



Factorising quadratics where $a > 1$

Mana Maths

Te reo Māori terms



whakatauwehe

factorise

Open in Te Aka

kīanga

expression

Open in Te Aka

tau whakarea

coefficient

Open in Te Aka

whārite

equation

Open in Te Aka

Factorising quadratics â 1

Notes & Steps



Key idea

For $ax^2 + bx + c$ with $a > 1$, multiply $a \times c$, find two numbers that multiply to that product and add to b , then split the middle term and factor by grouping.

AC method

1. Write the quadratic in standard form $ax^2 + bx + c$.
2. Multiply $a \times c$.
3. Find two integers whose product is ac and whose sum is b .
4. Split the middle term using those two numbers.
5. Factor each pair, then take out the common bracket.

Common mistake

Jumping straight to brackets without checking that the inside terms multiply to ac .
For $2x^2 + 7x + 3$, the middle-term split is $6x + x$, not $3x + 4x$.

Quick checks

- If the constant term is positive and the middle term is positive, both signs are usually $+$.
- If the constant term is negative, the signs must be different.
- If there is an HCF first, take it out before using the ac method.
- Expand your answer to check it returns to the original quadratic.

Factorising quadratics aâ‰‰ 1

Notes & Steps



Example 1: positive middle term

Factorise $2x^2 + 7x + 3$.

$$ac = 2 \times 3 = 6$$

The pair that multiplies to 6 and adds to 7 is 6 and 1.

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

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

Example 2: negative constant term

Factorise $3x^2 - 8x + 4$.

$$ac = 3 \times 4 = 12$$

The pair that multiplies to 12 and adds to -8 is -6 and -2 .

$$3x^2 - 8x + 4 = 3x^2 - 6x - 2x + 4$$

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

Try these

1. Factorise $2x^2 + 9x + 10$.
2. Factorise $4x^2 + 4x - 3$.
3. Factorise $5x^2 - 13x + 6$.

Factorising quadratics aâ‰‰ 1

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Example 3: larger leading coefficient

Factorise $4x^2 + 4x - 15$.

$$ac = 4 \times (-15) = -60$$

The pair that multiplies to -60 and adds to 4 is 10 and -6 .

$$4x^2 + 10x - 6x - 15$$

$$2x(2x + 5) - 3(2x + 5) = (2x - 3)(2x + 5)$$

Example 4: HCF first

Factorise $18x^2 - 33x + 15$ fully.

$$18x^2 - 33x + 15 = 3(6x^2 - 11x + 5)$$

Now factorise the bracket:

$$ac = 6 \times 5 = 30, \quad -10 + (-1) = -11$$

$$6x^2 - 11x + 5 = 6x^2 - 10x - x + 5$$

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

So the full factorisation is $3(2x - 1)(3x - 5)$.

Common mistake

Stopping after grouping when there is still a common factor outside. In a question that says *fully*, keep going until no factor can be taken out.

