5.2 Linear Relations

Math 10   **Linear Relations**

Relations can be presented in various ways:

| **Words**	**Equation**	**Ordered Pairs**
Three times the length of your ear, e, is equal to the length of your face, f, (from chin to hairline).	$f = 3e$	(4, 12), (4.5, 13.5) (5, 15), (5.5, 16.5) (6, 18), (6.5, 19.5)

Table of Values   **Graph**

Ear Length, e (cm)	Face Length, f (cm)
4	12
4.5	13.5
5	15
5.5	16.5
6	18
6.5	19.5

Face Length Compared to Ear Length
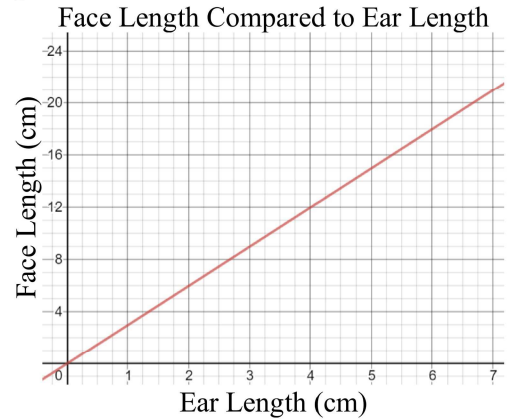
Linear and Non-linear Relations

Linear relations have graphs that are straight lines. *linear*
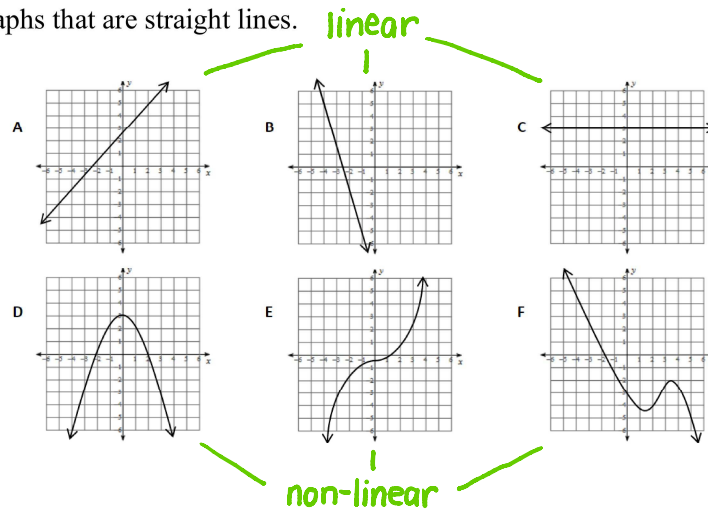
non-linear

If the change in each variable in a table of values is constant, then the relation in linear.

x	y
−1	1
0	4
1	7
2	10

+1 ⟩ +3
+1 ⟩ +3
+1 ⟩ +3

linear

x	Y
5	3
4	5
3	7
2	9

−1 ⟩ +2
−1 ⟩ +2
−1 ⟩ +2

linear

x	y
1	1
2	4
3	9
4	16

+1 ⟩ +3
+1 ⟩ +5
+1 ⟩ +7

non-linear

The equation of a linear relation has one or two variables and its degree is 1.

Linear Relations

$x = 7$

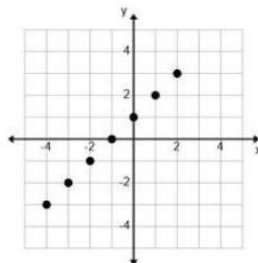$3m + 2n = -12$

$y = -\frac{2}{3}x + 5$

Non-Linear Relations

$2x + y^2 = 6$

$h = k^3$
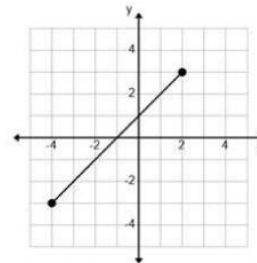
$xy = 3$

$\qquad \llcorner$ degree is 2

$y = \frac{1}{x}$

Discrete or Continuous Data

A graph of discrete data can only show points because the values in between them have no meaning. A graph of continuous data is a solid line or curve.

discrete data   continuous data

The graph of the cost based on the number of people attending an event should only show points because it does not make sense to have anything other than a whole number of people. A graph showing the distance travelled over time should be a solid line or curve since time and distance are continuous.

Independent or Dependent Variables

In a relation with two variables, one is the independent variable and the other is the dependent variable.

In a table of values, the independent variable is in the first column, or top row.
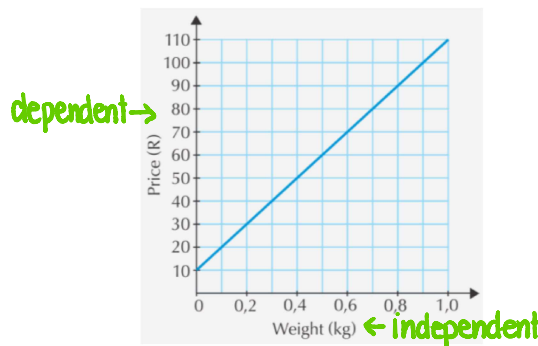
independent ⌐ dependent

"input"

x	$y = 3x + 4$
−1	1
0	4
1	7
2	10

"output"

independent

x	−1	0	1	2
y	1	4	7	10

dependent

On a graph, the independent variable is on the horizontal axis (often known as the *x*-axis).

dependent →

← independent

Math 10   **Linear Relations**

Example 1: At a fireworks display, 20 firework shells are sent off each minute.

a) Is the relationship between the total number of fireworks and the duration of the event linear or non-linear? How do you know?

The relationship is linear the number of fireworks set off each minute is constant.

b) Assign a variable to represent each quantity in the relation. What variable is the dependent variable? Which is the independent variable?
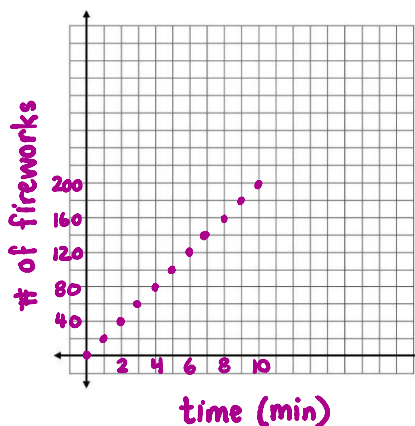
x : time
y : # of fireworks   or   *t : time*
                                          f : # of fireworks

c) Create a table of values for this relation. What are appropriate values for the independent variable?

x	y
1	20
2	40
3	60
4	80
5	100
6	120
7	140
8	160
9	180
10	200

d) Create a graph for the relation. Are the data discrete or continuous?

Example 2: Determine whether each relation is linear. Justify your answer.

a) the relationship between the cost to rent a dance hall and the number of people attending the dance, if the hall charges $200 plus $5 for each person who attends
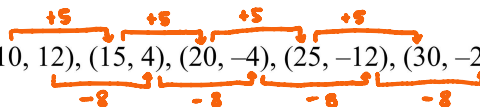
linear – cost increases at a constant rate per person

b) the relation described by the equation $x^2 + y^2 = 25$

non-linear – equation is not degree 1

c) the relation described by the set of ordered pairs {(10, 12), (15, 4), (20, –4), (25, –12), (30, –20)}

linear – change in value is constant for each variable

Assignment: p.119 #2 – 4, 6, 9