

IDENTIFY THE METHOD, THEN SOLVE

$$x^2 + 7x = 0$$

Y11
Quadratics practice

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IDENTIFY THE METHOD, THEN SOLVE

$$x^2 - 36 = 0$$

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IDENTIFY THE METHOD, THEN SOLVE

$$x^2 + 8x + 16 = 0$$

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IDENTIFY THE METHOD, THEN SOLVE

$$x^2 + 9x + 14 = 0$$

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IDENTIFY THE METHOD, THEN SOLVE

$$x^2 - 11x + 24 = 0$$

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IDENTIFY THE METHOD, THEN SOLVE

$$x^2 + 3x - 28 = 0$$

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IDENTIFY THE METHOD, THEN SOLVE

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

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IDENTIFY THE METHOD, THEN SOLVE

$$x^2 + 5x = 24$$

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Discriminant: $b^2 - 4ac = 0^2 - 4 \times 1 \times (-36) = 144$, which is a perfect square, so it **factorises**

Method: difference of two squares

Why: two terms, a minus sign, and both are perfect squares (x^2 and 6^2). The discriminant is a perfect square (144).

$$(x + 6)(x - 6) = 0$$

$$x = -6 \text{ or } x = 6$$



Discriminant: $b^2 - 4ac = 7^2 - 4 \times 1 \times 0 = 49$, which is a perfect square, so it **factorises**

Method: common factor

Why: there is no constant term, so every term has an x. Take x out.

$$x(x + 7) = 0$$

$$x = 0 \text{ or } x + 7 = 0$$

$$x = 0 \text{ or } x = -7$$



Discriminant: $b^2 - 4ac = 9^2 - 4 \times 1 \times 14 = 25$, which is a perfect square, so it **factorises**

Method: factorise: two numbers

Why: $a = 1$ and the discriminant is a perfect square (25), so it factorises. Find two numbers that multiply to 14 and add to 9: 2 and 7.

$$(x + 2)(x + 7) = 0$$

$$x = -2 \text{ or } x = -7$$



Discriminant: $b^2 - 4ac = 8^2 - 4 \times 1 \times 16 = 0$, which is zero, so **one repeated solution** (a perfect square)

Method: perfect square

Why: the discriminant is 0, so the roots are the same. First and last terms are squares and $8x = 2 \times x \times 4$.

$$(x + 4)^2 = 0$$

$$x + 4 = 0$$

$$x = -4 \text{ (one repeated solution)}$$



Discriminant: $b^2 - 4ac = 3^2 - 4 \times 1 \times (-28) = 121$, which is a perfect square, so it **factorises**

Method: factorise: two numbers

Why: the discriminant is a perfect square (121). c is negative, so the signs differ, and the larger number takes the sign of b : 7 and -4 .

$$(x + 7)(x - 4) = 0$$

$$x = -7 \text{ or } x = 4$$



Discriminant: $b^2 - 4ac = (-11)^2 - 4 \times 1 \times 24 = 25$, which is a perfect square, so it **factorises**

Method: factorise: two numbers

Why: $a = 1$ and the discriminant is a perfect square (25). c is positive and b is negative, so both numbers are negative: -3 and -8 multiply to 24 and add to -11 .

$$(x - 3)(x - 8) = 0$$

$$x = 3 \text{ or } x = 8$$



Discriminant: $b^2 - 4ac = 5^2 - 4 \times 1 \times (-24) = 121$, which is a perfect square, so it **factorises**

Method: factorise, after making one side 0

Why: the equation is not equal to 0 yet. Subtract 24 first, then the discriminant is 121 (a perfect square), so it factorises.

