Unit Intro to Functions

Day 6
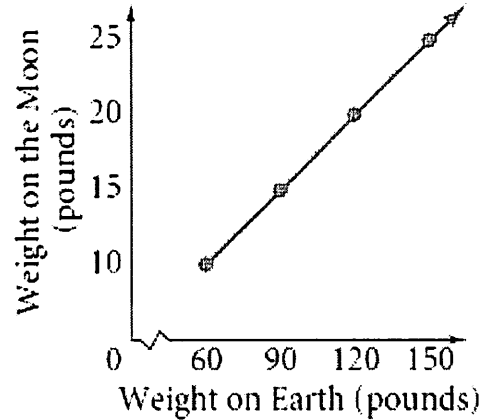## Linear Functions Day 2
(Real World Problems)

I can . . .

. . . determine if a function is linear by determining if it has a rate of change.
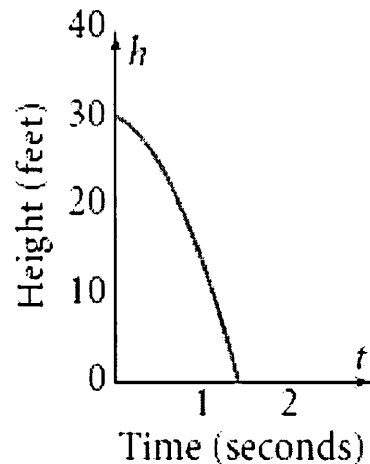
The function, $M(w) = \frac{1}{6}w$, describes your weight on the moon as a function of your weight on Earth w, in pounds.

w	M(w)
60	10
90	15
120	20
150	25

Suppose you drop a stick from a cliff, 30 feet high. The force of gravity causes the stick to fall toward Earth. The function $h = -16t^2 + 30$ gives the height of the stick h in feet after t seconds.

t	h
0	30
0.5	26
1	14
1.5	-6
2	-34

EXAMPLE

When a scuba diver goes under water, the weight of the water puts pressure on the diver. The table shows how the water pressure on the diver increases as the diver's depth increases.

Water Pressure on a Diver

Diver's Depth (ft)	Water Pressure (lb/in.^{2})
10	4.4
20	8.8
30	13.2
40	17.6

Is the relationship between the water pressure and the diver's depth a function?

Is the relationship between the water pressure and the diver's depth a linear function? If so, what is the rate of change?

What does this rate of change represent in this situation?

Use the rate of change to predict the water pressure on a diver at a depth of 60 feet and at a depth of 100 feet.

I THINK I GOT IT?

1. The table shows the population growth of mice over five years in a laboratory. Does the table represent a linear function or a nonlinear function? Justify.

Population of Mice					
Year	2008	2009	2010	2011	2012
Population	200	600	1,800	5,400	16,200

I GOT IT!

1. The table shows the age and the length of a shark over a 20-year period.

Length of a Shark	
Age (years)	Length (cm)
5	40.75
10	44.5
15	48.25
20	52

a. What is the rate of change of this linear function?

b. What does this rate of change represent in this situation?

c. Predict what the length of the shark after 25 years.

ANSWERS: 1) No, there is no rate of change. (SHOW THE LOOPS!)

2) a. $\dfrac{\Delta y}{\Delta x} = \dfrac{0.75 \text{ cm}}{1 \text{ year}}$ b. Each year the shark grows 0.75 cm. c. 55.75 cm

PRACTICE

1. The table shows the relationship between time and elevation as an airplane *descends*. Does the relation represent a linear function? Explain

Airplane Descent	
Time (min)	Elevation (ft)
0	40,000
3	37,600
6	35,200
16	27,200

2. Does the set of ordered pairs represent a function? {(1,5), (2,7), (2,9), (2,11), (4,13)}. Explain.

3. A student is completing a homework assignment. Each minute, the student records the number of problems left to complete. The table shows the data.

Homework Assignment						
Time (minutes)	0	1	2	3	4	5
Problems Left	23	20	17	14	11	8

a) What is the rate of change of this linear function?

b) What does the rate of change represent in this situation?

