

Key

**Domain & Range of Functions**

Students will be able to identify the domain and range of functions.

Precalculus 11: Function

Honors Precalculus/  
Precalculus

**Domain:** The set of all possible "x-values" which will make the function work. INPUT

**Range:** The resulting "y-values" after substituting all the possible x-values. OUTPUT

*Identifying the Domain & Range of a Function Algebraically*

Domain

The domain of any function is the set of all real numbers unless the function includes:

- Division with a variable. Denominators  $\neq 0$ .
- Finding the even root of a number.  $\sqrt{x}$ ,  $\sqrt[4]{x}$ ,  $\sqrt[6]{x}$  etc.
- Logarithms. You can only take the log of a positive number.
- Applications with real life restrictions such as time. Time is never negative.

**Example 1:** Find the domain of each function.

a)  $f(x) = 3x^2 - 2$

all real numbers  $\mathbb{R}$   
 $(-\infty, \infty)$

b)  $f(x) = \frac{2x}{x^2 - x - 6}$  ← division with a variable  
 $x^2 - x - 6 = (x - 3)(x + 2) \rightarrow x \neq 3$  or  $-2$   
 all real numbers except  $-2$  and  $3$   
 $(-\infty, -2) \cup (-2, 3) \cup (3, \infty)$

c)  $f(x) = \sqrt{x - 9}$  ← even root  
 $x - 9 \geq 0 \quad x \geq 9$   
 $[9, \infty)$

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d)  $f(x) = \frac{2x}{\sqrt{x-9}}$  ← division with a variable + square root  
 $x - 9 > 0$  (cannot = 0)  
 $x > 9$   
 $(9, \infty)$

e)  $f(x) = \frac{\sqrt{x-4}}{x^2-25}$  ← even root } 2 considerations  
 ← division by variable }  
 $x - 4 \geq 0$   $x \geq 4$   
 $x^2 - 25 = 0$   $x^2 = 25$   $x = \pm 5$   
 $(4, 5) \cup (5, \infty)$

f)  $f(x) = \log 2x$

$x \geq 0$   
 $(0, \infty)$

You Try:

g)  $f(x) = \frac{x+7}{x^2-49}$  (Division by variable)  
 $x^2 - 49 = 0$   $x^2 = 49$   $x \neq \pm 7$   
 $(-\infty, -7) \cup (-7, 7) \cup (7, \infty)$

h)  $f(x) = \sqrt{2x-8}$  (even root)

$2x - 8 \geq 0$   
 $2x \geq 8$   
 $x \geq 4$   
 $[4, \infty)$

i)  $f(x) = \frac{1}{\sqrt{2x-6}}$  ← Division by variable + even root

$2x - 6 > 0$   
 $2x > 6$   
 $x > 3$   
 $(3, \infty)$

j)  $f(x) = \log(x-5)$

$x - 5 > 0$   $(5, \infty)$   
 $x > 5$

Domain and Range

Name: \_\_\_\_\_

Date: \_\_\_\_\_ Per. \_\_\_\_\_

Identify the domain of each function algebraically using interval notation.

