

# Lesson 6.3 Understanding Linear and Nonlinear Functions Day 1

Week 1 Thursday Course 3 Warm-up



At a fund raising event, a booth was set up to sell handmade cards and photo frames. On the first day, 3 cards and 9 photo frames were sold for a total of \$75. The next day, 8 cards and 5 photo frames were sold for a total of \$67. Find the selling price of a card

## Finding Functions

Which graph shows  $y$  as a function of  $x$ ?

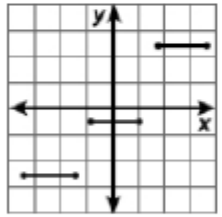


Figure 1

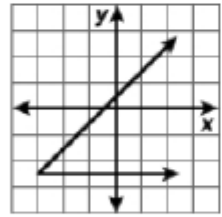


Figure 2

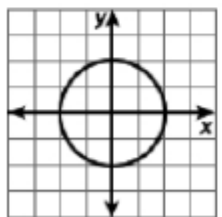


Figure 3

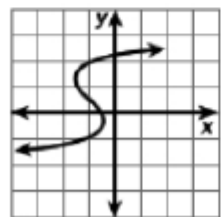
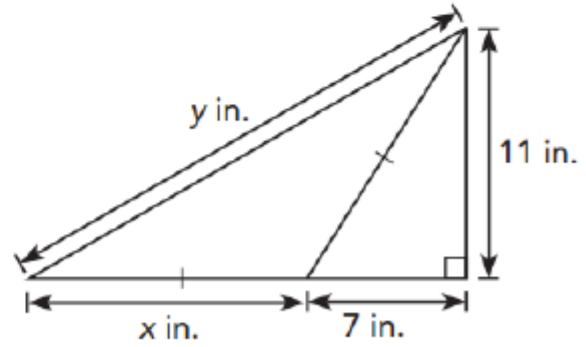


Figure 4

Calculate the missing length  $Y$ . Round to nearest tenth



# Lesson 6.3 Understanding Linear and Nonlinear Functions Day 1

At a fund raising event, a booth was set up to sell handmade cards and photo frames. On the first day, 3 cards and 9 photo frames were sold for a total of \$75. The next day, 8 cards and 5 photo frames were sold for a total of \$67. Find the selling price of a card and the selling price of a photo frame.

Subtract Eq. 4 from Eq. 3:  $(24x + 72y) - (24x + 15y) = 600 - 201$   
 $24x - 24x + 72y - 15y = 399$   
 $57y = 399$   
 $\frac{57y}{57} = \frac{399}{57}$   
 $y = 7$

Substitute 7 for y into Eq. 2:  
 $8x + 5(7) = 67$   
 $8x + 35 = 67$   
 $8x + 35 - 35 = 67 - 35$   
 $8x = 32$   
 $\frac{8x}{8} = \frac{32}{8}$   
 $x = 4$

The selling price of a card is \$4 and that of a photo frame is \$7.

Let the price of a card be  $x$  and the price of a photo frame be  $y$ .

$3x + 9y = 75$  — Eq. 1  
 $8x + 5y = 67$  — Eq. 2

Multiply Eq. 1 by 8:  
 $8(3x + 9y) = 8(75)$   
 $24x + 72y = 600$  — Eq. 3

Multiply Eq. 2 by 3:  
 $3(8x + 5y) = 3(67)$   
 $24x + 15y = 201$  — Eq. 4

## Finding Functions

Which graph shows  $y$  as a function of  $x$ ?

