

Lines Tell Rates

Connect slopes, equations, and proportional relationships.

GRADE 8 • 8.EE.B

CCSS.Math.Content.8.EE.B "Understand the connections between proportional relationships, lines, and linear equations."

NAME _____

DATE _____

THE BIG IDEA

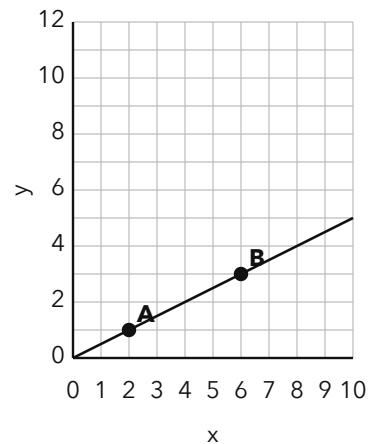
A proportional relationship has equation $y = mx$: its line passes through $(0, 0)$, and m is both unit rate and slope. On a nonvertical line, slope is rise/run. Right triangles along the same line have the same rise/run ratio. In $y = mx + b$, b is the y -intercept; a nonzero b means the relationship is not proportional.

WORKED EXAMPLE

The graph shows $y = x/2$. Read $(2, 1)$ and $(6, 3)$. What is the slope, and why is the relationship proportional?

1. From A to B: rise = $3 - 1 = 2$; run = $6 - 2 = 4$. Slope = $2/4 = 1/2$.
2. The line goes through $(0, 0)$, so y is always half of x .

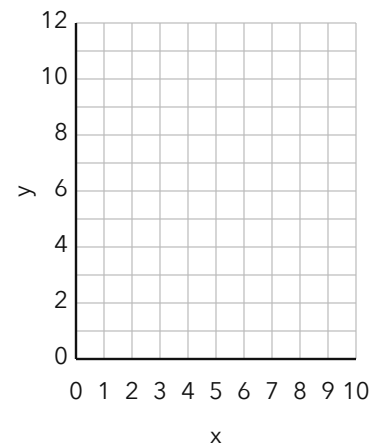
Answer: Slope and unit rate are $1/2$. The origin lies on the line.



PRACTICE 4 problems

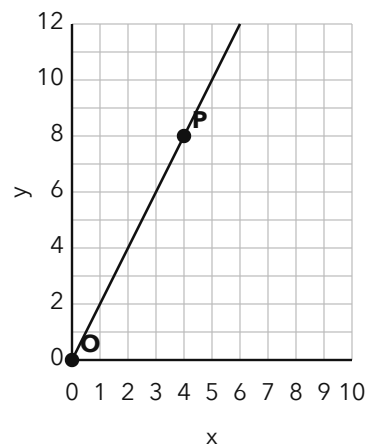
- 1** Graph $y = 3x$ on this grid. Plot $(0, 0)$, $(1, 3)$, $(2, 6)$ and $(3, 9)$, then draw the line. State the unit rate.

ANSWER _____



- 2** The graph shows a second relationship. Find its slope and equation from the labeled points. Is it proportional?

ANSWER _____

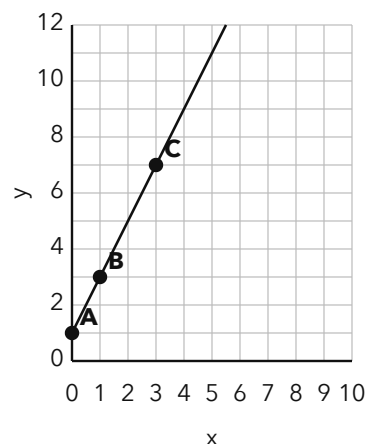


- 3** Compare Practice 1 and 2 on their matching scales. Which relationship has the greater unit rate? Explain how the graphs show it.

ANSWER _____

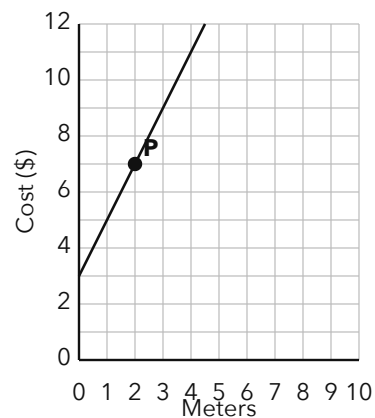
- 4** Draw two slope triangles along this line: from A(0, 1) to B(1, 3), and from A to C(3, 7). Use horizontal runs and vertical rises. Compare the ratios.