1.  $f(d) = d + 3$

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

2.  $f(x) = 2x^2 + 4x - 6$

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

3.  $f(x) = \log(x + 2)$

$$\begin{aligned} x + 2 &> 0 \\ x &> -2 \end{aligned}$$

Domain:  $(-2, \infty)$

4.  $f(t) = \sqrt{9 - 3t}$

$$\begin{aligned} 9 - 3t &\geq 0 \\ 9 &\geq 3t \\ 3 &\geq t \end{aligned}$$

Domain:  $(-\infty, 3]$

5.  $f(x) = \frac{x-5}{2x+4}$

$$\begin{aligned} 2x + 4 &> 0 \\ 2x &> -4 \\ x &> -2 \end{aligned}$$

Domain:  $(-2, \infty)$

6.  $f(x) = \frac{2}{x^2 + 3x}$

$$x^2 + 3x > 0$$

$$x(x + 3) > 0$$

$$\begin{aligned} x &\neq 0 & x + 3 &\neq 0 \\ & & x &\neq -3 \end{aligned}$$

Domain:  $(-\infty, -3) \cup (-3, 0) \cup (0, \infty)$

$$7. f(r) = r + \frac{1}{r-1}$$

$$r-1 \neq 0$$

$$r \neq 1$$

$$\text{Domain: } (-\infty, 1) \cup (1, \infty)$$

$$8. f(w) = \frac{w+4}{w^2-16}$$

$$w^2 - 16 \neq 0$$

$$w^2 \neq 16$$

$$w \neq \pm 4$$

$$\text{Domain: } (-\infty, -4) \cup (-4, 4) \cup (4, \infty)$$

$$9. f(s) = \frac{s}{\sqrt{s+3}}$$

$$s+3 > 0$$

$$s > -3$$

$$\text{Domain: } (-3, \infty)$$

$$10. f(v) = \frac{\sqrt[3]{v-2}}{v} \leftarrow \text{not an even root}$$

$$v \neq 0$$

$$\text{Domain: } (-\infty, 0) \cup (0, \infty)$$

$$11. f(x) = \sqrt{x^2 - 2x - 8}$$

$$x^2 - 2x - 8 \geq 0$$

$$(x-4)(x+2) \geq 0$$

$$x \neq 4 \text{ or } -2$$

$$\text{Domain: } [4, \infty)$$

$$12. f(p) = \sqrt{\frac{p}{1+p}}$$

$$\frac{p}{1+p} \geq 0$$

$$p \neq -1$$

$$\text{Domain: } [0, \infty)$$

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### Range

To find the range of a function algebraically you must find the domain of the functions inverse.

### Identifying the Domain & Range of a Function Graphically

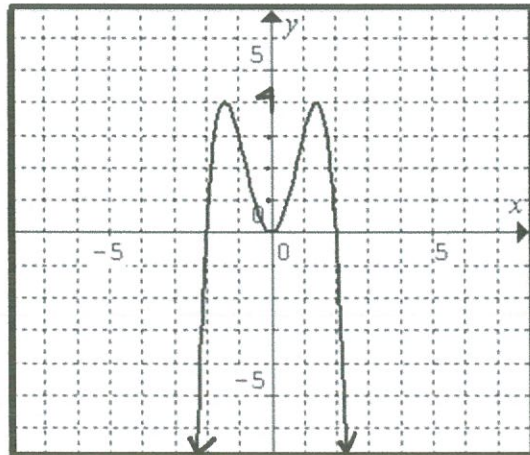
#### Domain

- Read the graph from left to right
- The domain will be all real numbers, unless there are breaks in the graph, points of discontinuity or the graphs are not continuous

#### Range

- Read the graph from bottom to top
- The Range will be all real numbers, unless there are breaks in the graph, points of discontinuity or the graphs are not continuous

**Example 2:** Find the domain and range of the graph of a function.



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

Range:  $(-\infty, 4]$

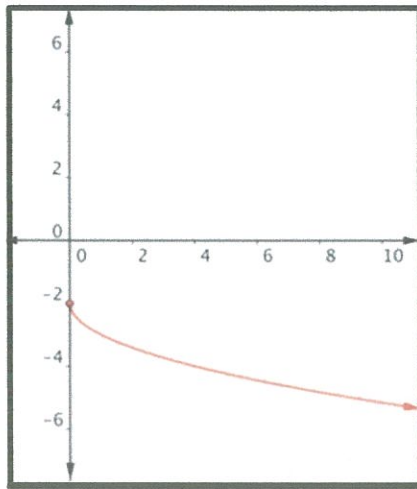
no bullets  
one  
more  
line



# Domain & Range of Functions

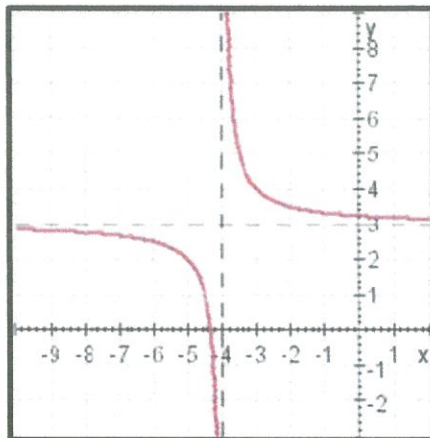
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Domain:  $[0, \infty)$

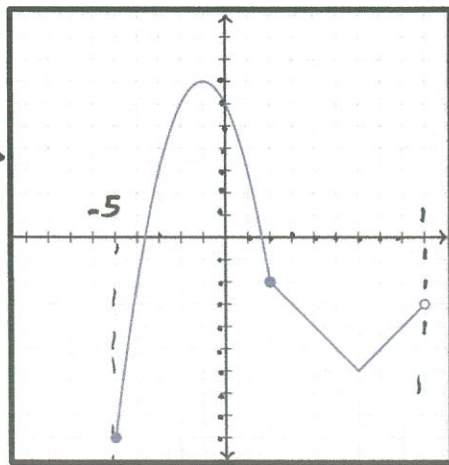
Range:  $(-\infty, -2]$



Domain:  $(-\infty, -4) \cup (-4, \infty)$

Range:  $(-\infty, 3) \cup (3, \infty)$

not continuous →



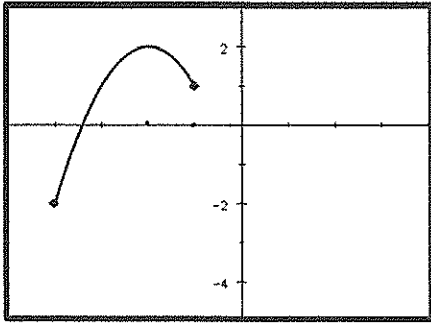
Domain:  $[-5, 9)$

Range:  $[-9, 7]$

why isn't -3 excluded from the range?