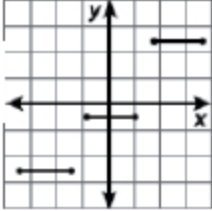


Figure 1

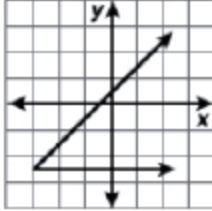


Figure 2

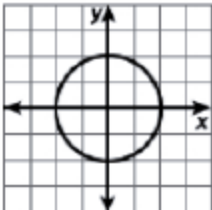


Figure 3

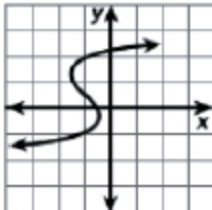


Figure 4

Calculate the missing length  $y$ . Round to nearest tenth

The value of  $x$  is approximately 13.0.

$$y^2 \approx 11^2 + (13.04 + 7)^2$$

$$y^2 \approx 11^2 + 20.04^2$$

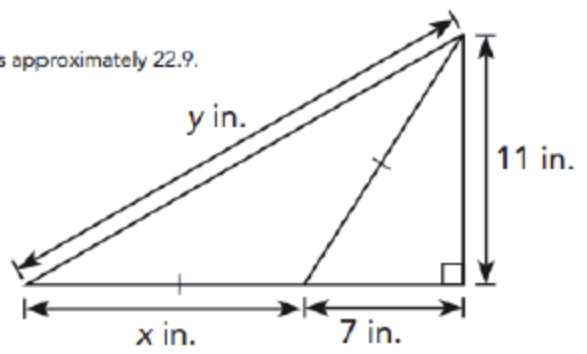
$$y^2 \approx 121 + 401.60$$

$$y^2 \approx 522.60$$

$$y = \sqrt{522.60}$$

$$y \approx 22.9$$

The value of  $y$  is approximately 22.9.



# Lesson 6.3 Understanding Linear and Nonlinear Functions

## Day 1

### Objective

TSW identify linear and nonlinear functions by analyzing tables and graphs.



▶ A function is a relation between a set of inputs and a set of outputs, in which every input has exactly one output. You can use tables, graphs, and equations to represent many functions.

### Common Core State Standards

8 F2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal description) 8 F3 Interpret the equation  $y=mx+b$  as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

**Mathematical Practices** *MP1 Solve problems/persevere MP2 Reason MP 4 Model Mathematics*

# Lesson 6.3 Understanding Linear and Nonlinear Functions Day 1

Vocabulary	
Linear Function	Rate of Change

# Lesson 6.3 Understanding Linear and Nonlinear Functions Day 1

## Vocabulary

### Linear Function

A function that can be expressed in the form of  $Y=mx +b$

### Rate of Change

The ratio of changes in two quantities

$$\text{Rate of change} = \frac{\text{Change in output values}}{\text{Change in input values}}$$

# Lesson 6.3 Understanding Linear and Nonlinear Functions Day 1

You can find tell whether a function is linear by finding the rate of change, as shown below:

## Examples of Linear Functions

a)

<b>x</b>	1	3	5	7	9
<b>y</b>	12	18	24	30	36

The diagram illustrates a linear function with a constant rate of change. The x-values are 1, 3, 5, 7, and 9, with green curved arrows above them indicating a constant increase of +2 between consecutive values. The y-values are 12, 18, 24, 30, and 36, with blue curved arrows below them indicating a constant increase of +6 between consecutive values.

## Lesson 6.3 Understanding Linear and Nonlinear Functions Day 1

You can find tell whether a function is linear by finding the rate of change, as shown below:

### Examples of Linear Functions

a)