Start Tasks



1. Factorise $2x^2 + 7x + 3$.

2. Factorise
 $2x^2 + 9x + 10$.

3. Factorise $3x^2 + 8x + 4$.

4. Factorise
 $3x^2 + 13x + 4$.

5. Factorise
 $4x^2 + 11x + 6$.

6. Factorise
 $5x^2 + 13x + 6$.

7. Factorise $2a^2 + 5a + 2$.

8. Factorise $3y^2 + 7y + 2$.

9. Factorise
 $6m^2 + 11m + 3$.

Start Tasks – Answers



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

4. $(3x + 1)(x + 4)$

7. $(2a + 1)(a + 2)$

2. $(2x + 5)(x + 2)$

5. $(4x + 3)(x + 2)$

8. $(3y + 1)(y + 2)$

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

6. $(5x + 3)(x + 2)$

9. $(2m + 3)(3m + 1)$

Start Tasks



10. Factorise $2x^2 + x - 3$.

11. Factorise
 $2x^2 - 5x - 3$.

12. Factorise $3x^2 - x - 2$.

13. Factorise
 $3x^2 - 8x + 4$.

14. Factorise
 $4x^2 - 4x - 3$.

15. Factorise
 $5x^2 + 2x - 3$.

16. Factorise $6x^2 - x - 2$.

17. Factorise
 $2p^2 - 7p + 3$.

18. Factorise
 $3q^2 - 14q + 8$.

Start Tasks – Answers



10. $(2x + 3)(x - 1)$

13. $(3x - 2)(x - 2)$

16. $(2x + 1)(3x - 2)$

11. $(2x + 1)(x - 3)$

14. $(2x + 1)(2x - 3)$

17. $(2p - 1)(p - 3)$

12. $(3x + 2)(x - 1)$

15. $(5x - 3)(x + 1)$

18. $(3q - 2)(q - 4)$

Start Tasks



19. Fill in: $2x^2 + 7x + 3 = (2x + \square)(x + \square)$.

20. Fill in: $3x^2 + 8x + 4 = (3x + \square)(x + \square)$.

21. Fill in: $2x^2 - 5x - 3 = (2x + \square)(x + \square)$.

22. Which is correct for $4x^2 + 11x + 6$:
 $(4x + 3)(x + 2)$ or
 $(4x + 6)(x + 1)$?

23. Which is correct for $3x^2 - 8x + 4$:
 $(3x - 2)(x - 2)$ or
 $(3x - 4)(x - 1)$?

24. Factorise
 $2x^2 + 11x + 5$.

25. Factorise
 $4x^2 + 4x - 3$.

26. Factorise
 $3x^2 + 2x - 8$.

27. Factorise
 $5x^2 - 13x + 6$.

Start Tasks – Answers



19. $(2x + 1)(x + 3)$

22. $(4x + 3)(x + 2)$

25. $(2x + 3)(2x - 1)$

20. $(3x + 2)(x + 2)$

23. $(3x - 2)(x - 2)$

26. $(3x - 4)(x + 2)$

21. $(2x + 1)(x - 3)$

24. $(2x + 1)(x + 5)$

27. $(5x - 3)(x - 2)$

Build Tasks



1. Factorise
 $6x^2 + 17x + 12.$

2. Factorise $8x^2 + 2x - 3.$

3. Factorise
 $12x^2 - 7x - 10.$

4. Factorise
 $15x^2 + 14x - 8.$

5. Factorise
 $10x^2 - 13x + 3.$

6. Factorise
 $9x^2 - 21x + 10.$

7. Factorise $4x^2 + 4x - 15.$

8. Factorise
 $14x^2 - 9x - 5.$

9. Factorise
 $12x^2 + 11x - 5.$

Build Tasks – Answers



1. $(2x + 3)(3x + 4)$

4. $(3x + 4)(5x - 2)$

7. $(2x + 5)(2x - 3)$

2. $(2x - 1)(4x + 3)$

5. $(10x - 3)(x - 1)$

8. $(14x + 5)(x - 1)$

3. $(3x + 2)(4x - 5)$

6. $(3x - 2)(3x - 5)$

9. $(3x - 1)(4x + 5)$

Build Tasks



10. Factorise
 $2x^2 + 14x + 20$ fully.

11. Factorise
 $3x^2 - 27x + 60$ fully.

12. Factorise
 $4x^2 - 20x - 24$ fully.

13. Factorise
 $-6x^2 - 7x + 3$.

14. Factorise
 $-8x^2 + 10x + 3$.

15. Factorise
 $-12x^2 + x + 6$.

16. Factorise
 $6a^2 + 13a - 5$.

17. Factorise
 $15p^2 - 11p - 14$.

18. Factorise
 $8m^2 - 22m + 15$.

Build Tasks – Answers



10. $2(x + 2)(x + 5)$

13. $-(3x - 1)(2x + 3)$

16. $(2a + 5)(3a - 1)$

11. $3(x - 4)(x - 5)$

14. $-(4x + 1)(2x - 3)$

17. $(3p + 2)(5p - 7)$

12. $4(x - 6)(x + 1)$

15. $-(4x - 3)(3x + 2)$

18. $(2m - 3)(4m - 5)$

Build Tasks



19. Fill in:

$$12x^2 - 7x - 10 = (3x + \square)(4x + \square).$$

20. Fill in:

$$10x^2 - 13x + 3 = (5x + \square)(2x + \square).$$

21. Fill in: $8x^2 + 2x - 3 = (4x + \square)(2x + \square).$

22. A student says

$$6x^2 + 17x + 12 = (6x + 3)(x + 4).$$

Is the student correct?

