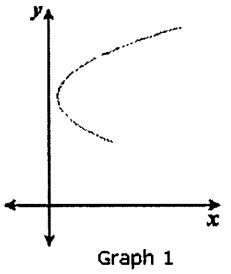
Unit Intro to Functions

Day 5
Linear Functions Day 1

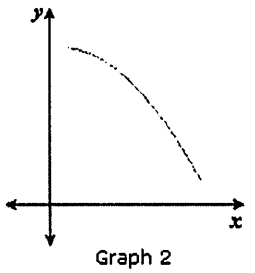
I can . . .

. . . determine if a function is linear by determining if it has a rate of change.

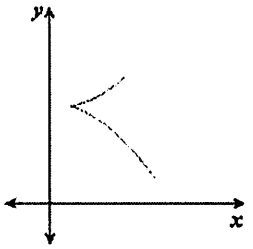
Which graph is linear?



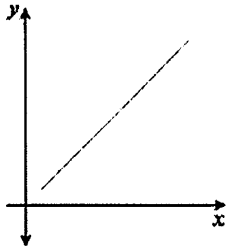
Graph 1



Graph 2



Graph 3



Graph 4

Which equation is linear?

1. $f(x)=\frac{2}{3}x+4$

2. $g(x)=x^2+3x-28$

3. $h(x)=|-5x|$

Which table is linear?

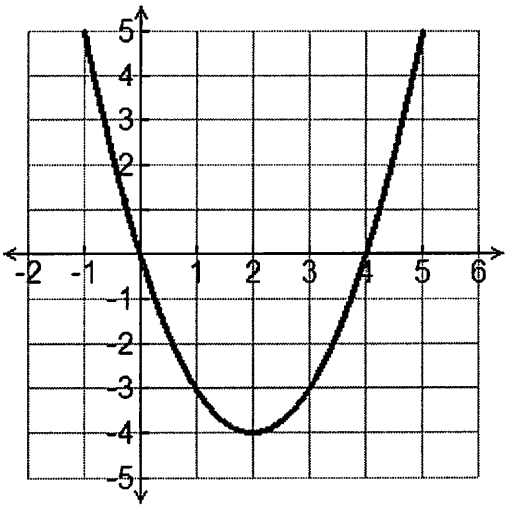
Input (x)	Output (y)
0	0
1	-3
2	-4
3	-3
4	0

Input (x)	Output (y)
-1	9
0	5
1	1
2	-3
3	-7

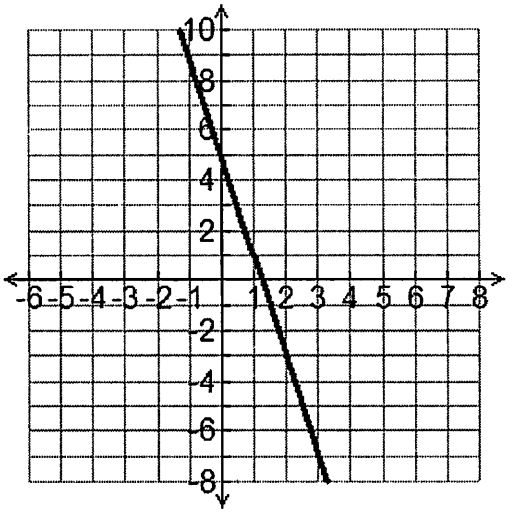
Input (x)	Output (y)
0	1
1	2
2	4
3	8
4	16

Which table is linear?

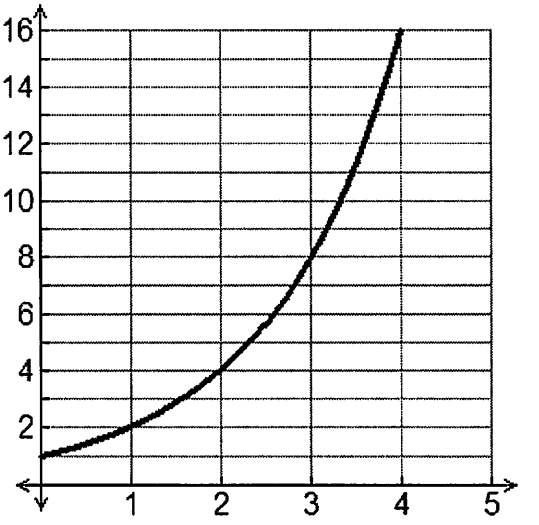
Input (x)	Output (y)
0	0
1	-3
2	-4
3	-3
4	0



Input (x)	Output (y)
-1	9
0	5
1	1
2	-3
3	-7



Input (x)	Output (y)
0	1
1	2
2	4
3	8
4	16



A **linear function** is a function that has a constant rate of change. Its graph is a straight line.

