Factorisation: Common Factors and Regrouping

Unit: Algebra - Student Practice Worksheet

Overview: Arjun tried to factorise $6x^2 + 9x$ and wrote $3(2x + 3x)$, then simplified it back to $6x^2 + 9x^2$ and stared at the mismatch. Meera pointed at his second term. "You multiplied the 3 back in wrong. Watch what happens if you pull it out of BOTH terms properly." Arjun redid it, and this time multiplying back out gave him exactly what he'd started with.

Practice Questions (30 Total)

Section A - Easy

Q1. Teal $6x^2$ plus maroon $9x$. Factor using the GCF.

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

Q2. What is factorisation the reverse of?

- [ ] **A.** Simplifying fractions
- [ ] **B.** Expanding brackets
- [ ] **C.** Solving equations
- [ ] **D.** Adding like terms

Q3. In regrouping $xy + 3x + 2y + 6$, what is the common factor of the first pair $(xy + 3x)$?

- [ ] **A.** y
- [ ] **B.** 3
- [ ] **C.** x
- [ ] **D.** 6

Q4. Teal $10y$ minus maroon 15. Factor using the GCF.

- [ ] **A.** 5(2y – 3)
- [ ] **B.** 5(2y – 15)
- [ ] **C.** 10(y – 15)
- [ ] **D.** 5y(2 – 3)

Q5. Why did Arjun's first attempt at factorising $6x^2 + 9x$ fail?

- [ ] **A.** He used a wrong common factor
- [ ] **B.** He divided the two terms by different numbers
- [ ] **C.** He forgot the x^2 term
- [ ] **D.** He added instead of factoring

Q6. Find the GCF of $6x^2$ and $9x$.

- [ ] **A.** $3x$
- [ ] **B.** $3x^2$
- [ ] **C.** $9x$
- [ ] **D.** $18x^2$

Q7. Four term-blocks, no single shared factor. When do you regroup?

- [ ] **A.** When there is exactly one term
- [ ] **B.** When every term is negative
- [ ] **C.** Never — GCF always works
- [ ] **D.** When there are four terms with no single common factor

Q8. How should you always check a factorisation?

- [ ] **A.** Guess and see if it looks right
- [ ] **B.** Substitute x = 0 only
- [ ] **C.** Expand it back out and compare to the original
- [ ] **D.** Check that it has two brackets

Q9. What should you try if grouping the terms in their given order does not produce matching brackets?

- [ ] **A.** Give up entirely
- [ ] **B.** Multiply everything by -1
- [ ] **C.** Reorder and regroup differently
- [ ] **D.** Add a new term

Q10. After pairing xy+3x and 2y+6, which shared bracket lets you finish?

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

Section B - Medium

Q11. Factorise $12x^2y + 18xy^2$ using the GCF of both monomials.

$$12x^2y \quad + \quad 18xy^2$$

- [ ] **A.** $6xy(2x + 3y)$
- [ ] **B.** $6x(2xy + 3y^2)$
- [ ] **C.** $6xy(2x + 3)$
- [ ] **D.** $xy(12x + 18y)$

Q12. What is the GCF of $8a^2b^3$ and $12a^3b^2$?

- [ ] **A.** $4a^3b^3$
- [ ] **B.** $8a^2b^2$
- [ ] **C.** $4a^2b^2$
- [ ] **D.** $4ab$

Q13. Factorise $5x^3 – 20x^2 + 15x$.

- [ ] **A.** $5(x^3 – 4x^2 + 3x)$
- [ ] **B.** $5x(x^2 – 4x + 3)$
- [ ] **C.** $x(5x^2 – 20x + 15)$

- [ ] **D.** $5x(x^2 - 4x + 15)$

Q14. Both bars negative: $-3x^2 - 6x$. Pull a negative common factor.

$-3x^2 - 6x$

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

Q15. Factorise by grouping: $ax + ay + bx + by$.

- [ ] **A.** $(a + x)(b + y)$
- [ ] **B.** $(a - b)(x + y)$
- [ ] **C.** $(a + b)(x + y)$
- [ ] **D.** $ab(x + y)$

Q16. Factorise by grouping: $2x^2 + 3x + 4x + 6$ (after grouping into pairs).

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

Q17. Three terms $7p^2q$, $14pq^2$, $21pq$. Factor the GCF.

$7p^2q + 14pq^2 + 21pq$

- [ ] **A.** $7p(pq + 2q^2 + 3q)$
- [ ] **B.** $pq(7p + 14q + 21)$
- [ ] **C.** $7pq(p + 2q + 21)$
- [ ] **D.** $7pq(p + 2q + 3)$

Q18. Factorise by grouping: $xy - 2x - 3y + 6$.

- [ ] **A.** $(y + 2)(x - 3)$

- ☐ **B.** $(y - 2)(x - 3)$
- ☐ **C.** $(y - 3)(x - 2)$
- ☐ **D.** $(x - 2)(y + 3)$

Q19. Factorise $m^2 - mn + m - n$ by grouping.

