

Factorisation: Splitting the Middle Term

Unit: Algebra - Student Practice Worksheet

Overview: Meera and Arjun raced to factorise $x^2 + 7x + 12$. Meera finished in one line. Arjun tried five different number pairs before he found the right one. "You didn't guess faster," Meera said. "You just weren't checking a rule first." She showed him the two questions that turn guessing into a two-step search.

Practice Questions (30 Total)

Section A - Easy

Q1. Four tiles for $x^2 + 7x + 12$. Factorised form?



- ☐ A. $(x + 2)(x + 6)$
- ☐ B. $(x + 12)(x + 1)$
- ☐ C. $(x + 3)(x + 4)$
- ☐ D. $(x + 7)(x + 12)$

Q2. To factorise $x^2 + 7x + 12$, what two conditions must the pair of numbers satisfy?

- ☐ A. Multiply to 12 and add to 7
- ☐ B. Add to 12 and multiply to 7
- ☐ C. Multiply to 7 and add to 12
- ☐ D. Both equal 7

Q3. Which pair of numbers multiplies to 12 and adds to 7?

- ☐ A. 2 and 6
- ☐ B. 3 and 4
- ☐ C. 1 and 12
- ☐ D. 6 and 1

Q4. Factorise $x^2 - x - 12$ using a split of the middle term.

$$x^2 - x - 12$$

- ☐ A. $(x + 3)(x - 4)$
- ☐ B. $(x - 3)(x + 4)$
- ☐ C. $(x + 12)(x - 1)$
- ☐ D. $(x - 6)(x + 2)$

Q5. In $x^2 - x - 12$, what sign pattern must the two numbers have, since the constant is negative?

- ☐ A. Both positive
- ☐ B. Both negative
- ☐ C. Both zero
- ☐ D. Opposite signs

Q6. Which pair of numbers multiplies to 6 and adds to 7?

- ☐ A. 2 and 3
- ☐ B. 6 and 1
- ☐ C. 1 and 6
- ☐ D. 3 and 2

Q7. For $2x^2 + 7x + 3$, which two pieces do you multiply first?

$2x^2$	$+3$	first $\times$ last
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- ☐ A. The two coefficients 2 and 7
- ☐ B. The first coefficient and the last term
- ☐ C. The two constants 7 and 3
- ☐ D. Nothing — just use 7 directly

Q8. After splitting the middle term, what technique finishes the factorisation?

- ☐ A. Expanding brackets
- ☐ B. Squaring both sides
- ☐ C. Dividing by x

☐ D. Factoring by grouping

Q9. For a quadratic $x^2 + bx + c$ with c positive, what must be true of the two numbers you find?

☐ A. They multiply to a negative number

☐ B. They share the same sign as b

☐ C. They are always both 1

☐ D. One is always zero

Q10. After factorising, how do you check, and why expanding is the reliable test?

☐ A. Check by expanding it back out

☐ B. Divide by the leading coefficient

☐ C. Substitute $x=1$ only

☐ D. Nothing further is needed

Section B - Medium

Q11. Factorise $x^2 + 8x + 15$.

$$x^2 + 8x + 15$$

☐ A. $(x + 3)(x + 5)$

☐ B. $(x + 1)(x + 15)$

☐ C. $(x + 8)(x + 15)$

☐ D. $(x + 5)(x + 15)$

Q12. Factorise $x^2 - 6x - 27$.

☐ A. $(x + 9)(x - 3)$

☐ B. $(x - 9)(x + 3)$

☐ C. $(x - 27)(x + 1)$

☐ D. $(x - 6)(x + 4)$

Q13. Factorise $x^2 - 2x - 15$.

☐ A. $(x - 3)(x + 5)$

☐ B. $(x + 3)(x - 5)$

☐ C. $(x - 15)(x + 1)$

☐ D. $(x + 15)(x - 1)$

Q14. Factorise $2x^2 - 5x - 3$ by splitting the middle term.

$$2x^2 - 5x - 3$$

☐ A. $(2x - 1)(x + 3)$

☐ B. $(2x + 3)(x - 1)$

☐ C. $(2x - 3)(x + 1)$

☐ D. $(2x + 1)(x - 3)$

Q15. Factorise $x^2 + 2x - 24$.

☐ A. $(x - 6)(x + 4)$

☐ B. $(x + 8)(x - 3)$

☐ C. $(x - 8)(x + 3)$

☐ D. $(x + 6)(x - 4)$

Q16. Factorise $3x^2 + 11x + 6$.

☐ A. $(3x + 3)(x + 2)$

☐ B. $(x + 2)(3x + 6)$

☐ C. $(3x + 2)(x + 3)$

☐ D. $(3x + 6)(x + 1)$

Q17. Factorise $4x^2 + 4x - 3$.

