Math-1010

Lesson 1-2

Graphs of Functions

(Book Activities 1.3 and 1.4)

What is the difference between domain and practical domain?

Domain: the set made up of the input values for which *there is a corresponding output value*.

Practical Domain: the set made up of input values that satisfy real-world constraints.

Domain by itself is limited only be the mathematical function and practical domain is limited by real-world constraints.

Give an example of a real-world situation where the domain is restricted.

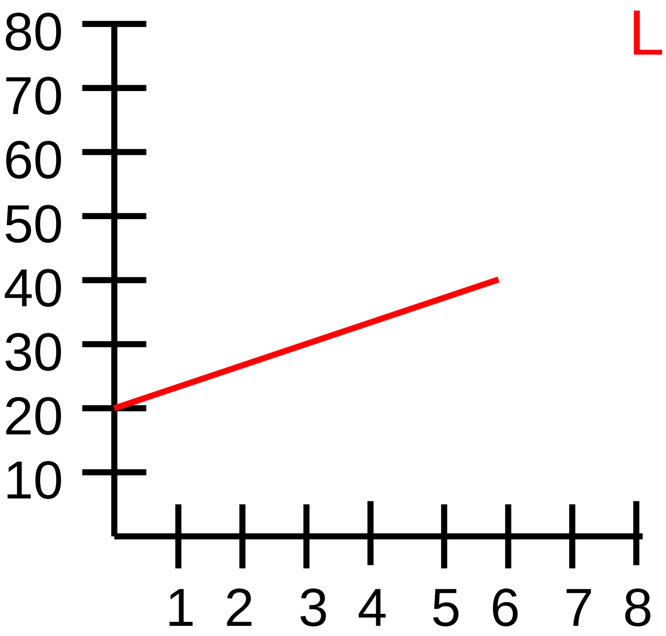
-prices are never negative

-often “time” is “stopwatch time” and can never be negative

-prices can never be any smaller than a penny (can be \$1.00 or \$1.01 but not \$1.009)

-The amount of liquid in a container can never be negative or more than the size of the container.

Graph: a method of visually displaying a relation



List everything you know about the graph

y-intercept: (0, 20)

slope: 20/6 = 10/3 ≈ 3.33

linear function

increasing on interval x = (0, 6)

domain: x = [0, 6]

range: y = [20, 40]

absolute max: y = 40

absolute min: y = 20

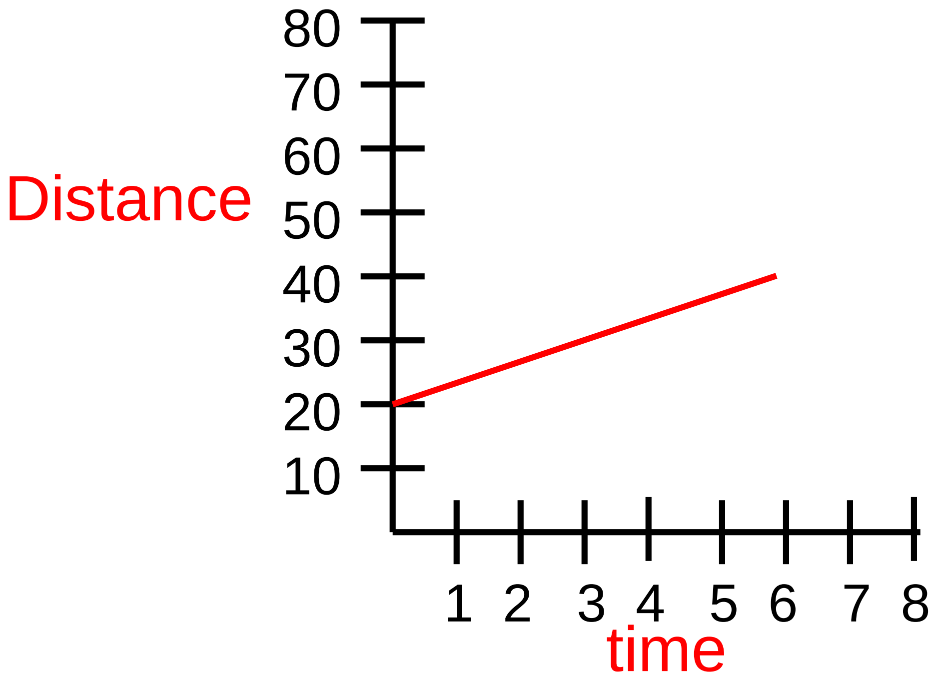
y = f(x)

y = f(x) = 3.33(t) + 20

Is this a graph of a real world relation?

