



MATH 140: WEEK-IN-REVIEW 7 (5.1)

**Problem 1** For each of the following, draw a number line representing the given information, and then write the equivalent interval notation.



$\Rightarrow [2, \infty)$



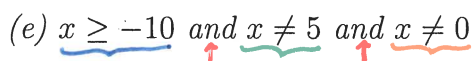
$\Rightarrow (-\infty, 96)$



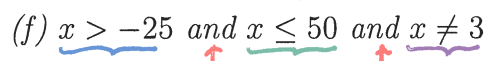
$\Rightarrow (-\infty, -8) \cup (-8, \infty)$



$\Rightarrow (4, 100]$



$\Rightarrow [-10, 0) \cup (0, 5) \cup (5, \infty)$



$\Rightarrow (-25, 3) \cup (3, 50]$



$\Rightarrow (-\infty, 0) \cup [1, \infty)$

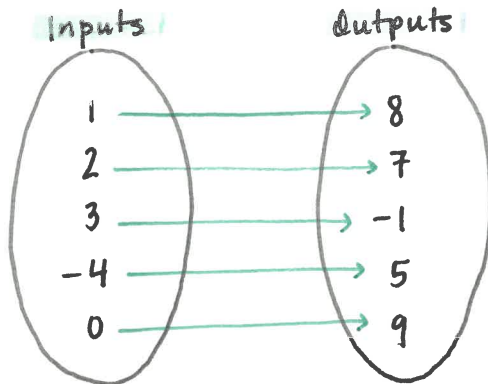
$\circ \rightarrow ( \text{ or } )$  : DON'T INCLUDE ENDPOINT

$\bullet \rightarrow [ \text{ or } ]$  : INCLUDE ENDPOINT



**Problem 2** State the inputs and outputs of the given relation. Then, determine whether or not the relation is a function.

(a)  $\{(1, 8), (2, 7), (3, -1), (-4, 5), (0, 9)\}$

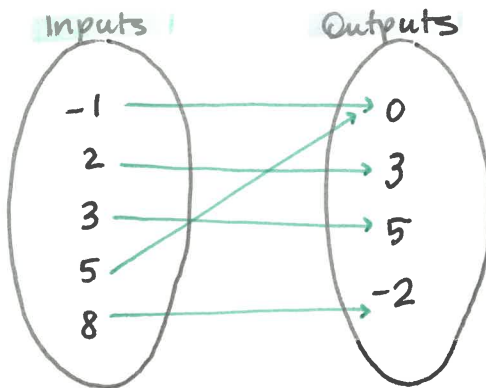


A function is a relation that assigns a single element in the set of outputs to each element in the set of inputs.

Relation is a function.

(each input goes to exactly one output)

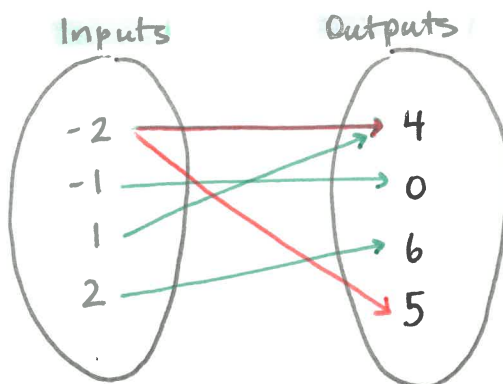
(b)  $\{(-1, 0), (2, 3), (3, 5), (5, 0), (8, -2)\}$



Relation is a function.

(each input goes to exactly one output)

(c)  $\{(-2, 4), (-1, 0), (1, 4), (2, 6), (-2, 5)\}$



Relation is **NOT** a function.

(the input of -2 goes to more than one output: 4 and 5)



**Problem 3** Determine whether or not each of the following graphs represents a function. If the graph is that of a function, write the domain and range of the function, using interval notation.

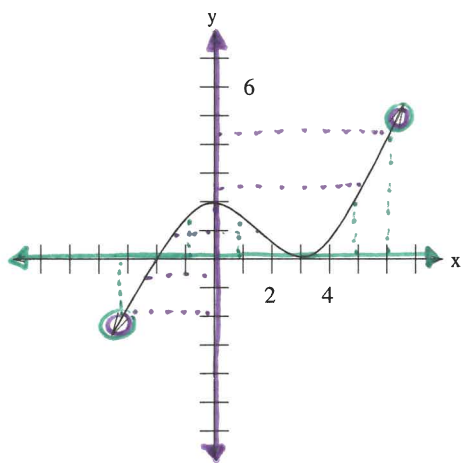
Vertical Line Test (V.L.T.) ← used to determine if a graph is a function

A graph of points in the plane represents  $y$  as a function of  $x$  if and only if no two points lie on the same vertical line.

