

# Linear and Nonlinear Functions

## Identify Linear and Nonlinear Functions

In a previous lesson, you learned that **linear functions** have graphs that are **straight lines**. This is because the **rate of change between any two data points** is a **constant**. **Nonlinear functions** are functions whose **rates of change are not constant**. Therefore, their **graphs are not straight lines**.

### Examples



Determine whether each table represents a **linear** or **nonlinear** function. Explain.

1.

x	y
2	50
4	35
6	20
8	5

+2 (between x values), -15 (between y values)

As x increases by 2, y decreases by 15 each time. The **rate of change is constant**, so this function is **linear**.

2.

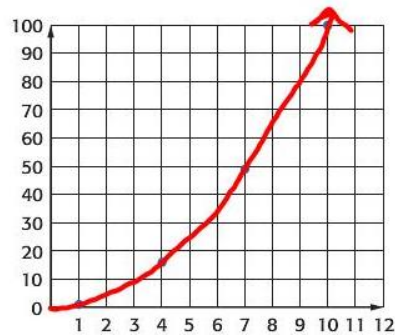
x	y
1	1
4	16
7	49
10	100

+3 (between x values), +15, +33, +51 (between y values)

As x increases by 3, y increases by a **greater amount each time**. The **rate of change is not a constant**, so this function is **nonlinear**.

Check

Graph the points on a coordinate plane.



The points do not fall in a line. The function is nonlinear. ✓

a. **Linear; the rate of change is constant; as x increases by 5, y decreases by 4.**

b. **Nonlinear; as x increases by 2, y increases by a greater amount each time.**

**Got It?** Do these problems to find out.

Determine whether each table represents a **linear** or **nonlinear** function. Explain.

a.

x	0	5	10	15
y	20	16	12	8

b.

x	0	2	4	6
y	0	2	8	18

**3. Use the table to determine whether the minimum number of Calories a tiger cub should eat is a linear function of its age in weeks.**

Age (weeks)	Minimum Calorie Intake
1	825
2	1,000
3	1,185
4	1,320
5	1,420

Use the table to find the rates of change.

$$1,000 - 825 = 175$$

$$1,185 - 1,000 = 185$$

$$1,320 - 1,185 = 135$$

$$1,420 - 1,320 = 100$$

The rates of change are not the same. Therefore, this function is nonlinear.

**Check** Graph the data to verify the ordered pairs do not lie on a straight line.



**Example**



**4. A square has a side length of  $s$  inches. The area of the square is a function of the side length. Does this situation represent a linear or nonlinear function? Explain.**

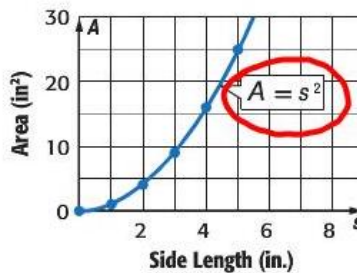
Make a table to show the area of the square for side lengths of 1, 2, 3, 4, and 5 inches.



Side Length (in.)	1	2	3	4	5
Area (in <sup>2</sup> )	1	4	9	16	25

$$y = x^2$$

Graph the function. The function is not linear because the points (1, 1), (2, 4), (3, 9), (4, 16), and (5, 25) are not on a straight line.



d. linear because there is a constant rate of change.  $CROC = 4$

**Got It?** Do this problem to find out.

d. A square has a side length of  $s$  inches. The perimeter of the square is a function of the side length. Does this situation represent a linear or nonlinear function? Explain.

$$P = 4s$$

$s$	$P$
1	4
2	8
3	12
4	16

**Guided Practice**



Determine whether each table represents a *linear* or *nonlinear* function.

Explain.