

Welcome to GCSE 7+

Friday 9 April 2021

Session 4: Quadratic graphs

Keep GCSE 7+ safe for everyone

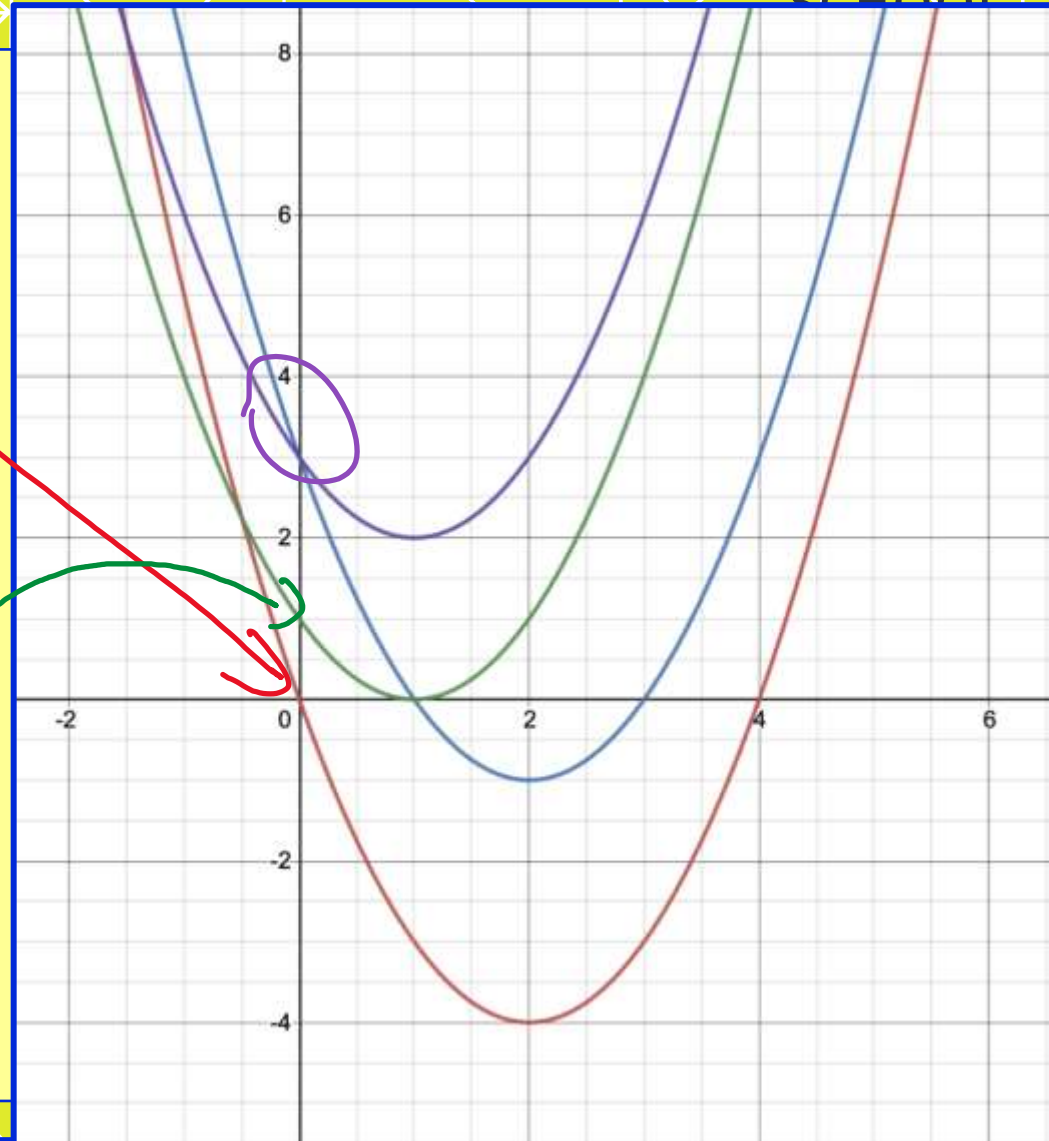
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- **Do not GIVE** anyone **your** personal contact details: email, 'phone number, social media name, Instagram address etc.
- If **anyone** asks you, in the Chat or directly, for your personal contact details, or
- If you read in the Chat, or if you overhear, **anyone** asking for or giving out personal contact details, or
- If you have any concerns about the welfare/wellbeing of any participant, including yourself, then you must **as soon as possible**
 - email the Head teacher dan.abramson@kcl.ac.uk or text him 07902 911144 and say what your concern is,
 - or email kclmsoutreach@kcl.ac.uk and ask Dan to contact you.

Quadratic graphs

Match the equations and the graphs:

- $y = x^2 - 4x$
- $y = x^2 - 2x + 3$
- $y = x^2 - 2x + 1$
- $y = x^2 - 4x + 3$

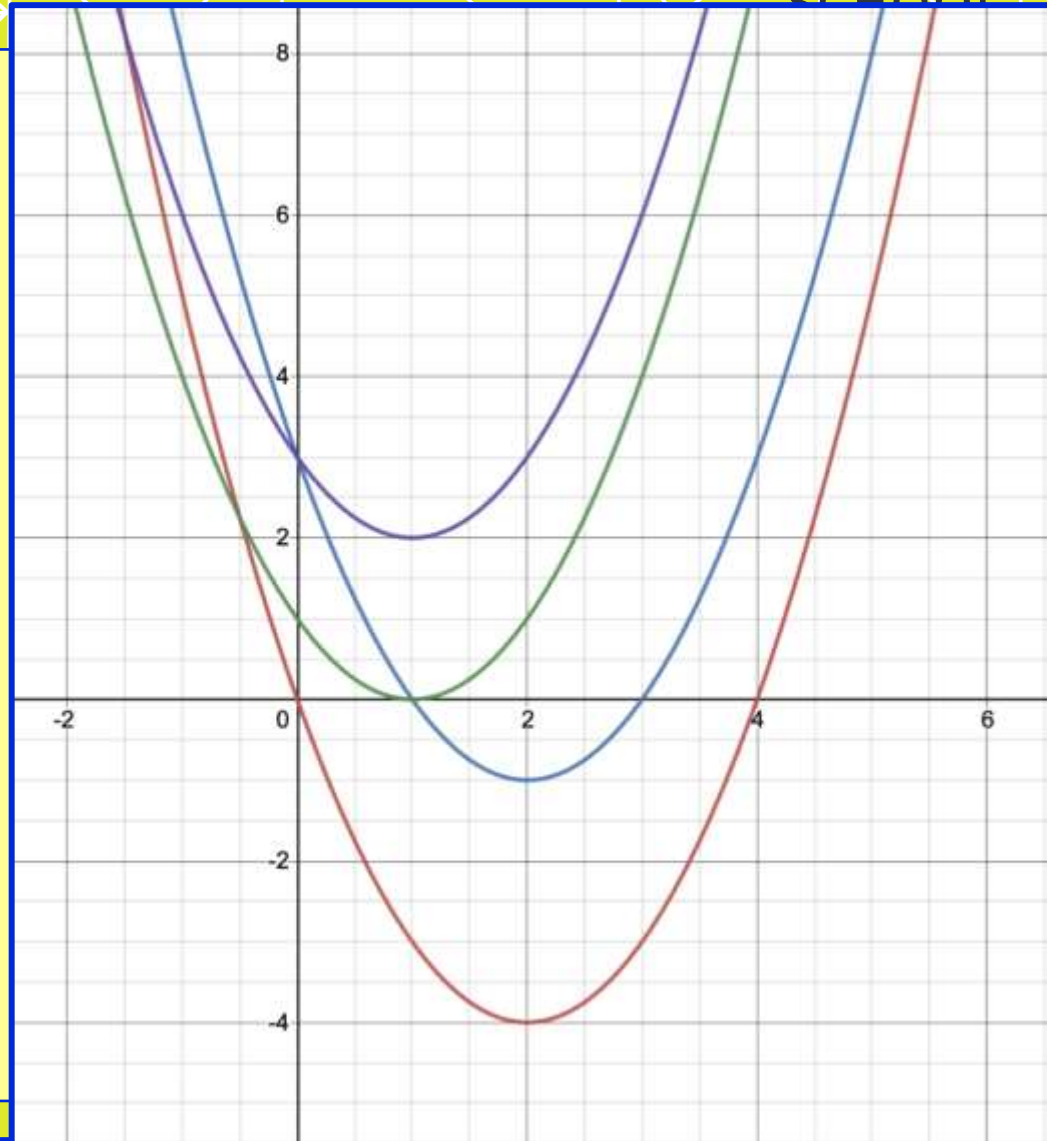
0
3
1
3



Quadratic graphs

Match the equations and the **y-intercepts**:

- $y = x^2 - 4x$
 $0^2 - 4 \times 0 = 0$
- $y = x^2 - 2x + 3$
 $0^2 - 2 \times 0 + 3 = 3$
- $y = x^2 - 2x + 1$
 $0^2 - 2 \times 0 + 1 = 1$
- $y = x^2 - 4x + 3$
 $0^2 - 4 \times 0 + 3 = 3$



Quadratic graphs

Match the equations and
the x -intercepts: *roots*

- $y = x^2 - 4x$

→ $0 = x(x - 4)$ $x = 0 \text{ or } 4$

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

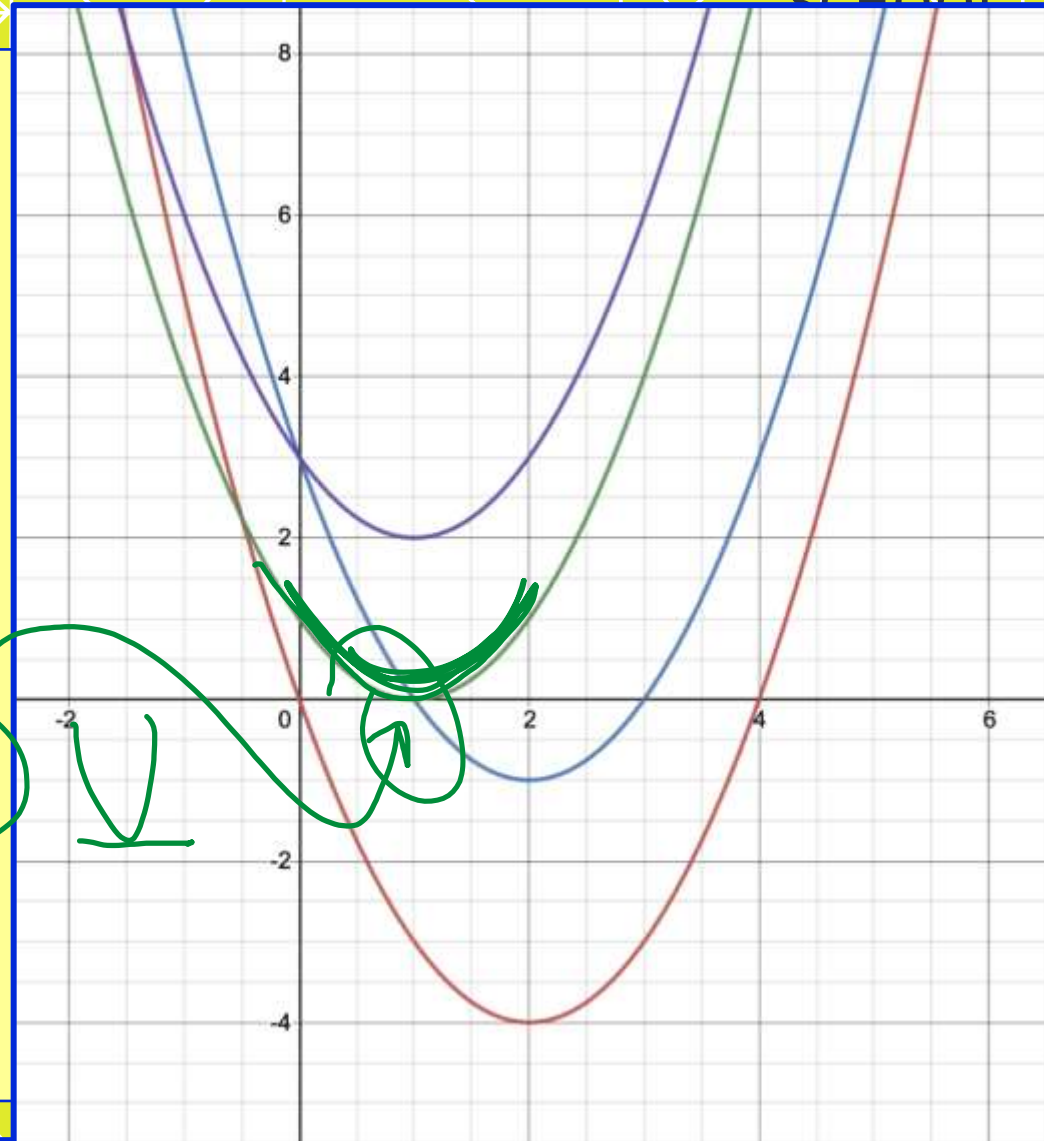
→ $0 = x^2 - 2x + 3$?

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

→ $0 = (x - 1)^2$ $x = 1 \text{ or } 1$

- $y = x^2 - 4x + 3$

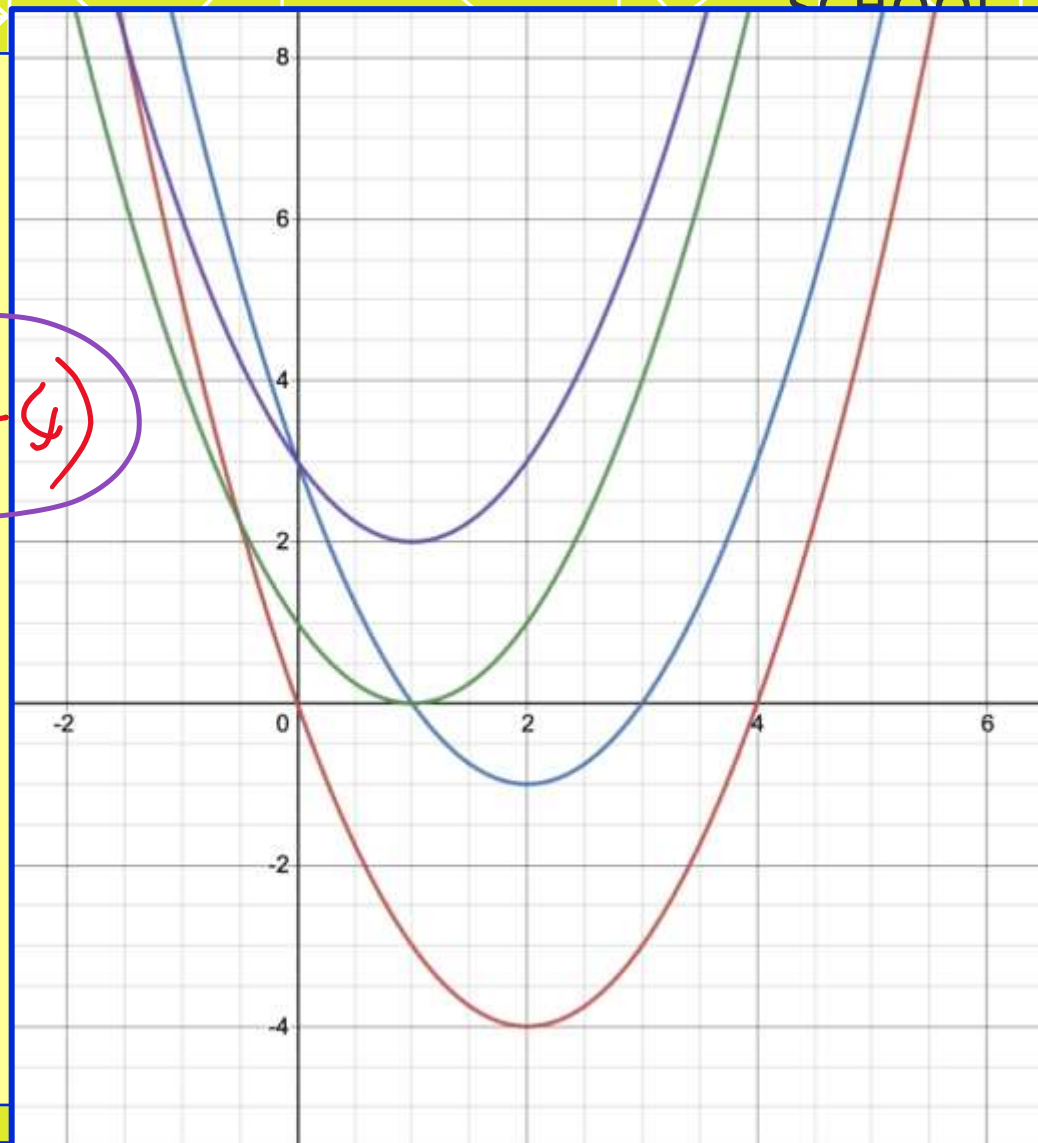
→ $0 = (x - 1)(x - 3)$
 $x = 1 \text{ or } x = 3$