- ☐ **A.** $(m + n)(m - 1)$
- ☐ **B.** $(m - n)(m + 1)$
- ☐ **C.** $(m - n)(m - 1)$
- ☐ **D.** $m(m - n + 1)$

Q20. Which pairing of $x^2+5x+2x+10$ yields matching brackets, and why?

- ☐ **A.** $(x^2 + 5x) + (2x + 10)$
- ☐ **B.** $(x^2 + 2x) + (5 + 10)$
- ☐ **C.** $(x^2 + 10) + (5x + 2x)$
- ☐ **D.** No grouping works

Section C - Challenge

Q21. Factorise $4x^3y^2 - 6x^2y^3 + 8x^2y^2$ by taking the full GCF.

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

- ☐ **A.** $2x^2y^2(2x - 3y + 4)$
- ☐ **B.** $2xy(2x^2y - 3xy^2 + 4x)$
- ☐ **C.** $2x^2y^2(2x - 3y + 8)$
- ☐ **D.** $x^2y^2(4x - 6y + 8)$

Q22. Factorise $x^2y + x^2z - y^3 - y^2z$ by grouping in pairs (x^2 with y^2, not by variable).

- ☐ **A.** $(x + y)(x - y)(y + z)$
- ☐ **B.** $(x^2 - y^2)(y + z)$
- ☐ **C.** $(x^2 + y^2)(y - z)$
- ☐ **D.** $(x - y)(x + y)(y - z)$

Q23. Factorise $6x^2 - 9x - 4x + 6$ by grouping.

- ☐ **A.** $(3x - 2)(2x + 3)$

- **B.** $(2x - 3)(3x - 2)$
- **C.** $(2x + 3)(3x - 2)$
- **D.** $(6x - 4)(x - 3)$

Q24. Rectangle area $15x^2+20x$, one side $5x$. Other side?

area $15x^2+20x$, side $5x$

- **A.** $(3x + 20)$
- **B.** $(15x + 4)$
- **C.** $(3x + 4)$
- **D.** $(3x + 5)$

Q25. Factorise $p(q + r) - s(q + r)$ fully, recognising the shared bracket immediately.

- **A.** $(p - s)(q - r)$
- **B.** $(q + r)(p + s)$
- **C.** $(q + r)(p - s)$
- **D.** $pq + pr - sq - sr$

Q26. Factorise $2ax - 2ay - bx + by$ by grouping, taking care with the negative signs.

- **A.** $(x + y)(2a - b)$
- **B.** $(x - y)(2a + b)$
- **C.** $(2a - b)(x + y)$
- **D.** $(x - y)(2a - b)$

Q27. Group x^2+xy with $xz+yz$. Fully factorised form?

$$x^2+xy \qquad + \qquad xz+yz$$

- **A.** $(x + y)(x + z)$
- **B.** $(x + y)(z + y)$
- **C.** $(x - y)(x + z)$
- **D.** $x(x + y + z) + yz$

Q28. If $8x^2y^3$ is divided by the common factor $4xy^2$, what remains?

- ☐ **A.** $2x^2y$
- ☐ **B.** $2xy^2$
- ☐ **C.** $4xy$
- ☐ **D.** $2xy$

Q29. Two expressions, $2xy + 6x + y + 3$ and $2xy + 2x + 3y + 3$, look similar. Which one groups cleanly into two matching brackets without reordering?

- ☐ **A.** Only the second: $2xy + 2x + 3y + 3$
- ☐ **B.** Only the first: $2xy + 6x + y + 3$
- ☐ **C.** Both group cleanly
- ☐ **D.** Neither groups cleanly

Q30. GCF first on $3x^3–3x^2–18x$, then factor the quadratic fully.

- ☐ **A.** $3x(x – 3)(x + 2)$
- ☐ **B.** $3x(x^2 – x – 18)$
- ☐ **C.** $3x(x – 6)(x + 3)$
- ☐ **D.** $x(3x – 3)(x + 6)$

Answer Key

Q1: (A) (a) $3x(2x + 3)$. Dividing $6x^2$ by $3x$ gives $2x$, and dividing $9x$ by $3x$ gives 3, using the true greatest common factor.

Q2: (B) (b) Expanding brackets. Factorising and expanding undo each other, which is exactly why expanding back out is the reliable way to check a factorisation.

Q3: (C) (c) x. Both xy and $3x$ contain a factor of x, so $x(y + 3)$ is the factored pair.

Q4: (A) (a) $5(2y – 3)$. 5 is the GCF of 10 and 15; dividing $10y$ by 5 gives $2y$, and dividing 15 by 5 gives 3.

Q5: (B) (b) He divided the two terms by different numbers. Pulling 3 out of one term and effectively 1 out of the other made the two sides of the equation stop matching.

