LESSON MAKER PRO

Shift the Line

Build non-proportional equations from proportional rules.

GRADE 8 · 8.PAR.4.1

8.PAR.4.1 "Use the equation y = mx (proportional) for a line through the origin to derive the equation y = mx + b (non-proportional) for a line intersecting the vertical axis at b."

NAME _____ DATE _____

MOVE OFF THE ORIGIN

A proportional line has the rule y = mx, so it passes through the origin. If the line crosses the vertical axis at b instead, add b to the rule: y = mx + b. A positive b moves the line up, and a negative b moves it down.

WORKED EXAMPLE

Start with the proportional rule y = 5x. The line is shifted down 3 units. Write the new equation.

1. The proportional rule is y = 5x, so m = 5.
2. Shifting down 3 changes each y-value by -3.
3. Add -3 to the rule: y = 5x - 3.

Answer: y = 5x - 3

PRACTICE 6 problems

1 For y = -4x + 7, identify m and b.

ANSWER _____

2 A line has slope 6 and crosses the vertical axis at -2. Write its equation.

ANSWER _____

3 For y = 2x - 7, find y when x = 4.

ANSWER _____

4 Start with y = -6x. Shift the line up 8 units. Write the new equation.

ANSWER _____

5 A line passes through (0, -2), (1, 2), and (2, 6). Write its equation in the form y = mx + b.

ANSWER _____

6 A line rises 1 unit for every 2 units it moves right and crosses the vertical axis at -8. Write its equation.

ANSWER _____

APPLY IT Show your work

1 A music app charges a $6 sign-up fee and $2 for each month of use. Let x be the number of months and y be the total cost in dollars. Write an equation, then find the total cost after 4 months.

WORK SPACE

ANSWER _____

2 A mobile game gives 8 starting points, then gives 4 points for each round completed. Use the table to write an equation for y in terms of x. Then find the points after 6 rounds.

GAME CHALLENGE POINTS

x, rounds	y, points
0	8
1	12
2	16
4	24

ANSWER _____

CHALLENGE One step up

A line passes through (2, 11) and (6, 19). Find m by using change in y divided by change in x. Then use either point to find b. Write the equation y = mx + b and explain how b changes the proportional rule y = mx.

WORK SPACE AND ANSWER

ANSWER KEY

Shift the Line

GRADE 8 · 8.PAR.4.1

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	For y = -4x + 7, identify m and b.	**m = -4, b = 7**
2	A line has slope 6 and crosses the vertical axis at -2. Write its equation.	**y = 6x - 2**
3	For y = 2x - 7, find y when x = 4.	**1**
4	Start with y = -6x. Shift the line up 8 units. Write the new equation.	**y = -6x + 8**
5	A line passes through (0, -2), (1, 2), and (2, 6). Write its equation in the form y = mx + b.	**y = 4x - 2**
6	A line rises 1 unit for every 2 units it moves right and crosses the vertical axis at -8. Write its equation.	**y = 1/2x - 8**

PART 2 · APPLY IT

1. **y = 2x + 6; after 4 months, y = 14 dollars.** The monthly charge is the slope, 2, and the sign-up fee is the vertical-axis intercept, 6. Substitute x = 4 to get y = 2(4) + 6 = 14.
2. **y = 4x + 8; after 6 rounds, y = 32 points.** The points increase by 4 for each round, so m = 4. At 0 rounds there are 8 points, so b = 8; substitute x = 6.

CHALLENGE

m = 2 because (19 - 11)/(6 - 2) = 8/4 = 2. b = 7 because 11 = 2(2) + b. The equation is y = 2x + 7, and b shifts y = 2x up 7 units.

Accept equivalent forms such as y - 7 = 2x for the challenge equation. For equations, students may write + -2 or + -8, but the simplified forms shown are preferred.