



Solving quadratics where $a > 1$

Mana Maths

Te reo Māori terms



whārite pūrua

quadratic equation

Open in Te Aka

whakatauwehe

factorise

Open in Te Aka

pūtakerua

root

Open in Te Aka

whārite

equation

Open in Te Aka

Solving quadratics

Notes & Steps



Key idea

To solve a quadratic by factorising, first make one side equal to zero. Then factorise. Finally use the zero-product property: if two brackets multiply to zero, at least one bracket must equal zero.

Steps

1. Rearrange so the equation is $ax^2 + bx + c = 0$.
2. Factorise the quadratic fully.
3. Set each factor equal to zero.
4. Solve the two linear equations.
5. Check both solutions in the original equation.

Common mistake

Stopping after factorising. For example, $(2x + 1)(x + 3) = 0$ is not the final answer. You still need $2x + 1 = 0$ or $x + 3 = 0$, so the roots are $x = -\frac{1}{2}$ and $x = -3$.

Useful reminders

- Keep the $= 0$ before trying to use factors.
- If there is an HCF, take it out first.
- A repeated factor gives a repeated root.
- Fractions in the roots are normal when $a > 1$.

Solving quadratics aâ% 1

Notes & Steps



Example 1: already equal to zero

Solve $2x^2 + 7x + 3 = 0$.

$$2x^2 + 7x + 3 = (2x + 1)(x + 3)$$

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

So $2x + 1 = 0$ or $x + 3 = 0$.

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

Example 2: rearrange first

Solve $4x^2 + 4x = 3$.

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

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

So $2x + 3 = 0$ or $2x - 1 = 0$.

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

Try these

1. Solve $3x^2 + 8x + 4 = 0$.
2. Solve $5x^2 - 13x + 6 = 0$.
3. Solve $2x^2 + 7x = -3$.



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Example 3: HCF first

Solve $18x^2 - 33x + 15 = 0$.

$$3(6x^2 - 11x + 5) = 0$$

$$3(2x - 1)(3x - 5) = 0$$

The factor 3 does not give a root, so:

$$2x - 1 = 0 \quad \text{or} \quad 3x - 5 = 0$$

$$x = \frac{1}{2} \quad \text{or} \quad x = \frac{5}{3}$$

Example 4: repeated root

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

$$16x^2 - 24x + 9 = (4x - 3)^2$$

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

So $4x - 3 = 0$, which gives

$$x = \frac{3}{4}$$

This is a repeated root.

Common mistake

Forgetting to solve both brackets, or treating the common factor outside as another root. Only the variable brackets create roots.

