# Linear Functions & Systems Error Analysis



Find the mistake. Explain it. Fix it.

Name: _____ Period: _____ Date: _____

## 1. Point-slope form: sign of $x_1$

**ORIGINAL PROBLEM**

Write the equation of the line through $(-3, 5)$ and $(2, -5)$ in slope-intercept form.

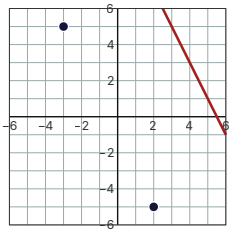
**INCORRECT WORKED SOLUTION**

$m = \frac{-5 - 5}{2 - (-3)} = \frac{-10}{5} = -2$

Use point $(-3, 5)$: $y - 5 = -2(x - 3)$

$y - 5 = -2x + 6$

$y = -2x + 11$

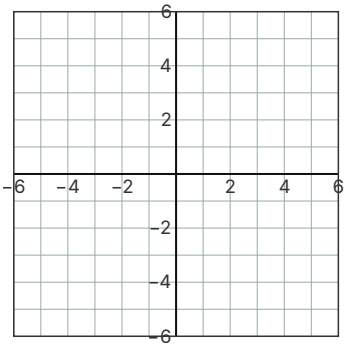



Dots: given points. Red: student's line.

**A. EXPLAIN THE MISTAKE (1 POINT)**

Describe exactly which step is wrong and why.

**B. SHOW CORRECT WORK (1 POINT)**




Sketch the correct graph on this grid.

## 2. Perpendicular slopes

**ORIGINAL PROBLEM**

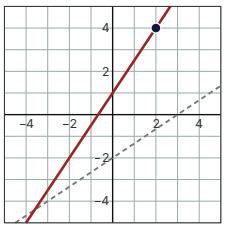
Line $\ell$ is $2x - 3y = 6$ (dashed). Write the equation of the line through $(2, 4)$ that is perpendicular to $\ell$.

**INCORRECT WORKED SOLUTION**

$y = \frac{2}{3}x - 2$, so the slope of $\ell$ is $\frac{2}{3}$.

Perpendicular slope: flip it, $m = \frac{3}{2}$.

$y - 4 = \frac{3}{2}(x - 2)$, so $y = \frac{3}{2}x + 1$

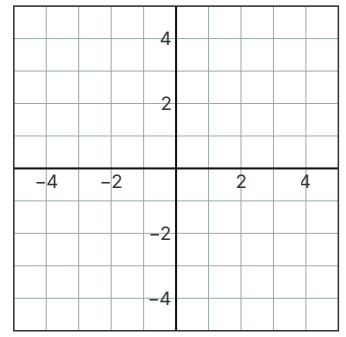



Dashed: $\ell$. Red: student's line.

**A. EXPLAIN THE MISTAKE (1 POINT)**

Describe exactly which step is wrong and why.

**B. SHOW CORRECT WORK (1 POINT)**




Sketch the correct graph on this grid.

Scoring: Explanation = 1 point • Correct work/answer = 1 point • Total = 20 points

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## 3. Linear model: which variable is which?

**ORIGINAL PROBLEM**

A kayak rental costs \$38 for 2 hours and \$74 for 5 hours. The cost $C$ (dollars) is a linear function of the hours $h$. How many hours can you rent a kayak for \$110?

**INCORRECT WORKED SOLUTION**

Rate: $\frac{74 - 38}{5 - 2}$ = \$12 per hour, so $C = 12h + 14$.

For \$110: $C = 12(110) + 14$

$C = 1320 + 14 = 1334$

You can rent the kayak for 1,334 hours.

**A. EXPLAIN THE MISTAKE (1 POINT)**

Describe exactly which step is wrong and why.

**B. SHOW CORRECT WORK (1 POINT)**

## 4. Solving a system by graphing

**ORIGINAL PROBLEM**

Solve the system by graphing: $y = 2x - 1$ and $x + y = 5$.