x	1	3	5	7	9
y	12	18	24	30	36

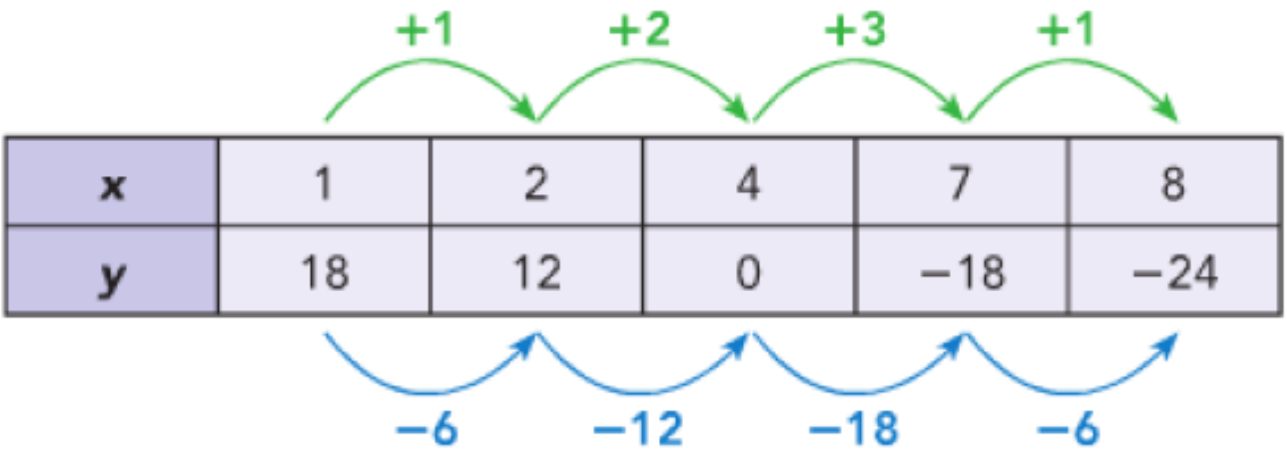
**Rate of change:**  $\frac{6}{2} = 3$     $\frac{6}{2} = 3$     $\frac{6}{2} = 3$     $\frac{6}{2} = 3$

The function has a constant rate of change, 3.

So, the table represents a linear function.

# Lesson 6.3 Understanding Linear and Nonlinear Functions Day 1

b)





# Lesson 6.3 Understanding Linear and Nonlinear Functions Day 1

b)

The table shows the following data points:

x	1	2	4	7	8
y	18	12	0	-18	-24

Green arrows above the table indicate the change in x values: +1 (from 1 to 2), +2 (from 2 to 4), +3 (from 4 to 7), and +1 (from 7 to 8).

Blue arrows below the table indicate the change in y values: -6 (from 18 to 12), -12 (from 12 to 0), -18 (from 0 to -18), and -6 (from -18 to -24).

Rate of change:  $\frac{-6}{1} = -6$     $\frac{-12}{2} = -6$     $\frac{-18}{3} = -6$     $\frac{-6}{1} = -6$

# Lesson 6.3 Understanding Linear and Nonlinear Functions Day 1

## Examples of Non-Linear Functions

c)

<b>x</b>	1	2	4	7	8
<b>y</b>	1	4	16	49	64

Changes in x: +1, +2, +3, +1  
Changes in y: +3, +12, +33, +15

**Math Note**

A function with a varying rates of change is nonlinear.

# Lesson 6.3 Understanding Linear and Nonlinear Functions Day 1

## Examples of Non-Linear Functions

c)

		+1	+2	+3	+1	
x	1	2	4	7	8	
y	1	4	16	49	64	
		+3	+12	+33	+15	

Rate of change:  $\frac{3}{1} = 3$     $\frac{12}{2} = 6$     $\frac{33}{3} = 11$     $\frac{15}{1} = 15$

**Math Note**

A function with a varying rates of change is nonlinear.

## Lesson 6.3 Understanding Linear and Nonlinear Functions Day 1

### Example 7 Tell whether a function represented in a table is linear.

The table shows the cooking times recommended for roasting turkeys of different weights. Tell whether the relation between the weight of a turkey,  $x$  pounds, and the time it takes to roast the turkey,  $t$  hours, is a linear function.

<b>Weight of Turkey (<math>x</math> pounds)</b>	10	15	20	30
<b>Time Taken (<math>t</math> hours)</b>	3.0	3.5	4.0	5.0

# Lesson 6.3 Understanding Linear and Nonlinear Functions Day 1

## Example 7 Tell whether a function represented in a table is linear.

The table shows the cooking times recommended for roasting turkeys of different weights. Tell whether the relation between the weight of a turkey,  $x$  pounds, and the time it takes to roast the turkey,  $t$  hours, is a linear function.

