Building Linear Functions

Explore ideas and representations

Name _____ **Date** _____ **Score** _____ / 10

QUICK REVIEW

To build a linear function from two distinct inputs, calculate $m = (y_2 - y_1)/(x_2 - x_1)$, then use either point in $y = mx + b$ to find b. For $(1, 5)$ and $(3, 9)$, $m = 4/2 = 2$ and $5 = 2(1) + b$, so $b = 3$. Check the finished rule $y = 2x + 3$ against both points, including their original input and output values.

Worked example

Example for form 1: construct a line. Use $(0, 2)$ and $(2, 8)$. Write $y = mx + b$.

1. The slope is $m = (8 - (2))/(2 - (0)) = 3$. Substitute $(0, 2)$ into $y = mx + b$.

2. $2 = 3(0) + b$, so $b = 2 - (0) = 2$. The rule is $y = 3x + 2$.

3. Check the other point: $3(2) + (2) = 8 = 8$. Both given pairs satisfy the equation.

Answer: $y = 3x + 2$

Practice Problems

Show your thinking.

1. Build an increasing line. Use $(0, 3)$ and $(2, 7)$. Write $y = mx + b$.

2. Build a line from nonzero inputs. Use $(1, 6)$ and $(4, 15)$. Write $y = mx + b$.

3. Build a decreasing line. Use $(0, 10)$ and $(3, 4)$. Write $y = mx + b$.

4. Build a line with negative inputs. Use $(-2, -3)$ and $(2, 5)$. Write $y = mx + b$.

5. Build a fractional-slope line. Use $(0, 2)$ and $(4, 4)$. Write $y = mx + b$.

6. Build a horizontal rule. Use $(-1, 7)$ and $(3, 7)$. Write $y = mx + b$.

7. Build a line through the origin. Use $(1, 3)$ and $(3, 9)$. Write $y = mx + b$.

8. Build a negative-intercept rule. Use $(2, 1)$ and $(5, 7)$. Write $y = mx + b$.

9. Write a linear rule with slope 4 and y-intercept -5. Find its output at $x = 2$.

10. Build a linear rule from the table.

x	y
0	2
2	8
4	14

Answer Key

1. $y = 2x + 3$
2. $y = 3x + 3$
3. $y = -2x + 10$
4. $y = 2x + 1$
5. $y = \frac{1}{2}x + 2$
6. $y = 0x + 7$
7. $y = 3x + 0$
8. $y = 2x - 3$
9. $y = 4x - 5$; output 3.
10. $y = 3x + 2$

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The slope is $m = (7 - (3))/(2 - (0)) = 2$. Substitute $(0, 3)$ into $y = mx + b$.
2. $3 = 2(0) + b$, so $b = 3 - (0) = 3$. The rule is $y = 2x + 3$.
3. Check the other point: $2(2) + (3) = 7 = 7$. Both given pairs satisfy the equation.

Problem 2

1. The slope is $m = (15 - (6))/(4 - (1)) = 3$. Substitute $(1, 6)$ into $y = mx + b$.
2. $6 = 3(1) + b$, so $b = 6 - (3) = 3$. The rule is $y = 3x + 3$.
3. Check the other point: $3(4) + (3) = 15 = 15$. Both given pairs satisfy the equation.

Problem 3

1. The slope is $m = (4 - (10))/(3 - (0)) = -2$. Substitute $(0, 10)$ into $y = mx + b$.
2. $10 = -2(0) + b$, so $b = 10 - (0) = 10$. The rule is $y = -2x + 10$.
3. Check the other point: $-2(3) + (10) = 4 = 4$. Both given pairs satisfy the equation.

Problem 4

1. The slope is $m = (5 - (-3))/(2 - (-2)) = 2$. Substitute $(-2, -3)$ into $y = mx + b$.
2. $-3 = 2(-2) + b$, so $b = -3 - (-4) = 1$. The rule is $y = 2x + 1$.
3. Check the other point: $2(2) + (1) = 5 = 5$. Both given pairs satisfy the equation.

Problem 5

1. The slope is $m = (4 - (2))/(4 - (0)) = \frac{1}{2}$. Substitute $(0, 2)$ into $y = mx + b$.
2. $2 = \frac{1}{2}(0) + b$, so $b = 2 - (0) = 2$. The rule is $y = \frac{1}{2}x + 2$.
3. Check the other point: $\frac{1}{2}(4) + (2) = 4 = 4$. Both given pairs satisfy the equation.

Problem 6

1. The slope is $m = (7 - (7))/(3 - (-1)) = 0$. Substitute $(-1, 7)$ into $y = mx + b$.
2. $7 = 0(-1) + b$, so $b = 7 - (0) = 7$. The rule is $y = 0x + 7$.
3. Check the other point: $0(3) + (7) = 7 = 7$. Both given pairs satisfy the equation.

Problem 7

1. The slope is $m = (9 - (3))/(3 - (1)) = 3$. Substitute $(1, 3)$ into $y = mx + b$.
2. $3 = 3(1) + b$, so $b = 3 - (3) = 0$. The rule is $y = 3x + 0$.
3. Check the other point: $3(3) + (0) = 9 = 9$. Both given pairs satisfy the equation.

Problem 8

1. The slope is $m = (7 - (1))/(5 - (2)) = 2$. Substitute $(2, 1)$ into $y = mx + b$.
2. $1 = 2(2) + b$, so $b = 1 - (4) = -3$. The rule is $y = 2x - 3$.
3. Check the other point: $2(5) + (-3) = 7 = 7$. Both given pairs satisfy the equation.

Problem 9

1. Insert the given parameters into $y = mx + b$: $m = 4$ and $b = -5$ give $y = 4x - 5$.
2. At $x = 2$, $y = 4(2) - 5 = 8 - 5 = 3$. At $x = 0$, the rule gives -5, confirming the stated intercept.

Problem 10

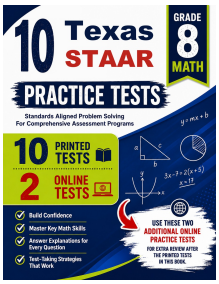
1. Between inputs 0 and 2, the slope is $(8 - 2)/(2 - 0) = 6/2 = 3$. The row at $x = 0$ gives $b = 2$.
2. Thus $y = 3x + 2$. Check the last row: $3(4) + 2 = 14$, which matches the table and verifies the constant rate.

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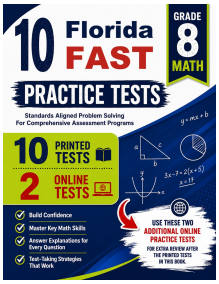
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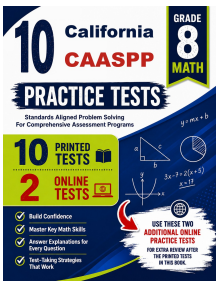
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