

Line in Context

Model rates, read graphs, and set realistic limits.

HIGH SCHOOL • MA.912.AR.2.5

MA.912.AR.2.5 "Solve and graph mathematical and real-world problems that are modeled with linear functions. Interpret key features and determine constraints in terms of the context."

NAME _____

DATE _____

LINEAR MODELS

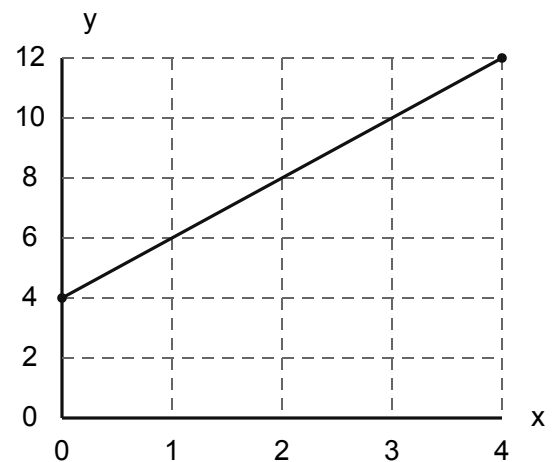
Define both variables and units. A linear model has a constant rate; its intercept gives the value when $x = 0$. Context can restrict inputs. Join points for continuous quantities, but keep counts as isolated points. State domain and range with inequalities or sets. Graph only allowed values, then interpret the answer in context.

WORKED EXAMPLE

A bike rental costs \$4 plus \$2 per hour, for any rental from 0 to 4 hours (partial hours allowed). Let x be hours and y be cost. Model, graph and find the cost for 3 hours.

1. The fee gives $y = 2x + 4$. Domain: $0 \leq x \leq 4$.
2. Range: $4 \leq y \leq 12$. Draw the closed segment.
3. At $x = 3$, $y = 10$. The rate is \$2/hour; (0,4) is the \$4 fee.

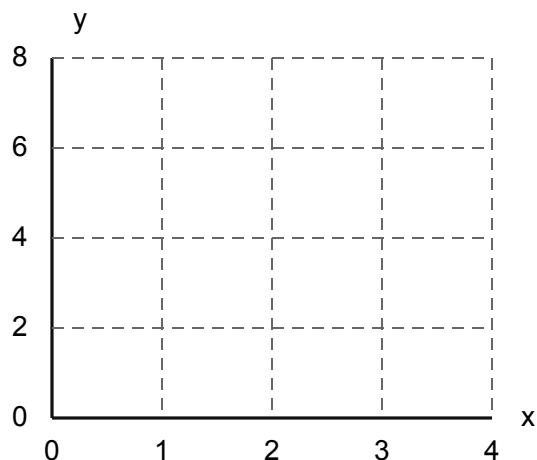
Answer: \$10 for 3 hours. The algebraic x-intercept is -2, outside the allowed domain.



PRACTICE 4 problems

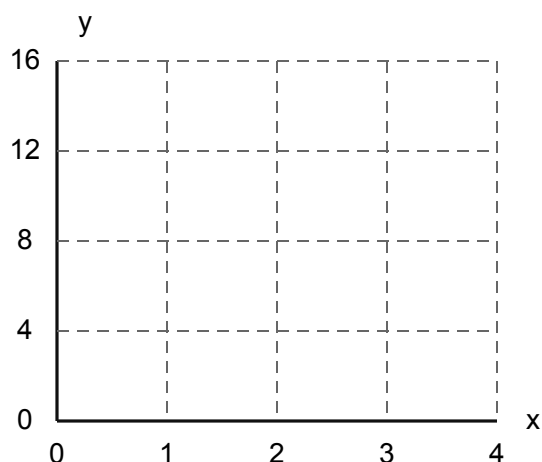
- 1** A tank starts with 8 liters and drains at 2 liters/minute until empty. Let x be minutes and y be liters. Write and graph the model. Give domain, range and when the tank empties.

