Day 13 – Characteristics of Linear Functions (Real World)

Now that you have learned all the characteristics that apply to linear functions, we are going to focus on a few characteristics that have very real world applications to them – slope, domain & range, and intercepts.

The Real Number System

When we apply domain and range to real world situations, we need to consider what types of numbers are suitable for a domain and range. Typically, we describe domain and range using one of the types of number classifications.

Types of Numbers	Example
Counting Numbers	1, 2, 3, 4… (Zero is not included) ~~0~~
Whole Numbers	0, 1, 2, 3… (Also called non-negative integers)
Integers	…-3, -2, -1, 0, 1, 2, 3, …
Rational Numbers	Everything above plus decimals & fractions $\frac{1}{4}$
Real Numbers	Everything above plus irrational numbers

Most of the real world applications of domain and range do not include rational numbers (you can't have a fractional piece of an item or person) or non-negative numbers (such as time).

Domain & Range

When determining appropriate domains and ranges for a function, think about what the independent and dependent quantities are and what type of numbers are appropriate and which are not appropriate.

Example 1: A plumber charges $96 an hour for making house calls to do plumbing work. What would be an appropriate domain and range? Assume he charges by hour.

$y = 96x$

x Independent Quantity:
x = # of hrs

y Dependent Quantity:
y = total cost

$0 = 96(0)$
$96 = 96(1)$
$192 = 96(2)$
$288 = 96(3)$

Domain:
x = all whole #s

Range:
y = all whole #s

Example 2: Laura is selling cookies to raise funds for a school club. Each cookie costs $0.50. What would be an appropriate domain and range?

$y = 0.50x$

x Independent Quantity:
x = # of cookies

y Dependent Quantity:
y = total cost

$0 = 0.5(0)$
$0.50 = 0.5(1)$
$1.00 = 0.5(2)$
$1.50 = 0.5(3)$

Domain:
all whole #s

Range:
all positive rational #s

Example 3: Rentals cars at ABC Rental Car Company cost $100 to rent, plus $1 per mile. What would be an appropriate domain and range?

rate

$y = 100 + 1x$

$100 = 100 + 1(0)$

$101 = 100 + 1(1)$

$102 = 100 + 1(2)$

X Independent Quantity:

x = # of miles

y Dependent Quantity:

y = total cost

Domain:

all whole #s

Range:

all counting #s

~~**Example 4:**~~ Jason goes to an amusement park where he pays $8 admission and $2 per ride. He has $30 to spend.

Independent Quantity:

Dependent Quantity:

Domain:

Range:

Example 5: Hunter is shopping for pencils. He has $5.00 from his allowance and he finds the pencils he wants cost $0.65 each.

rate

spending limit

$y = 0.65x$

$\frac{5.00}{0.65} = \frac{0.65x}{0.65}$

$7.69 = x$

$5.20 = 0.65(8)$

Independent Quantity:

X = # of pencils

Dependent Quantity:

y = total cost/ $

Domain:

$0 \le x \le 7.69$

$0 \le x \le 7$

x: [0, 7]

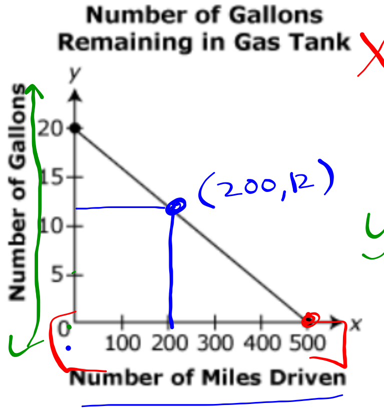
Range:

$0 \le y \le 5.00$

[0, 5]

Intercepts

1. *A car owner recorded the number of gallons of gas remaining in the car's gas tank after driving a number of miles. Use the graph below to answer the following questions.*



a. What does x-intercept represent on the graph?