Start Tasks



1. Solve

$$(2x + 1)(x + 3) = 0.$$

2. Solve

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

3. Solve

$$(4x + 3)(x + 2) = 0.$$

4. Solve

$$(5x + 3)(x + 2) = 0.$$

5. Solve

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

6. Solve

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

7. Solve

$$(2a + 1)(a - 3) = 0.$$

8. Solve

$$(3y - 2)(y + 4) = 0.$$

9. Solve

$$(2m - 5)(3m + 1) = 0.$$

Start Tasks – Answers



1. $x = -\frac{1}{2}, -3$

4. $x = -\frac{3}{5}, -2$

7. $a = -\frac{1}{2}, 3$

2. $x = -\frac{2}{3}, -2$

5. $x = -\frac{3}{2}, 1$

8. $y = \frac{2}{3}, -4$

3. $x = -\frac{3}{4}, -2$

6. $x = \frac{2}{3}, 2$

9. $m = \frac{5}{2}, -\frac{1}{3}$

Start Tasks



10. Factorise and solve
 $2x^2 + 7x + 3 = 0$.

11. Factorise and solve
 $3x^2 + 8x + 4 = 0$.

12. Factorise and solve
 $4x^2 + 11x + 6 = 0$.

13. Factorise and solve
 $2x^2 - 5x - 3 = 0$.

14. Factorise and solve
 $4x^2 + 4x - 3 = 0$.

15. Factorise and solve
 $5x^2 - 13x + 6 = 0$.

16. Factorise and solve
 $2p^2 - 7p + 3 = 0$.

17. Factorise and solve
 $3q^2 - 14q + 8 = 0$.

18. Factorise and solve
 $6m^2 + 11m + 3 = 0$.

Start Tasks – Answers



10. $x = -3, -\frac{1}{2}$

13. $x = 3, -\frac{1}{2}$

16. $p = 3, \frac{1}{2}$

11. $x = -2, -\frac{2}{3}$

14. $x = \frac{1}{2}, -\frac{3}{2}$

17. $q = 4, \frac{2}{3}$

12. $x = -2, -\frac{3}{4}$

15. $x = 2, \frac{3}{5}$

18. $m = -\frac{1}{3}, -\frac{3}{2}$

Start Tasks



19. Rearrange and solve
 $2x^2 + 7x = -3$.

20. Rearrange and solve
 $3x^2 + 8x = -4$.

21. Rearrange and solve
 $4x^2 + 4x = 3$.

22. One root of
 $(2x + 1)(x + 3) = 0$ is -3 .
What is the other root?

23. One root of
 $(3x - 2)(x - 2) = 0$ is 2 .
What is the other root?

24. Solve
 $(4x - 1)(x + 5) = 0$.

25. Solve
 $(5x - 3)(x - 2) = 0$.

26. Solve
 $(3x + 1)(2x - 5) = 0$.

27. Solve
 $(2x - 3)(3x + 4) = 0$.

Start Tasks – Answers



19. $x = -3, -\frac{1}{2}$

22. $-\frac{1}{2}$

25. $x = \frac{3}{5}, 2$

20. $x = -2, -\frac{2}{3}$

23. $\frac{2}{3}$

26. $x = -\frac{1}{3}, \frac{5}{2}$

21. $x = -\frac{3}{2}, \frac{1}{2}$

24. $x = \frac{1}{4}, -5$

27. $x = \frac{3}{2}, -\frac{4}{3}$

Build Tasks



1. Solve

$$6x^2 + 17x + 12 = 0.$$

2. Solve $8x^2 + 2x - 3 = 0.$

3. Solve

$$12x^2 - 7x - 10 = 0.$$

4. Solve

$$15x^2 + 14x - 8 = 0.$$

5. Solve

$$10x^2 - 13x + 3 = 0.$$

6. Solve

$$9x^2 - 21x + 10 = 0.$$

7. Solve

$$4x^2 + 4x - 15 = 0.$$

8. Solve

$$14x^2 - 9x - 5 = 0.$$

9. Solve

$$12x^2 + 11x - 5 = 0.$$

Build Tasks – Answers



1. $x = -\frac{3}{2}, -\frac{4}{3}$

4. $x = \frac{2}{5}, -\frac{4}{3}$

7. $x = \frac{3}{2}, -\frac{5}{2}$

2. $x = \frac{1}{2}, -\frac{3}{4}$

5. $x = 1, \frac{3}{10}$

8. $x = 1, -\frac{5}{14}$

3. $x = \frac{5}{4}, -\frac{2}{3}$

6. $x = \frac{5}{3}, \frac{2}{3}$

9. $x = \frac{1}{3}, -\frac{5}{4}$

Build Tasks



10. Factorise fully, then solve $2x^2 + 14x + 20 = 0$.

11. Factorise fully, then solve $3x^2 - 27x + 60 = 0$.

12. Factorise fully, then solve $4x^2 - 20x - 24 = 0$.

13. Solve $-6x^2 - 7x + 3 = 0$.

14. Solve $-8x^2 + 10x + 3 = 0$.

15. Solve $-12x^2 + x + 6 = 0$.

16. Solve $6a^2 + 13a - 5 = 0$.

17. Solve $15p^2 - 11p - 14 = 0$.

18. Solve $8m^2 - 22m + 15 = 0$.

Build Tasks – Answers



10. $x = -5, -2$

13. $x = \frac{1}{3}, -\frac{3}{2}$

16. $a = \frac{1}{3}, -\frac{5}{2}$

11. $x = 5, 4$

14. $x = \frac{3}{2}, -\frac{1}{4}$

17. $p = \frac{7}{5}, -\frac{2}{3}$

12. $x = 6, -1$

15. $x = \frac{3}{4}, -\frac{2}{3}$

18. $m = \frac{3}{2}, \frac{5}{4}$

Build Tasks



19. Rearrange and solve
 $12x^2 - 7x = 10$.

20. Rearrange and solve
 $10x^2 + 3 = 13x$.

21. Rearrange and solve
 $8x^2 + 2x = 3$.

22. A student says the roots of
 $6x^2 + 17x + 12 = 0$ are