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

$$(x + 8)(x - 3) = 0$$

$$x = -8 \text{ or } x = 3$$



Discriminant: $b^2 - 4ac = (-5)^2 - 4 \times 1 \times (-24) = 121$, which is a perfect square, so it **factorises**

Method: factorise: two numbers

Why: the discriminant is a perfect square (121). c is negative, so the signs differ, and the larger number is negative because b is negative: -8 and 3.

$$(x - 8)(x + 3) = 0$$

$$x = 8 \text{ or } x = -3$$



IDENTIFY THE METHOD, THEN SOLVE

$$x^2 = 7x - 12$$

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IDENTIFY THE METHOD, THEN SOLVE

$$x^2 + 6x + 3 = 0$$

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IDENTIFY THE METHOD, THEN SOLVE

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

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IDENTIFY THE METHOD, THEN SOLVE

$$x^2 + 10x + 20 = 0$$

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IDENTIFY THE METHOD, THEN SOLVE

$$x^2 - 8x + 5 = 0$$

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IDENTIFY THE METHOD, THEN SOLVE

$$x^2 + 4x + 9 = 0$$

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IDENTIFY THE METHOD, THEN SOLVE

$$x^2 - 6x + 10 = 0$$

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IDENTIFY THE METHOD, THEN SOLVE

$$x^2 + 14x + 49 = 0$$

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Discriminant: $b^2 - 4ac = 6^2 - 4 \times 1 \times 3 = 24$, which is positive but not a perfect square, so it **will not** factorise nicely

Method: complete the square

Why: no pair of integers multiplies to 3 and adds to 6, and the discriminant is not a perfect square, so it will not factorise. Complete the square.

$$(x + 3)^2 - 9 + 3 = 0$$

$$(x + 3)^2 = 6$$

$$x + 3 = \pm \sqrt{6}$$

$$x = -3 + \sqrt{6} \text{ or } x = -3 - \sqrt{6}$$



Discriminant: $b^2 - 4ac = (-7)^2 - 4 \times 1 \times 12 = 1$, which is a perfect square, so it **factorises**

Method: factorise, after making one side 0

Why: move everything to one side so the equation equals 0. The discriminant is 1, a perfect square, so it factorises.

$$x^2 - 7x + 12 = 0$$

$$(x - 3)(x - 4) = 0$$

$$x = 3 \text{ or } x = 4$$



Discriminant: $b^2 - 4ac = 10^2 - 4 \times 1 \times 20 = 20$, which is positive but not a perfect square, so it **will not** factorise nicely

Method: complete the square

Why: the discriminant is 20, not a perfect square, so it will not factorise. Half of 10 is 5.

$$(x + 5)^2 - 25 + 20 = 0$$

$$(x + 5)^2 = 5$$

$$x + 5 = \pm \sqrt{5}$$

$$x = -5 + \sqrt{5} \text{ or } x = -5 - \sqrt{5}$$



Discriminant: $b^2 - 4ac = (-4)^2 - 4 \times 1 \times (-1) = 20$, which is positive but not a perfect square, so it **will not** factorise nicely

Method: complete the square

Why: the discriminant is 20, not a perfect square, so it will not factorise. Half of -4 is -2 .

$$(x - 2)^2 - 4 - 1 = 0$$

$$(x - 2)^2 = 5$$

$$x - 2 = \pm \sqrt{5}$$

$$x = 2 + \sqrt{5} \text{ or } x = 2 - \sqrt{5}$$



Discriminant: $b^2 - 4ac = 4^2 - 4 \times 1 \times 9 = -20$, which is negative, so **no real solutions**

Method: none needed: no real solutions

Why: the discriminant is negative, so the parabola never reaches the x-axis. Completing the square shows why: $(x + 2)^2 + 5 = 0$ has $(x + 2)^2 = -5$, which is impossible.

$$(x + 2)^2 + 5 = 0$$

No real solutions



Discriminant: $b^2 - 4ac = (-8)^2 - 4 \times 1 \times 5 = 44$, which is positive but not a perfect square, so it **will not** factorise nicely

Method: complete the square

Why: the discriminant is 44, not a perfect square, so it will not factorise. Half of -8 is -4 .

