

5.3 Graphing Linear Relations

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Learning Goals: I will learn to

- Graph linear relations
- Solve problems by graphing a linear relation and analyzing the graph

coefficient $T = 12n + 10$ *constant = 10*

Example 1: Graph a Linear Equation

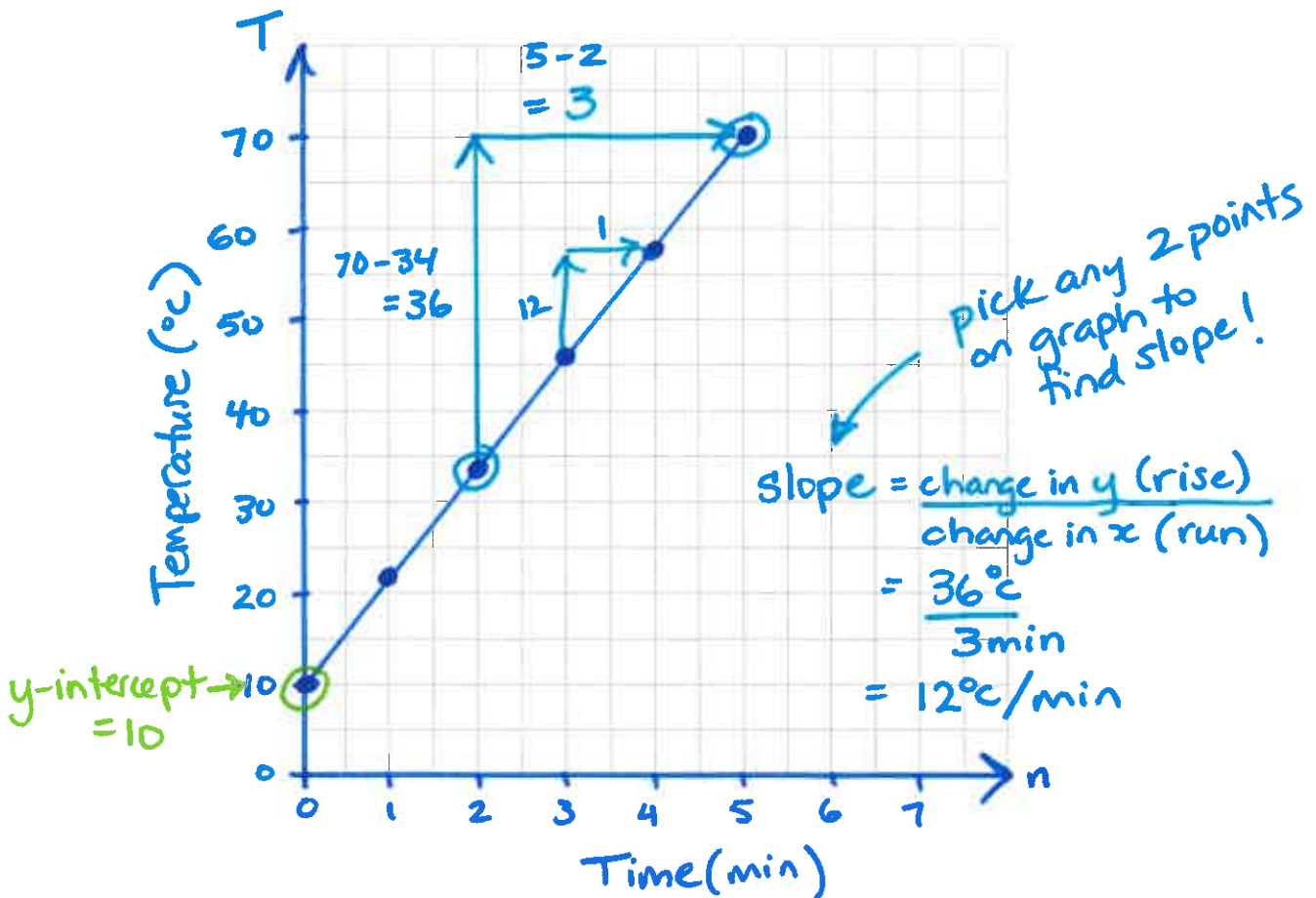
The equation $T = 12n + 10$ represents the temperature, T , in $^{\circ}\text{C}$, of a pot of soup heating up n minutes after being placed on a stove.