Why can't you tell?

What more do you know that you didn't know before?



$D = f(t)$

$D = f(t) = 3.33(t) + 20$

How far did person go?

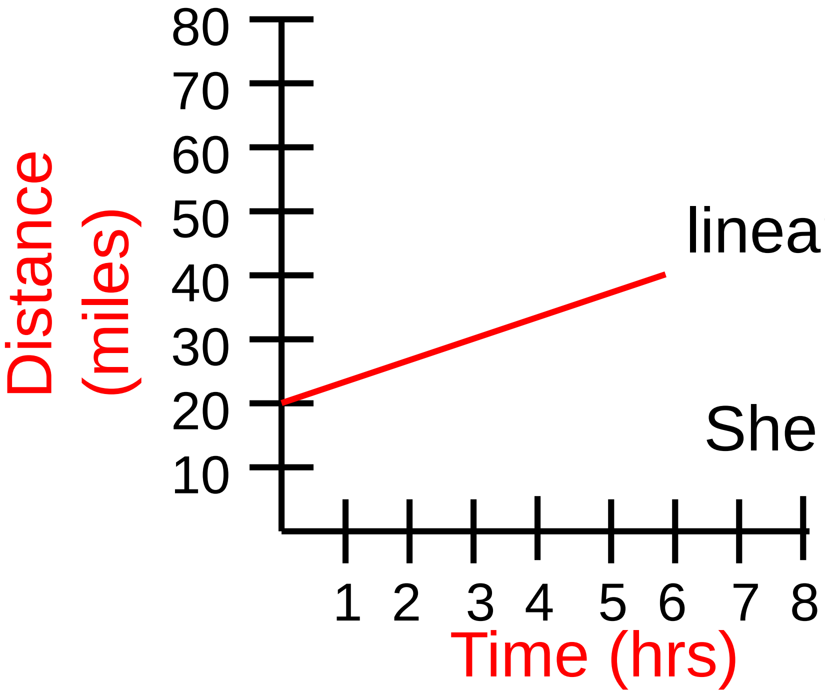
What's missing from the graph?

How far did person go?

How long did the person travel?

How fast did the person go?

What more do you know that you didn't know before?



At t = 0, she was 20 miles away

slope = speed: 3.33 miles per hour
linear function: constant (walking?) speed

graph covers a 6 hour time period
She was between 20 and 40 miles away

At t = 6, she was 40 miles away

Her distance (in miles) from the reference point (from home?), as a function of time (in hours) from the starting time can be modeled by:

$$D = f(t) = 3.33(t) + 20$$

What information is <u>essential</u> when graphing relationships in the real world?

Both axes must have <u>quantity</u> and <u>unit of measure</u>.

Data table:

Is the data linear?

1st "difference"

In engineering we often refer to the change (or difference) as the "delta", (using the Greek letter)

x	f(x)
-2	-7
0	-5
2	-3
4	-1
6	1
8	3
10	5
12	7

change in $x = 2$

$\Delta x = 2$

$\Delta x = 2$

$\Delta x = 2$

$\Delta x = 2$

$\Delta y = 2$

$\Delta y = 2$

$\Delta y = 2$

$\Delta y = 2$

$\Delta y = 2$

If the 1st difference for both input and output ("x" and "y") is always the same then the relation is linear.

Why is that?

Your turn: Which data set is linear? What is the equation that "fits" the data that is linear?