$$(x - 4)^2 - 16 + 5 = 0$$

$$(x - 4)^2 = 11$$

$$x - 4 = \pm \sqrt{11}$$

$$x = 4 + \sqrt{11} \text{ or } x = 4 - \sqrt{11}$$



Discriminant: $b^2 - 4ac = 14^2 - 4 \times 1 \times 49 = 0$, which is zero, so **one repeated solution** (a perfect square)

Method: perfect square

Why: the discriminant is 0, so there is one repeated root. $49 = 7^2$ and $14x = 2 \times x \times 7$.

$$(x + 7)^2 = 0$$

$$x = -7 \text{ (one repeated solution)}$$



Discriminant: $b^2 - 4ac = (-6)^2 - 4 \times 1 \times 10 = -4$, which is negative, so **no real solutions**

Method: none needed: no real solutions

Why: the discriminant is negative. Completing the square: $(x - 3)^2 + 1 = 0$ would need $(x - 3)^2 = -1$, which is impossible.

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

No real solutions



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$$3x^2 = 75$$

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IDENTIFY THE METHOD, THEN SOLVE

$$(x + 3)^2 = 25$$

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IDENTIFY THE METHOD, THEN SOLVE

$$(x - 1)^2 = 7$$

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IDENTIFY THE METHOD, THEN SOLVE

$$x^2 + 9 = 0$$

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IDENTIFY THE METHOD, THEN SOLVE

$$x^2 - 20 = 0$$

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IDENTIFY THE METHOD, THEN SOLVE

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

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IDENTIFY THE METHOD, THEN SOLVE

$$x^2 - 12x + 36 = 0$$

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IDENTIFY THE METHOD, THEN SOLVE

$$x^2 - 3x - 40 = 0$$

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Method: square roots

Why: it is already a squared bracket equal to a number, so square root both sides and remember $\pm$.

$$x + 3 = \pm 5$$

$$x + 3 = 5 \text{ or } x + 3 = -5$$

$$x = 2 \text{ or } x = -8$$

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Method: square roots (or difference of two squares)

Why: there is no x term, so isolate x^2 and square root both sides.

$$x^2 = 25$$

$$x = \pm 5$$

$$x = 5 \text{ or } x = -5$$

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Discriminant: $b^2 - 4ac = 0^2 - 4 \times 1 \times 9 = -36$, which is negative, so **no real solutions**

Method: none needed: no real solutions

Why: $x^2 = -9$, and a square can never be negative. The discriminant is -36 .

$$x^2 = -9$$

No real solutions

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Method: square roots

Why: a squared bracket equals a number. Square root both sides with $\pm$. 7 is not a square number, so leave $\sqrt{7}$.

$$x - 1 = \pm \sqrt{7}$$

$$x = 1 + \sqrt{7} \text{ or } x = 1 - \sqrt{7}$$

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Discriminant: $b^2 - 4ac = 2^2 - 4 \times 1 \times (-5) = 24$, which is positive but not a perfect square, so it **will not factorise nicely**

Method: complete the square

Why: the discriminant is 24, not a perfect square, so it will not factorise. Half of 2 is 1.

$$(x + 1)^2 - 1 - 5 = 0$$

$$(x + 1)^2 = 6$$

$$x + 1 = \pm \sqrt{6}$$

$$x = -1 + \sqrt{6} \text{ or } x = -1 - \sqrt{6}$$

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Method: square roots

Why: there is no x term. 20 is not a square number, so it is not a difference of two squares: use square roots.

$$x^2 = 20$$

$$x = \pm \sqrt{20} = \pm 2\sqrt{5}$$

$$x = 2\sqrt{5} \text{ or } x = -2\sqrt{5}$$

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Discriminant: $b^2 - 4ac = (-3)^2 - 4 \times 1 \times (-40) = 169$, which is a perfect square, so it **factorises**

Method: factorise: two numbers

Why: the discriminant is a perfect square (169). c is negative so the signs differ, and the larger number is negative because b is negative: -8 and 5 .

