

Advanced Math — Practice Set I

Equivalent Expressions and Quadratic Equations: Easy to Medium

6 Questions | Full Solutions | Mistake-Pattern Analysis

Question 1 [EASY]

Which expression is equivalent to $3x(2x + 5)$?

- A) $6x + 5$
- B) $6x^2 + 5$
- C) $6x^2 + 15x$
- D) $6x + 15x^2$

Algebraic: Distribute the $3x$ across both terms: $3x(2x) + 3x(5) = 6x^2 + 15x$.

Desmos: Graph $y = 3x(2x+5)$ and $y =$ each answer choice; the one that overlaps exactly is equivalent.

Faster path: Algebraic. Distributing one term across a binomial is faster than graphing four separate functions to compare.

Mistake: **Concept gap**: student distributes the $3x$ to only the first term, getting $6x^2 + 5$.

Question 2 [EASY]

Which expression is equivalent to $(x + 3)(x - 3)$?

- A) $x^2 - 9$
- B) $x^2 + 9$
- C) $x^2 - 6x - 9$
- D) $x^2 - 6x + 9$

Algebraic: This is a difference of squares: $(x+3)(x-3) = x^2 - 9$.

Desmos: Graph $y = (x+3)(x-3)$ and each choice; only $y = x^2 - 9$ will overlap.

Faster path: Algebraic, recognizing the difference-of-squares pattern is instant once it is familiar.

Mistake: **Concept gap**: student confuses this with expanding $(x-3)^2$, producing $x^2 - 6x + 9$ instead of recognizing the cross terms cancel.

Question 3 [MEDIUM]

Which expression shows $x^2 + 7x + 12$ completely factored?

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

Algebraic: Find two numbers that multiply to 12 and add to 7: 3 and 4. So $(x+3)(x+4)$.

Desmos: Graph $y = x^2 + 7x + 12$ and find its x -intercepts; they should be -3 and -4 , matching roots of $(x+3)(x+4)$.

Faster path: Algebraic, factoring small integer coefficients is quicker than graphing and reading intercepts.

Mistake: **Concept gap**: student picks a factor pair that multiplies to 12 but does not check that it also sums to 7, choosing $(x+2)(x+6)$, which sums to 8.

Question 4 [MEDIUM]

What is the larger solution to $x^2 - 7x + 12 = 0$?

- A) 3
- B) 4
- C) 7
- D) 12

Algebraic: Factor: $(x-3)(x-4) = 0$, so $x = 3$ or $x = 4$. The larger solution is 4.

Desmos: Graph $y = x^2 - 7x + 12$ and read its two x-intercepts directly.

Faster path: Desmos, slightly. Reading two intercepts off a graph is about as fast as factoring here, and removes any risk of a sign slip.

Mistake: **Wording trap**: student reads the coefficient 7 directly from the equation instead of solving for the actual roots.

Question 5 [MEDIUM]

How many real solutions does $x^2 + 4x + 4 = 0$ have?

- A) No real solutions
- B) Exactly one real solution
- C) Exactly two real solutions
- D) Infinitely many solutions

Algebraic: The discriminant is $b^2 - 4ac = 16 - 16 = 0$, which means exactly one real solution (a repeated root).

Desmos: Graph $y = x^2 + 4x + 4$; it touches the x-axis at exactly one point without crossing it.

Faster path: Algebraic, computing the discriminant is faster than graphing and zooming in to confirm a tangency.

Mistake: **Concept gap**: student assumes every quadratic equation has exactly two solutions and chooses C without checking the discriminant.

Question 6 [MEDIUM]

How many real solutions does $x^2 + 2x + 5 = 0$ have?

- A) No real solutions
- B) Exactly one real solution
- C) Exactly two real solutions
- D) Infinitely many solutions

Algebraic: The discriminant is $4 - 20 = -16$, which is negative, so there are no real solutions.

Desmos: Graph $y = x^2 + 2x + 5$; the parabola stays entirely above the x-axis and never crosses it.

Faster path: Algebraic, the discriminant sign answers this instantly without needing to view a graph.

Mistake: **Concept gap**: student computes the discriminant but misreads the negative sign, assuming a nonzero discriminant always means two real solutions.