Quadratic graphs

Match the equations and the **vertices** by 'completing the square':

- $y = x^2 - 4x$
 $\equiv (x - 2)^2 - 4$ $(2, -4)$
- $y = x^2 - 2x + 3$
 $\equiv (x - 1)^2 + 2$ $(1, 2)$
- $y = x^2 - 2x + 1$
 $\equiv (x - 1)^2$ $(1, 0)$
- $y = x^2 - 4x + 3$
 $\equiv (x - 2)^2 - 1$ $(2, -1)$



Quadratic graphs

Match the equations and the **vertices** by 'partial factorisation':

- $y = x^2 - 4x$

$$\equiv x(x - 4)$$

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

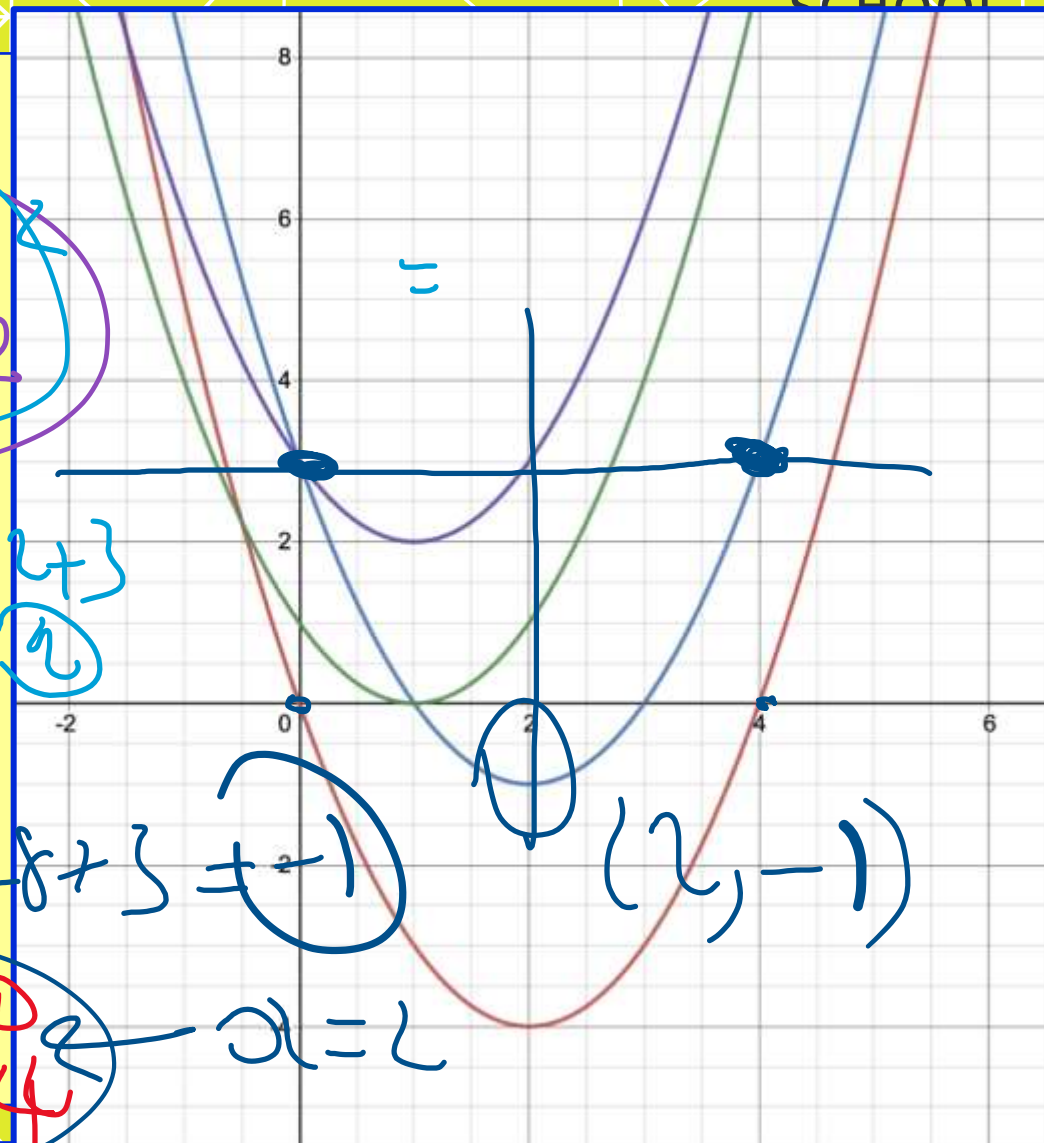
$$\equiv x(x - 2) + 3$$

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

$$\equiv x(x - 2) + 1$$

- $y = x^2 - 4x + 3$

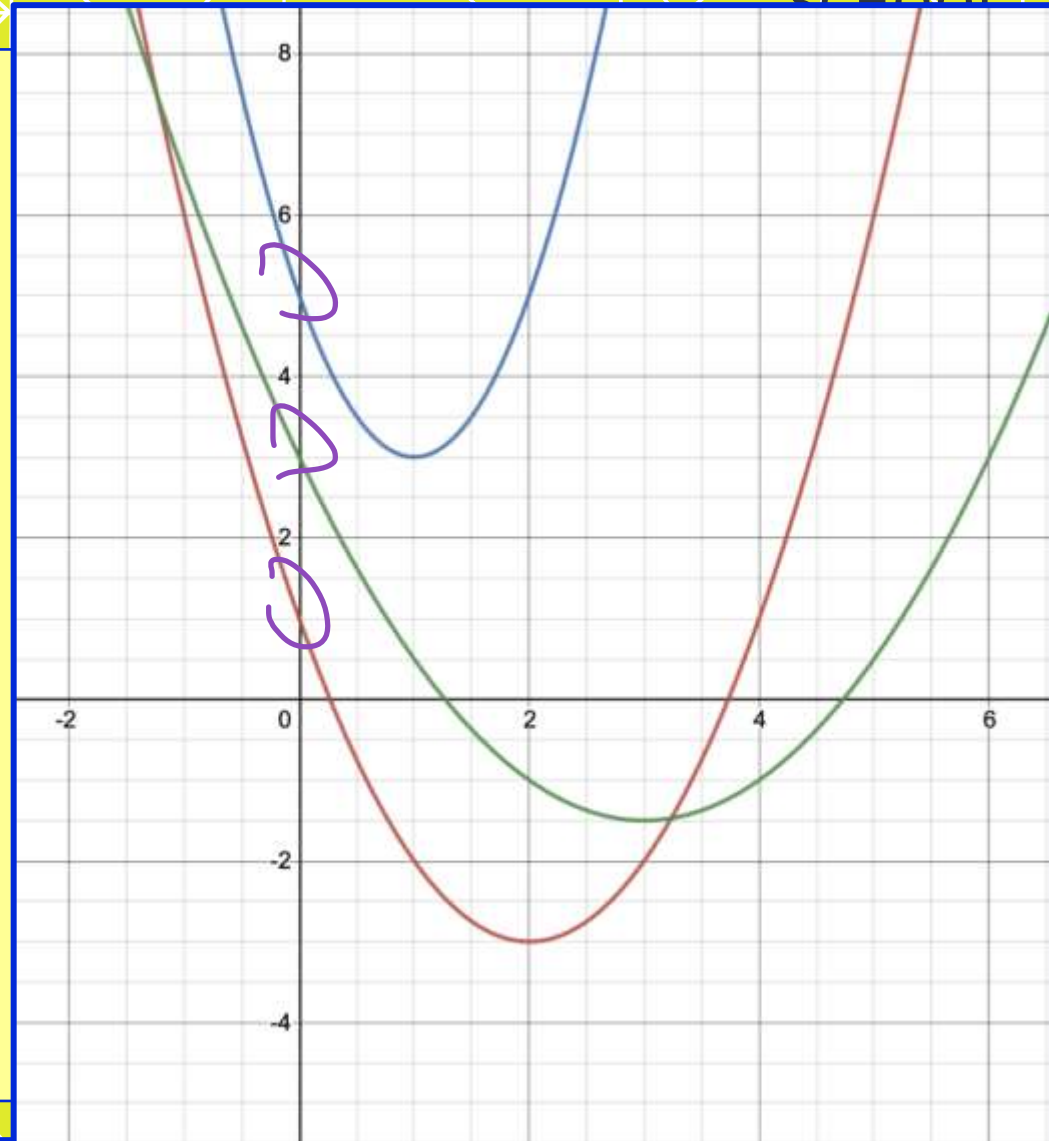
$$\equiv x(x - 4) + 3$$



Quadratic graphs

Match the equations and the graphs:

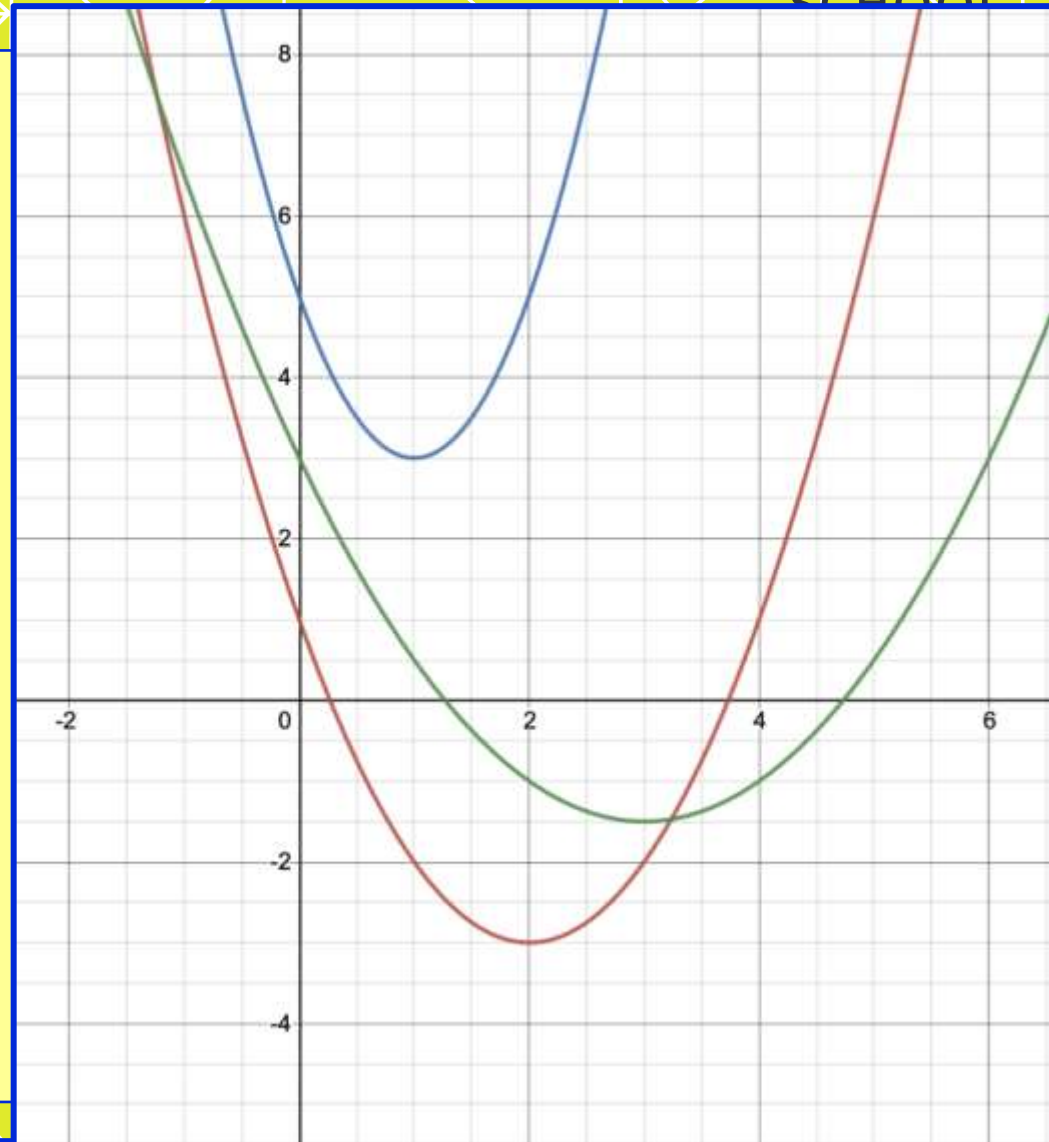
- $y = x^2 - 4x + 1$
- $y = 2x^2 - 4x + 5$
- $y = \frac{1}{2}x^2 - 3x + 3$



Quadratic graphs

Match the equations and the **y-intercepts**:

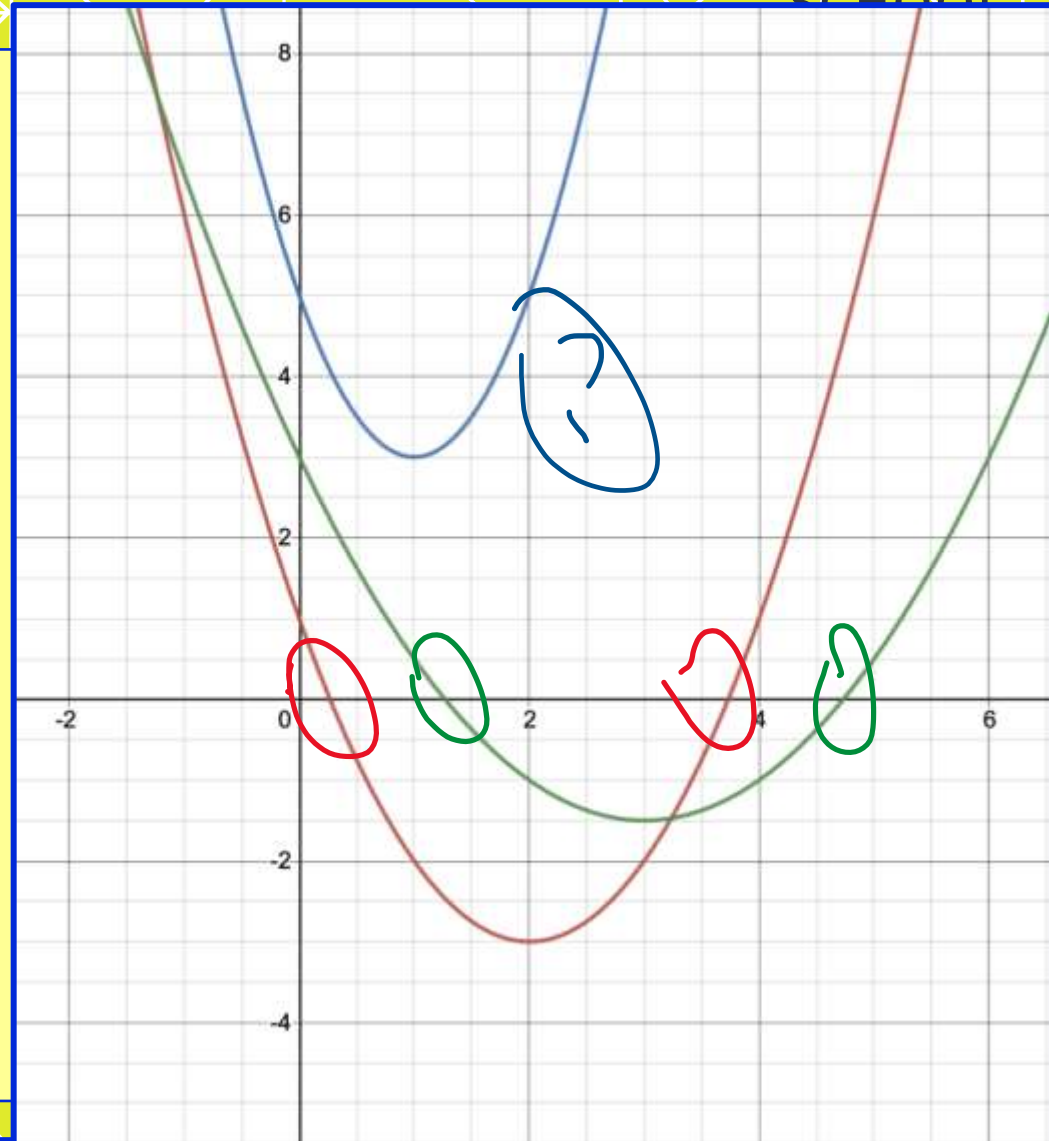
- $y = 0^2 - 4 \times 0 + 1$
- $y = 2 \times 0^2 - 4 \times 0 + 5$
- $y = \frac{1}{2} \times 0^2 - 3 \times 0 + 3$