$$(x - 8)(x + 5) = 0$$

$$x = 8 \text{ or } x = -5$$

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Discriminant: $b^2 - 4ac = (-12)^2 - 4 \times 1 \times 36 = 0$, which is zero, so **one repeated solution** (a perfect square)

Method: perfect square

Why: the discriminant is 0. $36 = 6^2$ and $12x = 2 \times x \times 6$.

$$(x - 6)^2 = 0$$

$$x = 6 \text{ (one repeated solution)}$$

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EXTENDED: IDENTIFY THE METHOD, THEN SOLVE

$$2x^2 + 11x + 5 = 0$$

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EXTENDED: IDENTIFY THE METHOD, THEN SOLVE

$$3x^2 + 10x + 8 = 0$$

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EXTENDED: IDENTIFY THE METHOD, THEN SOLVE

$$2x^2 - 5x - 3 = 0$$

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EXTENDED: IDENTIFY THE METHOD, THEN SOLVE

$$6x^2 - x - 2 = 0$$

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EXTENDED: IDENTIFY THE METHOD, THEN SOLVE

$$4x^2 - 9 = 0$$

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EXTENDED: IDENTIFY THE METHOD, THEN SOLVE

$$4x^2 + 12x + 9 = 0$$

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EXTENDED: IDENTIFY THE METHOD, THEN SOLVE

$$3x^2 - 12x = 0$$

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EXTENDED: IDENTIFY THE METHOD, THEN SOLVE

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

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Discriminant: $b^2 - 4ac = 10^2 - 4 \times 3 \times 8 = 4$, which is a perfect square, so it factorises

Method: factorise: the ac method

Why: the discriminant is 4, a perfect square, so it factorises. $a \times c = 24$: numbers that multiply to 24 and add to 10 are 4 and 6.

$$\begin{aligned}3x^2 + 4x + 6x + 8 &= 0 \\x(3x + 4) + 2(3x + 4) &= 0 \\(3x + 4)(x + 2) &= 0\end{aligned}$$

$$x = -\frac{4}{3} \text{ or } x = -2$$

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Discriminant: $b^2 - 4ac = 11^2 - 4 \times 2 \times 5 = 81$, which is a perfect square, so it factorises

Method: factorise: the ac method

Why: a is not 1 and the discriminant is a perfect square (81), so it factorises. $a \times c = 10$: find two numbers that multiply to 10 and add to 11: 1 and 10.

$$\begin{aligned}2x^2 + x + 10x + 5 &= 0 \\x(2x + 1) + 5(2x + 1) &= 0 \\(2x + 1)(x + 5) &= 0\end{aligned}$$

$$x = -\frac{1}{2} \text{ or } x = -5$$

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Discriminant: $b^2 - 4ac = (-1)^2 - 4 \times 6 \times (-2) = 49$, which is a perfect square, so it factorises

Method: factorise: the ac method

Why: the discriminant is 49, a perfect square. $a \times c = -12$: numbers that multiply to -12 and add to -1 are -4 and 3.

$$\begin{aligned}6x^2 - 4x + 3x - 2 &= 0 \\2x(3x - 2) + 1(3x - 2) &= 0 \\(2x + 1)(3x - 2) &= 0\end{aligned}$$

$$x = -\frac{1}{2} \text{ or } x = \frac{2}{3}$$

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Discriminant: $b^2 - 4ac = (-5)^2 - 4 \times 2 \times (-3) = 49$, which is a perfect square, so it factorises

Method: factorise: the ac method

Why: the discriminant is 49, a perfect square. $a \times c = -6$: numbers that multiply to -6 and add to -5 are -6 and 1.

$$\begin{aligned}2x^2 - 6x + x - 3 &= 0 \\2x(x - 3) + 1(x - 3) &= 0 \\(2x + 1)(x - 3) &= 0\end{aligned}$$

$$x = -\frac{1}{2} \text{ or } x = 3$$

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Discriminant: $b^2 - 4ac = 12^2 - 4 \times 4 \times 9 = 0$, which is zero, so one repeated solution (a perfect square)