### Solution

Weight of Turkey ( $x$ pounds)	10	15	20	30
Time Taken ( $t$ hours)	3.0	3.5	4.0	5.0

Rate of change:

$$\frac{0.5}{5} = 0.1 \quad \frac{0.5}{5} = 0.1 \quad \frac{1.0}{10} = 0.1$$

The function has a constant rate of change, 0.1.  
So, the table represents a linear function.

# Lesson 6.3 Understanding Linear and Nonlinear Functions Day 1

## Guided Practice

Tell whether each table of values represents a linear or nonlinear function. Explain.

1

		$+2$	$?$	$?$	
$x$	2	4	8	10	
$y$	3	8	18	23	
		$+5$	$?$	$?$	

# Lesson 6.3 Understanding Linear and Nonlinear Functions Day 1

## Guided Practice

Tell whether each table of values represents a linear or nonlinear function. Explain.

1

		+2	<u>?</u>	<u>?</u>	
					+4; +2
<b>x</b>	2	4	8	10	
<b>y</b>	3	8	18	23	
		+5	<u>?</u>	<u>?</u>	+10; +5

Rate of change:  $\frac{5}{2} = \frac{?}{?} = \frac{?}{?} = \frac{?}{?}$   $2\frac{1}{2}; \frac{10}{4}; 2\frac{1}{2}; \frac{5}{2}; 2\frac{1}{2}$

Because the rate of change for the function is ?, **constant**  
 the table represents a ? function. **linear**

## Lesson 6.3 Understanding Linear and Nonlinear Functions Day 1

### Guided Practice

Tell whether each table of values represents a linear or nonlinear function. Explain.

2

$x$	-5	-3	-1	1	3
$y$	28	26	22	14	4



## Lesson 6.3 Understanding Linear and Nonlinear Functions Day 1

### Guided Practice

Tell whether each table of values represents a linear or nonlinear function. Explain.

2

$x$	-5	-3	-1	1	3
$y$	28	26	22	14	4

Because the rate of change for the function is ?, **not constant**  
the table represents a ? function. **nonlinear**

# Lesson 6.3 Understanding Linear and Nonlinear Functions Day 1

## Practice 6.3 #1-4

## Challenge-

\*Solve created equations

“Pick a Snowflake”

\*BuzzMath

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Practice 6.3**

Tell whether each table of values represents a linear or nonlinear function.

1 

x	3	5	7	9
y	6	12	18	24

2 

x	-15	-10	-5	20
y	12	8	4	-16

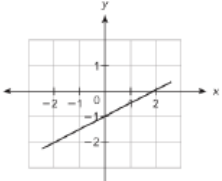
3 

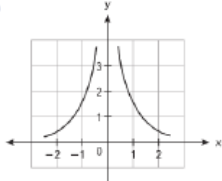
x	-8	-3	8	27
y	-2	-1	2	3

4 

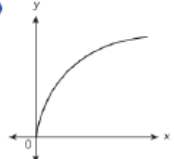
x	-8	-6	-2	2
y	-1	-4	2	8

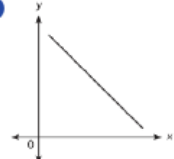
Tell whether each graph represents a linear function. If so, find the rate of change.

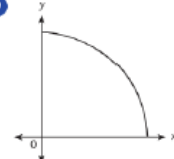
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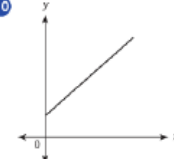
6 

Tell whether each function is linear or nonlinear. Then tell whether the function is increasing or decreasing.

7 

8 

9 

10 

Course 3



Lesson Check #1 & 3-can tell whether a table of values represents a linear or nonlinear functions

## Ticket Out the Door- Connect, Extend, Challenge

1. How are the ideas and information presented **CONNECTED** to what you already knew?
2. What new ideas did you get that **EXTENDED** or pushed your thinking in new directions?
3. What is still **CHALLENGING** or confusing for you to get your mind around? What questions, wonderings or puzzles do you now have?