ANSWER _____



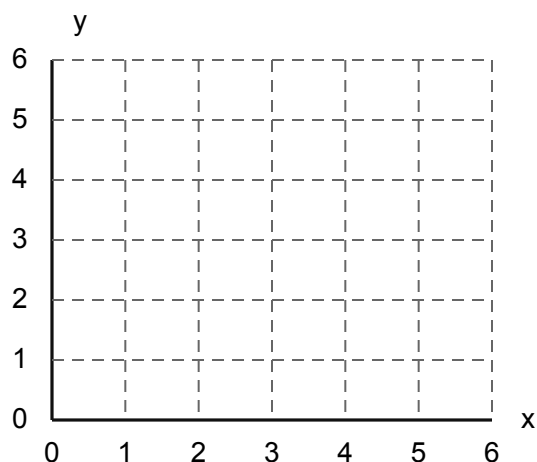
- 2** A shop sells 0 to 4 badges, at \$3 each plus a \$2 order fee. Let x be badges and y be dollars. Model and graph allowed orders; state domain and range. Why are points separate?

ANSWER _____



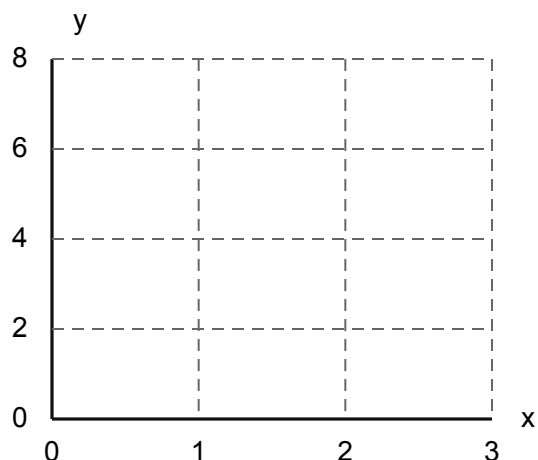
- 3** A uniform ribbon is 6 meters long. The remaining length y after cutting x meters obeys $x + y = 6$. Graph its allowed values. Give intercepts, domain and range, with meanings.

ANSWER _____



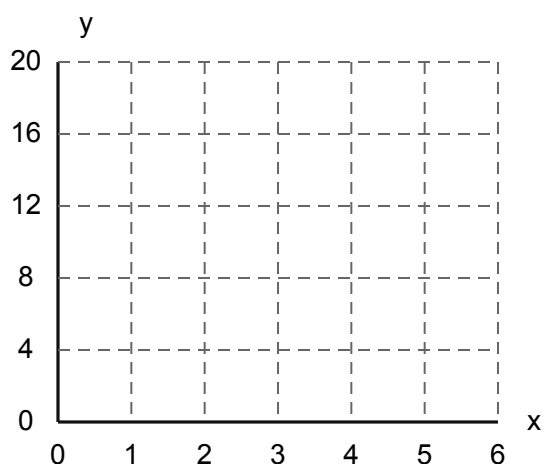
- 4** A runner is 3 km from the start after 1 hour and runs at 2 km/hour: $y - 3 = 2(x - 1)$, for $0 \leq x \leq 3$. Graph the model; give the initial distance and range.

ANSWER _____



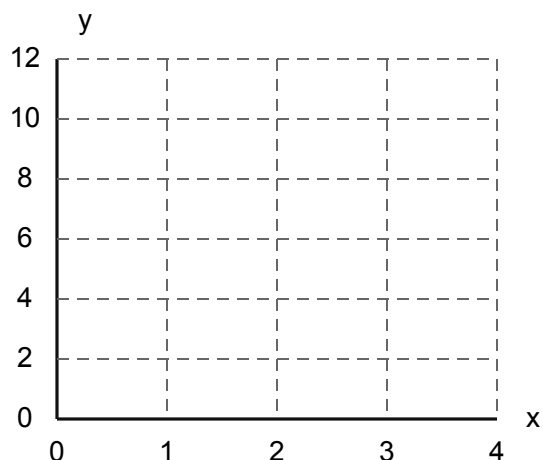
APPLY IT Show your work

- 1** A streaming service charges a \$6 activation fee and \$2 per month. Let x be whole months, from 0 to 6, and y be dollars. Write and graph allowed costs. With \$14, what is the greatest number of months?