Method: perfect square

Why: the discriminant is 0. $4x^2 = (2x)^2$, $9 = 3^2$ and $12x = 2 \times 2x \times 3$.

$$(2x + 3)^2 = 0$$

$$x = -\frac{3}{2} \text{ (one repeated solution)}$$

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Discriminant: $b^2 - 4ac = 0^2 - 4 \times 4 \times (-9) = 144$, which is a perfect square, so it factorises

Method: difference of two squares

Why: two terms, a minus sign, and both are perfect squares: $(2x)^2$ and 3^2 .

$$(2x + 3)(2x - 3) = 0$$

$$x = -\frac{3}{2} \text{ or } x = \frac{3}{2}$$

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Discriminant: $b^2 - 4ac = 0^2 - 4 \times 2 \times (-8) = 64$, which is a perfect square, so it factorises

Method: common factor, then difference of two squares

Why: there is no x term. Take out 2 first, then $x^2 - 4$ is a difference of two squares. (Square roots also works: $x^2 = 4$.)

$$\begin{aligned}2(x^2 - 4) &= 0 \\2(x + 2)(x - 2) &= 0\end{aligned}$$

$$x = -2 \text{ or } x = 2$$

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Discriminant: $b^2 - 4ac = (-12)^2 - 4 \times 3 \times 0 = 144$, which is a perfect square, so it factorises

Method: common factor

Why: there is no constant term. Take out the common factor 3x.

$$3x(x - 4) = 0$$

$$x = 0 \text{ or } x = 4$$

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EXTENDED: IDENTIFY THE METHOD, THEN SOLVE

$$2x^2 + 8x + 1 = 0$$

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EXTENDED: IDENTIFY THE METHOD, THEN SOLVE

$$-x^2 + 5x - 6 = 0$$

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EXTENDED: IDENTIFY THE METHOD, THEN SOLVE

$$3x^2 + 7x = 6$$

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EXTENDED: IDENTIFY THE METHOD, THEN SOLVE

$$5x^2 + 13x + 6 = 0$$

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EXTENDED: IDENTIFY THE METHOD, THEN SOLVE

$$2x^2 + 3x + 5 = 0$$

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EXTENDED: IDENTIFY THE METHOD, THEN SOLVE

$$3x^2 + 6x - 2 = 0$$

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EXTENDED: IDENTIFY THE METHOD, THEN SOLVE

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

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EXTENDED: IDENTIFY THE METHOD, THEN SOLVE

$$9x^2 - 24x + 16 = 0$$

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Discriminant: $b^2 - 4ac = 5^2 - 4 \times (-1) \times (-6) = 1$, which is a perfect square, so it **factorises**

Method: multiply by -1, then factorise

Why: a is negative, which is awkward. Multiply every term by -1. The discriminant is 1, a perfect square, so it factorises.

$$\begin{aligned}x^2 - 5x + 6 &= 0 \\(x - 2)(x - 3) &= 0\end{aligned}$$

$$x = 2 \text{ or } x = 3$$

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Discriminant: $b^2 - 4ac = 8^2 - 4 \times 2 \times 1 = 56$, which is positive but not a perfect square, so it **will not factorise nicely**

Method: complete the square

Why: the discriminant is 56, not a perfect square, so it will not factorise. With $a = 2$, take the 2 out of the x terms only.

$$\begin{aligned}2(x^2 + 4x) + 1 &= 0 \\2[(x + 2)^2 - 4] + 1 &= 0 \\2(x + 2)^2 - 7 &= 0 \\(x + 2)^2 &= \frac{7}{2}\end{aligned}$$

$$x = -2 \pm \sqrt{\left(\frac{7}{2}\right)} \approx -0.13 \text{ or } -3.87$$

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Discriminant: $b^2 - 4ac = 13^2 - 4 \times 5 \times 6 = 49$, which is a perfect square, so it **factorises**

