

10 Equivalent expressions and domain restrictions

Name: _____ Class: _____ Date: _____ Total: 13 marks

KEY WORDS equivalent expressions • factor

Objective

- Factor and expand expressions without changing their values
- Simplify rational and radical expressions on the original domain
- Use expression structure to identify zeros and coefficients

Original public practice; marks below are classroom self-check points, not official criteria.

1 Key knowledge and worked examples

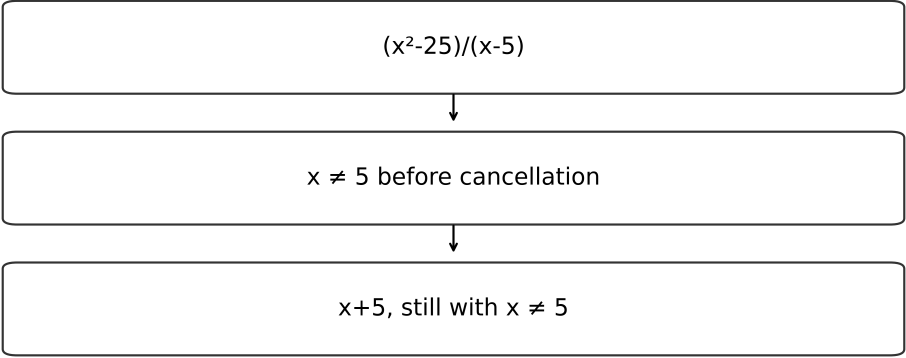
Expansion distributes each factor across the others; factorisation reverses that process. $x^2-5x+6=(x-2)(x-3)$, so the product form exposes zeros while the expanded form exposes coefficients. Choose the form that serves the question rather than treating one representation as always preferable.

Cancel factors, never terms in a sum. $(x^2-4)/(x-2)$ becomes $x+2$ only for $x \neq 2$, because the original expression is undefined at 2. A restriction may remain after every denominator disappears from the simplified formula. State it before cancelling, then carry it through comparisons or equation solving.

Exponent rules depend on their setting: $a^m a^n = a^{(m+n)}$ and $(a^m)^n = a^{(mn)}$ in the permitted real domain. Negative exponents form reciprocals and require nonzero bases. With real square roots, $\sqrt{(x^2)}=|x|$, because the principal square root is nonnegative; it is not x for every real x .

To check equivalence, a numerical substitution can expose a mistake, but one matching value does not prove two expressions equal. A valid algebraic identity plus matching domain does. When the question requests a coefficient, expand only as far as needed and account for every contribution to that power.

Equivalent expressions must agree on the stated domain . $E(x) = (x^2 - 25)/(x - 5) = (x + 5)$ only for $x \neq 5$. Cancellation removes a factor, but it cannot restore an excluded input. Also $\sqrt{x^2} = |x|$, because the principal square root cannot be negative.



Worked steps: $(x^2-25)/(x-5) \rightarrow x \neq 5$ before cancellation $\rightarrow x+5$, still with $x \neq 5$

Worked example. $(x^2-9)/(x-3)=(x-3)(x+3)/(x-3)=x+3$ for $x \neq 3$. At $x=3$ the original is undefined. For $x=-5$, $\sqrt{(x^2)}=5=|x|$. In $(2x+1)(x-4)$, the x coefficient is $-8+1=-7$ and the full expression is $2x^2-7x-4$.

2 Practice

2.1 Simplify $(x^2-16)/(x-4)$, with $x \neq 4$. [1]

- A $x+4$
- B $x-4$
- C x^2-4

2.2 For $x=-6$, $\sqrt{(x^2)}$ equals: [1]

- A 6
- B -6
- C 36

2.3 In $(x+2)(x+5)$, the x coefficient is _____. [1]

2.4 Matching at $x=1$ proves two expressions equivalent for all x . [1]

3 Exam-style questions

Use the data stated in each original task.

3.1 Simplify $F(x) = (x^2 - 4x)/(x^2 - 16)$. State every original restriction and explain why F is not identical to $x/(x + 4)$ on that latter formula's whole domain. [3]

3.2 Find the coefficient of x in $(3x - 2)(x + 5)$ and evaluate $\sqrt{(x - 5)^2}$ when $x = 1$. [3]

3.3 A student tests $x = 2$ and concludes that x^2 and $2x$ are equivalent. Refute the conclusion and solve where they actually agree. [3]