

Domain and Range

Sept 10/2019

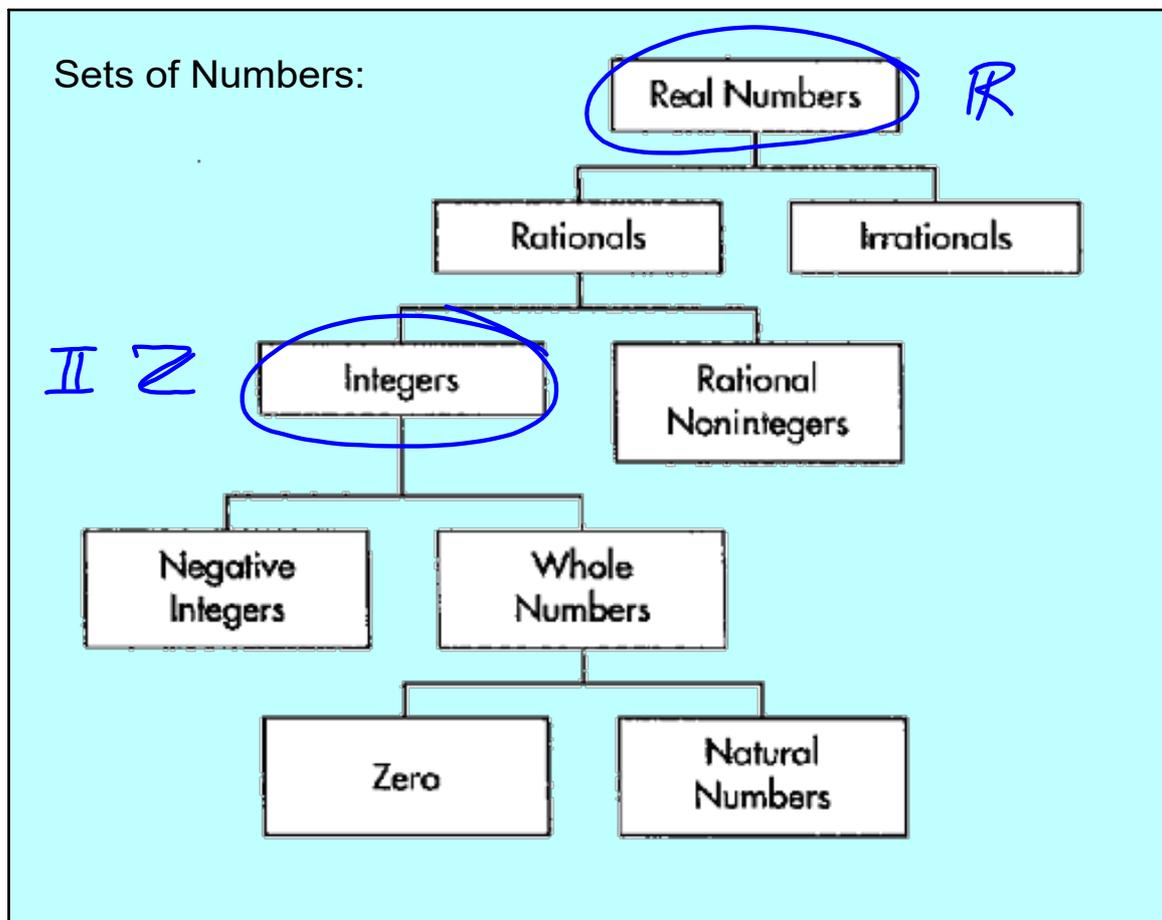
Domain is the set of all possible values for the independent variable.

Range is the set of all possible values for the dependent variable.