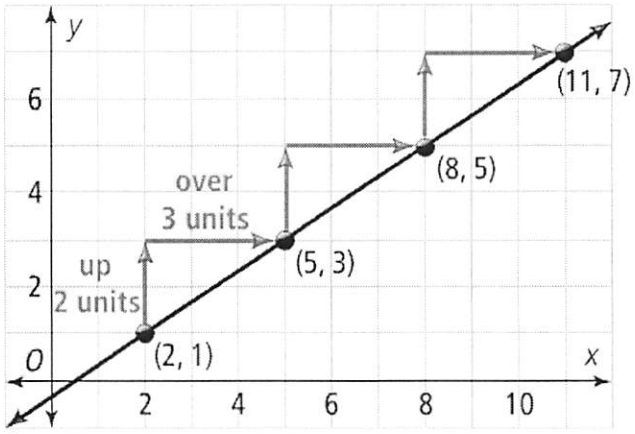
A ***slope*** of a line is a ratio that compares a vertical change to the corresponding horizontal change. You can also describe slope as a rate of change. A ***rate of change*** is a comparison between two quantities that are changing.

$$\text{slope (rate of change)} = \frac{\text{vertical change}}{\text{horizontal change}} = \frac{\Delta y}{\Delta x}$$

Consider the following set of ordered pairs.

{(2, 1), (5, 3), (8, 5), (11, 7)}

x	y
2	1
5	3
8	5
11	7



You can find the rate of change from a table by finding the change in the inputs and the change in the outputs.

$$\text{rate of change} = \frac{\text{change in output}}{\text{change in input}}$$

Does the table represent a linear function?

Input	Output
1	5
2	8
3	11
4	14
5	17

1, 1, 1, 1 (input changes) 3, 3, 3, 3 (output changes)

$$\text{rate of change} = \frac{\text{change in output}}{\text{change in input}} = \frac{3}{1}$$

EXAMPLES

Does the relation defined by each table represent a linear function? Explain.

a.

Input	Output
0	2
1	4
2	7
3	8
4	10

b.

Input	Output
0	0
3	1
6	3
9	6
12	10

Is the relation, shown in the table, a function? And if so, is it a linear function?

Input	Output
1	10
2	13
3	16
4	19
5	22

I THINK I GOT IT?

1. Does the relation defined by the table represent a linear function? Explain.

Input	Output
−10	8
−5	5
0	2
5	−1
10	−4

I GOT IT!

2. Is the relation, shown in the table, a function? And if so, is it a linear function? Explain.

Input (x)	Output (y)
0	3
1	5
2	8
3	12
4	17

ANSWERS: 1) Yes the rate of change is, $\frac{\Delta y}{\Delta x} = \frac{-3}{5}$. 2) Yes, it is a function. Each input has exactly one output. No, it is not a linear function because it does not have a constant rate of change.

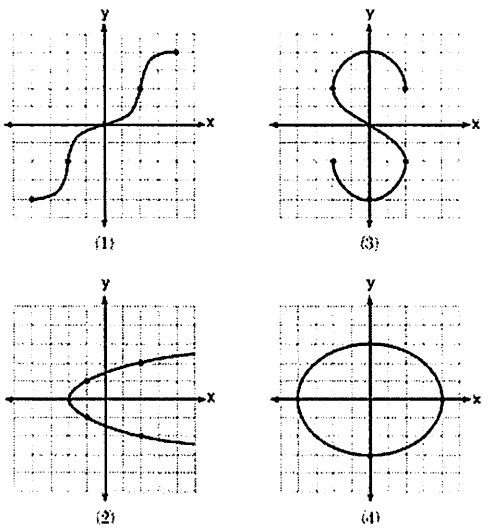
PRACTICE

1. a. Create a mapping diagram for the following set of ordered pairs. Is the relation a function?

