



Constant Rate of Change (page 1)

Relationships that have straight-line graphs are *called linear relationships*. The rate of change between any two points in a linear relationship is the same or *constant*. A linear relationship has a **constant rate of change**.

Example: Camille downloads three songs from the Internet each minute. The table below shows this. Note that as the number of songs increases by 3, the time in minutes increases by 1.

Time (minutes)	0	1	2	3	4
# of Songs	0	3	6	9	12



The **rate of change** is 3 songs per minute or $\frac{3}{1}$.

Example: Use the table to determine if the relationship between degrees Fahrenheit and degrees Celsius is linear.

	Degrees Celsius	Degrees Fahrenheit	
+5	0	32	+9
+5	5	41	+9
+5	10	50	+9
+5	15	59	+9
+5	20	68	+9

constant rate of change:

$$\frac{\text{change in } ^\circ F}{\text{change in } ^\circ C} = \frac{9}{5}$$

Since the rate of change is constant, this is a linear relationship.

Example: Use the table to determine if the cooling of water represents a linear relationship.

Cooling Water	
Time (min)	Temperature ($^\circ F$)
5	95
10	90
15	86
20	82

The rate of change from 5 to 10 minutes is $\frac{90-95}{10-5} = \frac{-5}{5} = -1^\circ F$

The rate of change from 10 to 15 minutes is $\frac{86-90}{15-10} = \frac{-4}{5}$ or $-0.8^\circ F$

The relationship is **NOT** linear since the rate of change is not constant.

Example: The altitude of a certain airplane, already in the air, is shown after a few minutes in the table below. Is the relationship linear? If so, find the constant rate of change.

Time (min)	2	4	6	8
Altitude (ft)	3500	3000	2500	2000

The relationship is linear.
 $\frac{3000-3500}{4-2} = \frac{-500}{2}$ or -250 ft / min

Constant Rate of Change (page 2)

For the tables below, determine whether the relationship between the two quantities shown is linear. If it is linear, determine the constant rate of change. Show your work.

1.

Cost of Electricity to Run Computer	
Time (h)	Cost (1¢)
5	15
10	30
15	45
20	60

2.

Italian Dressing Recipe				
Oil (cups)	2	4	6	8
Vinegar (cups)	$\frac{3}{4}$	$1\frac{1}{2}$	$2\frac{1}{4}$	3

3.

Distance Traveled by Falling Object				
Time (sec)	1	2	3	4
Distance (m)	4.8	19.5	44.3	78.5

4. 4.

Cost of Amusement Ride	
# of people	Total cost (\$)
5	35
8	56
10	70
20	140

Match the table with its rate of change.

Time (min)	1	2	3
Distance (ft)	15	30	45

0.8 ft/min

Time (min)	4	6	8
Height (ft)	2	2.5	3

0.25 ft/min

Time (min)	10	20	30
Altitude (ft)	152	160	168

2.5 ft/min

Time (min)	8	10	16
Depth (ft)	20	25	40

15 ft/min