X: [0,500] (x-axis)
(500,0)
mile gal

At 500 miles the car will have 0 gallons.

(b)
b. What does the y-intercept represent on the graph?

y: [0,20] (y-axis)
(0, 20)
mi gal

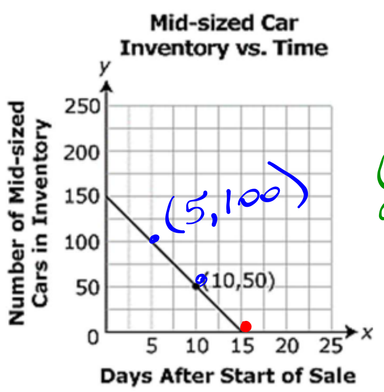
At 0 miles driven, the car has 20 gal.
At the beginning, the car has 20 gal.

c. What does the point (200, 12) represent on the graph?

(200,12)
mi gal

At 200 miles, the car will have 12 gal.

2. *The graph below shows the relationship between the number of mid-sized cars in a car dealer's inventory and the number of days after the start of a sale.*



a. What does x-intercept represent on the graph?

(15,0)
days # cars

After 15 days, there are 0 cars left to sell.

b. What does the y-intercept represent on the graph?

(0, 150)
days # cars

At the start of the sale (0 day) there are 150 cars.

c. What does the point (10, 50) represent on the graph?
days cars
Is the point a solution of the graph?

At 10 days, there are 50 cars left to sell. Yes, this point is a solution.

d. What does the point (5, 125) represent on the graph?
Is the point a solution of the graph?

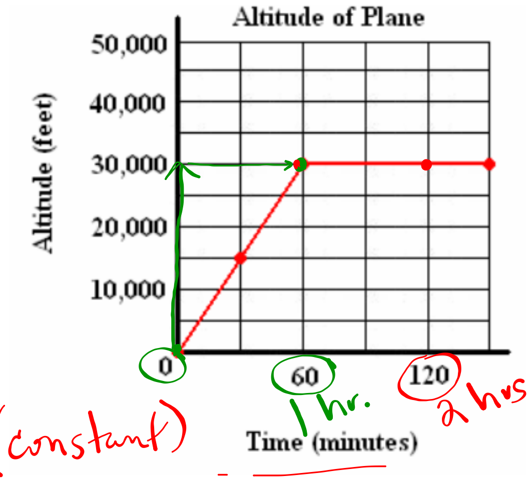
At 5 days, there are 125 cars left to sell.

No, (5,125) is not a solution on this graph.

Slope/Average Rate of Change

ROC

Example 1: The graph shows the altitude of a plane.



SLOPE $\frac{\text{rise}}{\text{run}}$

a. Find the plane's rate of change during the first hour.

$$\frac{\uparrow 30{,}000 \text{ ft}}{\rightarrow 60 \text{ mins}} = \frac{500 \text{ ft}}{1 \text{ min.}}$$

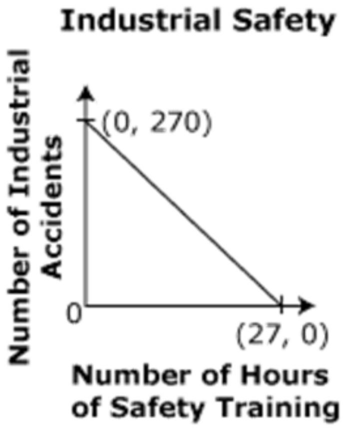
The plane ascends at 500 feet per minute in the first hour.

b. Find the plane's rate of change during the second hour.

$$\frac{0 \text{ ft.}}{60 \text{ mins}} = 0 \text{ slope}$$

The plane's ROC is 0 (constant) at two hours.

Example 2: An industrial-safety study finds there is a relationship between the number of industrial accidents and the number of hours of safety training for employees. This relationship is shown in the graph below.



a. Find the rate of change.

b. Explain what it represents.