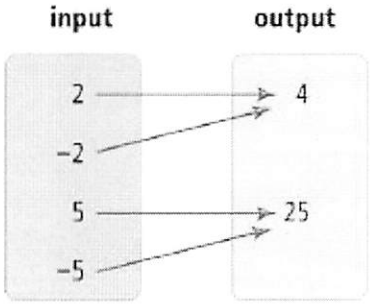
$$\{(1, -3),\ (2, -4),\ (3, -5),\ (4, -6),\ (4, -7)\}$$

b. Is the relation a linear function? (hint: make a table.)

2. Which graph is a function?



3. Write a relation that is represented by the mapping diagram. Is it a function?



4. Is the function a linear function? Explain.

x	y
-4	-6
-2	-4
0	-2
2	0
4	2

5. Which table(s) represent a linear function? For each table that is a linear function, state the rate of change.

A.

x	y
0	0
1	3
2	6
3	9

B.

x	y
0	0
1	-3
2	-6
3	-9

C.

x	y
-3	6
-2	2
-1	1
0	0

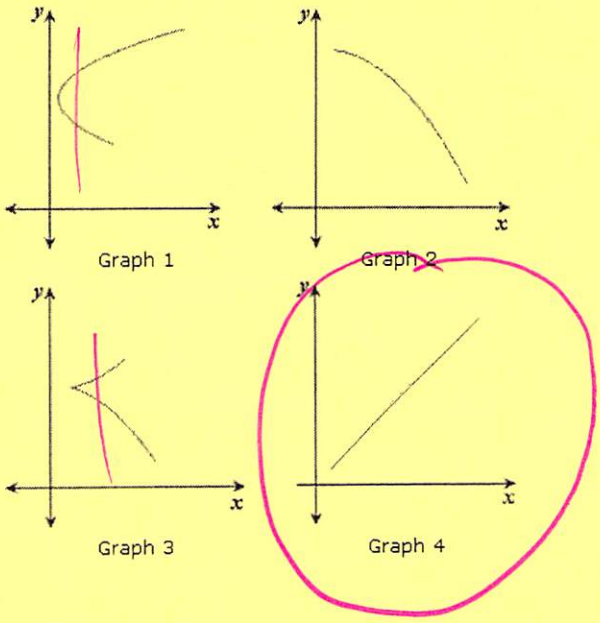
Unit Intro to Functions

Day 5
Linear Functions Day 1

I can . . .

. . . determine if a function is linear by determining if it has a rate of change.

Which graph is linear?



Which equation is linear?

1. $f(x) = \frac{2}{3}x + 4$

2. $g(x) = x^2 + 3x - 28$

3. $h(x) = |-5x|$

Which table is linear?

Input (x)	Output (y)
0	0
1	-3
2	-4
3	-3
4	0

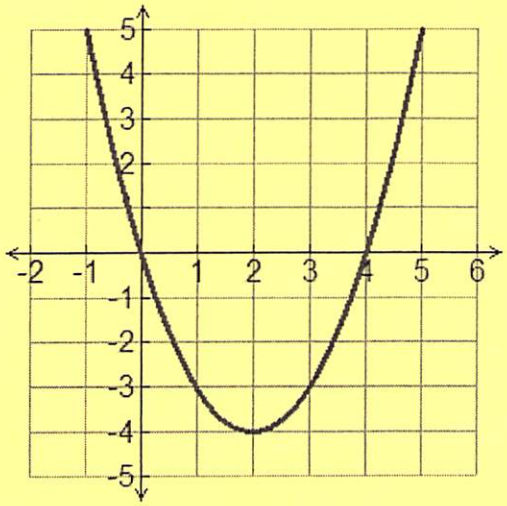
Input (x)	Output (y)
-1	9
0	5
1	1
2	-3
3	-7

+1 +1 +1 +1 -4 -4 -4

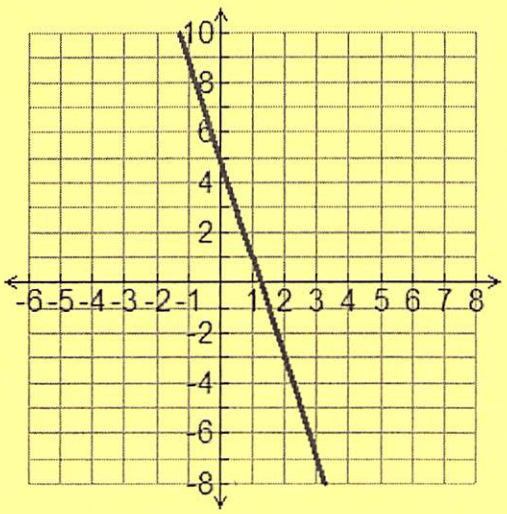
Input (x)	Output (y)
0	1
1	2
2	4
3	8
4	16

Which table is linear?