4. Which graph is NOT a function? Explain.
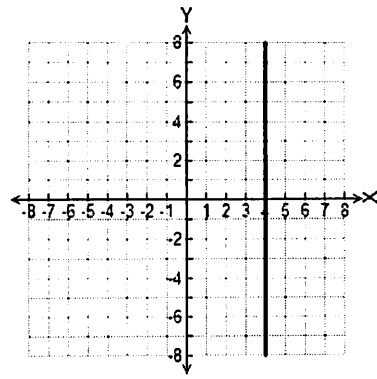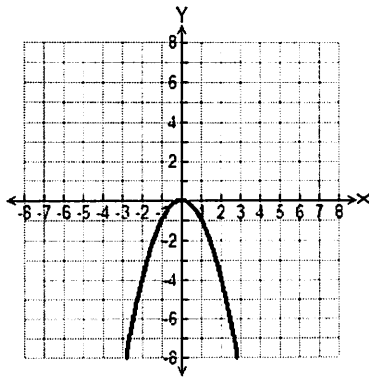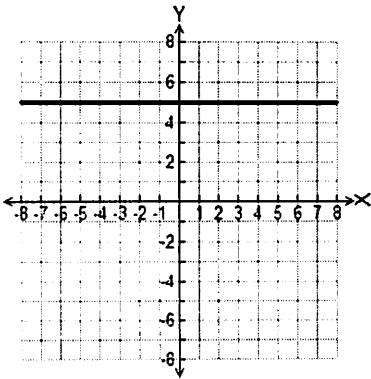
5. Make a table of values for the function $g(x) = 6 - 2x$

x	g(x)
-4	
-1	
0	
1	
4	

6. Identify the domain and range of the function represented in the table.

Input	Output
3	19
5	27
7	35
9	43
11	51

Unit Intro to Functions

Day 6
Linear Functions Day 2
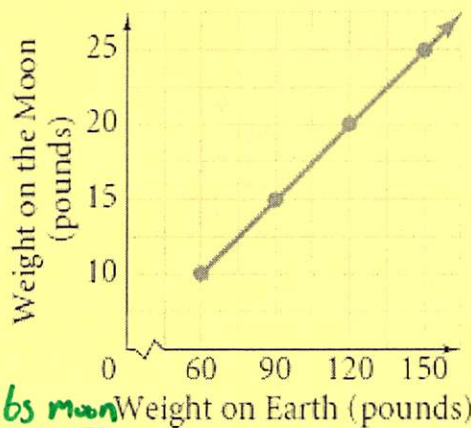## (Real World Problems)

I can ...

... determine if a function is linear by determining $\bigodot$ if it has a rate of change.   *Constant*

The function, $M(w) = \dfrac{1}{6}w$, describes your weight on the moon as a function of your weight on Earth w, in pounds.

O   R

w	$M(w)$
60	10
90	15
120	20
150	25

+30 ... +5
+30 ... +5
+30 ... +5

Yes its Linear

rate of change: $\dfrac{5}{30} = \dfrac{1}{6}$ $\dfrac{lbs\ moon}{lbs\ earth}$

Weight on the Moon (pounds) vs Weight on Earth (pounds)

Suppose you drop a stick from a cliff, 30 feet high. The force of gravity causes the stick to fall toward Earth. The function $h = -16t^2 + 30$ gives the height of the stick h in feet after t seconds.

Quadratic

t	h
0	30
0.5	26
1	14
1.5	-6
2	-34

+0.5 ... -4
+0.5 ... -12
+0.5 ... -20
+0.5 ... -28

Height (feet) vs Time (seconds)
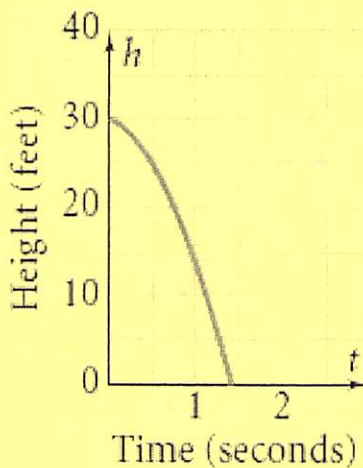
Not Linear

EXAMPLE

When a scuba diver goes under water, the weight of the water puts pressure on the diver. The table shows how the water pressure on the diver increases as the diver's depth increases.

