Graphing Proportional Relationships

Proportional Graphs: Ratios and Models

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

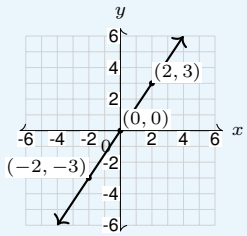
QUICK REVIEW

A proportional relationship has equation $y = kx$, where k is the constant ratio y/x for $x \neq 0$. Its graph is a straight line through $(0, 0)$. For $y = 2x$, points $(1, 2)$ and $(2, 4)$ show a rise of 2 per unit run. Use equal axis units, label coordinates, and distinguish a continuous line from discrete counts.

Worked example

Graph $y = \frac{3}{2}x$ using three points. State the unit rate.

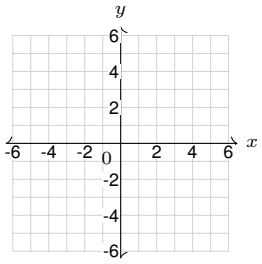
1. With $x = 0, 2, -2$, calculate $y = \frac{3}{2}(0) = 0$, $\frac{3}{2}(2) = 3$, and $\frac{3}{2}(-2) = -3$. These substitutions give exact coordinates.
2. Plot $(0, 0), (2, 3), (-2, -3)$ on the numbered plane. Join them with a straight line extending in both directions.
3. The ratio $3/2$ equals a rise of 3 over a run of 2. Thus the unit rate is 1.5 per unit.
Answer: Line through $(0, 0), (2, 3), (-2, -3)$; $k = \frac{3}{2}$.



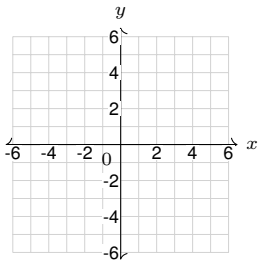
Practice Problems

Show your thinking.

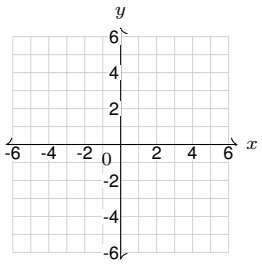
1. Graph $y = 2x$. Label the origin and two other points.



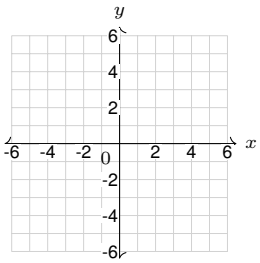
2. Graph the proportional table $(x, y) = (0, 0), (2, 1), (4, 2)$. Write its equation.



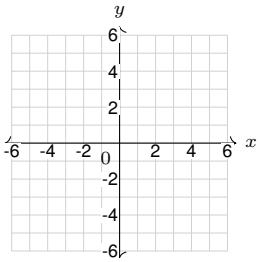
3. Graph $y = -x$. Describe how y changes when x increases by 2.



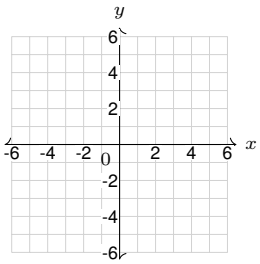
4. A proportional line contains $P = (3, 6)$. Draw it and find y when $x = -1$.



5. On one plane, graph $y = x$ and $y = \frac{1}{3}x$. Which has the greater unit rate?



6. Graph $y = -\frac{2}{3}x$ using integer-coordinate points. State the rise for a run of 3.



Answer Key

1. Line through $(0,0), (1,2), (-2,-4)$.
2. $y = \frac{1}{2}x$.
3. Line through $(0,0), (2,-2), (-2,2)$; y decreases by 2.
4. $y = 2x$; $y = -2$.
5. $y = x$ has the greater unit rate: $1 > \frac{1}{3}$.
6. Line through $(0,0), (3,-2), (-3,2)$; rise $= -2$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Substitute $x = 0, 1, -2$: $2(0) = 0$, $2(1) = 2$, and $2(-2) = -4$. These values give three points.

2. Plot $(0,0), (1,2), (-2,-4)$ and join them with a straight line. The graph continues in both directions.

3. From $(0,0)$ to $(1,2)$, the rise is 2 and run is 1. The constant ratio is $k = 2$.

Problem 2

1. For the nonzero inputs, calculate $1/2 = \frac{1}{2}$ and $2/4 = \frac{1}{2}$. Both rows have the same ratio.

2. Plot $(0,0), (2,1), (4,2)$ and draw their straight line. All three points belong to the proportional graph.

3. The common ratio is $k = \frac{1}{2}$, so substitute it into $y = kx$. The equation is $y = \frac{1}{2}x$.

Problem 3

1. Compute $y = -(0) = 0$, $y = -(2) = -2$, and $y = -(-2) = 2$. These points fit inside the numbered plane.

2. Plot $(0,0), (2,-2), (-2,2)$ and draw the line. Its downward direction matches the negative constant $k = -1$.

3. For an input change $\Delta x = 2$, calculate $\Delta y = (-1)(2) = -2$. Therefore the output decreases by 2.

Problem 4

1. Use the given nonzero point to compute $k = y/x = 6/3 = 2$. The equation must therefore be $y = 2x$.

2. Plot the origin and $(3,6)$, then draw their line. Add $(-1,-2)$ using the same constant ratio.

3. Substitute $x = -1$ into $y = 2x$: $y = 2(-1) = -2$. The requested output is exactly -2.

Problem 5

1. For $y = x$, choose $(0,0), (3,3)$. For $y = \frac{1}{3}x$, choose $(0,0), (3,1)$ by substituting $x = 0, 3$.

2. Draw lines through $(0,0), (3,3)$ and $(0,0), (3,1)$. Label each equation; their common origin does not imply equal unit rates.

3. The first ratio is $3/3 = 1$; the second is $1/3$. Since $1 > \frac{1}{3}$, $y = x$ has the greater unit rate.

Problem 6

1. Choose multiples of 3: $y = -\frac{2}{3}(3) = -2$ and $y = -\frac{2}{3}(-3) = 2$. Also $y = 0$ at $x = 0$.

2. Plot $(0,0), (3,-2), (-3,2)$ and join them. Integer coordinates make the fractional unit rate easy to represent accurately.

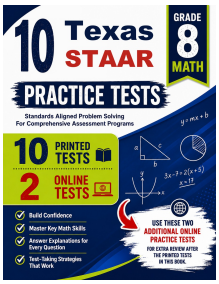
3. Between $(0,0)$ and $(3,-2)$, the run is $3 - 0 = 3$ and rise is $-2 - 0 = -2$.

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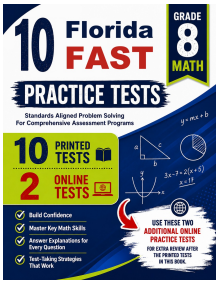
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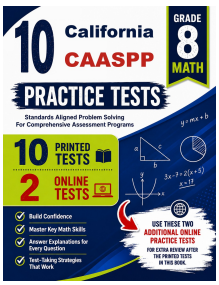
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