 -4 and $-\frac{3}{2}$. Is the student correct?

23. A student says the roots of
 $4x^2 + 4x - 15 = 0$ are $-\frac{5}{2}$
and $\frac{3}{2}$. Is the student correct?

24. Solve
 $18x^2 - 9x - 20 = 0$.

25. Solve
 $16x^2 - 24x + 9 = 0$.

26. Factorise fully, then solve
 $18x^2 - 33x + 15 = 0$.

27. Solve
 $20x^2 - 13x - 21 = 0$.

Build Tasks – Answers



19. $x = \frac{5}{4}, -\frac{2}{3}$

22. No. The roots are $-\frac{3}{2}$ and $-\frac{4}{3}$.

25. $x = \frac{3}{4}$ repeated

20. $x = 1, \frac{3}{10}$

23. Yes.

26. $x = 1, \frac{5}{6}$

21. $x = \frac{1}{2}, -\frac{3}{4}$

24. $x = \frac{4}{3}, -\frac{5}{6}$

27. $x = \frac{7}{5}, -\frac{3}{4}$

Push Tasks



1. Solve

$$24x^2 + 2x - 15 = 0.$$

2. Solve

$$21x^2 - 29x - 12 = 0.$$

3. Solve

$$16x^2 - 40x + 21 = 0.$$

4. Solve

$$18x^2 - 9x - 20 = 0.$$

5. Solve

$$14x^2 + 17x - 6 = 0.$$

6. Solve

$$35x^2 - 37x - 6 = 0.$$

**7. Factorise fully, then
solve $12x^2 + 2x - 24 = 0$.**

8. Solve
 $-15x^2 + 7x + 2 = 0.$

**9. Factorise fully, then
solve**
 $-18x^2 + 33x - 15 = 0.$

Push Tasks – Answers



1. $x = \frac{3}{4}, -\frac{5}{6}$

4. $x = \frac{4}{3}, -\frac{5}{6}$

7. $x = \frac{4}{3}, -\frac{3}{2}$

2. $x = \frac{12}{7}, -\frac{1}{3}$

5. $x = \frac{2}{7}, -\frac{3}{2}$

8. $x = \frac{2}{3}, -\frac{1}{5}$

3. $x = \frac{7}{4}, \frac{3}{4}$

6. $x = \frac{6}{5}, -\frac{1}{7}$

9. $x = 1, \frac{5}{6}$

Push Tasks



10. Find k so that $2x^2 + kx + 3 = 0$ has roots -3 and $-\frac{1}{2}$.

11. Find k so that $3x^2 + kx - 4 = 0$ has roots -1 and $\frac{4}{3}$.

12. Find k so that $4x^2 + kx - 3 = 0$ has roots -1 and $\frac{3}{4}$.

13. Solve $2x^2 + 7x + 3 = 0$, then write the roots in ascending order.

14. Solve $4x^2 + 4x - 15 = 0$, then state which root is positive.

15. Solve $8x^2 + 2x - 3 = 0$, then state which root has the greater absolute value.

16. Make a quadratic equation with roots $\frac{3}{2}$ and $-\frac{5}{2}$.

17. Make a quadratic equation with roots $\frac{1}{4}$ and -5 .

18. Make a quadratic equation with roots $\frac{2}{3}$ and $-\frac{1}{5}$.

Push Tasks – Answers



10. $k = 7$

13. $-3, -\frac{1}{2}$

16. $2x^2 + 2x - 15 = 0$

11. $k = -1$

14. $-\frac{5}{2}, \frac{3}{2}$; **positive**
root $= \frac{3}{2}$

17. $4x^2 + 19x - 5 = 0$

12. $k = 1$

15. $-\frac{3}{4}, \frac{1}{2}$; **greater**
absolute value $= \frac{3}{4}$

18. $15x^2 - x - 2 = 0$

Push Tasks



19. A student writes
 $12x^2 - 7x - 10 = 0 \Rightarrow$
 $(3x - 5)(4x + 2) = 0$.
Explain the error.

20. A student writes
 $10x^2 - 13x + 3 = 0 \Rightarrow x =$
 $\frac{3}{10}$ or 1. Is this correct?
Explain.

21. Expand
 $(4x - 3)(x + 2)$. Then
solve the quadratic
equation you get when it
is equal to zero.

22. Create a quadratic
equation with factors
 $(3x + 2)(2x - 5) = 0$.
Then solve it.

23. Create a quadratic
equation with factors
 $(5x - 3)(x + 4) = 0$. Then
solve it.

24. Which is easier to
solve by factorising:
 $6x^2 + 17x + 12 = 0$ or
 $24x^2 + 2x - 15 = 0$? Give
one reason.

25. Solve
 $30x^2 - 29x + 6 = 0$.

26. Solve
 $28x^2 - 31x + 6 = 0$.

27. Solve
 $45x^2 + 72x - 5 = 0$.

Push Tasks – Answers



19. The middle terms give $-15x + 8x = -7x$, so the brackets are wrong. Correct:

$$(2x + 9)(4x - 5) = 0$$

20. Yes.
 $(10x - 3)(x - 1) = 0$, so
 $10x - 3 = 0$ or
 $x - 1 = 0$. **Therefore**
 $\frac{3}{10}$ or 1

21. $4x^2 + 5x - 6 = 0$, so
 $x = \frac{3}{4}, -2$

22. $6x^2 - 11x - 10 = 0$,
so $x = \frac{5}{2}, -\frac{2}{3}$

23. $5x^2 + 17x - 12 = 0$,
so $x = \frac{3}{5}, -4$

24. $6x^2 + 17x + 12 = 0$,
because $ac = 72$ is
easier to split than
 $ac = 360$.

25. $x = \frac{2}{3}, \frac{3}{10}$

26. $x = \frac{6}{7}, \frac{1}{4}$

27. $x = \frac{1}{15}, -\frac{5}{3}$