Quadratic graphs

Match the equations and the x -intercepts:

- $0 = x^2 - 4x + 1$
- $0 = 2x^2 - 4x + 5$
- $0 = \frac{1}{2}x^2 - 3x + 3$



Quadratic graphs

Match the equations and the **vertices** by 'partial factorisation':

• $y = x^2 - 4x + 1$
 $\equiv x(x - 4) + 1$

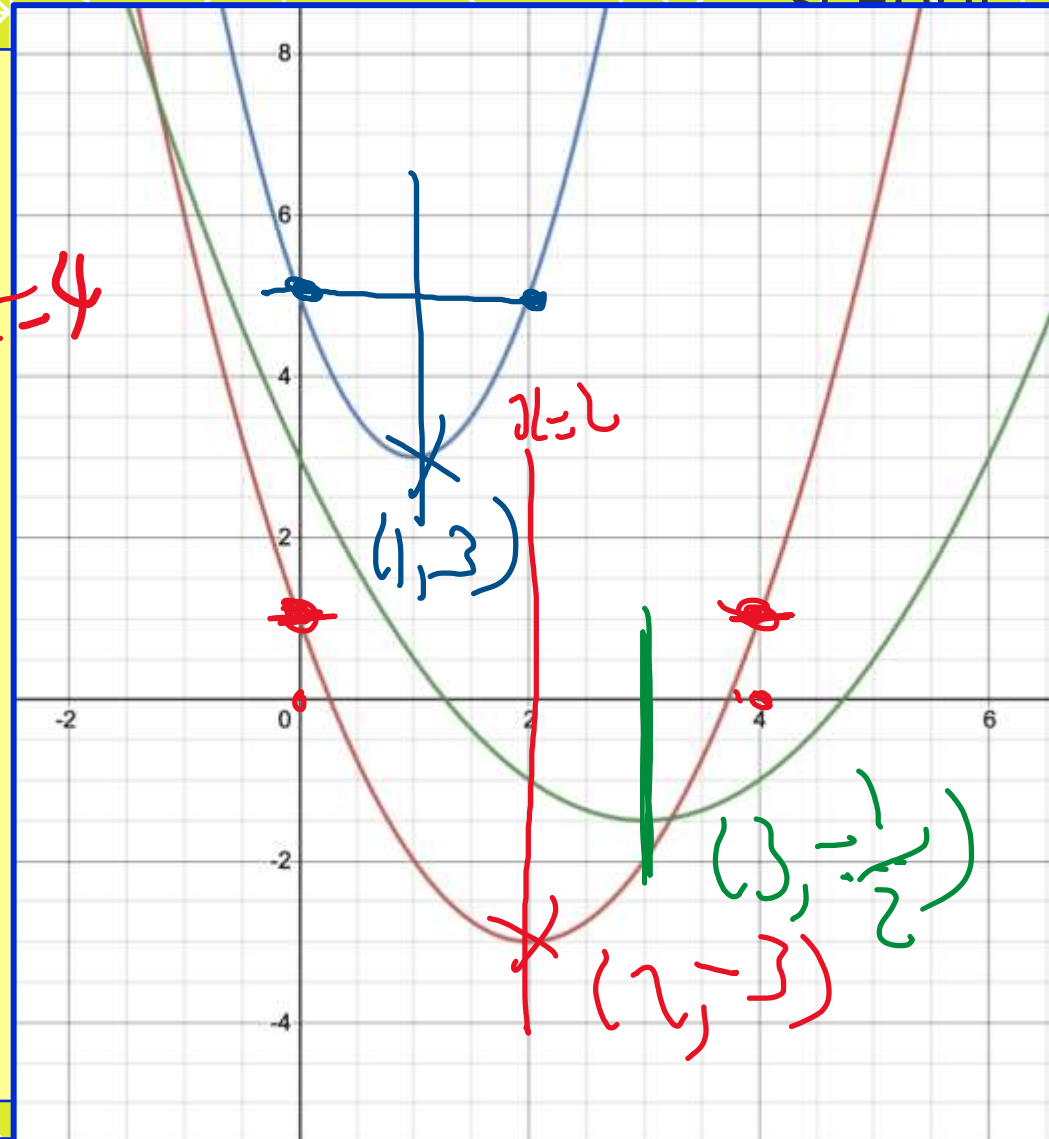
$y = 1$
 $x = 0, x = 4$

• $y = 2x^2 - 4x + 5$
 $\equiv 2x(x - 2) + 5$

$x = 0$
 $x = 2$

• $y = \frac{1}{2}x^2 - 3x + 3$
 $\equiv x\left(\frac{1}{2}x - 3\right) + 3$

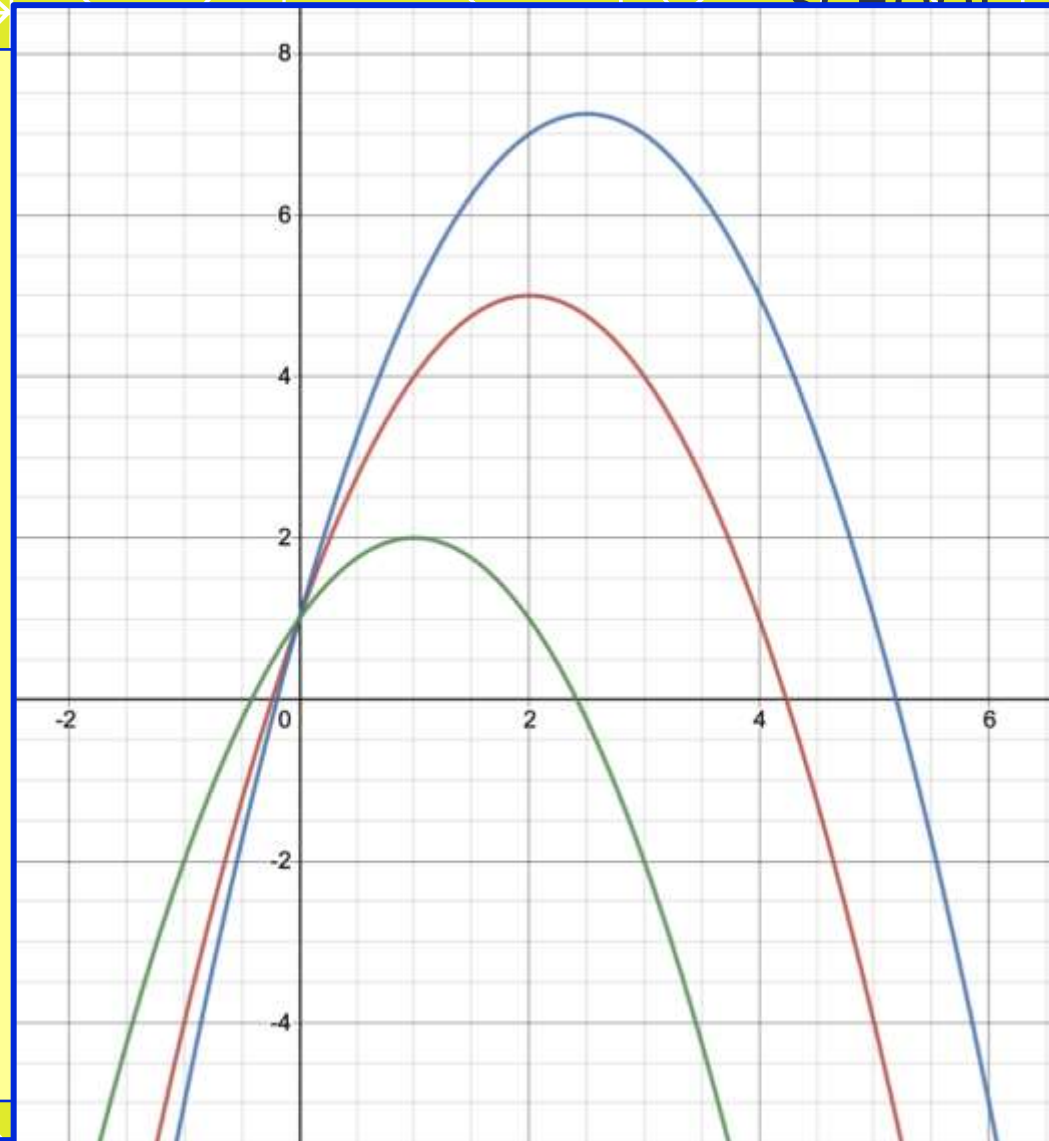
$x = 0$
 $x = 6$
 $x = 3$



Quadratic graphs

Match the equations and the graphs:

- $y = -x^2 + 2x + 1$
- $y = -x^2 + 4x + 1$
- $y = -x^2 + 5x + 1$



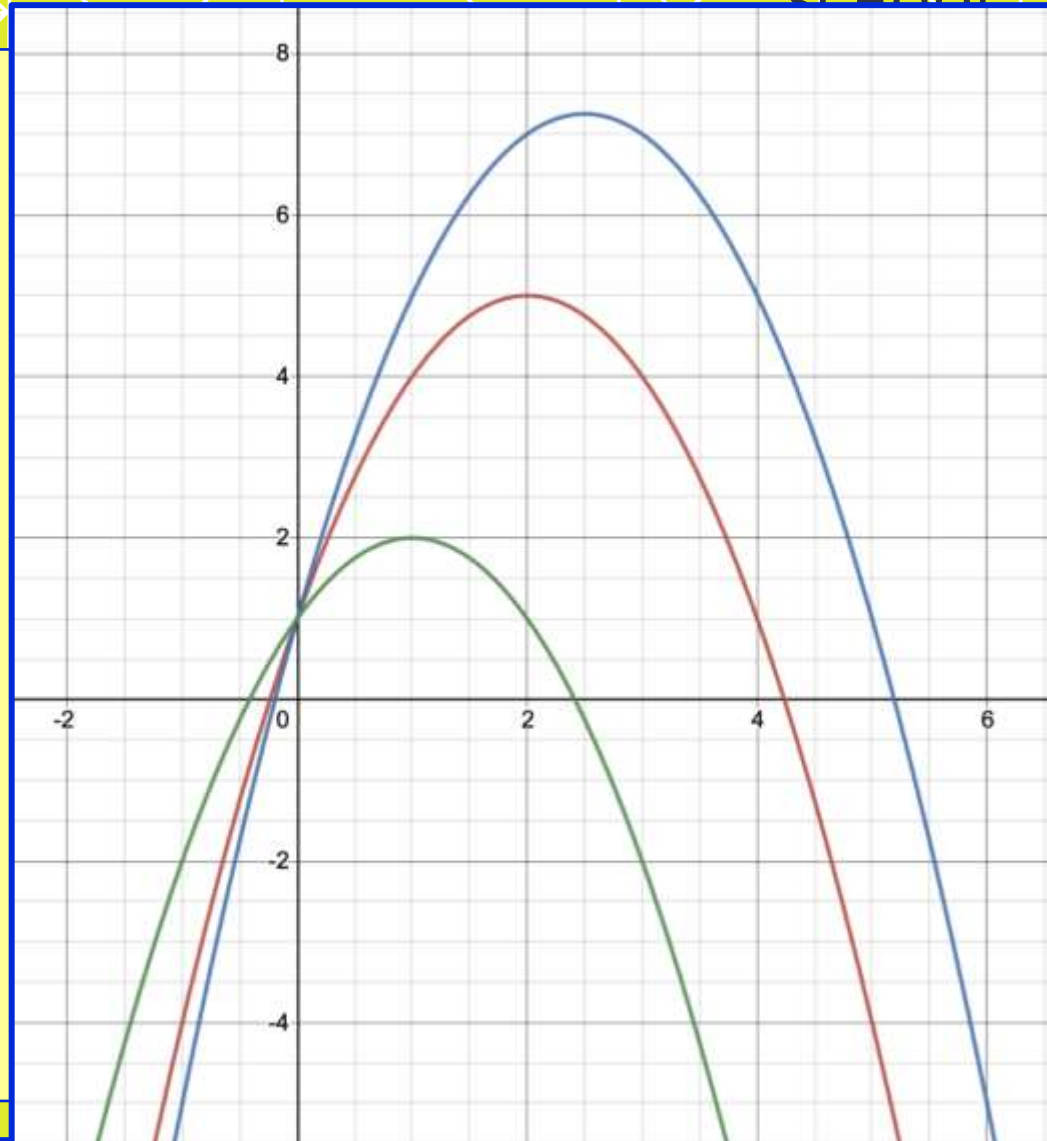
Quadratic graphs

Match the equations and the **y-intercepts**:

- $y = -0^2 + 2 \times 0 + 1$

- $y = -0^2 + 4 \times 0 + 1$

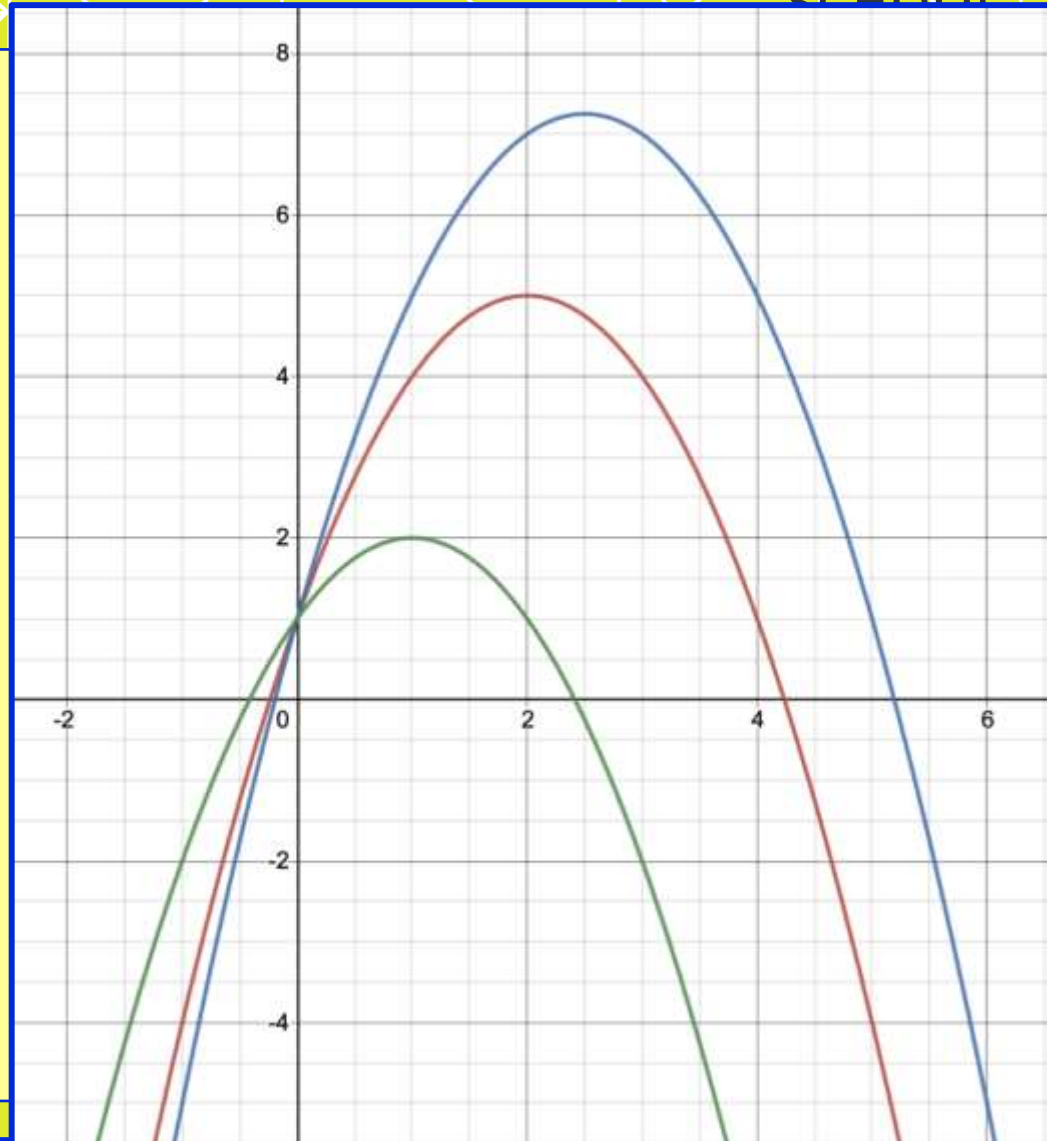
- $y = -0^2 + 5 \times 0 + 1$



Quadratic graphs

Match the equations and the x -intercepts :