A

x	f(x)
-4	-7
-3	-5
-2	-3
-1	-1
0	1
1	3
2	5
3	7
4	9

B

x	g(x)
-4	32
-3	18
-2	8
-1	2
0	0
1	2
2	8
3	18
4	32

C

x	f(x)
0	0
1	1
2	1.4
3	1.7
4	2.0
5	2.2
6	2.4
7	2.6
8	2.8
9	3

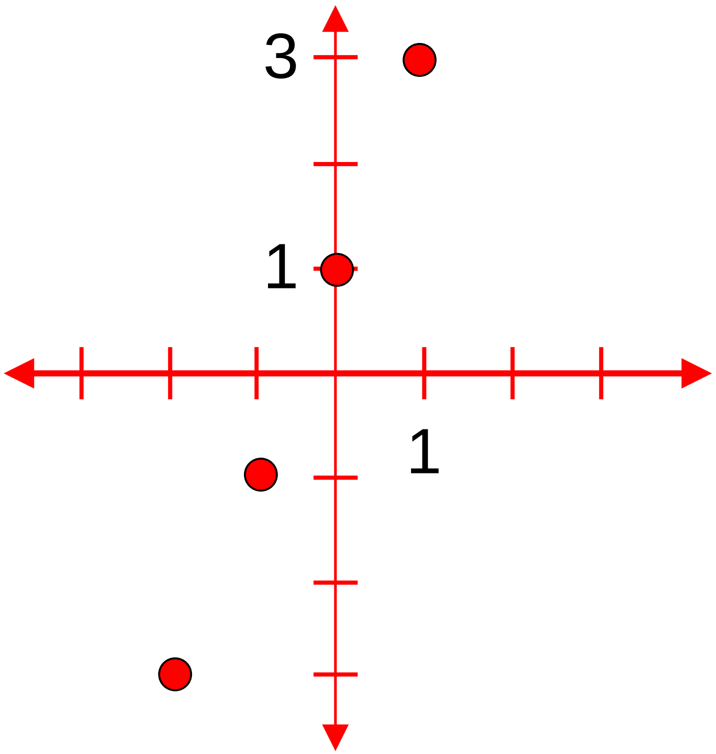
What is the difference between the three representations?

Discrete data: defined only at isolated, distinct, input values

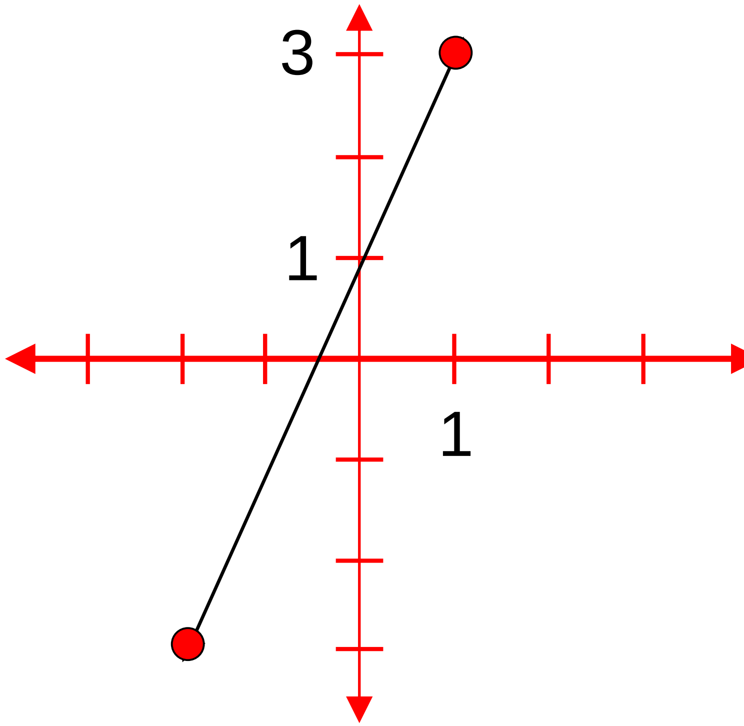
Continuous data: data is “filled in”, there are no gaps