Domain: the set of inputs of a function (x-values)

Range: the set of outputs of a function (y-values)

(a)

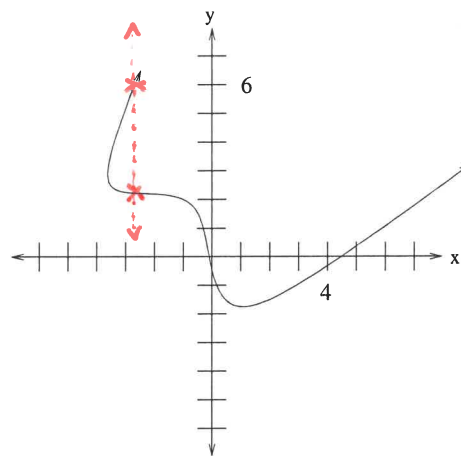


Passes VLT  $\Rightarrow$  FUNCTION

Domain:  $(-\infty, \infty)$

Range:  $(-\infty, \infty)$

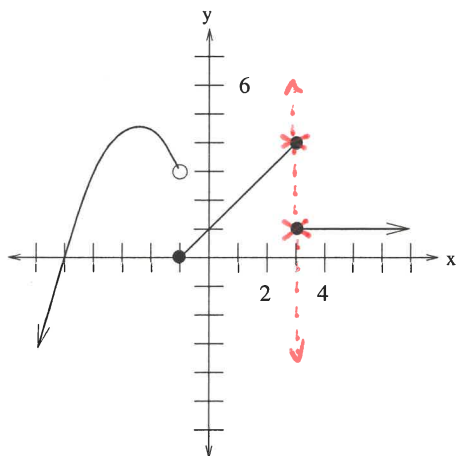
(b)



Fails VLT  $\Rightarrow$  NOT a FUNCTION

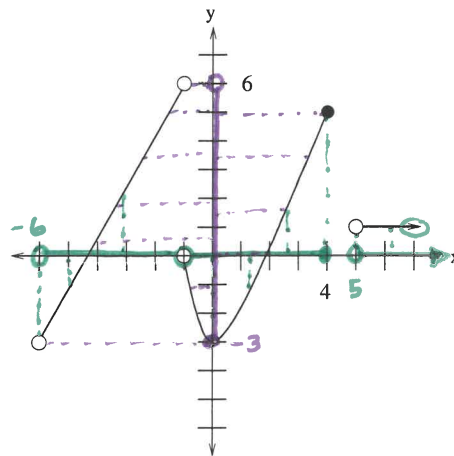


(c)



Fails VLT  
⇒ NOT a FUNCTION

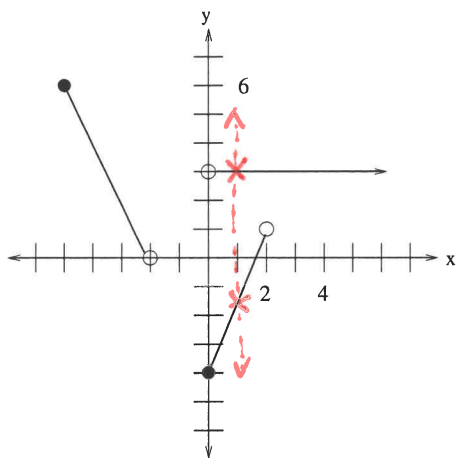
(d)



Passes VLT ⇒ FUNCTION

Domain:  $(-6, -1) \cup (-1, 4] \cup (5, \infty)$   
Range:  $[-3, 6)$

(e)



Fails VLT  
⇒ NOT a FUNCTION



**Problem 4**

(a) Use the function notation  $h(x) = y$  to represent the function information given in each row of the table below.

(x) Domain	(y) Range	
1	2	→ $h(1) = 2$
3	5	→ $h(3) = 5$
6	7	→ $h(6) = 7$

(b) Use the function notation  $m(x) = y$  to represent the function information given in each row of the table below.