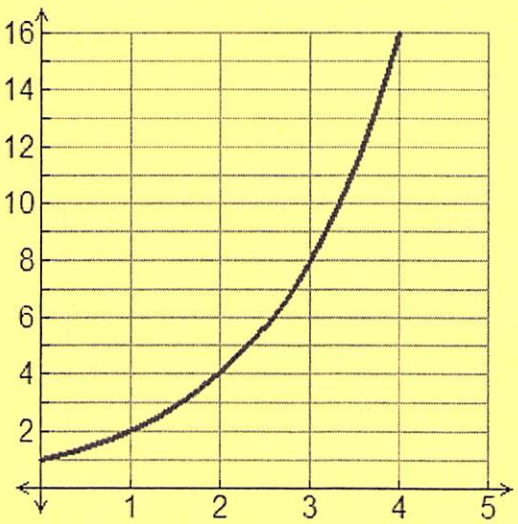
Input (x)	Output (y)
0	0
1	-3
2	-4
3	-3
4	0



Input (x)	Output (y)
-1	9
0	5
1	1
2	-3
3	-7



Input (x)	Output (y)
0	1
1	2
2	4
3	8
4	16



A **linear function** is a function that has a constant rate of change. Its graph is a straight line.

A ***slope*** of a line is a ratio that compares a vertical change to the corresponding horizontal change. You can also describe slope as a rate of change. A ***rate of change*** is a comparison between two quantities that are changing.

$$\text{slope (rate of change)} = \frac{\text{vertical change}}{\text{horizontal change}} = \frac{\Delta y}{\Delta x}$$

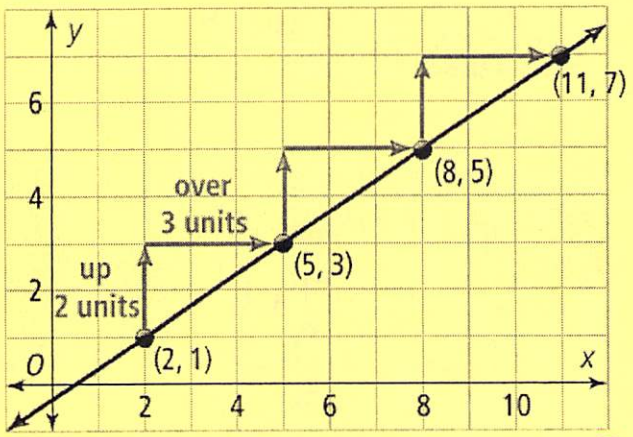
Consider the following set of ordered pairs.

$\{(2, 1), (5, 3), (8, 5), (11, 7)\}$

x	y
2	1
5	3
8	5
11	7

+3, +3, +3 (changes in x) and +2, +2, +2 (changes in y)

$\frac{2}{3}$



rate of change = $\frac{2}{3}$

You can find the rate of change from a table by finding the change in the inputs and the change in the outputs.

$$\text{rate of change} = \frac{\text{change in output}}{\text{change in input}}$$

Does the table represent a linear function?

Input	Output
1	5
2	8
3	11
4	14
5	17

1, 1, 1, 1 (changes in Input) and 3, 3, 3, 3 (changes in Output)

$$\text{rate of change} = \frac{\text{change in output}}{\text{change in input}} = \frac{3}{1}$$

EXAMPLES

Does the relation defined by each table represent a linear function? Explain.

a.

Input	Output	
0	2	
1	4	+2
2	7	+3
3	8	+1
4	10	+2
		+1
		+1
		+1
		+1

No, there is not a constant rate of change.

b.

Input	Output	
0	0	
3	1	+1
6	3	+2
9	6	+3
12	10	+4
		+3
		+3
		+3
		+3

Is the relation, shown in the table, a function? And if so, is it a linear function?

X	Y
Input	Output
1	10
2	13
3	16
4	19
5	22

+1 +1 +1 +1 | +3 +3 +3 +3

Yes this is a function because every input has one output.