- a) Create a table of values for the first five minutes. Show the change in temperature. Graph the ordered pairs. Should the points be connected?

YES — continuous relation
(all values between points make sense)

n	T
Time (min)	Temperature ($^{\circ}\text{C}$)
0	10
1	22
2	34
3	46
4	58
5	70

Handwritten notes: $= 12(0) + 10$, $= 12(1) + 10$, $= 12(2) + 10$. Arrows indicate $+12$ between rows.



b) What is the initial temperature of the soup? How does it relate to the equation? How does it relate to the graph?

starting value
y when $x=0$

- soup starts at 10°C
- 10 is the constant in our equation
- 10 is the y-intercept on our graph

c) What is the rate of change of the temperature? How does it relate to the equation? How does it relate to the graph?

rate of change
= $\frac{\text{change in } y}{\text{change in } x}$

- temperature goes up by 12°C every minute
- 12 is the coefficient in our equation
- 12 is the slope on our graph

variable term (has variable in it)
 ax

fixed term (constant)
 b

A linear relation can have the form:

$$y = ax + b.$$

- x is the independent variable
(these values are usually easier to input into an equation).
- y is the dependent variable
(these output values are usually easier to calculate)
- b is the starting point
 - the constant in the equation
 - the starting value in the table
 - the y-intercept of the graph
- a is the rate of change
 - the coefficient in the equation
 - how y changes relative to x in the table
 - the slope of the graph

$$y = ax + b$$

Example 2: Graph and Interpret a Linear Relation

a) Create a table of values and graph the linear relation:

$$y = 3x - 2$$

x	y
-2	-8
-1	-5
0	-2
1	1
2	4

+1
+1

+3
+3

$$y = 3(-2) - 2$$

$$= -6 - 2$$

$$= -8$$

$$y = 3(0) - 2$$

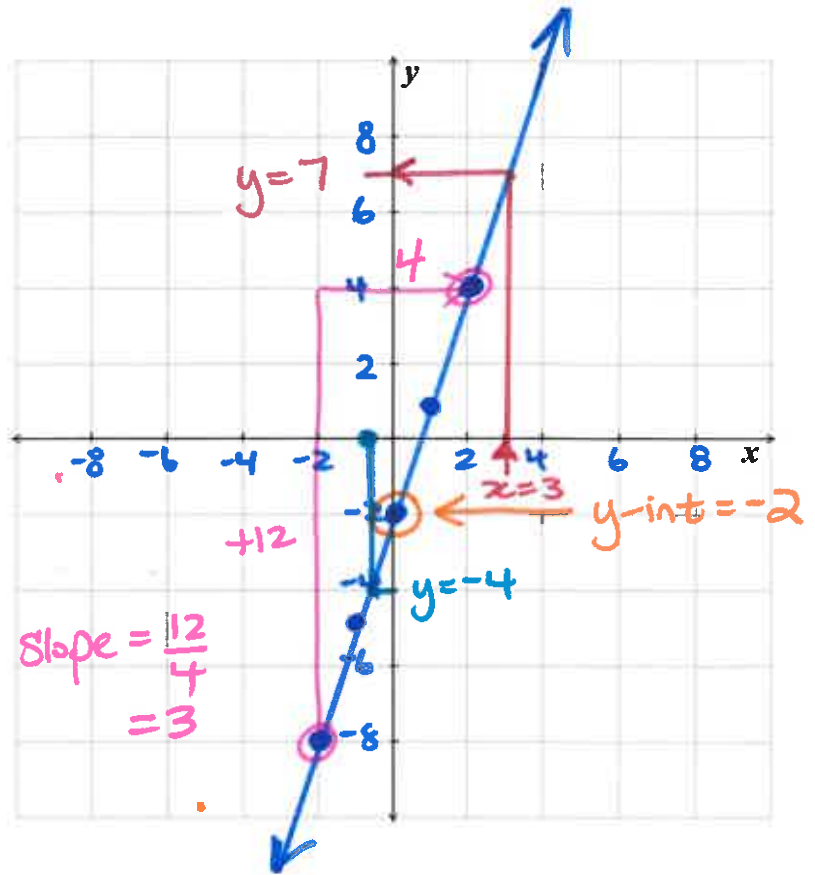
$$= 0 - 2$$

$$= -2$$

$$y = 3(-1) - 2$$

$$= -3 - 2$$

$$= -5$$



b) Relate the a and b values of the equation to the graph.