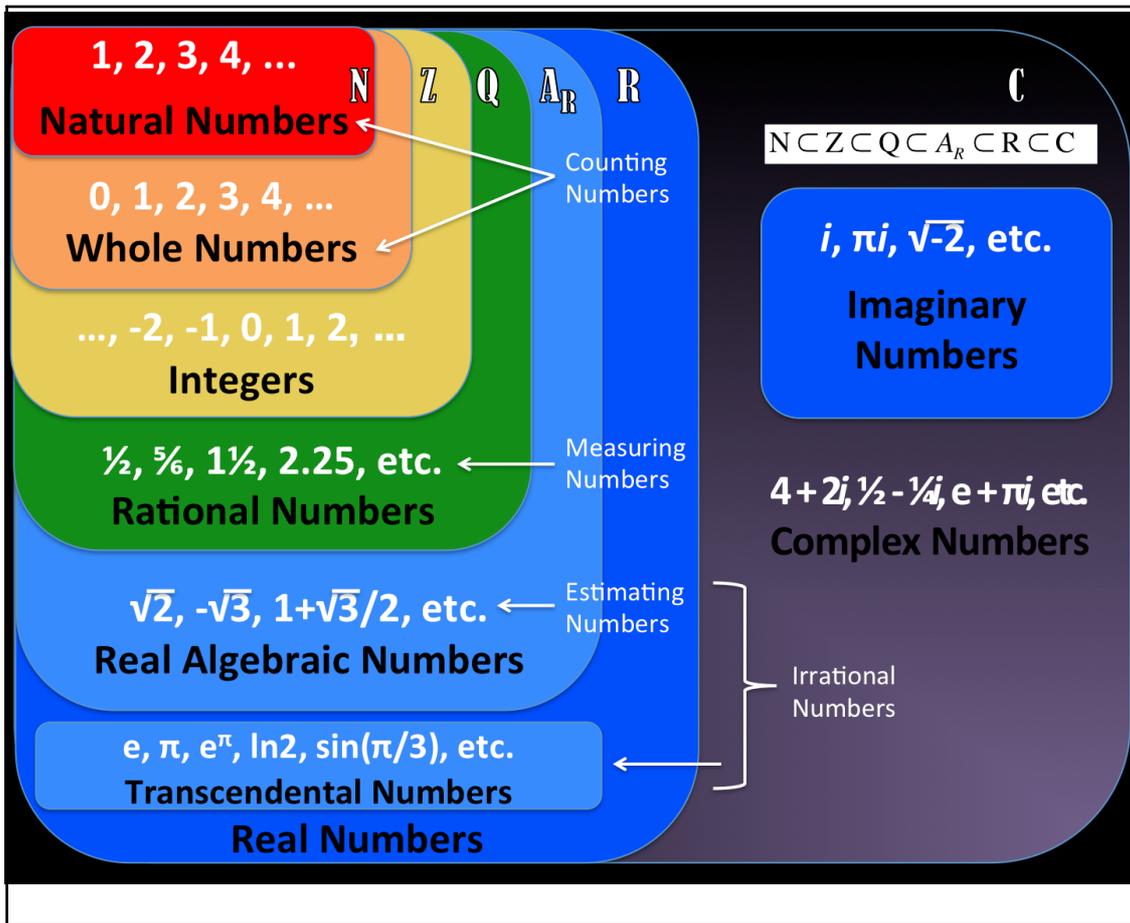
A set can be represented as:

- (1) the list of all values, e.g.,  $\{-4, -1, 3, 6, 11\}$
- (2) a rule defining all values, e.g.,  $\{x \in \mathbb{R} \mid x \leq 2\}$
- (3) a rule excluding some values, e.g.,  $\{x \in \mathbb{R} \mid x \neq -5\}$

Feb 12-9:14 PM

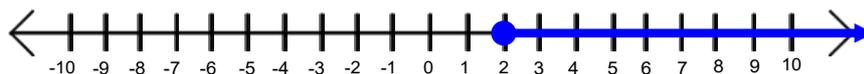


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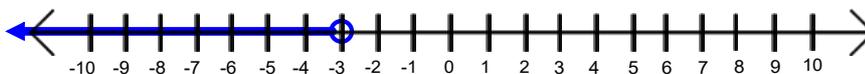


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Some visual examples of domain:



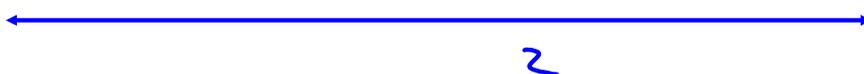
$$\{x \in \mathbb{R} \mid x \geq 2\}$$



$$\{x \in \mathbb{R} \mid x < -3\}$$

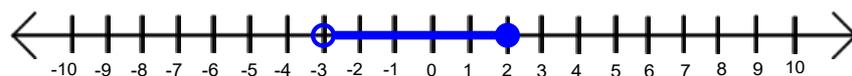


$$\{x \in \mathbb{R} \mid x < -3 \text{ or } x \geq 2\}$$



Sep 7-6:22 PM

Some visual examples of domain:



$$\{x \in \mathbb{R} \mid x > -3 \text{ and } x \leq 2\} \text{ or } \{x \in \mathbb{R} \mid -3 < x \leq 2\}$$

preferred



$$\{2, 3, 4, 5, 6, 7\} \quad \{x \in \mathbb{Z} \mid 2 \leq x \leq 7\}$$

where  $\mathbb{Z}$  is the set of integers

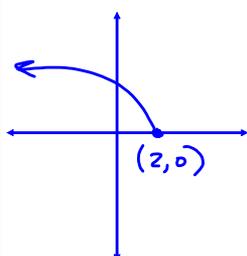
$$\{x \in \mathbb{Z} \mid 1 < x < 8\}$$

this is not good!  
why?

Sep 7-10:05 PM

Visualizing or sketching a graph is a good way to see D & R.  
Algebraically, we may need to consider an inequality.

Ex. Determine domain and range for  $f(x) = \sqrt{2-x}$



require  $2-x \geq 0$   
(cannot  $\sqrt{\quad}$  a negative)

① solve  $2-x = 0$   
 $2 = x$

②  $2-x$  is linear,  
check values on either side  
of  $x=2$

try  $x=1$   
 $f(1) = \sqrt{2-1}$   
 $= \sqrt{1} \checkmark$

try  $x=3$   
 $f(3) = \sqrt{2-3}$   
 $= \sqrt{-1} \times$

$$D = \{x \in \mathbb{R} \mid x \leq 2\}$$

$$R = \{y \in \mathbb{R} \mid y \geq 0\}$$

Sep 8-9:07 AM

Determining restrictions using inequalities:

For example,  $f(x) = \sqrt{2-x}$  requires  $2-x \geq 0$

Create an equation  
and solve for zero(s)

$$2 - x = 0$$

$$x = 2$$

Test values around  
zeroes:

$$x = 1: 2 - 1 = 1, \text{ pass}$$

$$x = 3: 2 - 3 = -1, \text{ fail}$$

$$\therefore x \geq 2$$

$$2 - x \geq 0$$

$$2 \geq x$$

"2 is greater than  
or equal to x"

or

$$x \leq 2$$

"x is less than  
or equal to 2"

$$2 - x \geq 0$$

$$-x \geq -2$$

To isolate x, divide  
by -1. When  
multiplying or  
dividing by a  
negative, reverse  
the inequality.

$$\frac{-x}{-1} \leq \frac{-2}{-1}$$

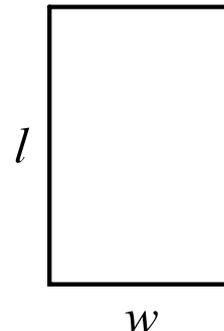
$$x \leq 2$$

Sep 8-8:38 AM

Some restrictions are based on real-world considerations.

Ex. You have 20 m of fencing for a rectangular area.

