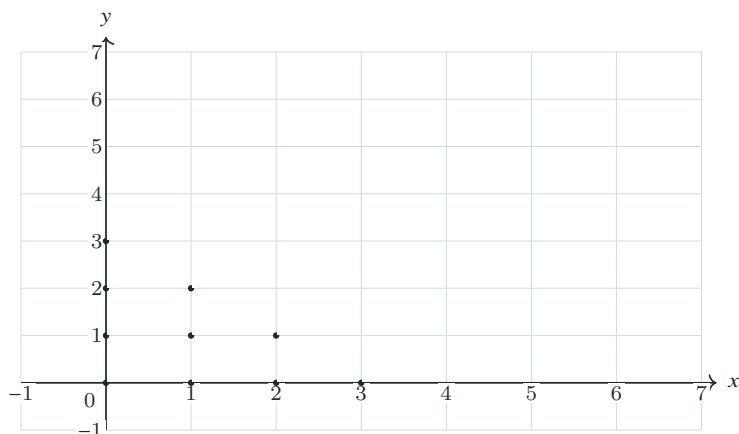
There are four permitted values of each coordinate.



Q14

$$4 + 3 + 2 + 1 = 10$$

For $x = 0, 1, 2, 3$, count y from zero to $3 - x$.



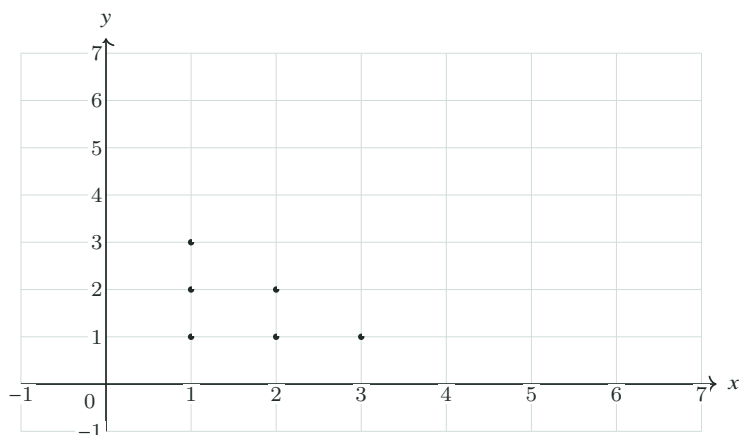
Q15

$$x = 1 : 3; \quad x = 2 : 2; \quad x = 3 : 1$$

Use strictly positive integer coordinates.

$$3 + 2 + 1 = 6$$

Exclude the diagonal $x + y = 5$.



Q16

$$2x \geq 4 \Rightarrow y \leq 7$$

The smallest x leaves most room for y .

$$(x, y) = (2, 7)$$

This achieves the upper bound.

Q17

★★★★

$$y \leq 2x \leq 2(6 - y) \Rightarrow y \leq 4$$

$$y = 0, 1, 2, 3, 4$$

$$x = 6, 5, 4, 3, 2$$

$$x + 3y = 6, 8, 10, 12, 14$$

Greatest value 14 at (2, 4)

So y can be 0, 1, 2, 3 or 4.

List the possible y -values.

For each y , use the greatest x allowed by $x + y$ at most 6.

Calculate and compare the totals.

This pair satisfies all four inequalities.

Q18

★★★★

$$5(3) = 15 \text{ pounds}$$

$$(30 - 15)/2 = 7.5$$

$$5 + 7 = 12 \text{ people}$$

$$5(3) + 8(2) = 31 > 30$$

The five required adults cost £15.

Spend the remaining £15 on the cheaper child tickets.

Seven children fit the budget and meet the minimum of four.

Even with the minimum five adults, thirteen people cost too much.

Q19

★★★

$$x = -3, 3$$

$$-3 < x < 3$$

Read the two roots.

The graph is below the x -axis between -3 and 3 . Exclude the roots because the inequality is strict.

Q20

★★★

$$x = -2, 2$$

$$x \leq -2 \text{ or } x \geq 2$$

Read the two roots.

The graph is on or above the x -axis outside the interval from -2 to 2 . Include both roots.

Q21

$$x = -2, 3$$

$$-2 \leq x \leq 3$$

Read the two roots.

The graph is on or below the x -axis between -2 and 3 . Include both roots.

Q22

$$x = -2, 2$$

$$-2 < x < 2$$

Read the two roots.

The graph is above the x -axis between -2 and 2 . Exclude both roots.

Q23

$$(x - 2)^2 \geq 0$$

$$x = 2$$

A square is never negative.

Only the touching point gives zero.

Q24

$$(x - 3)(x + 2) < 0 \Rightarrow -2 < x < 3$$

$$x = -1, 0, 1, 2$$

Identify where the quadratic graph that opens upwards is negative.

List the integers strictly inside the interval.