# Graphing Proportional Relationships

Proportional Graphs: Diagnose and Reconstruct

**Name** _____ **Date** _____ **Score** _____ / 6

### QUICK REVIEW

A straight graph is proportional only when it passes through $(0, 0)$; a constant slope alone is not enough. Check nonzero points with $y/x = k$. For example, $(2, 3)$ gives $k = \frac{3}{2}$, so $(4, 6)$ fits but $(4, 5)$ does not. Reconstruct a missing value using $y = kx$, and use a plotted counterexample to correct a claim.

**Worked example**

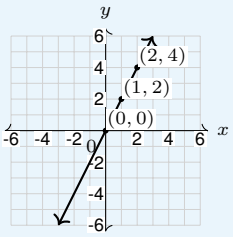
Mia says the proportional line through $(2, 4)$ has equation $y = \frac{1}{2}x$. Correct her and graph the correct line.

**1.** The ratio uses output divided by input: $k = 4/2 = 2$, not $2/4 = \frac{1}{2}$. Mia reversed the two coordinates.

**2.** Test her equation at $x = 2$: $y = \frac{1}{2}(2) = 1 \neq 4$. The given point cannot lie on her proposed line.

**3.** Use $y = 2x$ and plot $(0, 0), (1, 2), (2, 4)$. Drawing their line corrects both the equation and the graph.

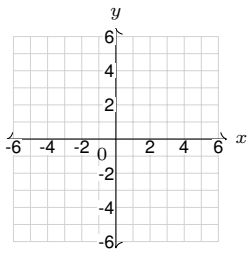
**Answer:** $y = 2x$, not $y = \frac{1}{2}x$.



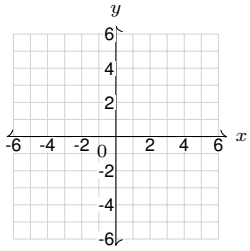

## Practice Problems

Show your thinking.

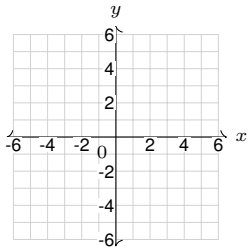
**1.** Noah plots $(0, 1), (1, 3), (2, 5)$ and calls the line proportional. Draw it and refute the claim.



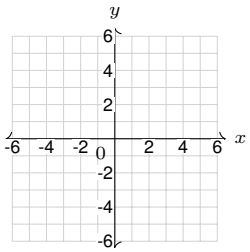

**2.** A proportional line contains $(-4, 2)$. Reconstruct its equation and graph it.



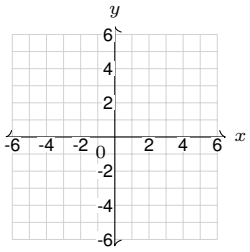

**3.** Two rows of a proportional table are $(2, 3)$ and $(4, a)$. Find $a$ and graph the relationship.



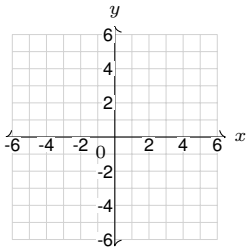

**4.** A student graphs $y = \frac{2}{3}x$ through $(0, 0)$ and $(2, 3)$. Repair the second point and draw the correct line.




**5.** Draw two different proportional lines through the origin, one with positive rate and one with negative rate. Give equations.




**6.** A line through $(0, 0)$ and $(4, 2)$ is claimed to give $y = 3$ at $x = 6$. Graph it and decide.



# Answer Key

1. $y = 2x + 1$ is not proportional.
2. $y = -\frac{1}{2}x$.
3. $a = 6$; $y = \frac{3}{2}x$.
4. Use $(3, 2)$; line $y = \frac{2}{3}x$.
5. One choice: $y = x$ and $y = -2x$.
6. The claim is correct; $y = \frac{1}{2}x$.

## Step-by-Step Solutions

Follow each calculation, then check your own work.

### Problem 1

**1.** The outputs increase by $2$ for each input increase of $1$. At $x = 0$, however, the output is $1$.

**2.** Plot $(0, 1), (1, 3), (2, 5)$ and draw the line $y = 2x + 1$. It crosses the vertical axis above the origin.

**3.** A proportional graph requires $(0, 0)$. Also $3/1 = 3$ while $5/2 = 2.5$, so the nonzero ratios are unequal.

### Problem 2

**1.** The given point has nonzero input, so $k = 2/(-4) = -\frac{1}{2}$. A negative input and positive output give a negative ratio.

**2.** Write $y = -\frac{1}{2}x$. Substituting $x = 0, 2$ gives $y = 0, -1$, providing two additional points for the graph.

**3.** Draw the line through $(-4, 2), (0, 0), (2, -1)$. Check the original point: $-\frac{1}{2}(-4) = 2$, as required.

### Problem 3

**1.** The known pair gives $k = 3/2 = \frac{3}{2}$. Keeping this ratio fixed makes the output at $x = 4$ equal to $\frac{3}{2}(4) = 6$.

**2.** Thus $a = 6$, not $5$. Plot $(0, 0), (2, 3), (4, 6)$ on the plane and draw the proportional line.

**3.** Check both nonzero rows: $3/2 = \frac{3}{2}$ and $6/4 = \frac{3}{2}$. Equal ratios confirm the reconstructed table and graph.

### Problem 4

**1.** Test the incorrect point: when $x = 2$, $y = \frac{2}{3}(2) = \frac{4}{3}$, not $3$. The point $(2, 3)$ does not fit.

**2.** Choose $x = 3$ instead: $y = \frac{2}{3}(3) = 2$. Plot $(3, 2)$ together with $(0, 0)$ and $(-3, -2)$.

**3.** Draw the corrected line. Its rise of $2$ for a run of $3$ gives $2/3$, the required constant ratio.

### Problem 5

**1.** Choose constants $k = 1$ and $k = -2$. These have opposite signs and give equations $y = x$ and $y = -2x$.

**2.** For the first line plot $(0, 0), (2, 2)$; for the second plot $(0, 0), (2, -4)$. Draw and label each line.

**3.** The ratios $2/2 = 1$ and $-4/2 = -2$ verify the selected rates. Both lines pass through $(0, 0)$, so both are proportional.

### Problem 6

**1.** Find the constant from the nonzero point: $k = 2/4 = \frac{1}{2}$. The equation of this proportional line is $y = \frac{1}{2}x$.

**2.** Substitute $x = 6$: $y = \frac{1}{2}(6) = 3$. Plot $(0, 0), (4, 2), (6, 3)$ and draw their line.

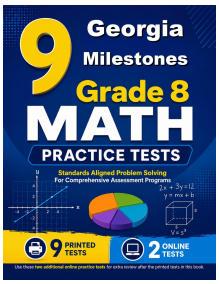
**3.** The point $(6, 3)$ has ratio $3/6 = \frac{1}{2}$, matching $2/4$. Therefore the plotted evidence supports the claim exactly.

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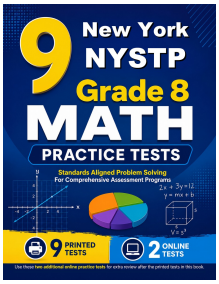

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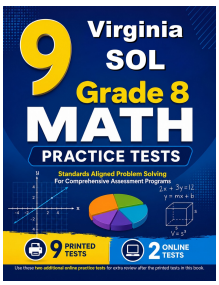

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