- (a) Express area as a function of width.  
(b) Determine the domain of this function.



$$2l + 2w = 20$$

$$(a) \quad A = lw$$

$$A(w) = w(10-w)$$

$$l + w = 10$$

$$l = 10 - w$$

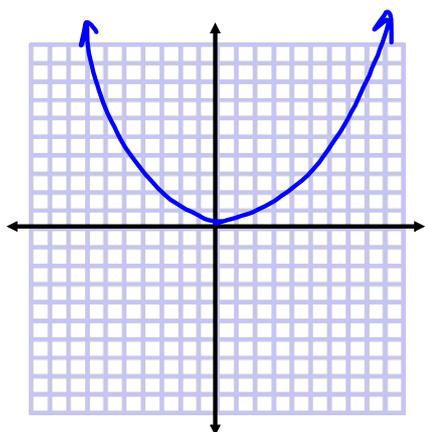
$$(b) \quad w > 0 \text{ and } w < 10$$

$$D = \{w \in \mathbb{R} \mid 0 < w < 10\}$$

Sep 8-9:09 AM

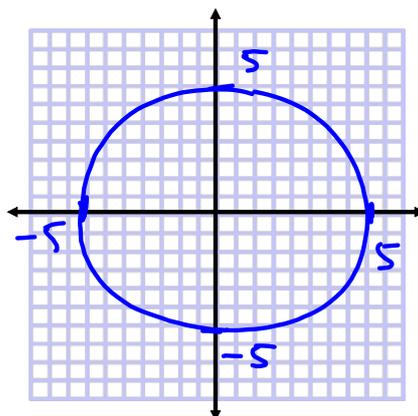
Ex.2 Graph and state the domain and range for each relation.

(a)  $y = x^2$



$D = \{x \in \mathbb{R}\}$   
 $R = \{y \in \mathbb{R} \mid y \geq 0\}$

(b)  $x^2 + y^2 = 25$

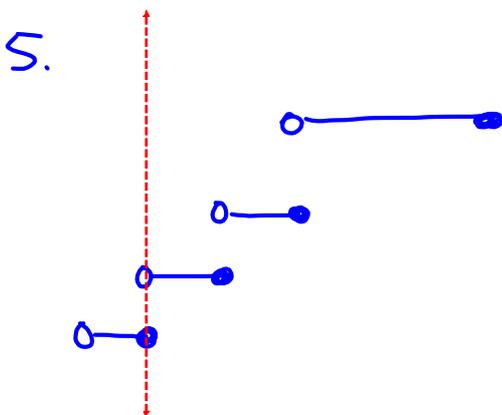


$D = \{x \in \mathbb{R} \mid -5 \leq x \leq 5\}$   
 $R =$

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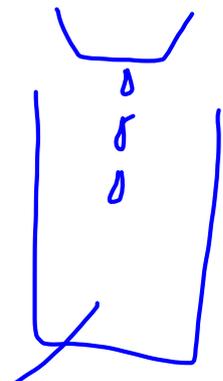
Assigned Work:

p.35 # 2-5, 8, 10, 11, 12cd, 13, 17\*



Feb 10-10:23 PM

8.