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

☐ A. $(2x + 3)(2x - 1)$

☐ B. $(2x - 3)(2x + 1)$

☐ C. $(4x + 3)(x - 1)$

☐ D. $(4x - 3)(x + 1)$

Q18. Factorise $5x^2 + 13x + 6$.

- ☐ A. $(5x + 2)(x + 3)$
- ☐ B. $(5x + 6)(x + 1)$
- ☐ C. $(5x + 3)(x + 2)$
- ☐ D. $(5x + 1)(x + 6)$

Q19. Factorise $x^2 - 9x + 20$.

- ☐ A. $(x + 4)(x + 5)$
- ☐ B. $(x - 4)(x - 5)$
- ☐ C. $(x - 2)(x - 10)$
- ☐ D. $(x - 1)(x - 20)$

Q20. Which pair multiplies to -6 and adds to -1 , and why both conditions matter?

- ☐ A. 2 and -3
- ☐ B. -2 and 3
- ☐ C. 1 and -6
- ☐ D. 6 and -1

Section C - Challenge

Q21. Factorise $6x^2 + 5x - 6$.

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

- ☐ A. $(3x - 2)(2x + 3)$
- ☐ B. $(3x + 2)(2x - 3)$
- ☐ C. $(6x - 2)(x + 3)$
- ☐ D. $(6x + 3)(x - 2)$

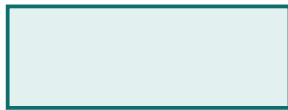
Q22. If $x^2 + bx - 20$ has integer factors and b is as small in magnitude as possible, what is b ?

- ☐ A. 8
- ☐ B. 19
- ☐ C. 1
- ☐ D. -19

Q23. Factorise $8x^2 - 2x - 15$.

- ☐ A. $(4x - 5)(2x + 3)$
- ☐ B. $(4x + 5)(2x - 3)$
- ☐ C. $(8x + 5)(x - 3)$
- ☐ D. $(8x - 5)(x + 3)$

Q24. Area $6x^2 + 19x + 10$, one side $2x + 5$. Other side?



area $6x^2 + 19x + 10$, side $2x + 5$

- ☐ A. $(3x + 5)$
- ☐ B. $(6x + 2)$
- ☐ C. $(3x + 2)$
- ☐ D. $(2x + 2)$

Q25. Factorise $10x^2 + x - 3$.

- ☐ A. $(5x - 3)(2x + 1)$
- ☐ B. $(10x + 3)(x - 1)$
- ☐ C. $(10x - 3)(x + 1)$
- ☐ D. $(5x + 3)(2x - 1)$

Q26. Factorise $x^2 - 3x - 40$.

- ☐ A. $(x + 8)(x - 5)$
- ☐ B. $(x - 4)(x + 10)$
- ☐ C. $(x + 4)(x - 10)$
- ☐ D. $(x - 8)(x + 5)$

Q27. Factorise $9x^2 - 24x + 16$ and say if it is a perfect square.



$9x^2 - 24x + 16$

- ☐ A. $(3x - 4)^2$, a perfect square trinomial
- ☐ B. $(3x + 4)(3x - 4)$, a difference of squares
- ☐ C. $(9x - 4)(x - 4)$

☐ **D.** $(3x - 4)(3x + 6)$

Q28. Factorise $12x^2 - 17x + 6$.

☐ **A.** $(3x + 2)(4x + 3)$

☐ **B.** $(3x - 2)(4x - 3)$

☐ **C.** $(6x - 2)(2x - 3)$

☐ **D.** $(12x - 2)(x - 3)$

Q29. Factorise $6x^2 - 7x - 3$ completely.

☐ **A.** $(3x - 1)(2x + 3)$

☐ **B.** $(3x + 1)(2x - 3)$

☐ **C.** $(6x + 1)(x - 3)$

☐ **D.** $(6x - 1)(x + 3)$

Q30. Pull -1 from $-x^2+5x+6$, then factor the quadratic fully.