(x) Domain	(y) Range	
-3	-8	→ $m(-3) = -8$
-1	0	→ $m(-1) = 0$
0	4	→ $m(0) = 4$



**Problem 5** If  $g(x) = 7x - 5$ , evaluate and fully expand and simplify each of the following, using proper mathematical notation.

$$(a) g(0) = 7(0) - 5 = 0 - 5 = \boxed{-5}$$

$$(b) g(3) = 7(3) - 5 = 21 - 5 = \boxed{16}$$

$$(c) g(-3) = 7(-3) - 5 = -21 - 5 = \boxed{-26}$$

$$(d) g(a) = 7(a) - 5 = \boxed{7a - 5}$$

$$(e) 3g(a) = 3[7(a) - 5] = \boxed{21a - 15}$$

$$(f) g(3a) = 7(3a) - 5 = \boxed{21a - 5}$$

$$(g) g(a) + 2 = [7(a) - 5] + 2 = 7a - 5 + 2 = \boxed{7a - 3}$$

$$(h) g(a + 2) = 7(a + 2) - 5 = 7a + 14 - 5 = \boxed{7a + 9}$$

$$\begin{aligned} (i) g(a) + g(2) &= [7(a) - 5] + [7(2) - 5] \\ &= 7a - 5 + 14 - 5 \\ &= 7a + 9 - 5 = \boxed{7a + 4} \end{aligned}$$



**Problem 6** If  $k(x) = 5x^2 - 3x + 1$ , evaluate and fully expand and simplify each of the following, using proper mathematical notation.

$$\begin{aligned}(a) k(0) &= 5(0)^2 - 3(0) + 1 \\ &= 5(0) - 0 + 1 \\ &= 0 + 1 \\ &= \boxed{1}\end{aligned}$$

$$\begin{aligned}(b) k(-2) &= 5(-2)^2 - 3(-2) + 1 \\ &= 5(4) + 6 + 1 \\ &= 20 + 7 \\ &= \boxed{27}\end{aligned}$$

$$\begin{aligned}(c) k(\sqrt{3}) &= 5(\sqrt{3})^2 - 3(\sqrt{3}) + 1 \\ &= 5(3) - 3\sqrt{3} + 1 \\ &= 15 - 3\sqrt{3} + 1 \\ &= \boxed{16 - 3\sqrt{3}}\end{aligned}$$

$$\begin{aligned}(d) k(a) &= 5(a)^2 - 3(a) + 1 \\ &= \boxed{5a^2 - 3a + 1}\end{aligned}$$



$$k(x) = 5x^2 - 3x + 1$$

(e)  $k(3a + 1)$

$$\begin{aligned} &= 5(3a+1)^2 - 3(3a+1) + 1 \\ &= 5(3a+1)(3a+1) - 9a - 3 + 1 \\ &= 5[9a^2 + 3a + 3a + 1] - 9a - 2 \\ &= 5(9a^2 + 6a + 1) - 9a - 2 \\ &= 45a^2 + 30a + 5 - 9a - 2 \\ &= 45a^2 + 21a + 3 \\ &\quad \text{or} \\ &= 3(15a^2 + 7a + 1) \end{aligned}$$

(f)  $k(x + h)$

$$\begin{aligned} &= 5(x+h)^2 - 3(x+h) + 1 \\ &= 5(x+h)(x+h) - 3x - 3h + 1 \\ &= 5[x^2 + xh + hx + h^2] - 3x - 3h + 1 \\ &= 5(x^2 + 2xh + h^2) - 3x - 3h + 1 \\ &= 5x^2 + 10xh + 5h^2 - 3x - 3h + 1 \end{aligned}$$

$$\begin{aligned} (g) \quad k(x+h) - k(x) &= [5x^2 + 10xh + 5h^2 - 3x - 3h + 1] - [5x^2 - 3x + 1] \\ &= 10xh + 5h^2 - 3h \\ &\quad \text{or} \\ &= h(10x + 5h - 3) \end{aligned}$$





**Problem 7** Given the graph of the function  $f(x)$  below to the right, determine the following:

(a) Domain of  $f(x)$ :

$$(-\infty, 7]$$

(b) Range of  $f(x)$ :

$$[-3, \infty)$$

(c)  $f(1) = \boxed{-1}$

(d)  $f(-2) = \boxed{0}$

(e) Where  $f(x) = -1$      At  $x = -1, 1, \text{ and } 6$   
 $\underbrace{\hspace{2cm}}_{y=-1}$

(f) Where  $f(x) = 0$      At  $x = -4, -2, 2, \text{ and } 5$   
 $\underbrace{\hspace{2cm}}_{y=0}$   
 (touches x-axis)