ANSWER _____

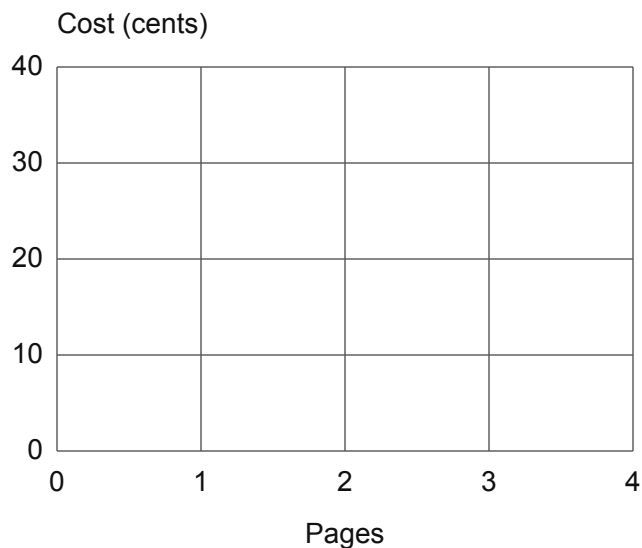


APPLY IT Show your work

- 1** A fictional craft service charges \$3 setup plus \$2 per meter of ribbon. The graph models $y = 2x + 3$. Interpret $(2, 7)$, the slope and the y-intercept. Is the cost proportional to length?



- 2** A fictional copying service charges \$0.10 per page with no fee. Write its equation with y in cents. Plot costs for 0, 1, 2 and 3 pages; use the labeled scale. What does $(3, 30)$ mean?

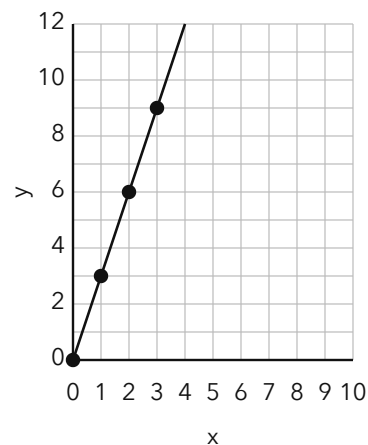


CHALLENGE One step up

A line crosses the y -axis at $(0, 3)$ and has slope 2. Use rise/run to explain why ANY point (x, y) on it satisfies $y = 2x + 3$. Include the intercept case $x = 0$.

PRACTICE 1

A straight line through all four points; unit rate 3.

**PRACTICE 2**

Slope = $(8 - 0)/(4 - 0) = 2$; $y = 2x$. Yes, its line goes through the origin.

PRACTICE 3

$y = 3x$ has the greater rate: $3 > 2$. For the same positive x , it has the larger y and the steeper line.

PRACTICE 4

Small: rise/run = $2/1$. Large: $6/3$. Both equal 2; the triangles are similar right triangles along the same line.

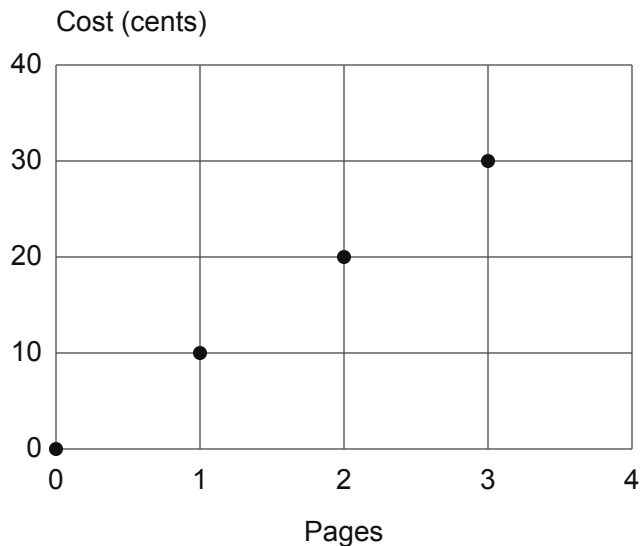
APPLY IT 1

\$7 for 2 meters; slope \$2 per meter; intercept \$3 setup. Not proportional.

The graph crosses the y -axis at 3, not 0. At $x = 2$, $y = 2(2) + 3 = 7$.

APPLY IT 2

$y = 10x$ cents. Three pages cost 30 cents.
Points are $(0, 0)$, $(1, 10)$, $(2, 20)$, $(3, 30)$. The origin and unit rate show proportional cost.

**CHALLENGE**

From $(0, 3)$, horizontal change is x and vertical change is $y - 3$. Slope 2 gives $y - 3 = 2x$, so $y = 2x + 3$. At $x = 0$, $y = 3$, which also satisfies the equation.

Check full plotted lines for abstract relationships and the specified separate points for whole-page copying costs. Scaled copying grid labels are cents, not grid-row numbers. For slope triangles, accept horizontal-then-vertical steps A to $(1, 1)$ to B and A to $(3, 1)$ to C; their rise/run ratios match. The challenge uses directed changes for negative x ; avoid dividing by x at the intercept.