x	f(x)
-2	-3
-1	-1
0	1
1	3

Discrete



Discrete

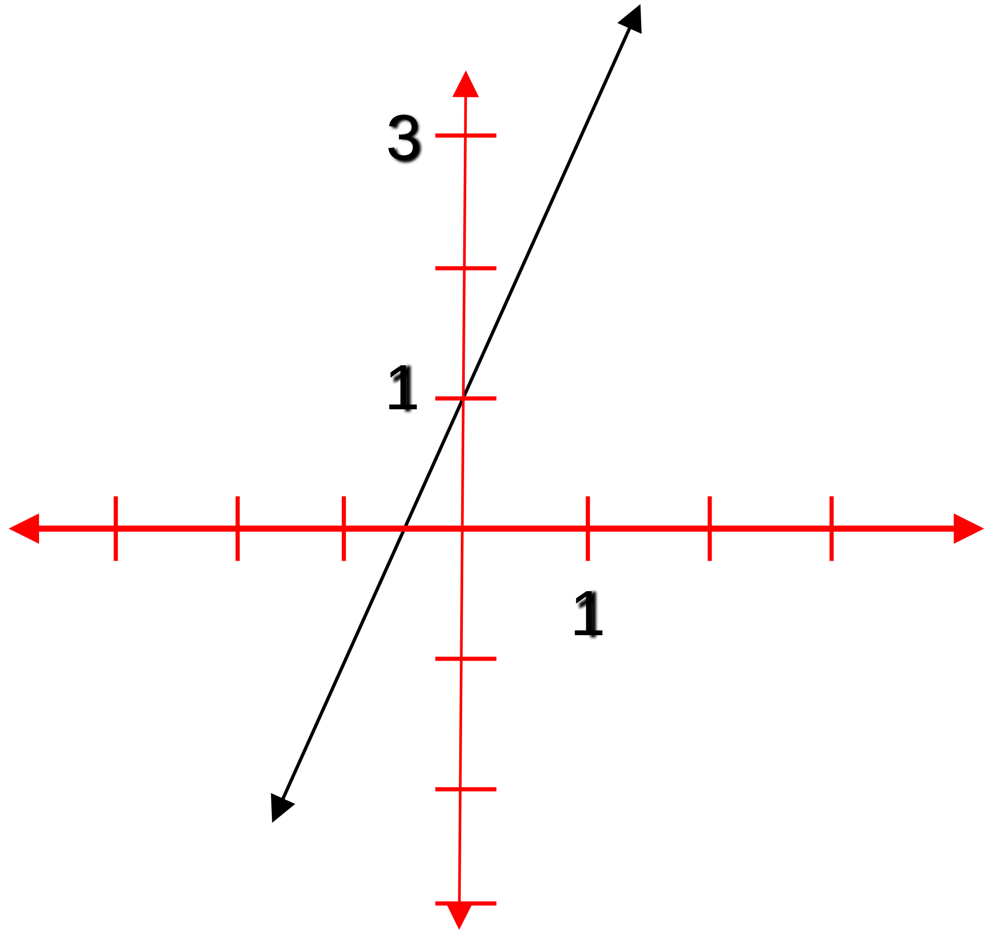


Continuous

Your turn: What is the difference between the two representations?

