Shift the Line

See how a constant moves a proportional graph.

8.PFA.3.a · Determine how adding a constant (b) to the equation of a proportional relationship y = mx will translate the line on a graph.

Name _____ Date _____

Vertical Shifts

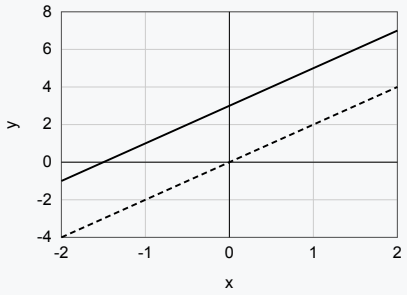
Start with y = mx. Adding b changes every y-value by b, so the slope stays the same. A positive b moves the line up, and a negative b moves the line down.

Worked example

The dashed line is y = 2x. The solid line is y = 2x + 3. Compare y-values at x = 0 and x = 1.

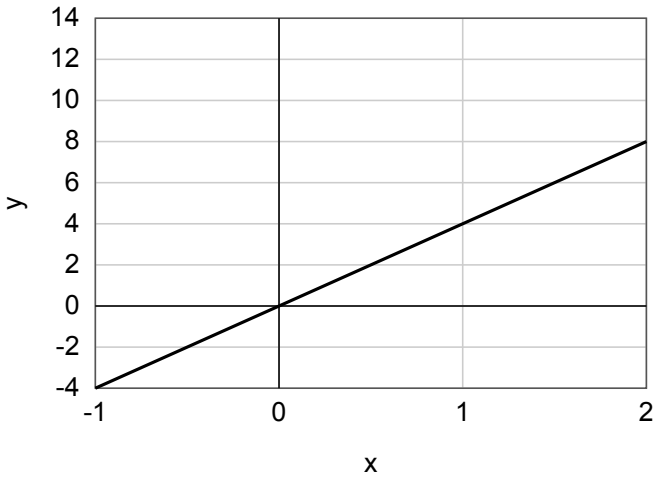
1. At x=0 the values are 0 and 3.
2. At x=1 the values are 2 and 5.
3. Each y-value increases by 3; slope stays 2.

Vertical shift up 3 units.



1. Practice

The given line is y = 4x. On the same axes, draw y = 4x + 5. Label two points on each line. Explain what changed and what stayed the same.



2. Practice

Compare y = -x - 6 with y = -x. How does the line move?

3. Practice

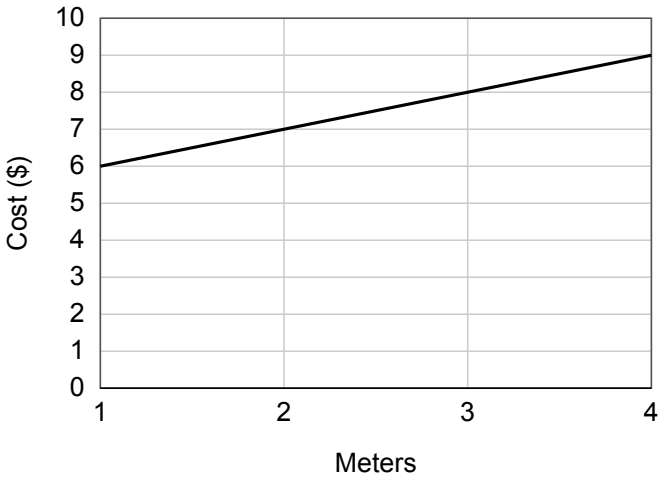
For y = 7x + 1, name the proportional relationship and the translation.

4. Practice

The line y = 9x - 4 is translated from y = 9x. What is the translated y-intercept?

5. Apply

A ribbon shop charges $1 per meter plus a $5 cutting fee for any order. For orders from 1 to 4 meters, the graph shows cost y for length x. Fractional meters are available. Write the equation and compare it with y = x. Explain the fee.



6. Apply

The number line shows the launch bonus b in a video game points model y = 8x + b. Write the equation and describe the shift from y = 8x.



7. Challenge

The number line marks b. For y = 5x + b, a student says the graph moves left 7 units. Is the student correct? Explain using the equation and y-intercept.

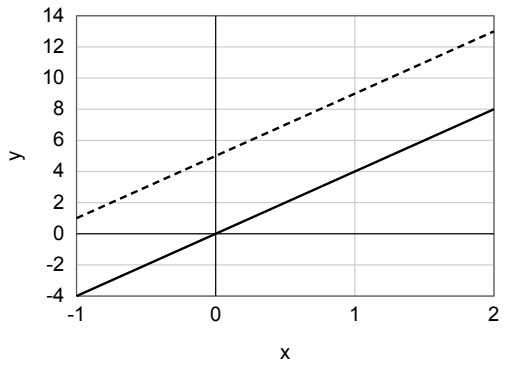


What to accept

Accept equivalent wording such as "shifted upward" or "shifted downward." For y-intercepts, accept either (0, -4) or -4 when the question asks only for the intercept value.

1. Practice

Shift up 5; slope stays 4. Original points (0,0),(1,4); shifted (0,5),(1,9).



2. Practice

down 6 units

3. Practice

y = 7x; up 1 unit

4. Practice

(0, -4)

5. Apply

y=x+5; each cost is $5 above y=x. The $5 fee shifts the line up; rate stays $1 per meter.

The graph covers positive-length orders from 1 to 4 meters, including fractional meters.

6. Apply

y = 8x + 6; up 6 units

The figure gives b = 6. A positive constant moves the graph up 6 units.

7. Challenge

No. The equation is y = 5x - 7, so the line moves down 7 units and has y-intercept (0, -7).