☐ **A.** $-(x - 6)(x + 1)$

☐ **B.** $-(x + 6)(x - 1)$

☐ **C.** $(x - 6)(x + 1)$

☐ **D.** $-(x - 5)(x + 6)$

Answer Key

- Q1:** (C) (c) $(x + 3)(x + 4)$. Using the pair 3 and 4, which multiply to 12 and add to 7.
- Q2:** (A) (a) Multiply to 12 and add to 7. Once found, those two numbers split the middle term.
- Q3:** (B) (b) 3 and 4. $3 \times 4 = 12$ and $3 + 4 = 7$ — both conditions satisfied together, unlike the other pairs which multiply correctly but don't add to 7.
- Q4:** (A) (a) $(x + 3)(x - 4)$. 3 and -4 multiply to -12 and add to -1 , matching $x^2 - x - 12$'s coefficients exactly.
- Q5:** (D) (d) Opposite signs. A negative product only happens when one number is positive and the other negative.
- Q6:** (C) (c) 1 and 6. $1 \times 6 = 6$ and $1 + 6 = 7$ — this pair is used to split the middle term of $2x^2 + 7x + 3$.
- Q7:** (B) (b) The first coefficient and the last term (2 and 3). This gives the target product (6) for the number-pair search when a is not 1.
- Q8:** (D) (d) Factoring by grouping. The split turns three terms into four, which then group into two matching-bracket pairs.
- Q9:** (B) (b) They share the same sign as b . A positive product means the two numbers have matching signs, and to also add up to b , that shared sign must match b 's own sign.
- Q10:** (A) (a) Check by expanding it back out. This is the one reliable check that catches an arithmetic slip anywhere in the process.
- Q11:** (A) (a) $(x + 3)(x + 5)$. 3 and 5 multiply to 15 and add to 8.
- Q12:** (B) (b) $(x - 9)(x + 3)$. -9 and 3 multiply to -27 and add to -6 .
- Q13:** (B) (b) $(x + 3)(x - 5)$. 3 and -5 multiply to -15 and add to -2 , matching $x^2 - 2x - 15$ exactly.
- Q14:** (D) (d) $(2x + 1)(x - 3)$. $\text{First} \times \text{last} = -6$; the pair 1 and -6 multiply to -6 and add to -5 .
- Q15:** (D) (d) $(x + 6)(x - 4)$. 6 and -4 multiply to -24 and add to 2.
- Q16:** (C) (c) $(3x + 2)(x + 3)$. $\text{First} \times \text{last} = 18$; the pair 2 and 9 multiply to 18 and add to 11, splitting to $3x^2 + 2x + 9x + 6 = x(3x + 2) + 3(3x + 2)$.
- Q17:** (A) (a) $(2x + 3)(2x - 1)$. $\text{First} \times \text{last} = -12$; the pair 6 and -2 multiply to -12 and add to 4, splitting to $4x^2 + 6x - 2x - 3$.
- Q18:** (C) (c) $(5x + 3)(x + 2)$. $\text{First} \times \text{last} = 30$; the pair 3 and 10 multiply to 30 and add to 13, splitting to $5x^2 + 3x + 10x + 6$.
- Q19:** (B) (b) $(x - 4)(x - 5)$. -4 and -5 multiply to 20 and add to -9 , both negative since c is positive and b is negative.
- Q20:** (A) (a) 2 and -3 . $2 \times (-3) = -6$ and $2 + (-3) = -1$, matching both conditions at once.
- Q21:** (A) (a) $(3x - 2)(2x + 3)$. $\text{First} \times \text{last} = -6$; the pair 9 and -4 multiply to -36 and add to 5, splitting to $6x^2 + 9x - 4x - 6$.
- Q22:** (C) (c) 1. Among all factor pairs of -20 ($1 \& -20$, $2 \& -10$, $4 \& -5$, and their sign-flips), 4 and -5 give the smallest-magnitude sum: $4 + (-5) = -1$, or $-4 + 5 = 1$ — the smallest magnitude achievable is 1.

Q23: (B) (b) $(4x + 5)(2x - 3)$. First $\times$ last=-120; the pair 10 and -12 multiply to -120 and add to -2, splitting to $8x^2+10x-12x-15$.

Q24: (C) (c) $(3x + 2)$. Check: $(2x+5)(3x+2) = 6x^2+4x+15x+10 = 6x^2+19x+10$, matching the given area.

Q25: (D) (d) $(5x + 3)(2x - 1)$. First $\times$ last=-30; the pair 6 and -5 multiply to -30 and add to 1, splitting to $10x^2+6x-5x-3$.

Q26: (D) (d) $(x - 8)(x + 5)$. -8 and 5 multiply to -40 and add to -3, matching $x^2 - 3x - 40$ exactly.

Q27: (A) (a) $(3x - 4)^2$, a perfect square trinomial. First $\times$ last=144; pair -12 and -12 multiply to 144 and add to -24, and since both halves match, it's really a perfect square in disguise.

Q28: (B) (b) $(3x - 2)(4x - 3)$. First $\times$ last=72; the pair -8 and -9 multiply to 72 and add to -17, splitting to $12x^2-8x-9x+6$.

Q29: (B) (b) $(3x + 1)(2x - 3)$. First $\times$ last=-18; the pair 2 and -9 multiply to -18 and add to -7, splitting to $6x^2+2x-9x-3$.

Q30: (A) (a) $-(x - 6)(x + 1)$. Pull out -1 first to get $-(x^2-5x-6)$, then factorise x^2-5x-6 using -6 and 1, which multiply to -6 and add to -5.

You've got this! Keep learning and shining! - Ruchi Math Coaching