$a = 3$ (coefficient in equation) \rightarrow slope of line = 3

$b = -2$ (constant in equation) \rightarrow y-intercept = -2

c) Use the graph to estimate the value of y if $x = 3$. Check with your equation.

FROM GRAPH

when $x = 3$

$y = 7$

$$y = 3x - 2$$

$$= 3(3) - 2$$

$$= 9 - 2$$

$$= 7$$

d) Use the graph to estimate the value of x if $y = -4$.

when $y = -4$, x is between 0 and -1
(hard to tell exactly on our graph)

Example 3: Graph Vertical and Horizontal Lines

Sketch a graph of each relation.

a) $y = 5$



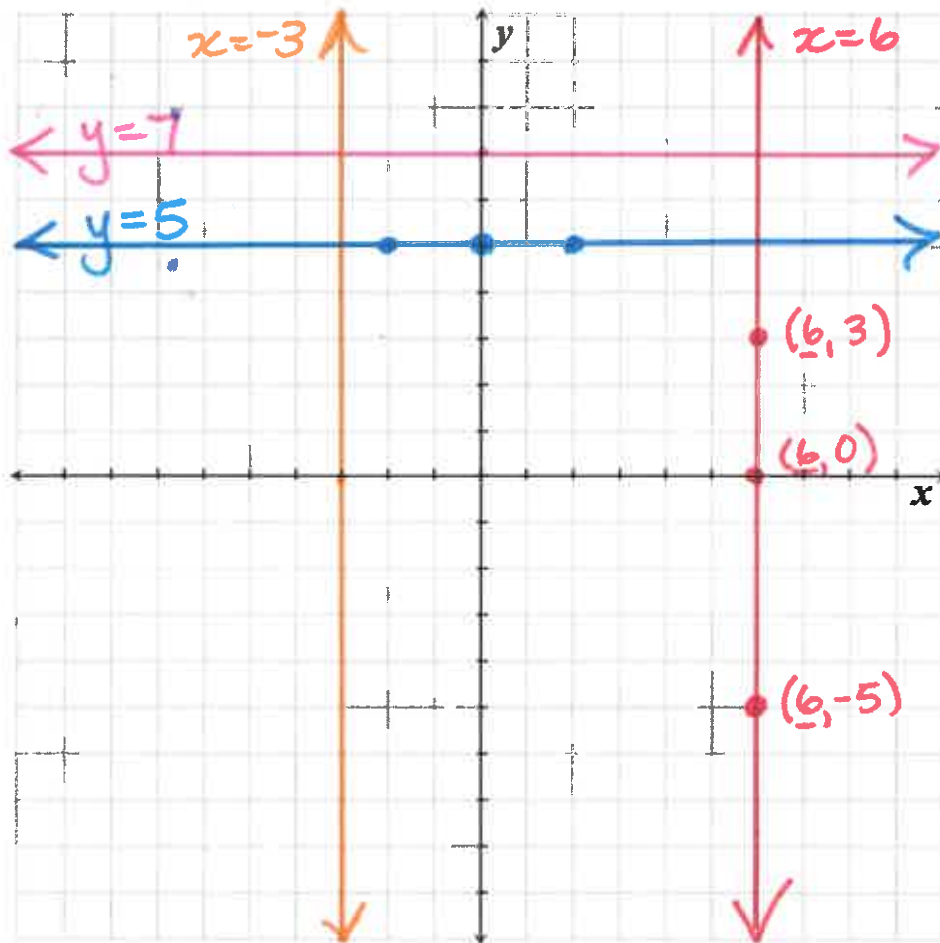
x	y
-2	5
0	5
2	5

$y = \text{constant}$
ALWAYS A
HORIZONTAL
LINE
slope = 0

b) $x = 6$



$x = \text{constant}$
ALWAYS A
VERTICAL LINE
slope is undefined.



Show You Know

Add the following relations to the graph above.

c) $x = -3$

d) $y = 7$