x	f(x)
-4	-7
-3	-5
-2	-3
-1	-1
0	1
1	3
2	5
3	7
4	9

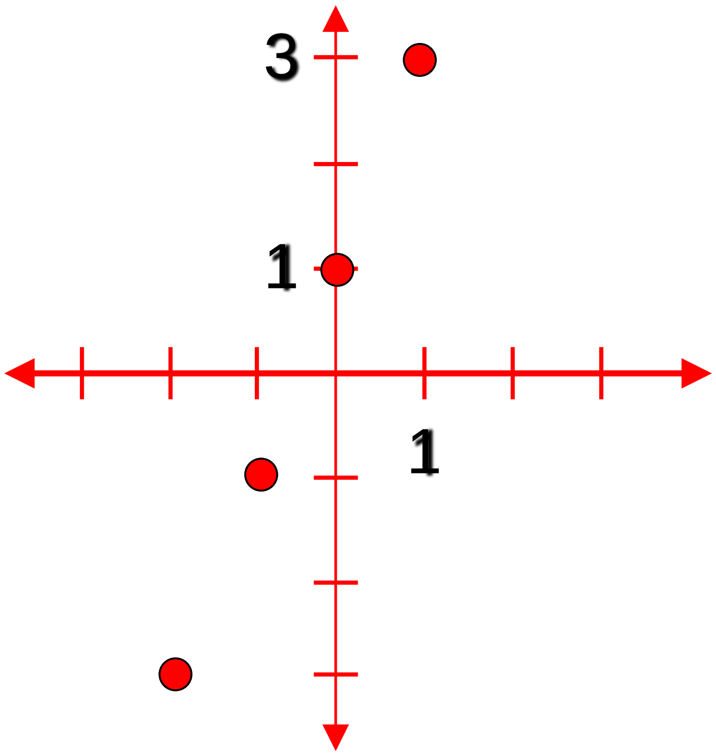
Discrete

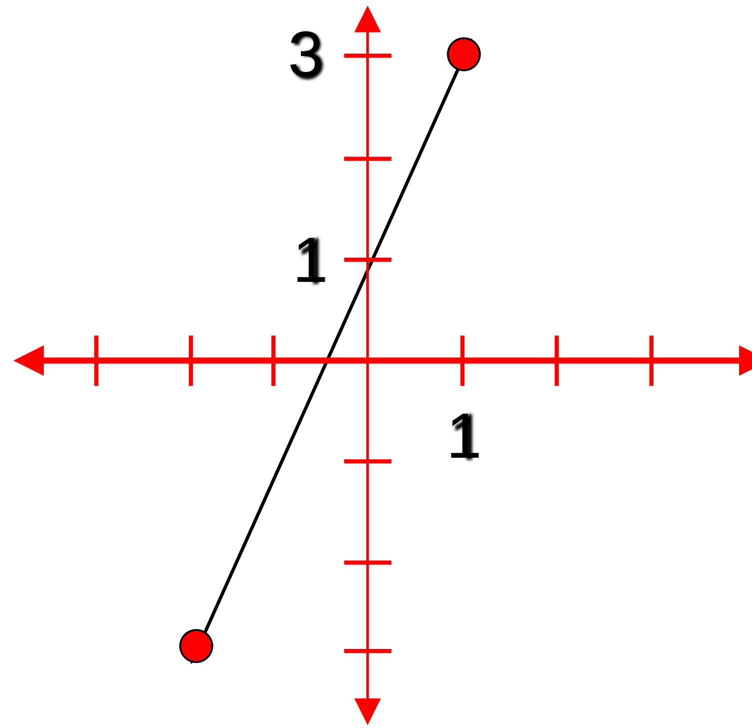


Continuous

What is the domain of each?

x	f(x)
-2	-3
-1	-1
0	1
1	3





<u>Discrete</u>

D = {x = -2, -1, 0, 1}

<u>Continuous</u>

D = {$-2 \leq x \leq 1$}

What is the difference between:
pure math,
applied math, and
engineering?

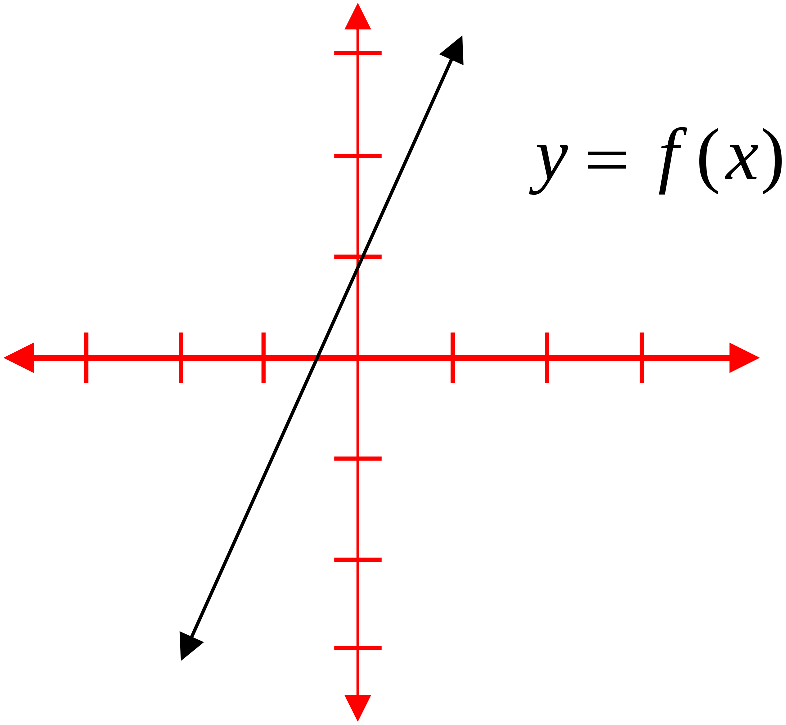
Pure Math: Equations, graphs, tables of numbers, ordered pairs, mappings, and proofs that are just math and are not being used to relate to the physical world around us

Applied Math: The use of equations, graphs, tables of numbers, ordered pairs, and mappings that are used to model relationships between quantities in the real world.