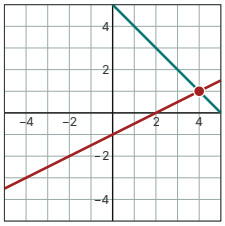
**INCORRECT WORKED SOLUTION**

Graph $y = 2x - 1$: start at $(0, -1)$. The slope is 2, so go right 2 and up 1.

Graph $x + y = 5$ through $(0, 5)$ and $(5, 0)$.

The lines cross at $(4, 1)$.

Solution: $(4, 1)$

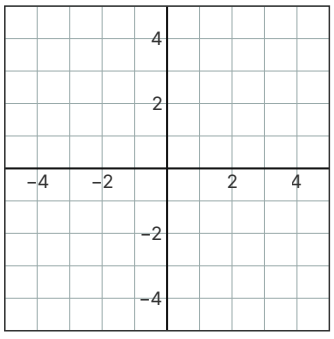



Red: student's $y = 2x - 1$. Teal: $x + y = 5$.

**A. EXPLAIN THE MISTAKE (1 POINT)**

Describe exactly which step is wrong and why.

**B. SHOW CORRECT WORK (1 POINT)**




Sketch the correct graph on this grid.

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## 5. Dependent system

**ORIGINAL PROBLEM**

Solve the system: $2x - 4y = 6$ and $-3x + 6y = -9$.

**INCORRECT WORKED SOLUTION**

Multiply the first equation by 3 and the second by 2:

$6x - 12y = 18$ and $-6x + 12y = -18$

Add the equations: $0 = 0$

Both variables disappeared, so there is no solution.

**A. EXPLAIN THE MISTAKE (1 POINT)**

Describe exactly which step is wrong and why.

**B. SHOW CORRECT WORK (1 POINT)**

## 6. System of inequalities: shading

**ORIGINAL PROBLEM**

Graph the solution set of the system and shade it.

$y \geq -x + 1$

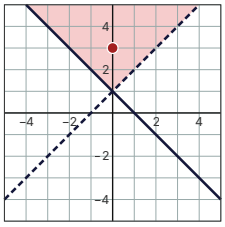
$y < x + 1$

**INCORRECT WORKED SOLUTION**

$y \geq -x + 1$: solid boundary, shade above.

$y < x + 1$: dashed boundary, shade above.

The solution is where the shading overlaps: the region above both lines.

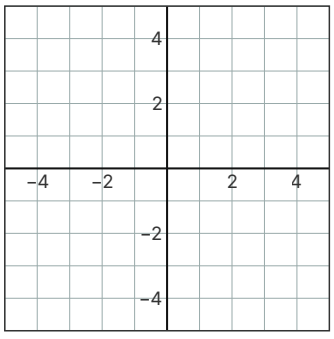



Red region: student's. (0, 3) fails $y < x + 1$.

**A. EXPLAIN THE MISTAKE (1 POINT)**

Describe exactly which step is wrong and why.

**B. SHOW CORRECT WORK (1 POINT)**




Sketch the correct graph on this grid.

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## 7. Dashed or solid boundary?

**ORIGINAL PROBLEM**

Graph the solution set of the system and shade it.

$y > 2x - 3$

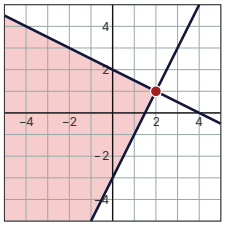
$y \leq -\frac{1}{2}x + 2$

**INCORRECT WORKED SOLUTION**

$y > 2x - 3$: solid boundary, shade above.

$y \leq -\frac{1}{2}x + 2$: solid boundary, shade below.

Shade the overlap. The corner (2, 1) is included.

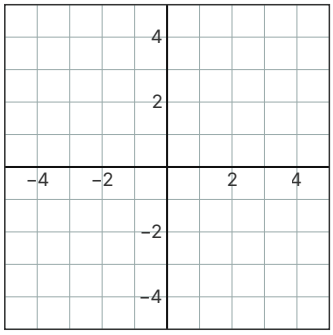



Both solid. Red dot: (2, 1), wrongly included.