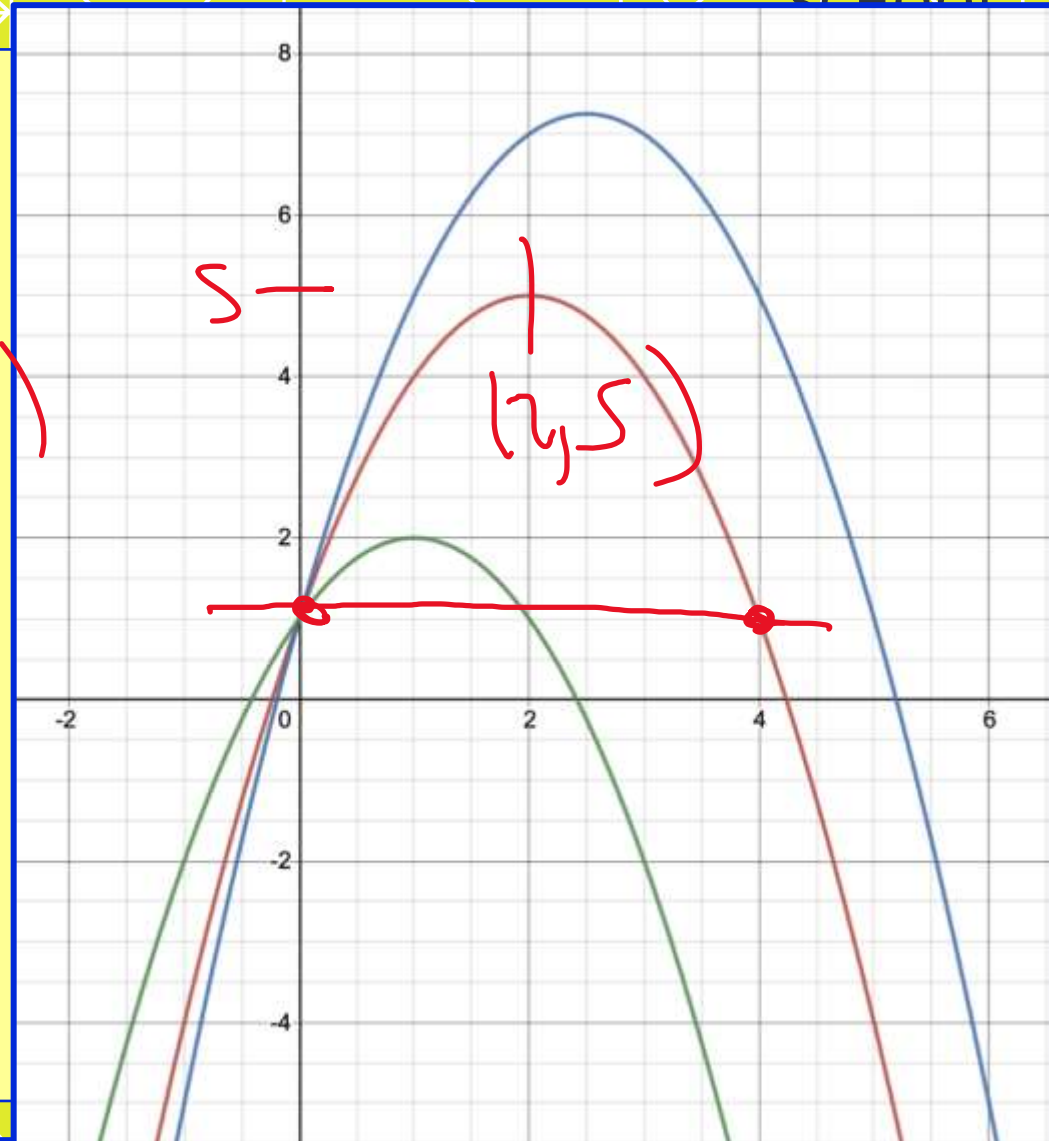
- $0 = -x^2 + 2x + 1$
- $0 = -x^2 + 4x + 1$
- $0 = -x^2 + 5x + 1$



Quadratic graphs

Match the equations and the **vertices** by 'partial factorisation':

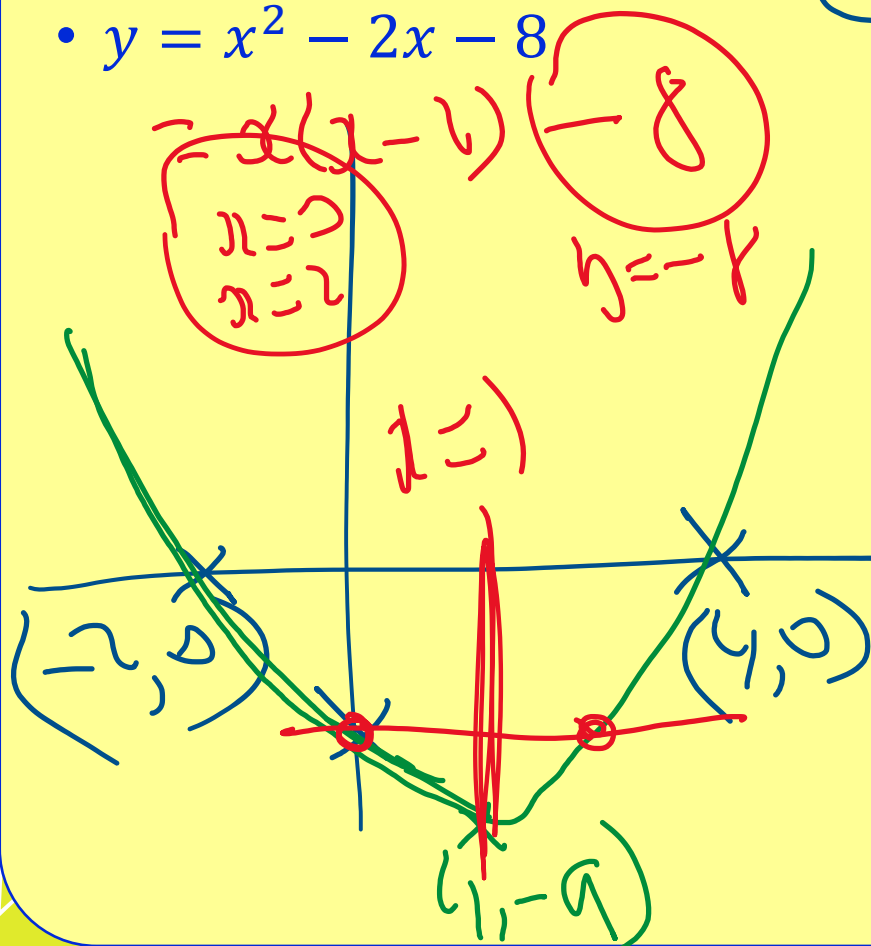
- $x=0$ $x=4$
- $y = -x^2 + 2x + 1$
 $\equiv x(2 - x) + 1$
 - $y = -x^2 + 4x + 1$
 $\equiv x(4 - x) + 1$
 - $y = -x^2 + 5x + 1$
 $\equiv x(5 - x) + 1$
- $y=1$