23. A student says

$$4x^2 + 4x - 15 = (2x + 5)(2x - 3).$$

Is the student correct?

24. Factorise

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

25. Factorise

$$16x^2 - 24x + 9.$$

26. Factorise

$$18x^2 - 33x + 15 \text{ fully.}$$

27. Factorise

$$20x^2 - 13x - 21.$$

Build Tasks – Answers



19. $(3x + 2)(4x - 5)$

22. **No. The correct factorisation is**
 $(2x + 3)(3x + 4)$.

25. $(4x - 3)^2$

20. $(10x - 3)(x - 1)$

23. **Yes.**

26. $3(2x - 1)(3x - 5)$

21. $(4x + 3)(2x - 1)$

24. $(3x - 4)(6x + 5)$

27. $(4x + 3)(5x - 7)$

Push Tasks



1. Factorise

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

2. Factorise

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

3. Factorise

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

4. Factorise

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

5. Factorise

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

6. Factorise

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

7. Factorise

$$12x^2 + 2x - 24 \text{ fully.}$$

8. Factorise

$$-15x^2 + 7x + 2.$$

9. Factorise

$$-18x^2 + 33x - 15 \text{ fully.}$$

Push Tasks – Answers



1. $(4x - 3)(6x + 5)$

4. $(3x - 4)(6x + 5)$

7. $2(3x - 4)(2x + 3)$

2. $(3x + 1)(7x - 12)$

5. $(2x + 3)(7x - 2)$

8. $-(5x - 1)(3x + 2)$

3. $(4x - 3)(4x - 7)$

6. $(5x - 6)(7x + 1)$

9. $-3(2x - 1)(3x - 5)$

Push Tasks



10. Solve by factorising:
 $2x^2 + 7x + 3 = 0$.

11. Solve by factorising:
 $3x^2 - 8x + 4 = 0$.

12. Solve by factorising:
 $5x^2 + 2x - 3 = 0$.

13. Solve by factorising:
 $6x^2 - x - 2 = 0$.

14. Solve by factorising:
 $4x^2 + 4x - 15 = 0$.

15. Solve by factorising:
 $8x^2 + 2x - 3 = 0$.

16. Find k so that
 $2x^2 + kx + 3 =$
 $(2x + 1)(x + 3)$.

17. Find k so that
 $3x^2 + kx - 4 =$
 $(3x - 4)(x + 1)$.

18. Find k so that
 $4x^2 + kx - 3 =$
 $(4x - 3)(x + 1)$.

Push Tasks – Answers



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

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

16. $k = 7$

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

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

17. $k = -1$

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

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

18. $k = 1$

Push Tasks



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

20. A student writes $10x^2 - 13x + 3 = (5x - 3)(2x - 1)$. Is this correct? Explain.

21. Expand $(4x - 3)(x + 2)$. Then factorise your result.

22. Create a quadratic with factors $(3x + 2)(2x - 5)$. Expand it.

23. Create a quadratic with factors $(5x - 3)(x + 4)$. Expand it.

24. Which is easier to factorise: $6x^2 + 17x + 12$ or $24x^2 + 2x - 15$? Give one reason.

25. Factorise $30x^2 - 29x + 6$.

26. Factorise $28x^2 - 31x + 6$.

27. Factorise $45x^2 + 72x - 5$.

Push Tasks – Answers



19. The middle term becomes
 $-15x + 8x = -7x$, so
the sign split is wrong.

~~The correct~~

20. No.
 $(5x - 3)(2x - 1) =$
 $10x^2 - 11x + 3$. **The**
correct factorisation is
 $(10x - 2)(x - 1)$

21. $4x^2 + 5x - 6 =$
 $(4x - 3)(x + 2)$

22. $6x^2 - 11x - 10$

23. $5x^2 + 17x - 12$

24. $6x^2 + 17x + 12$,
because $ac = 72$ **has**
fewer useful factor
pairs than $ac = 288$.

25. $(10x - 3)(3x - 2)$

26. $(4x - 1)(7x - 6)$

27. $(15x - 1)(3x + 5)$