Identify the domain and range of the function using the graphs provided.

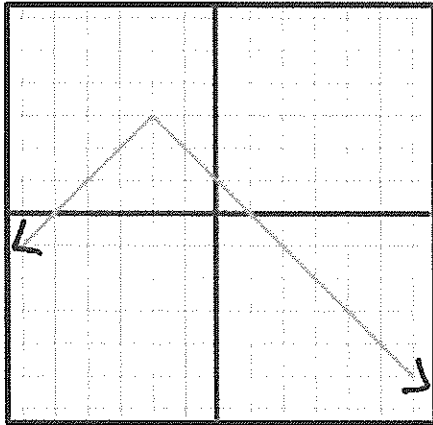
1.



Domain:  $[-4, -1]$

Range:  $[-2, 2]$

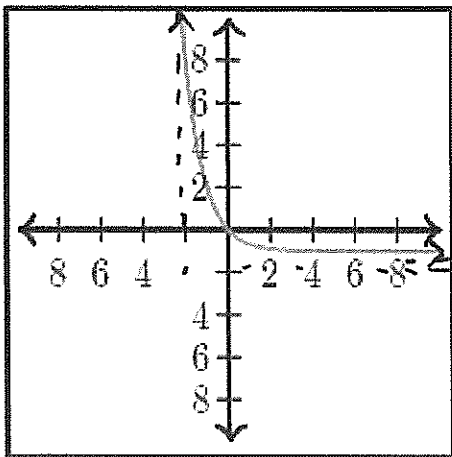
2.



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

Range:  $(-\infty, 3]$

3.

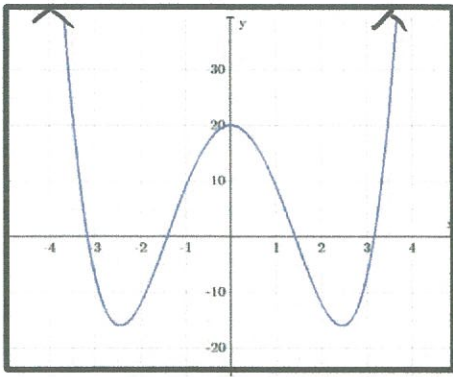


Domain:  $(-2, \infty)$

Range:  $(-\infty, 18]$

Debatable  
~~domain~~  
~~range~~

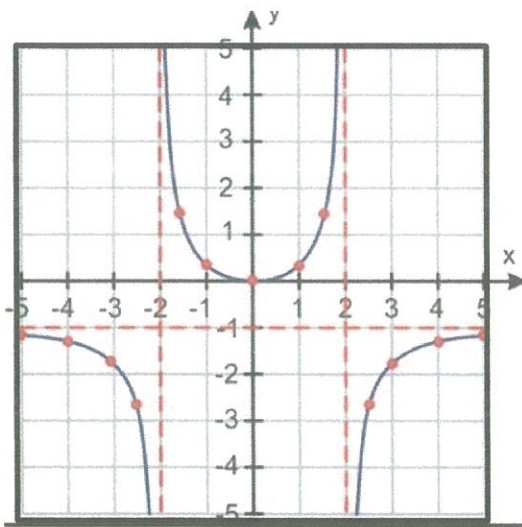
4.



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

Range:  $[-15, \infty)$

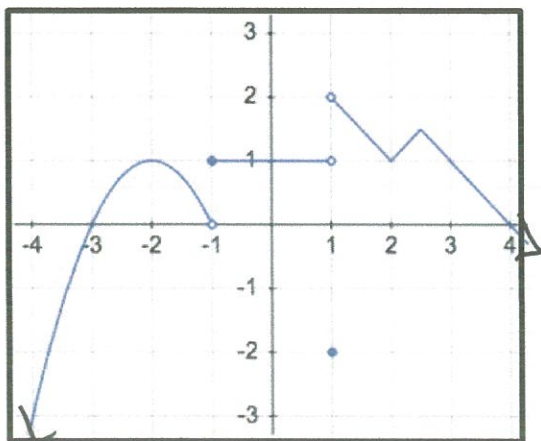
5.



Domain:  $(-\infty, -2) \cup (-2, 2) \cup (2, \infty)$

Range:  $(-\infty, -1) \cup (0, \infty)$

6.



Domain:  $(-\infty, 1) \cup (1, \infty)$

Range:  $(-\infty, 2)$