

Algebra — Free Sample

6 Questions · Easy to Very Hard · Full Solutions · Mistake-Pattern Analysis

Question 1 [EASY]

If $3x + 7 = 22$, what is the value of x ?

- A) 3
- B) 5
- C) 7
- D) 15

Algebraic: Subtract 7 from both sides to get $3x = 15$, then divide by 3. $x = 5$.

Desmos: Graph $y = 3x+7$ and $y = 22$ and read the x -coordinate of the intersection.

Faster path: Algebraic. Two steps, no need to open a graph.

Mistake: **Overcomplication**: student graphs or re-checks a problem solved correctly in one line, losing pace.

Question 2 [EASY]

If $f(x) = 2x$ minus 3 and $g(x) = f(x + 1)$, what is the value of $g(4)$?

- A) 5
- B) 7
- C) 9
- D) 11

Algebraic: $g(4) = f(5) = 2(5)$ minus 3 = 7.

Desmos: Graph $y = 2(x+1)$ minus 3 and trace to $x = 4$.

Faster path: Algebraic. Substituting $x+1$ into f is faster than graphing the composition.

Mistake: **Concept gap**: student computes $f(4) = 5$ instead of $f(4+1) = f(5)$, misreading $g(x) = f(x+1)$.

Question 3 [MEDIUM]

If $5x$ minus 3 is greater than or equal to $2x + 12$, which of the following describes all possible values of x ?

- A) x is greater than or equal to 3
- B) x is greater than or equal to 5
- C) x is less than or equal to 5
- D) x is less than or equal to 3

Algebraic: Subtract $2x$: $3x$ minus 3 is greater than or equal to 12. Add 3: $3x$ is greater than or equal to 15. Divide: x is greater than or equal to 5.

Desmos: Graph $y = 5x$ minus 3 and $y = 2x + 12$ and find where the first is above or equal to the second.

Faster path: Algebraic. Three steps, clean integer result.

Mistake: **Concept gap**: student reverses the inequality direction at the division step without any negative division having occurred.

Question 4 [MEDIUM]

If $2x + 5y = 16$ and $2x - 3y = 0$, what is the value of $x - y$?

- A) 0
- B) 1
- C) 2
- D) 3

Algebraic: Subtract equations: $8y = 16$, $y = 2$. Substitute into $2x - 3y = 0$, $x = 3$. $x - y = 3 - 2 = 1$.

Desmos: Graph both lines and read the intersection, then compute $x - y$.

Faster path: Algebraic. Elimination is clean and avoids two graph readings.

Mistake: **Wording trap**: student finds $x = 3$ and $y = 2$ correctly but reports $x = 3$ instead of $x - y = 1$.

Question 5 [HARD]

A trip covers 350 miles in 6 total hours. The first part is driven at 70 mph and the second at 50 mph. How many hours were spent on the first part?

(Student-produced response)

Algebraic: Let t = hours at 70 mph. Then $70t + 50(6 - t) = 350$. $70t + 300 - 50t = 350$. $20t = 50$. $t = 2.5$.

Desmos: Not useful. Set up and solve the equation algebraically.

Faster path: Algebraic, always, for a two-unknown word problem where one unknown is expressed in terms of the other.

Mistake: **Overcomplication**: student writes two separate equations with two unknowns and solves by substitution instead of expressing the second time as $6 - t$ directly.

Question 6 [VERY HARD]

For what value of k does the system $kx + 3y = 6$ and $2x + 6y = 10$ have no solution?

(Student-produced response)

Shortcut: Ratio Comparison: compare $k/2$, $3/6$, and $6/10$. First two must match, third must not.

Solution: For no solution, the coefficient ratios must match but the constant ratio must differ. $k/2 = 3/6 = 0.5$ gives $k = 1$. Check: $6/10 = 0.6$, which is not equal to 0.5, confirming no solution. $k = 1$.

Mistake: **Concept gap**: student substitutes to try to solve the system and finds a contradiction but cannot identify the value of k that caused it.