Q6: (A) (a) $3x$. 3 divides both 6 and 9; only one x divides both x^2 and x, since $9x$ only has one factor of x.

Q7: (D) (d) When there are four terms with no single common factor. That's exactly the situation $xy + 3x + 2y + 6$ presented Arjun with.

Q8: (C) (c) Expand it back out and compare to the original. This is the one check that never lies — matching brackets don't guarantee a correct factorisation, but a matching expansion does.

Q9: (C) (c) Reorder and regroup differently. The natural writing order doesn't always group into matching brackets on the first try.

Q10: (D) (d) $(y + 3)$. $x(y+3)$ and $2(y+3)$ both leave $(y+3)$, which is exactly what lets the whole thing factor to $(y+3)(x+2)$.

Q11: (A) (a) $6xy(2x + 3y)$. The GCF of $12x^2y$ and $18xy^2$ is $6xy$; dividing each term by it gives $2x$ and $3y$.

Q12: (C) (c) $4a^2b^2$. Take the smaller power of each letter present in both terms — a^2 (not a^3) and b^2 (not b^3) — with the numeric GCF of 8 and 12, which is 4.

Q13: (B) (b) $5x(x^2 – 4x + 3)$. The GCF of all three terms is $5x$; dividing $5x^3$, $-20x^2$, and $15x$ by it gives x^2, $-4x$, and 3.

Q14: (A) (a) $-3x(x + 2)$. Pulling $-3x$ out of $-3x^2$ gives x, and out of $-6x$ gives 2 — check by expanding: $-3x·x + -3x·2 = -3x^2 – 6x$.

Q15: (C) (c) $(a + b)(x + y)$. Group as $(ax + ay) + (bx + by) = a(x+y) + b(x+y) = (a+b)(x+y)$.

Q16: (D) (d) $(x + 2)(2x + 3)$. Group as $(2x^2+3x) + (4x+6) = x(2x+3) + 2(2x+3) = (2x+3)(x+2)$.

Q17: (D) (d) $7pq(p + 2q + 3)$. The GCF of all three terms is $7pq$; dividing each by it gives p, $2q$, and 3.

Q18: (B) (b) $(y – 2)(x – 3)$. Group as $(xy – 2x) + (–3y + 6) = x(y–2) – 3(y–2) = (y–2)(x–3)$.

Q19: (B) (b) $(m – n)(m + 1)$. Group as $(m^2–mn) + (m–n) = m(m–n) + 1(m–n) = (m–n)(m+1)$.

Q20: (A) (a) $(x^2 + 5x) + (2x + 10)$. This gives $x(x+5) + 2(x+5) = (x+5)(x+2)$, a genuine match, unlike the other pairings offered.

Q21: (A) (a) $2x^2y^2(2x – 3y + 4)$. The GCF is $2x^2y^2$ (smallest matching power of each letter, numeric GCF of 4,6,8 is 2); dividing gives $2x$, $–3y$, and 4.

Q22: (B) (b) $(x^2 - y^2)(y + z)$. Group as $(x^2y+x^2z) - (y^3+y^2z) = x^2(y+z) - y^2(y+z) = (x^2-y^2)(y+z)$.

Q23: (B) (b) $(2x - 3)(3x - 2)$. Group as $(6x^2-9x) + (-4x+6) = 3x(2x-3) - 2(2x-3) = (2x-3)(3x-2)$.

Q24: (C) (c) $(3x + 4)$. $15x^2 + 20x = 5x(3x + 4)$, found by dividing each term by the given side $5x$.

Q25: (C) (c) $(q + r)(p - s)$. Both terms already share the bracket $(q+r)$, so it factors out directly, leaving $p - s$ behind — option (d) is only the expanded, un-factorised form.

Q26: (D) (d) $(x - y)(2a - b)$. Group as $(2ax-2ay) + (-bx+by) = 2a(x-y) - b(x-y) = (x-y)(2a-b)$ — the second pair needs $-b$ factored out, not $+b$.

Q27: (A) (a) $(x + y)(x + z)$. Group as $(x^2+xy) + (xz+yz) = x(x+y) + z(x+y) = (x+y)(x+z)$; option (d) is only a partial, un-finished factorisation.

Q28: (D) (d) $2xy$. Divide the coefficients ($8\div4=2$) and subtract exponents for matching letters ($x^2\div x=x$, $y^3\div y^2=y$), giving $2xy$.

Q29: (B) (b) Only the first. $(2xy+6x) + (y+3) = 2x(y+3) + 1(y+3) = (y+3)(2x+1)$; the second expression's pairs give $2x(y+1)$ and $3(y+1)$ only after reordering the middle two terms first, so it does not group cleanly as originally written.

Q30: (A) (a) $3x(x - 3)(x + 2)$. First pull out GCF $3x$ to get $3x(x^2 - x - 6)$, then factorise x^2-x-6 using the $(x+a)(x+b)$ pattern with $a=-3$, $b=2$.

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