Engineering: The use of applied math and science to design machines and tools for use in the real world.

Mathematical Model: a graph or an equation that fits the data from a real-world relationship between two quantities.

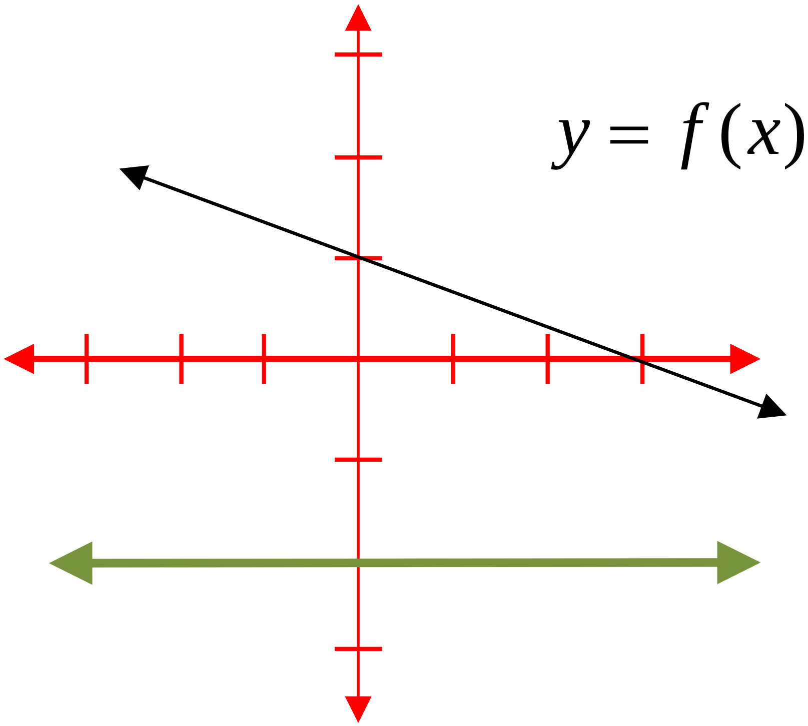
Increasing: draw a rough graph that is only increasing



$$y = f(x) = 2x + 1$$

As ‘x’ increases (goes from left to right) the corresponding ‘y’ value also increases) goes from bottom to top.

