Quadratic graphs: fact sheet

Planner week 17 · Learn these facts

Table of values

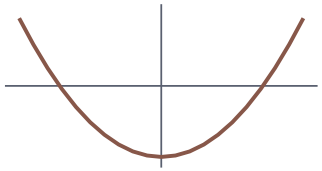
$y = x^2 - 3x + 1$

$x = -1$: $1 + 3 + 1 = 5$

Square first: $(-1)^2 = 1$

Use brackets on the calculator

U-shape



x^2 graphs are a smooth curve

Never join with a ruler

Key points

y-intercept: x = 0

turning point: the bottom

roots: where y = 0

Read them off the graph

Solving with a graph

$x^2 - 2x + 2 = 4$

read across at y = 4

Find where the curve meets the line

Usually 2 answers

Which sheet do I need?

Drawing and using quadratic graphs ▸
a table of values, a curve

Solving quadratics ▸
solve $x^2 \ldots = 0$

Recognising graph shapes ▸
match the graph to the equation

Key words

- **Quadratic** has x^2 as the highest power
- **Roots** where the graph crosses the x-axis ($y = 0$)
- **Turning point** the lowest (or highest) point
- **y-intercept** where the graph crosses the y-axis

Solving by factorising

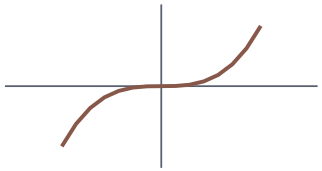
$x^2 - 2x - 15 = 0$

$(x - 5)(x + 3) = 0$

$x = 5$ or $x = -3$

Each bracket = 0

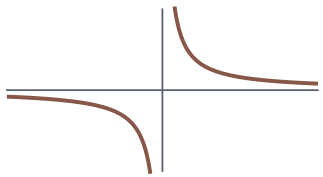
Cubic $y = x^3$



S-shape through the origin

$-x^3$ is the other way

Reciprocal $y = 1/x$



Two curves, never touch the axes

Shapes

$y = x^2$	U
$y = -x^2$	∩
$y = x^3$	S-shape
$y = 1/x$	two curves
$y = mx + c$	straight line

Exam tips

- Square negatives carefully: $(-2)^2 = 4$.
- Plot every point, then draw a smooth curve.
- The curve is symmetrical: check your table.
- Roots: read where the curve crosses $y = 0$.
- Solving "$= 4$": draw across at $y = 4$.
- Factorising: find two numbers that multiply and add.

Drawing and using quadratic graphs: fact sheet

Quadratic graphs · Planner week 17 · Learn the method

Worked example

QUESTION

(a) Complete the table of values for $y = x^2 - 2x - 3$. (b) Draw the graph and find where it crosses the x-axis.

x	−2	−1	0	1	2	3	4
y	5						

ANSWER

1. Put each x in. Square first: $x = -1 \rightarrow 1 + 2 - 3 = 0$
2. y values: 5, 0, −3, −4, −3, 0, 5
3. Plot the points and join them with a smooth U-shaped curve.
4. It crosses the x-axis where $y = 0$.

$x = -1$ and $x = 3$

Substitute each x, plot, then draw a smooth curve.

How to do it

1. Substitute each x value. Square first.
2. Plot the points carefully.
3. Join with a smooth curve, not straight lines.
4. Turning point: the lowest point of the U.
5. Solve: read the x values where the curve meets the line.

Model answer:

$x = -1$ and $x = 3$

Watch out

- $(-2)^2$ written as −4.
- Joining points with a ruler.
- Giving only one solution.

Solving quadratics: fact sheet

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Worked example

QUESTION

Solve $x^2 + 5x - 24 = 0$

ANSWER

1. Find two numbers that multiply to −24 and add to 5: 8 and −3
2. Factorise: $(x + 8)(x - 3) = 0$
3. Make each bracket equal 0: $x + 8 = 0$ or $x - 3 = 0$

$x = -8$ or $x = 3$

Factorise, then set each bracket equal to 0.

How to do it

1. Make sure the equation is "= 0".
2. Find two numbers that multiply to the number and add to the x number.
3. Write the two brackets.
4. Set each bracket to 0.
5. Solve each one: two answers.

Model answer:

$x = -8$ or $x = 3$

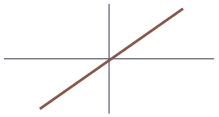
Watch out

- Keeping the signs from the brackets (x = 8).
- Giving one answer only.
- Not making it "= 0" first.

Recognising graph shapes: fact sheet

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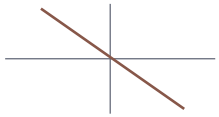
Worked example



Straight line

$y = 2x + 1$

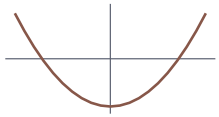
x only, no powers



Straight line going down

$y = 4 - 3x$

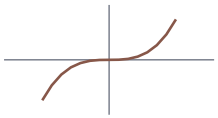
negative x



Quadratic: U-shape

$y = x^2 + 2x$

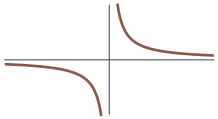
has x^2



Cubic: S-shape

$y = x^3 + 1$

has x^3



Reciprocal: 2 curves

$y = 1/x$

x on the bottom

Look at the highest power of x to know the shape.

How to do it

1. Only x (no power): a straight line.
2. Number in front of x negative: the line goes down.
3. Highest power x^2: a U-shape (∩ if $-x^2$).
4. Highest power x^3: an S-shape.
5. x on the bottom of a fraction (1/x): two separate curves.

Model answer:

$y = x^2 + 2x$ is a U-shape

Watch out

- Mixing up x^2 (U) and x^3 (S).
- Choosing an upward line for $y = 4 - 3x$.
- Thinking 1/x crosses the axes.