

3.2 Linear Functions (determining if linear)

Bellwork

Exponent Practice - Simplify each.

1. $3x^3y^{-4}x^{-3}$

$$3y^{-4} = \frac{3}{y^4}$$

2. $x^{-1}y^0x^5y^{-7}$

$$x^4y^{-6} = \frac{x^4}{y^6}$$

3. $4x^{-2}y^3$

$$\frac{4y^3}{x^2}$$

4. $8x^{-1}y^{-4} \cdot 2x^3y^{-5}$

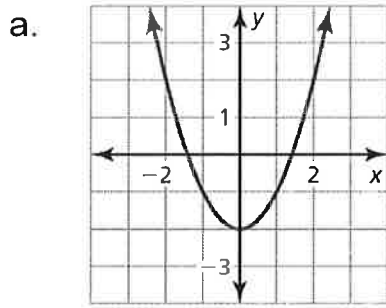
$$16x^2y^{-9} = \frac{16x^2}{y^9}$$

Rate of Change: $\frac{\text{difference of } y}{\text{difference of } x} = \frac{\Delta y}{\Delta x}$

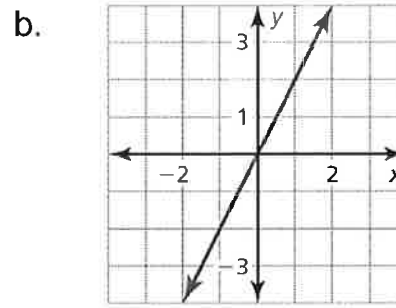
Linear Function: function with a constant rate of change (will give you a straight line)

Nonlinear Function: a function that does not have a constant rate of change

Does the graph represent a *linear* or *nonlinear* function? Explain.



nonlinear,
not a constant
rate of change



linear, constant
rate of change

Does the table represent a *linear* or *nonlinear* function? Explain.

a.

x	3	6	9	12
y	36	30	24	18

Handwritten annotations: +3 above 3, 6, 9; -6 below 3, 6, 9.

$$m = \frac{\Delta y}{\Delta x}$$

$$\frac{-6}{3} \quad \frac{-6}{3} \quad \frac{-6}{3}$$

$m = -2$
linear

b.

x	1	3	5	7
y	2	9	20	35

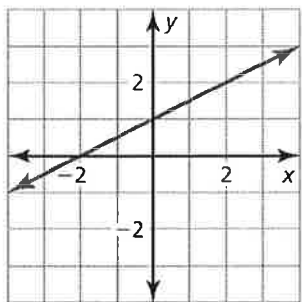
Handwritten annotations: +2 above 1, 3, 5; +7, +11, +15 below 1, 3, 5.

$$\frac{7}{2} \quad \frac{11}{2} \quad \frac{15}{2}$$

nonlinear,
not a constant
rate of change

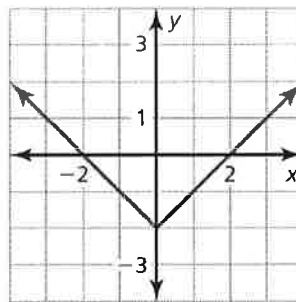
Does the graph or table represent a *linear* or *nonlinear* function? Explain.

1.



linear, constant
rate of change

2.



non linear, not
a constant rate
of change

Does the graph or table represent a *linear* or *nonlinear* function? Explain.

3.

x	0	1	2	3
y	3	5	7	9

$+1$ $+1$ $+1$

$+2$ $+2$ $+2$

$$\frac{2}{1} \quad \frac{2}{1} \quad \frac{2}{1}$$

$m = 2$
linear

4.

x	1	2	3	4
y	16	8	4	2

$+1$ $+1$ $+1$

-8 -4 -2

$$\frac{-8}{1} \quad \frac{-4}{1} \quad \frac{-2}{1}$$

nonlinear, not
a constant rate
of change

Linear Equations

To be a linear equation the following **MUST** be true:

- * x, y are NOT multiplied together
- * x, y have exponents of 1
- * x, y are NOT in the exponent
- * x, y are NOT in the denominator
- * x, y are not in a square root

Which of the following equations represent linear functions? Explain.

$$y = 3.8, y = \sqrt{x}, y = 3^x, y = \frac{2}{x}, y = 6(x-1), x^2 - y = 0$$

$$y = 3.8 \quad \text{yes}$$

$$y = \sqrt{x} \quad \text{no, has } \sqrt{\quad}$$

$$y = 3^x \quad \text{no, } x \text{ is in exponent}$$

$$y = \frac{2}{x} \quad \text{no, } x \text{ is in denominator}$$

$$y = 6(x-1) \quad \text{yes}$$

$$x^2 - y = 0 \quad \text{no, } x \text{ has exponent greater than 1}$$

Does the equation represent a *linear* or *nonlinear* function?
Explain.

3. $y = x + 9$

linear

4. $y = \frac{3x}{5}$

linear

5. $y = 5 - 2x^2$

nonlinear,
x has
exponent
greater than
1

Concept Summary

Representations of Functions

Words An output is 3 more than the input.

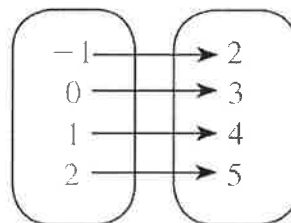
Equation $y = x + 3$

Input-Output Table

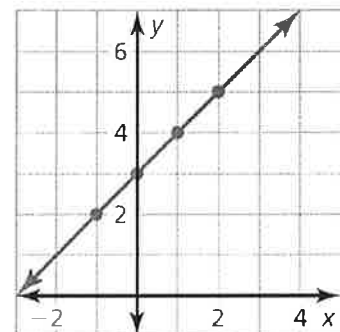
Input, x	Output, y
-1	2
0	3
1	4
2	5

Mapping Diagram

Input, x Output, y

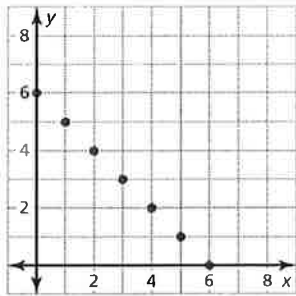


Graph



Write the domain and range of each relation.

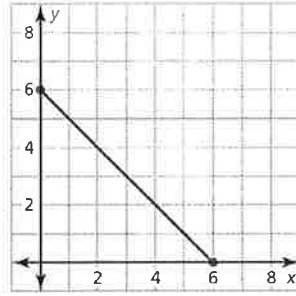
a.



$$D: \{0, 1, 2, 3, 4, 5, 6\}$$

$$R: \{0, 1, 2, 3, 4, 5, 6\}$$

b.

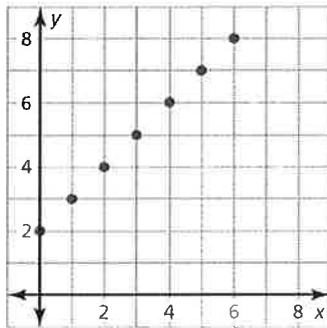


$$D: \{0 \leq x \leq 6\}$$

$$R: \{0 \leq y \leq 6\}$$

Write the domain and range of each relation.

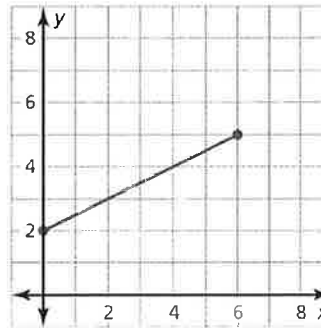
11.



$$D: \{0, 1, 2, 3, 4, 5, 6\}$$

$$R: \{2, 3, 4, 5, 6, 7, 8\}$$

12.



$$D: \{0 \leq x \leq 6\}$$

$$R: \{2 \leq y \leq 5\}$$

Homework

Pg. 117-120 #5 - 14, 18 - 24 even, 33, 51, 52