

Quadratic Inequalities

Starter

1. (Review of last lesson)

Label the region R that satisfies the inequalities $x < 2$ and $x + y \geq 1$

Working: $x = 2$ is a vertical line passing through 2 on the x -axis
 Draw a **dotted** line since the inequality is $<$.
 From $x < 2$, the required region is to the left of the line so shade the unwanted region to the right of the line.

Draw the line $x + y = 1$

The line $x + y = 1$ goes through the points $(0, 1)$ and $(1, 0)$

To check: Let $x = 2, y = -1 \Rightarrow$ plot $(2, -1)$

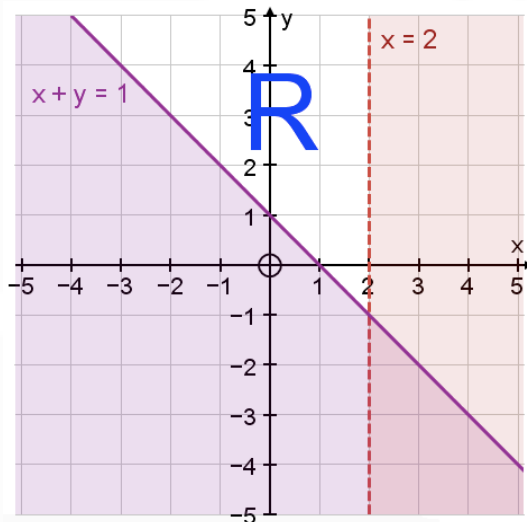
Draw a **solid** line since the inequality is \geq .

Choose the point $(0, 0)$ as it is not on the line.

Substitute into $x + y \geq 1$: $0 + 0 \geq 1$ False

$(0, 0)$ is not in the required region so shade its side of the line.

Write an R in the unshaded region.

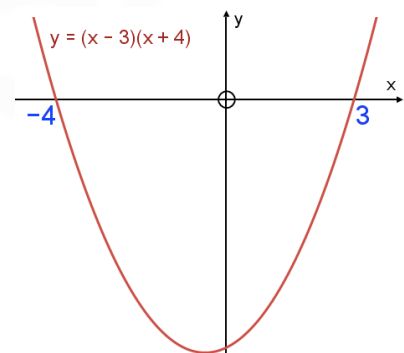


E.g. 1 Use the sketch of the graph of $y = (x - 3)(x + 4)$ to solve the inequality $(x - 3)(x + 4) > 0$.

Working: $(x - 3)(x + 4) > 0$ is the x -values where the graph is above ($>$) the x -axis

This happens when the x -values are less than -4 and more than 3 .

So the solution is $x < -4$ and $x > 3$.



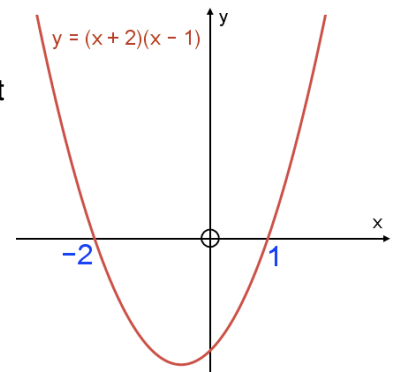
E.g. 2 Sketch the graphs of: (a) $y = (x + 2)(x - 1)$ (b) $y = -(x + 3)(x - 2)$

Working: (a) $y = (x + 2)(x - 1)$

$(x + 2)$ is a factor $\Leftrightarrow x = -2$ is a root

$(x - 1)$ is a factor $\Leftrightarrow x = 1$ is a root

Expanding the brackets the coefficient of x^2 is 1 which is > 0
 \Rightarrow concave-up

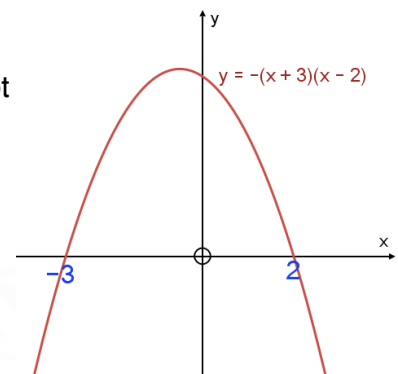


(b) $y = -(x + 3)(x - 2)$

$(x + 3)$ is a factor $\Leftrightarrow x = -3$ is a root

$(x - 2)$ is a factor $\Leftrightarrow x = 2$ is a root

Expanding the brackets the coefficient of x^2 is -1 which is < 0
 \Rightarrow concave-down



E.g. 3 Using your graphs from **E.g. 2**, solve the inequalities:

(a) $(x + 2)(x - 1) > 0$

(b) $-(x + 3)(x - 2) \geq 0$

Try and give your answer in set notation.

Working: (a) > 0 so above the x -axis

This happens when $x < -2$ and $x > 1$

In set notation: $\{x : x < -2, x > 1\}$

(b) ≥ 0 so above the x -axis

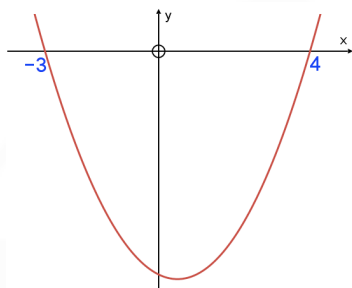
This happens when $-3 \leq x \leq 2$

In set notation: $\{x : -3 \leq x \leq 2\}$

E.g. 4 Solve the inequality $x^2 - x - 12 \leq 0$.

Hint: Solve $x^2 - x - 12 = 0$ to find the roots.

Working: Solve $x^2 - x - 12 = 0$
 $x^2 + 3x - 4x - 12 = 0 \Rightarrow x(x + 3) - 4(x + 3) = 0$
 $(x + 3)(x - 4) = 0 \Rightarrow x = -3$ or $x = 4$
The coefficient of x^2 is 1 which is > 0 so the curve is concave-up



From the inequality, ≤ 0 means below the x -axis.
This happens when the x -values are between -3 and 4 .
So $-3 \leq x \leq 4$
In set notation $\{x : -3 \leq x \leq 4\}$

Video: [Quadratic inequalities](#)

[Solutions to Starter and E.g.s](#)

Exercise

9-1 class textbook:	p515 E16.3 Qu 1-9
A*-G class textbook:	No exercise
9-1 homework book:	p174 E16.3 Qu 1-9
A*-G homework book:	No exercise

[Homework book answers \(only available during a lockdown\)](#)