**A. EXPLAIN THE MISTAKE (1 POINT)**

Describe exactly which step is wrong and why.

**B. SHOW CORRECT WORK (1 POINT)**




Sketch the correct graph on this grid.

## 8. Line of best fit

**ORIGINAL PROBLEM**

Typing speed $y$ (words per minute) after $x$ weeks. Use regression to find the line of best fit, then predict the speed at 6.5 weeks.

$x$: 1, 2, 3, 4, 5, 6, 7, 8

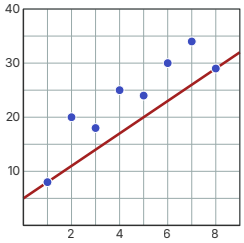
$y$: 8, 20, 18, 25, 24, 30, 34, 29

**INCORRECT WORKED SOLUTION**

Use the first and last points: (1, 8) and (8, 29).

$m = \frac{29 - 8}{8 - 1} = 3$, so $y = 3x + 5$

At $x = 6.5$: $y = 24.5$ words per minute

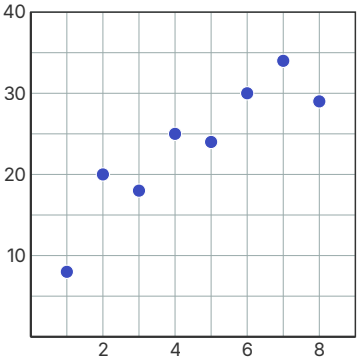



Red: student's line (first to last point).

**A. EXPLAIN THE MISTAKE (1 POINT)**

Describe exactly which step is wrong and why.

**B. SHOW CORRECT WORK (1 POINT)**




Sketch the correct graph on this grid.

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## 9. Linear programming: optimize at a vertex

**ORIGINAL PROBLEM**

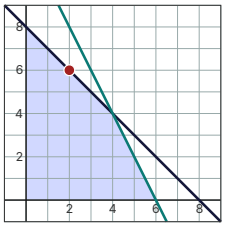
A bakery makes $x$ trays of muffins and $y$ trays of scones. Oven: $x + y \le 8$. Labor: $2x + y \le 12$. Also $x \ge 0$, $y \ge 0$. Profit: $P = 35x + 25y$. Find the maximum profit.

**INCORRECT WORKED SOLUTION**

The oven is the tight limit: pick a point on $x + y = 8$.

Try (2, 6): $P = 35(2) + 25(6) = 220$

Maximum profit: $220

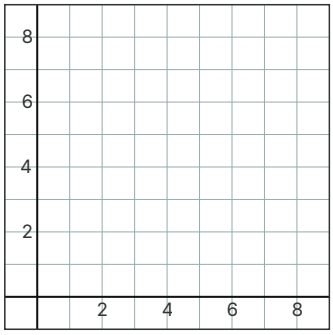



Red dot: student's point (not a corner).

**A. EXPLAIN THE MISTAKE (1 POINT)**

Describe exactly which step is wrong and why.

**B. SHOW CORRECT WORK (1 POINT)**




Sketch the correct graph on this grid.

## 10. Three variables: a lost term

**ORIGINAL PROBLEM**

Solve the system:

$x + y + z = 6$

$2x - y + z = 3$

$x + 2y - z = 2$

**INCORRECT WORKED SOLUTION**

Eliminate $z$ with Equation 1 − Equation 2:

$(x - 2x) + (y - y) + (z - z) = 6 - 3$

$-x = 3$, so $x = -3$

Equation 1 + Equation 3: $2x + 3y = 8$, so $y = \frac{14}{3}$

Then $z = 6 + 3 - \frac{14}{3} = \frac{13}{3}$

**A. EXPLAIN THE MISTAKE (1 POINT)**

Describe exactly which step is wrong and why.

**B. SHOW CORRECT WORK (1 POINT)**

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