# Factorisation Using Identities

## Unit: Algebra - Student Practice Worksheet

***Overview: Meera gave Arjun 60 seconds to factorise $x^2 - 81$ before she finished tying her shoelace. Arjun reached for the (x+a)(x+b) method and started hunting for two numbers that multiply to -81 and add to 0. Meera finished her laces, glanced at the problem, and said "9 and 9" without touching a pen.***

## Practice Questions (30 Total)

### Section A - Easy

**Q1. Big square $x^2$ minus small square 49. Factorise.**

$x^2$ minus 49

- [ ] **A.** (x + 7)(x – 7)
- [ ] **B.** (x + 49)(x – 1)
- [ ] **C.** $(x - 7)^2$
- [ ] **D.** $(x + 7)^2$

**Q2. Which sign must appear between two perfect squares for the difference-of-squares identity to apply?**

- [ ] **A.** Plus
- [ ] **B.** Times
- [ ] **C.** Minus
- [ ] **D.** Divide

**Q3. What is the square root of 81?**

- [ ] **A.** 8
- [ ] **B.** 9
- [ ] **C.** 18
- [ ] **D.** 6

**Q4. Tiles for $x^2 - 10x + 25$. Factor as a perfect square.**

$x^2 - 10x + 25$

- [ ] **A.** $(x - 5)^2$
- [ ] **B.** $(x + 5)^2$
- [ ] **C.** $(x + 5)(x - 5)$
- [ ] **D.** $(x - 25)(x + 1)$

**Q5. Does $x^2 + 9$ factor using real numbers with these identities?**

- [ ] **A.** Yes, as $(x+3)(x–3)$
- [ ] **B.** Yes, as $(x+3)^2$
- [ ] **C.** Yes, as $(x+9)(x–1)$
- [ ] **D.** No — it is a sum of two squares

**Q6. Factorise $x^2 – 16$.**

- [ ] **A.** $(x + 8)(x – 2)$
- [ ] **B.** $(x – 4)^2$
- [ ] **C.** $(x + 4)(x – 4)$
- [ ] **D.** $(x + 16)(x – 1)$

**Q7. Tiles for $x^2 + 6x + 9$. Factor as a perfect square.**

$x^2 + 6x + 9$

- [ ] **A.** $(x + 3)(x – 3)$
- [ ] **B.** $(x + 3)^2$
- [ ] **C.** $(x + 9)^2$
- [ ] **D.** $(x + 6)(x + 3)$

**Q8. For $x^2 – 10x + 25$ to be a perfect square trinomial, what must 25 be?**

- [ ] **A.** Twice a square root
- [ ] **B.** Half of 10
- [ ] **C.** The sum of the roots
- [ ] **D.** A perfect square, namely $5^2$

**Q9. Before using an identity to factorise, what should you check first?**

- A. Whether the expression has a fraction
- B. Whether both ends are perfect squares
- C. Whether it has three terms only
- D. Whether x is positive

**Q10. In $a^2+2ab+b^2$, what must the middle term equal, and why 2ab?**

- A. Twice the product of the square roots of the ends
- B. The sum of the ends
- C. The product of the ends
- D. Half the product of the ends

## Section B - Medium

**Q11. $(2x)^2$ minus $5^2$. Factorise $4x^2 - 25$.**

$(2x)^2 \quad - \quad 5^2$

- A. $(2x + 5)(2x - 5)$
- B. $(4x + 5)(x - 5)$
- C. $(2x - 5)^2$
- D. $(4x - 25)(x)$

**Q12. Which of these is NOT a perfect square trinomial?**

- A. $x^2 + 8x + 16$
- B. $x^2 + 5x + 25$
- C. $x^2 - 12x + 36$
- D. $x^2 + 14x + 49$

**Q13. Factorise $9x^2 + 12x + 4$.**

- A. $(3x + 4)(3x + 1)$
- B. $(3x + 2)^2$
- C. $(9x + 2)^2$
- D. $(3x + 2)(3x - 2)$

**Q14. $10^2$ minus $x^2$. Factorise $100 - x^2$.**

$10^2 \quad - \quad x^2$

- [ ] **A.** $(x + 10)^2$
- [ ] **B.** $(10 - x)^2$
- [ ] **C.** $(x - 100)(x + 1)$
- [ ] **D.** $(10 + x)(10 - x)$

**Q15. For $25x^2 + kx + 4$ to be a perfect square trinomial, what must k be?**

- [ ] **A.** 10
- [ ] **B.** 40
- [ ] **C.** 25
- [ ] **D.** 20

**Q16. Factorise $4x^2 - 20x + 25$.**

- [ ] **A.** $(2x + 5)^2$
- [ ] **B.** $(4x - 5)(x - 5)$
- [ ] **C.** $(2x - 5)^2$
- [ ] **D.** $(2x - 5)(2x + 5)$

**Q17. $(4x)^2$ minus $1^2$. Factorise $16x^2 - 1$.**

$(4x)^2 \quad - \quad 1^2$

- [ ] **A.** $(4x + 1)(4x - 1)$
- [ ] **B.** $(16x + 1)(x - 1)$
- [ ] **C.** $(4x - 1)^2$
- [ ] **D.** $(8x + 1)(2x - 1)$