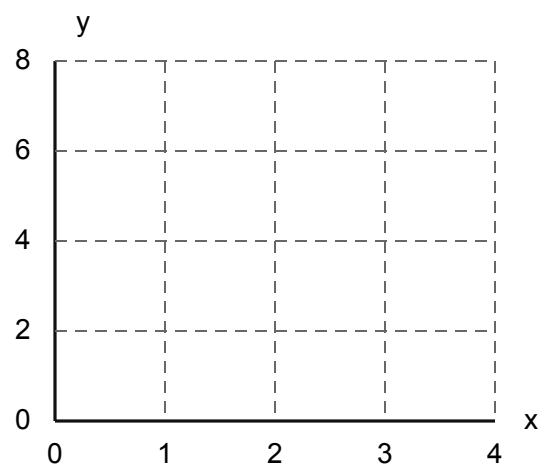
2

A cooler drops from 10 C to 2 C at a constant rate in 4 hours. Let x be hours and y be temperature. Model and graph $0 \leq x \leq 4$. When does it reach 5 C? Interpret the slope.

**CHALLENGE** One step up

A parking garage charges a flat \$6 for any stay from 0 to 4 hours, partial hours allowed. Graph cost y against hours x . State rate, domain, range and whether there is an x -intercept.

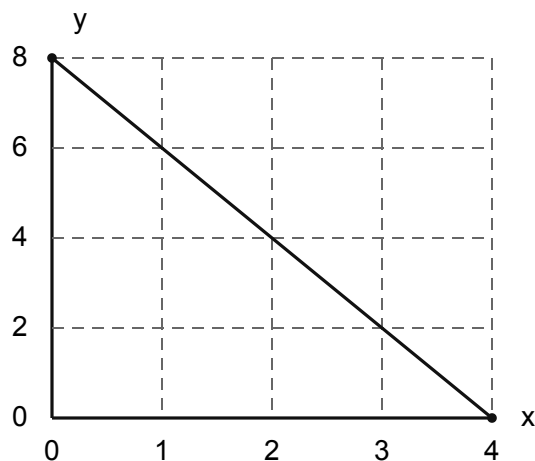
WORK SPACE AND ANSWER



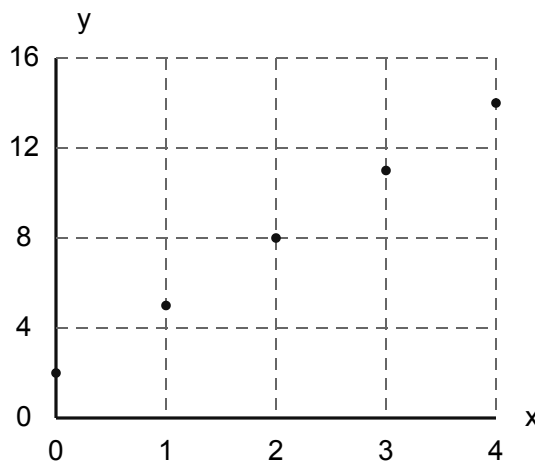
Require units and contextually restricted graphs. Counts use separate points, continuous quantities use closed segments. Accept inequality or set notation for domains/ranges (interval notation is also equivalent). Out-of-domain algebraic intercepts are not feasible contextual values. Interpret rates and fees distinctly.

PRACTICE 1

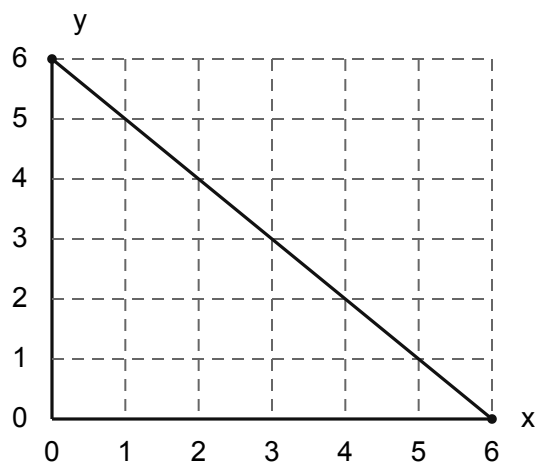
$y = 8 - 2x$; $0 \leq x \leq 4$; $0 \leq y \leq 8$. Empty at (4,0), after 4 minutes.