Method: factorise: the ac method

Why: the discriminant is 49, a perfect square. $a \times c = 30$: numbers that multiply to 30 and add to 13 are 3 and 10.

$$\begin{aligned}5x^2 + 3x + 10x + 6 &= 0 \\x(5x + 3) + 2(5x + 3) &= 0 \\(5x + 3)(x + 2) &= 0\end{aligned}$$

$$x = -\frac{3}{5} \text{ or } x = -2$$

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Discriminant: $b^2 - 4ac = 7^2 - 4 \times 3 \times (-6) = 121$, which is a perfect square, so it **factorises**

Method: factorise: the ac method, after making one side 0

Why: subtract 6 first. The discriminant is 121, a perfect square, so it factorises. $a \times c = -18$: numbers that multiply to -18 and add to 7 are 9 and -2.

$$\begin{aligned}3x^2 + 7x - 6 &= 0 \\3x^2 + 9x - 2x - 6 &= 0 \\3x(x + 3) - 2(x + 3) &= 0 \\(3x - 2)(x + 3) &= 0\end{aligned}$$

$$x = \frac{2}{3} \text{ or } x = -3$$

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Discriminant: $b^2 - 4ac = 6^2 - 4 \times 3 \times (-2) = 60$, which is positive but not a perfect square, so it **will not factorise nicely**

Method: complete the square

Why: the discriminant is 60, not a perfect square, so it will not factorise. Take the 3 out of the x terms only.

$$\begin{aligned}3(x^2 + 2x) - 2 &= 0 \\3[(x + 1)^2 - 1] - 2 &= 0 \\3(x + 1)^2 - 5 &= 0 \\(x + 1)^2 &= \frac{5}{3}\end{aligned}$$

$$x = -1 \pm \sqrt{\left(\frac{5}{3}\right)} \approx 0.29 \text{ or } -2.29$$

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Discriminant: $b^2 - 4ac = 3^2 - 4 \times 2 \times 5 = -31$, which is negative, so **no real solutions**

Method: none needed: no real solutions

Why: the discriminant is negative, so the graph never crosses the x-axis. No method will give a real solution.

No real solutions

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Discriminant: $b^2 - 4ac = (-24)^2 - 4 \times 9 \times 16 = 0$, which is zero, so **one repeated solution** (a perfect square)

Method: perfect square

Why: the discriminant is 0. $9x^2 = (3x)^2$, $16 = 4^2$ and $24x = 2 \times 3x \times 4$.

$$(3x - 4)^2 = 0$$

$$x = \frac{4}{3} \text{ (one repeated solution)}$$

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Discriminant: $b^2 - 4ac = 0^2 - 4 \times 8 \times (-2) = 64$, which is a perfect square, so it **factorises**

Method: common factor, then difference of two squares

Why: there is no x term. Take out 2: $4x^2 - 1$ is a difference of two squares.

$$\begin{aligned}2(4x^2 - 1) &= 0 \\2(2x + 1)(2x - 1) &= 0\end{aligned}$$

$$x = -\frac{1}{2} \text{ or } x = \frac{1}{2}$$

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EXTENDED: IDENTIFY THE METHOD, THEN SOLVE

$$2x^2 + x - 6 = 0$$

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EXTENDED: IDENTIFY THE METHOD, THEN SOLVE

$$25x^2 - 4 = 0$$

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COMPLETE THE SQUARE

Write $x^2 - 6x + 5$ in the form
 $(x - p)^2 + q$

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COMPLETE THE SQUARE

Write $x^2 + 8x + 3$ in the form
 $(x + p)^2 + q$

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COMPLETE THE SQUARE

Write $2x^2 - 12x + 7$ in the form
 $a(x - p)^2 + q$

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COMPLETE THE SQUARE

Write $x^2 + 5x + 1$ in the form
 $(x + p)^2 + q$

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COMPLETE THE SQUARE

Solve $x^2 - 2x - 8 = 0$ by
completing the square

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COMPLETE THE SQUARE

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

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Discriminant: $b^2 - 4ac = 0^2 - 4 \times 25 \times (-4) = 400$, which is a perfect square, so it factorises