**Q18. Factorise x■ − 16 (treat $x^2$ as the square root's square).**

- [ ] **A.** $(x^2 - 4)^2$
- [ ] **B.** $(x + 4)(x - 4)$
- [ ] **C.** $(x^2 + 4)(x^2 - 4)$

- [ ] **D.** $(x^2 + 4)^2$

**Q19. Is $x^2 + 4x + 4$ a perfect square trinomial? If so, factorise it.**

- [ ] **A.** No, it does not fit the shape
- [ ] **B.** Yes, $(x + 2)^2$
- [ ] **C.** Yes, $(x + 4)^2$
- [ ] **D.** Yes, $(x + 2)(x – 2)$

**Q20. Treat (x+1) as one square root: factorise $(x+1)^2 – 4$.**

- [ ] **A.** $(x + 3)(x – 1)$
- [ ] **B.** $(x + 1 + 4)(x + 1 – 4)$
- [ ] **C.** $(x – 1)(x + 1)$
- [ ] **D.** $(x + 3)^2$

## Section C - Challenge

**Q21. Factorise $9x^2 – 30x + 25$ and name the identity shape.**

$9x^2 – 30x + 25$

- [ ] **A.** $(3x – 5)^2$, a perfect square trinomial
- [ ] **B.** $(3x + 5)(3x – 5)$, a difference of squares
- [ ] **C.** $(9x – 5)(x – 5)$
- [ ] **D.** $(3x – 5)(3x + 25)$

**Q22. If $x^2 + kx + 49$ is a perfect square trinomial with a POSITIVE middle term, what is k?**

- [ ] **A.** 49
- [ ] **B.** 14
- [ ] **C.** 7
- [ ] **D.** -14

**Q23. Factorise x■ – 81 completely, using the difference-of-squares identity twice.**

- [ ] **A.** $(x^2 – 9)^2$
- [ ] **B.** $(x^2 + 9)(x + 3)(x – 3)$
- [ ] **C.** $(x + 3)^2(x – 3)^2$

- [ ] **D.** $(x^2 + 9)(x^2 – 9)$

**Q24. Square field area $x^2+20x+100$. Side length?**

area $x^2+20x+100$

- [ ] **A.** (x + 20) m
- [ ] **B.** (x + 100) m
- [ ] **C.** (x + 10) m
- [ ] **D.** (x + 10)(x – 10) m

**Q25. Factorise $x^2 – (y + 3)^2$ using the difference-of-squares identity with a compound second term.**

- [ ] **A.** (x + y – 3)(x – y + 3)
- [ ] **B.** (x – y)(x – 3)
- [ ] **C.** (x + y)(x – 3)
- [ ] **D.** (x + y + 3)(x – y – 3)

**Q26. Simplify $(x + 5)^2 – (x – 5)^2$ using identities, without fully expanding either bracket first.**

- [ ] **A.** 0
- [ ] **B.** 10x
- [ ] **C.** 50
- [ ] **D.** 20x

**Q27. GCF 3 from $3x^2–27$, then factor $x^2–9$.**

$x^2 – 9$ from $3x^2–27$

- [ ] **A.** $3(x + 3)(x – 3)$
- [ ] **B.** $3(x – 3)^2$
- [ ] **C.** $(3x + 9)(x – 3)$
- [ ] **D.** $3(x^2 – 9)^2$

**Q28. Evaluate $97^2 - 3^2$ using the difference-of-squares identity, without squaring either number directly.**

- [ ] **A.** 9409
- [ ] **B.** 9391
- [ ] **C.** 9400
- [ ] **D.** 94

**Q29. Factorise $x^2 - 2x + 1 - y^2$ completely, grouping the perfect square trinomial first.**

- [ ] **A.** $(x + y - 1)(x - y - 1)$
- [ ] **B.** $(x - 1 + y)(x - 1 - y)$
- [ ] **C.** $(x - 1)^2(y)$
- [ ] **D.** $(x - y)(x + y - 1)$

**Q30. Choose k so $4x^2+20x+k$ is a square, and write the factored form.**

- [ ] **A.** k=25, giving $(2x+5)^2$
- [ ] **B.** k=100, giving $(2x+10)^2$
- [ ] **C.** k=10, giving $(2x+5)(2x+2)$
- [ ] **D.** k=5, giving $(2x+5)(2x+1)$

## Answer Key

**Q1:** (A) (a) $(x + 7)(x – 7)$. Both $x^2$ and 49 are perfect squares ($49 = 7^2$) with a minus between them, matching $a^2 – b^2$.

**Q2:** (C) (c) Minus. $a^2 – b^2$ factors neatly; $a^2 + b^2$, a genuine sum of two squares, does not factor using real numbers.

**Q3:** (B) (b) 9, since $9 \times 9 = 81$ — this is exactly why $x^2 – 81$ becomes $(x+9)(x–9)$.

**Q4:** (A) (a) $(x – 5)^2$. The middle term is negative, matching $a^2 – 2ab + b^2$, so the bracket carries a minus sign.