Decreasing: draw a rough graph that is only decreasing



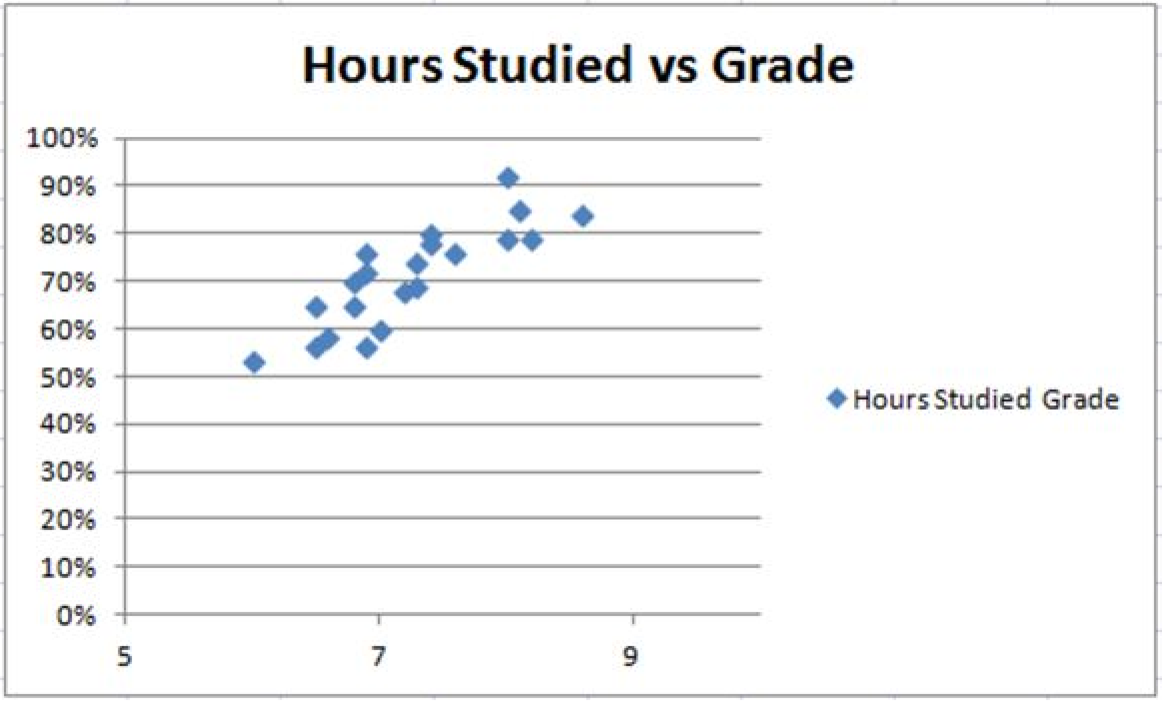
$$y = f(x) = -\frac{1}{3}x + 1$$

Constant: draw a rough graph that is constant

$$y = f(x) = -2$$

Linear Relationships

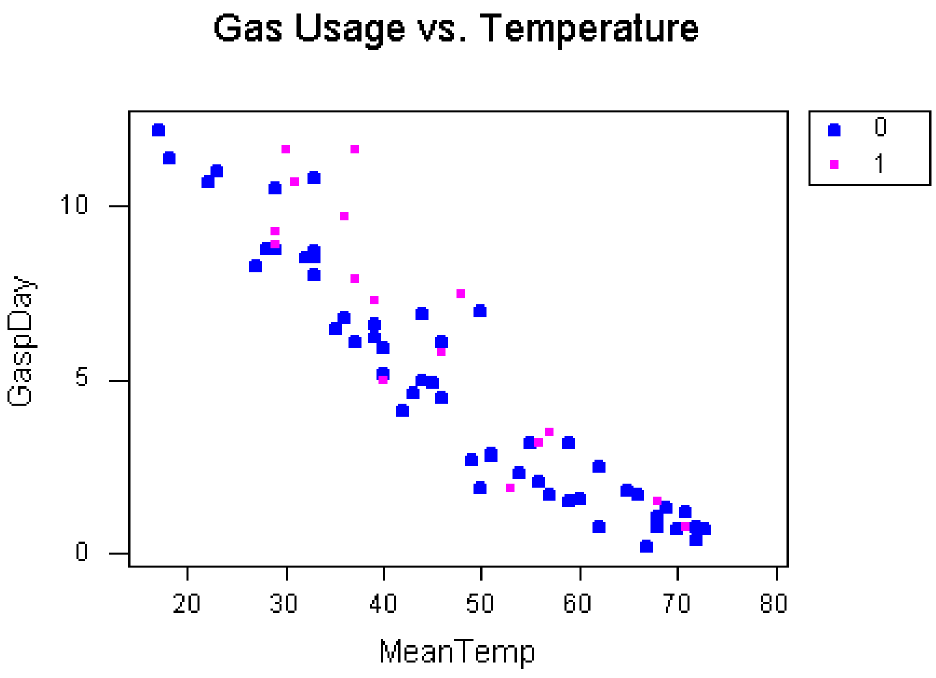
Does the grade a person earns vary linearly with the number of hours he/she studies?



For this relation, we say that "grades as a function of hours studied has a positive linear correlation."

Linear Relationships

Does the amount of natural gas used by a family vary linearly with the outside temperature?



For this relation, we say that "gas usage as a function of mean (outside air) temperature has a <u>negative linear correlation</u>."

Linear Relationships

Is height of a falling object a linear function of time?