**PRACTICE 2**

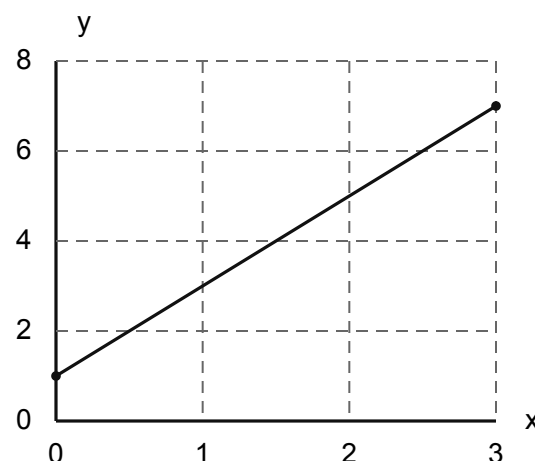
$y = 3x + 2$; $D = \{0, 1, 2, 3, 4\}$; $R = \{2, 5, 8, 11, 14\}$. Whole badges only; isolated points.

**PRACTICE 3**

Closed segment from (0,6) to (6,0). Both variables range from 0 to 6 m; initially 6 m remain, finally none.

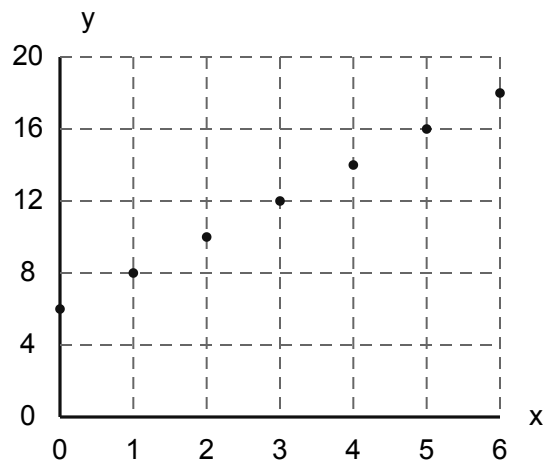
**PRACTICE 4**

$y = 2x + 1$. Initially 1 km from the start; range $1 \leq y \leq 7$ km.



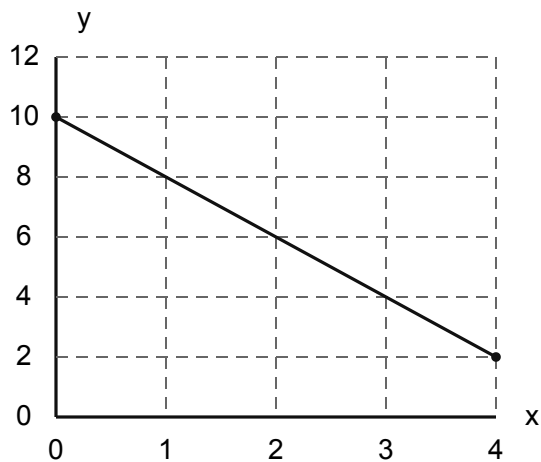
APPLY IT 1

$y = 2x + 6$; x in $\{0,1,2,3,4,5,6\}$. Costs $\{6,8,10,12,14,16,18\}$. At most 4 months.
Solve $2x + 6 \leq 14$ and apply the whole-month domain.



APPLY IT 2

$y = 10 - 2x$. At 2.5 hours; slope -2 C/hour. Domain $[0,4]$, range $[2,10]$, both endpoints included.
 $10 - 2x = 5$ gives $x = 2.5$. Temperatures and times are continuous.



CHALLENGE

Horizontal closed segment $y = 6$ for $0 \leq x \leq 4$; rate $\$0/\text{hour}$; range $\{6\}$; no x -intercept.