**Q5:** (D) (d) No — it is a sum of two squares. There is a plus sign, not a minus, so the difference-of-squares identity does not apply.

**Q6:** (C) (c) $(x + 4)(x – 4)$. $16 = 4^2$, and there's no middle term, matching the difference-of-squares shape exactly.

**Q7:** (B) (b) $(x + 3)^2$. $9 = 3^2$, and the middle term $6x$ equals $2 \times x \times 3$, matching the perfect square trinomial shape $a^2 + 2ab + b^2$.

**Q8:** (D) (d) A perfect square, namely $5^2$. Then check the middle term: $2 \times x \times 5 = 10x$, which matches, confirming $(x–5)^2$.

**Q9:** (B) (b) Whether both ends are perfect squares — that, plus checking the middle term (if any) fits, is the whole identity-spotting checklist.

**Q10:** (A) (a) Twice the product of the square roots of the ends. This is exactly what $2ab$ means once a and b are the square roots of the two outer terms.

**Q11:** (A) (a) $(2x + 5)(2x – 5)$. $4x^2 = (2x)^2$ and $25 = 5^2$, with no middle term — a genuine difference of squares.

**Q12:** (B) (b) $x^2 + 5x + 25$ is not a perfect square trinomial — for that shape the middle term would need to be $2 \times x \times 5 = 10x$, not $5x$.

**Q13:** (B) (b) $(3x + 2)^2$. $9x^2 = (3x)^2$, $4 = 2^2$, and $2 \times 3x \times 2 = 12x$ matches the middle term exactly.

**Q14:** (D) (d) $(10 + x)(10 – x)$. Reorder as a difference of squares with $a = 10$, $b = x$ — the identity works regardless of which perfect square is written first.

**Q15:** (D) (d) 20. Since $25x^2=(5x)^2$ and $4=2^2$, the middle term must be $2 \times 5x \times 2 = 20x$, so $k=20$.

**Q16:** (C) (c) $(2x – 5)^2$. $4x^2=(2x)^2$, $25=5^2$, and $2 \times 2x \times 5 = 20x$ matches with a minus sign throughout.

**Q17:** (A) (a) $(4x + 1)(4x – 1)$. $16x^2 = (4x)^2$ and $1 = 1^2$, with no middle term.

**Q18:** (C) (c) $(x^2 + 4)(x^2 – 4)$. $x\blacksquare = (x^2)^2$ and $16 = 4^2$, so the same identity applies with $a = x^2$, $b = 4$ — this can even factor further into $(x^2+4)(x+2)(x–2)$.

**Q19:** (B) (b) Yes, $(x + 2)^2$. $4 = 2^2$, and $2 \times x \times 2 = 4x$ matches the middle term — a genuine perfect square trinomial.

**Q20:** (A) (a) $(x + 3)(x – 1)$. Treat $(x+1)$ as a single square root: $(x+1)^2 – 2^2 = ((x+1)+2)((x+1)–2) = (x+3)(x–1)$.

**Q21:** (A) (a) $(3x – 5)^2$, a perfect square trinomial. $9x^2=(3x)^2$, $25=5^2$, and $2 \times 3x \times 5 = 30x$ matches the middle term with a minus sign.

**Q22:** (B) (b) 14. $49=7^2$, so the middle term must be $2\times x\times 7=14x$ for a positive middle term, giving $(x+7)^2$.

**Q23:** (B) (b) $(x^2 + 9)(x + 3)(x – 3)$. First x■–81 = $(x^2+9)(x^2–9)$, then $x^2–9$ factors again as $(x+3)(x–3)$ — option (d) stops one step too early.

**Q24:** (C) (c) (x + 10) m. The area is a perfect square trinomial: $100=10^2$, and $2\times x\times 10=20x$ matches, so the area is $(x+10)^2$, making the side length (x+10).

**Q25:** (D) (d) $(x + y + 3)(x – y – 3)$. Treat (y+3) as a single b: $x^2–b^2 = (x+b)(x–b) = (x+(y+3))(x–(y+3))$.

**Q26:** (D) (d) 20x. Using $a^2–b^2$ with a=(x+5), b=(x–5): $[(x+5)+(x–5)][(x+5)–(x–5)] = (2x)(10) = 20x$.

**Q27:** (A) (a) $3(x + 3)(x – 3)$. First pull out GCF 3 to get $3(x^2–9)$, then apply the difference-of-squares identity to $x^2–9$.

**Q28:** (C) (c) 9400. $(97+3)(97–3) = 100 \times 94 = 9400$ — far quicker than squaring 97 directly.

**Q29:** (B) (b) $(x – 1 + y)(x – 1 – y)$. First $x^2–2x+1 = (x–1)^2$, then $(x–1)^2 – y^2$ is a difference of squares: $((x–1)+y)((x–1)–y)$.

**Q30:** (A) (a) k=25, giving $(2x+5)^2$. Since $4x^2=(2x)^2$, and the middle term $20x=2\times 2x\times 5$ forces the missing root to be 5, so $k=5^2=25$.

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