Method: difference of two squares

Why: two terms, a minus sign, and both are perfect squares: $(5x)^2$ and 2^2 .

$$(5x + 2)(5x - 2) = 0$$

$$x = -\frac{2}{5} \text{ or } x = \frac{2}{5}$$

Discriminant: $b^2 - 4ac = 1^2 - 4 \times 2 \times (-6) = 49$, which is a perfect square, so it factorises

Method: factorise: the ac method

Why: the discriminant is 49, a perfect square. $a \times c = -12$: numbers that multiply to -12 and add to 1 are 4 and -3 .

$$2x^2 + 4x - 3x - 6 = 0$$

$$2x(x + 2) - 3(x + 2) = 0$$

$$(2x - 3)(x + 2) = 0$$

$$x = \frac{3}{2} \text{ or } x = -2$$

Method: complete the square

Why: half of 8 is 4, so the bracket is $(x + 4)^2$. This adds 16, so subtract 16.

$$(x + 4)^2 - 16 + 3$$

$$= (x + 4)^2 - 13$$

$$(x + 4)^2 - 13, \text{ vertex } (-4, -13)$$

Method: complete the square

Why: half of -6 is -3 , so the bracket is $(x - 3)^2$. This adds 9, so subtract 9.

$$(x - 3)^2 - 9 + 5$$

$$= (x - 3)^2 - 4$$

$$(x - 3)^2 - 4, \text{ vertex } (3, -4)$$

Method: complete the square

Why: half of 5 is $\frac{5}{2}$, so the bracket is $(x + \frac{5}{2})^2$. This adds $\frac{25}{4}$, so subtract $\frac{25}{4}$.

$$(x + \frac{5}{2})^2 - \frac{25}{4} + 1$$

$$= (x + \frac{5}{2})^2 - \frac{21}{4}$$

$$(x + \frac{5}{2})^2 - \frac{21}{4}, \text{ vertex } (-\frac{5}{2}, -\frac{21}{4})$$

Method: complete the square with $a = 2$

Why: take the 2 out of the x terms only. Then half of -6 is -3 .

$$2(x^2 - 6x) + 7$$

$$2[(x - 3)^2 - 9] + 7$$

$$= 2(x - 3)^2 - 11$$

$$2(x - 3)^2 - 11, \text{ vertex } (3, -11)$$

Discriminant: $b^2 - 4ac = (-5)^2 - 4 \times 1 \times 2 = 17$, which is positive but not a perfect square, so it will not factorise nicely

Method: complete the square

Why: the discriminant is 17, not a perfect square, so it will not factorise. Half of -5 is $-\frac{5}{2}$.

$$(x - \frac{5}{2})^2 - \frac{25}{4} + 2 = 0$$

$$(x - \frac{5}{2})^2 = \frac{17}{4}$$

$$x - \frac{5}{2} = \pm \frac{\sqrt{17}}{2}$$

$$x = \frac{5 \pm \sqrt{17}}{2} \approx 4.56 \text{ or } 0.44$$

Discriminant: $b^2 - 4ac = (-2)^2 - 4 \times 1 \times (-8) = 36$, which is a perfect square, so it factorises

Method: complete the square (as asked)

Why: the discriminant is 36, a perfect square, so factorising would also work: $(x - 4)(x + 2)$. But the question asks for completing the square. Half of -2 is -1 .

$$(x - 1)^2 - 1 - 8 = 0$$

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

$$x - 1 = \pm 3$$

$$x = 4 \text{ or } x = -2$$

USE THE DISCRIMINANT

How many solutions does $x^2 - 6x + 7 = 0$ have?