Water Pressure on a Diver

Diver's Depth (ft)	Water Pressure (lb/in.^{2})
10	4.4
20	8.8
30	13.2
40	17.6

(handwritten annotations on left: +10, +10, +10; on right: +4.4, +4.4, +4.4; below table: 60, 100)

Is the relationship between the water pressure and the diver's depth a function?

Yes it is a function because every input has exactly one output

Is the relationship between the water pressure and the diver's depth a linear function? If so, what is the rate of change?

Yes because the table shows a constant rate of change

What does this rate of change represent in this situation?

For every 10 ft down the water pressure increases 4.4 lb/in^2

Use the rate of change to predict the water pressure on a diver at a depth of 60 feet and at a depth of 100 feet.

60 ft → 26.4 lb/in^2
100 ft → 44 lb/in^2

$$\frac{4.4}{10} = \frac{44}{100}$$

PRACTICE

1. The table shows the relationship between time and elevation as an airplane **_descends_**. Does the relation represent a linear function? Explain

X   Y

Airplane Descent	
Time (min)	Elevation (ft)
0	40,000
3	37,600
6	35,200
16	27,200

+3 { 0 → 40,000 } $-2400 \searrow$ -800
+3 { 3 → 37,600 } $-2400 \rightarrow -800$
+10 { 6 → 35,200 } $-8000 \rightarrow -800$
        16 → 27,200

Yes this is linear b/c its constant rate of change $-800 \frac{ft}{min}$

2. Does the set of ordered pairs represent a function? {(1,5), (2,7), (2,9), (2,11), (4,13)}. Explain.

No not every input has exactly one output

3. A student is completing a homework assignment. Each minute, the student records the number of problems left to complete. The table shows the data.

+1 +1 +1   +1   +1

	Homework Assignment					
X	Time (minutes)	0	1	2	3	4	5
Y	Problems Left	23	20	17	14	11	8

−3 −3 −3 −3 −3

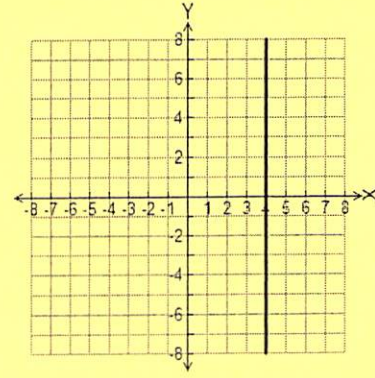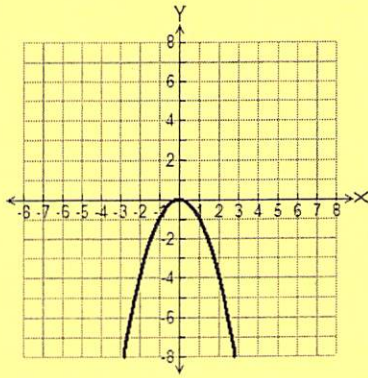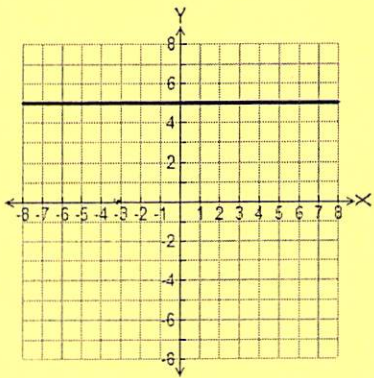a) What is the rate of change of this linear function?

$$\frac{-3}{1} = -3$$

b) What does the rate of change represent in this situation?

In every minute the students problems left decreases by 3

4. Which graph is NOT a function? Explain.

5. Make a table of values for the function $g(x) = 6 - 2x$

x	g(x)
-4	14
-1	8
0	6
1	4
4	-2

$6 - 2(-4)$
$6 - -8$

$6 - 2(-1)$
$6 - -2$

6. Identify the domain and range of the function represented in the table.

Input	Output
3	19
5	27
7	35
9	43
11	51

↑   ↑

domain   range