$1 \text{ mL/s}$

$$V(t) = t$$

$D = \{t \in \mathbb{R} \mid 0 \leq t \leq 2500\}$

$10 \text{ cups} = 2500 \text{ mL}$

$$R = \{V \in \mathbb{R} \mid 0 \leq V \leq 2500\}$$

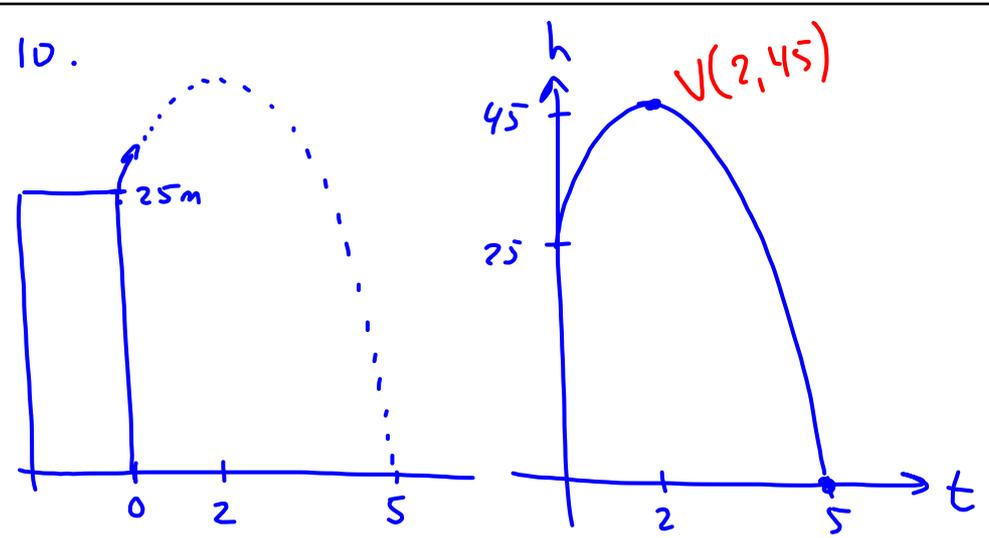
$250 \text{ mL/cup}$

seconds

mL

Sep 11-2:06 PM

10.



$$D = \{t \in \mathbb{R} \mid 0 \leq t \leq 5\}$$

$$R = \{h \in \mathbb{R} \mid 0 \leq h \leq 45\}$$

$$h(t) = -5(t-2)^2 + 45$$

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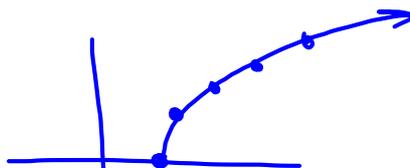
11 bd

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

$$x-2 \geq 0 \quad D = \{x \in \mathbb{R} \mid x \geq 2\}$$

$$\begin{array}{cc} +2 & +2 \\ \hline x & \geq 2 \end{array}$$

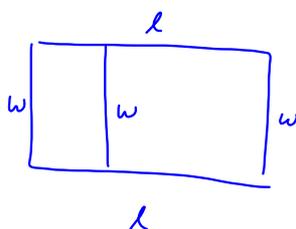
x	f(x)
2	0
3	1
4	$\sqrt{2} \approx 1.414$
5	$\sqrt{3} \approx 1.732$
6	2



$$R = \{y \in \mathbb{R} \mid y \geq 0\}$$

Sep 11-2:14 PM

13.



$$2l + 3w = 450 \quad A = lw$$

$$2l = 450 - 3w \quad A(w) = (w)(225 - \frac{3w}{2})$$

$$l = 225 - \frac{3}{2}w \quad w > 0 \quad l > 0$$

$$D = \{w \in \mathbb{R} \mid 0 < w < 150\}$$

$$225 - \frac{3}{2}w > 0$$

$$\frac{w}{2} \cdot 225 > \frac{3}{2}w \cdot \frac{w}{2}$$

for range,  $A > 0$ 

$$150 > w$$

$$w < 150$$

use vertex to find  $A_{\max}$ .

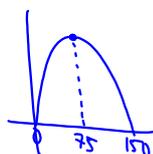
$$\textcircled{1} \text{ zeroes } 0 = w(225 - \frac{3w}{2})$$

$$w = 0 \quad 225 - \frac{3w}{2} = 0$$

$$225 = \frac{3w}{2}$$

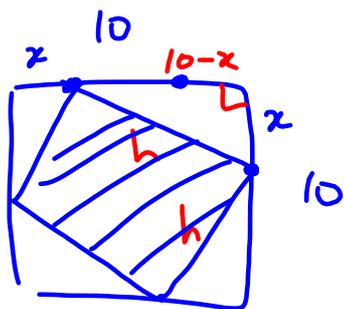
$$450 = 3w$$

$$w = 150$$



$$A(75) = 75(225 - \frac{3(75)}{2})$$

Sep 11-2:20 PM



$$A_{\Delta} = \frac{x(10-x)}{2}$$

$$A(x) = 100 - 2x(10-x)$$

$$= 100 - 20x + 2x^2$$

$$h^2 = (10-x)^2 + x^2$$

$$A(x) = h^2$$

$$= 100 - 20x + x^2 + x^2$$

$$= 2x^2 - 20x + 100$$

$$P = 4h$$

$$= 4\sqrt{(10-x)^2 + x^2}$$

Sep 11-3:24 PM

## Attachments

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