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USE THE DISCRIMINANT

How many solutions does $3x^2 + 2x + 1 = 0$ have?

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USE THE DISCRIMINANT

Does $2x^2 + 7x - 4 = 0$ factorise? Decide using the discriminant

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USE THE DISCRIMINANT

Does $x^2 + 5x + 3 = 0$ factorise nicely? Decide using the discriminant

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FACTORISE

$$9x^2 - 16$$

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FACTORISE

$$x^2 - 13x + 42$$

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IDENTIFY THE METHOD, THEN SOLVE

$$x^2 + 12x + 35 = 0$$

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IDENTIFY THE METHOD, THEN SOLVE

$$x^2 - 4x + 7 = 0$$

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Discriminant: $b^2 - 4ac = 2^2 - 4 \times 3 \times 1 = -8$, which is negative, so **no real solutions**

Method: discriminant only (nothing to solve)

Why: the discriminant is negative, so the parabola does not reach the x-axis.

No real solutions

Discriminant: $b^2 - 4ac = (-6)^2 - 4 \times 1 \times 7 = 8$, which is positive but not a perfect square, so it **will not factorise nicely**

Method: discriminant only (nothing to solve)

Why: the number of solutions depends on the sign of $b^2 - 4ac$. It is positive, so the parabola crosses the x-axis twice. It is not a perfect square, so the solutions are not whole numbers or simple fractions.

Two solutions (use completing the square to find them: $x = 3 \pm \sqrt{2}$)

Discriminant: $b^2 - 4ac = 5^2 - 4 \times 1 \times 3 = 13$, which is positive but not a perfect square, so it **will not factorise nicely**

Method: discriminant, then complete the square

Why: 13 is not a perfect square, so it will not factorise nicely.

Do not waste time hunting for factors. Half of 5 is $\frac{5}{2}$.

$$\left(x + \frac{5}{2}\right)^2 - \frac{25}{4} + 3 = 0$$

$$\left(x + \frac{5}{2}\right)^2 = \frac{13}{4}$$

$$\text{No, so } x = \frac{-5 \pm \sqrt{13}}{2}$$

Discriminant: $b^2 - 4ac = 7^2 - 4 \times 2 \times (-4) = 81$, which is a perfect square, so it **factorises**

Method: discriminant, then the ac method

Why: $81 = 9^2$, a perfect square, so yes it factorises. $a \times c = -8$: numbers that multiply to -8 and add to 7 are 8 and -1 .

$$2x^2 + 8x - x - 4 = 0$$

$$2x(x + 4) - 1(x + 4) = 0$$

$$(2x - 1)(x + 4) = 0$$

$$\text{Yes: } x = \frac{1}{2} \text{ or } x = -4$$

Method: two numbers

Why: three terms with $a = 1$. c is positive and b is negative, so both numbers are negative: -6 and -7 multiply to 42 and add to -13 .

$$(x - 6)(x - 7)$$

Method: difference of two squares

Why: two terms, a minus sign, and both are perfect squares: $(3x)^2$ and 4^2 .

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

Discriminant: $b^2 - 4ac = (-4)^2 - 4 \times 1 \times 7 = -12$, which is negative, so **no real solutions**

Method: none needed: no real solutions

Why: the discriminant is negative, so the graph never reaches the x-axis. Completing the square: $(x - 2)^2 + 3 = 0$ is impossible.

$$(x - 2)^2 + 3 = 0$$

No real solutions

Discriminant: $b^2 - 4ac = 12^2 - 4 \times 1 \times 35 = 4$, which is a perfect square, so it **factorises**

Method: factorise: two numbers

Why: $a = 1$ and the discriminant is a perfect square (4). Both numbers are positive: 5 and 7 multiply to 35 and add to 12 .

$$(x + 5)(x + 7) = 0$$

$$x = -5 \text{ or } x = -7$$