Yes, this is a linear function because there is a constant rate of change $= \frac{3}{1}$

I THINK I GOT IT?

1. Does the relation defined by the table represent a linear function? Explain.

Input	Output
−10	8
−5	5
0	2
5	−1
10	−4

+5 +5 +5 +5 | −3 −3 −3 −3

Yes, because there is a constant rate of change = $\frac{-3}{5}$

I GOT IT!

2. Is the relation, shown in the table, a function? And if so, is it a linear function? Explain.

Input (x)	Output (y)
0	3
1	5
2	8
3	12
4	17

+1 +1 +1 +1 | +2 +3 +4 +5

Function: ?

Yes, because every input has one output

Linear Function: ?

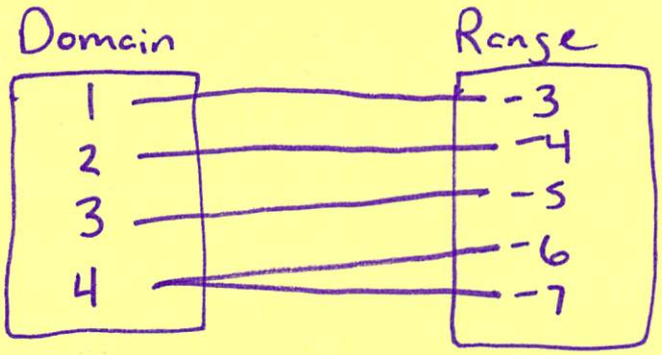
No, it does not have a constant rate of change

ANSWERS: 1) Yes the rate of change is, $\frac{\Delta y}{\Delta x} = \frac{-3}{5}$. 2) Yes, it is a function. Each input has exactly one output. No, it is not a linear function because it does not have a constant rate of change.

PRACTICE

1. a. Create a mapping diagram for the following set of ordered pairs. Is the relation a function?

{(1, -3), (2, -4), (3, -5), (4, -6), (4, -7)}

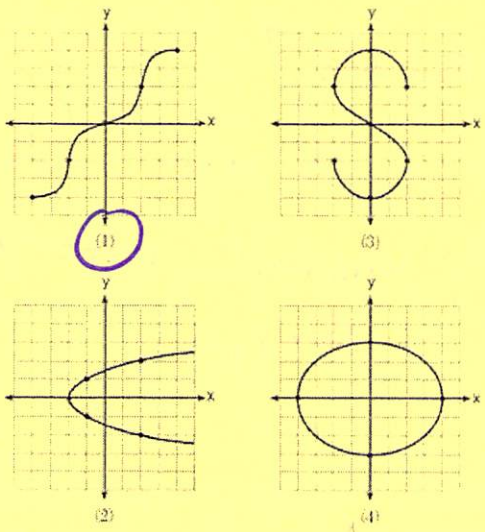


No!

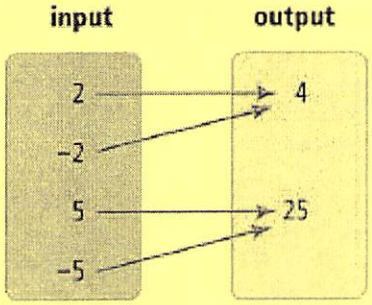
b. Is the relation a linear function? (hint: make a table.)

No, its not even a function!

2. Which graph is a function?



3. Write a relation that is represented by the mapping diagram. Is it a function?



(2, 4)
(-2, 4)
(5, 25)
(-5, 25)

Yes! because every input has 1 output

4. Is the function a linear function? Explain.

x	y
-4	-6
-2	-4
0	-2
2	0
4	2

+2, +2, +2, +2 (x) | +2, +2, +2, +2 (y)

Yes, because there is a constant slope

$\frac{2}{2} = 1$

5. Which table(s) represent a linear function? For each table that is a linear function, state the rate of change.

A.

x	y
0	0
1	3
2	6
3	9

+1, +1, +1 (x) | +3, +3, +3 (y)

Yes

Rate of Change $\frac{3}{1}$

B.

x	y
0	0
1	-3
2	-6
3	-9

+1, +1, +1 (x) | -3, -3, -3 (y)

Yes

Rate of Change $\frac{-3}{1}$

C.

x	y
-3	6
-2	2
-1	1
0	0

+1, +1, +1 (x) | -4, -1, -1 (y)

No!