Quadratic graphs

Sketch

- $y = x^2 - 2x - 8$



$x=3, y=-8$ y-intercept

x-intercept

(vertex) turning point

$y=0$

$x^2 - 2x - 8 = 0$

$\Rightarrow (x-4)(x+2) = 0$

$y = (x-1)^2 - 9$

$(1, -9)$

Quadratic graphs

Sketch

• $y = x^2 + 2x - 2$

$a = -1$

$(-1, -3)$

$(0, -2)$

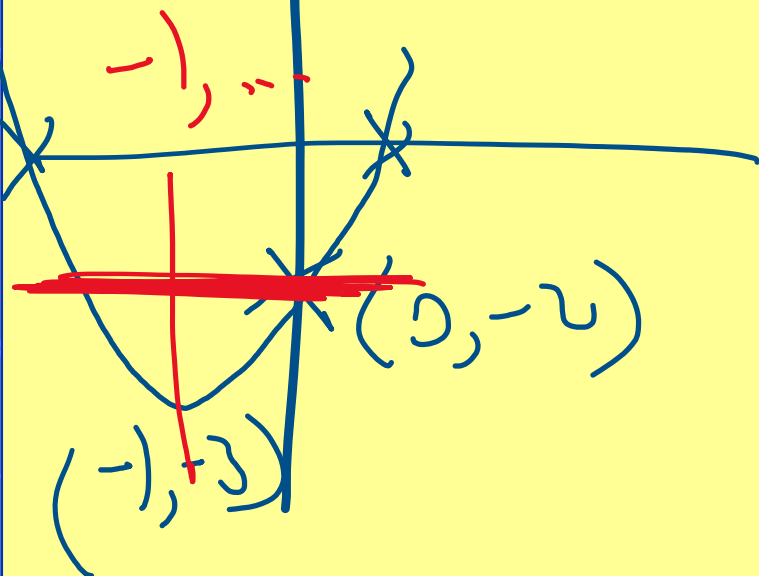
$x^2 + 2x - 2 = 0$

$\Rightarrow (x+1)^2 - 3 = 0$

$\Rightarrow x+1 = \pm\sqrt{3}$

$\Rightarrow x = -1 \pm \sqrt{3}$

$\approx \{-1 \pm 1.7\}$

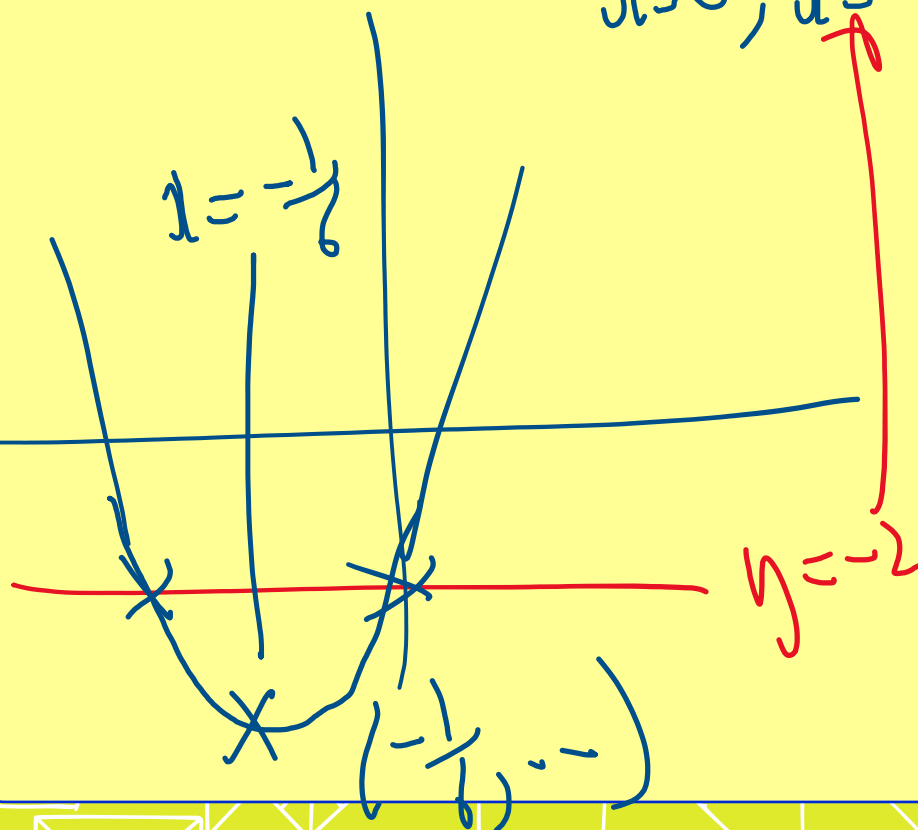


Quadratic graphs

Sketch

• $y = 3x^2 + x - 2$

$\hat{=} x(3x+1) - 2$
 $a=0, a=-\frac{1}{3}$

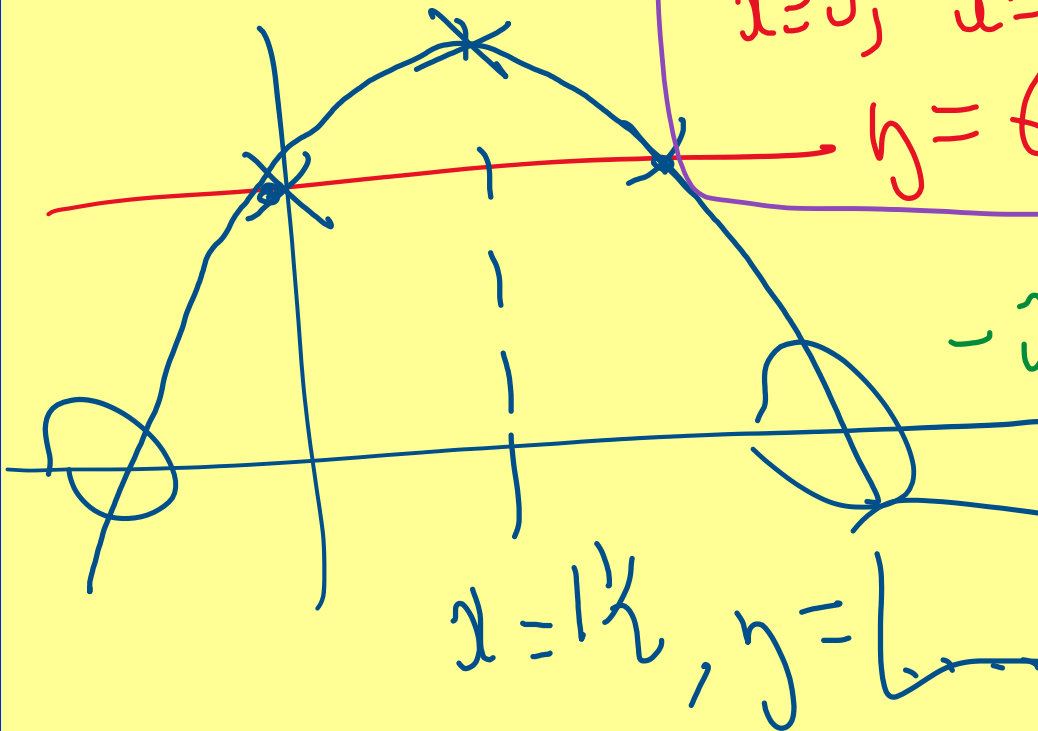


Quadratic graphs

Sketch

• $y = -x^2 + 3x + 6$ $\equiv x(-x+3) + 6$

$x=0, x=3$
 $y=6$



$x=1\frac{1}{2}, y=6\frac{3}{4}$

$-x^2 + 3x + 6 = 0$
 $\Rightarrow x^2 - 3x - 6 = 0$
 \downarrow

Hand-drawn graph on grid paper showing three parabolas:

- Blue parabola: $y = (x-2)^2 + 1$. Vertex at $(2, 1)$.
- Green parabola: $y = \frac{1}{2}(x-2)^2$. Vertex at $(2, 0)$.
- Red parabola: $y = (x-2)^2 - 6$. Vertex at $(2, -6)$.

Handwritten notes and calculations:

- For the blue parabola: $x=0, y=2^2+1=5 \checkmark$
- For the green parabola: $x(0, -1) \quad y = \frac{1}{2} []$
- For the red parabola: $\text{check: } x=0, y=-6$

Quadratic graphs

What are the equations of these quadratic graphs?

