

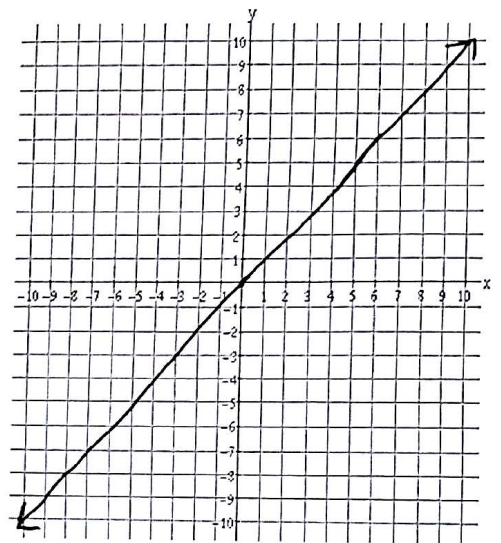
# Parent Functions

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# Linear Functions

$$f(x) = x$$



relative max: none

relative min: none

increasing intervals:  $(-\infty, \infty)$

decreasing intervals: none

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

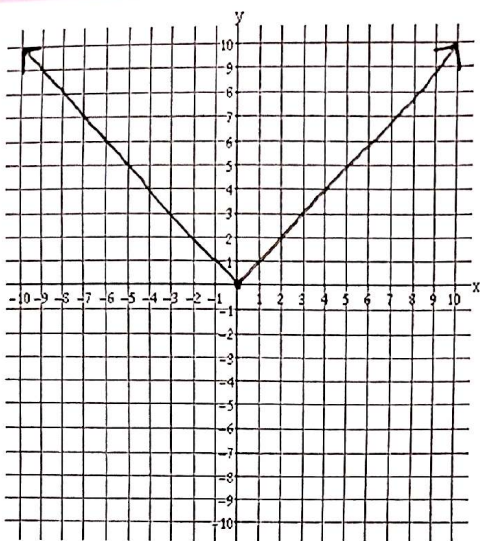
range:  $(-\infty, \infty)$

end behavior:  $x \rightarrow \infty$   $f(x) \rightarrow \underline{\infty}$

$x \rightarrow -\infty$   $f(x) \rightarrow \underline{-\infty}$

# Absolute Value

$$f(x) = |x|$$



relative max: none

relative min: (0, 0)

increasing intervals: (0, ∞)

decreasing intervals: (-∞, 0)

domain: (-∞, ∞)

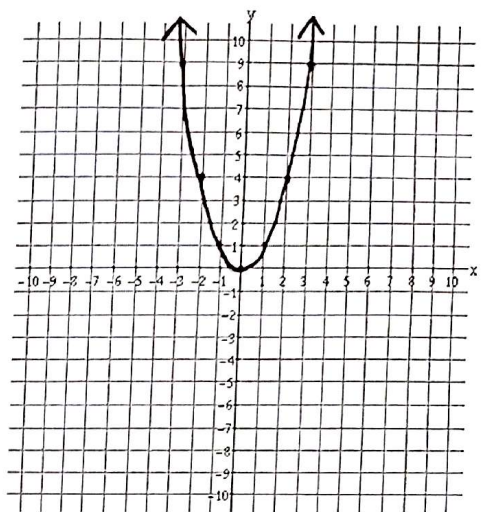
range: [0, ∞)

end behavior:  $x \rightarrow \infty \quad f(x) \rightarrow \infty$

$x \rightarrow -\infty \quad f(x) \rightarrow \infty$

# Quadratics

$$f(x) = x^2$$



relative max: none

relative min: (0, 0)

increasing intervals: (0, ∞)

decreasing intervals: (-∞, 0)

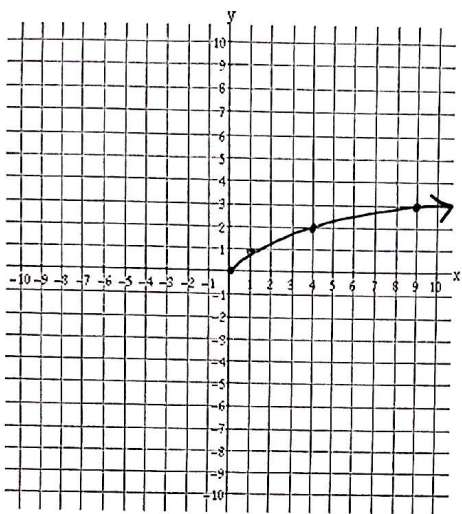
domain: (-∞, ∞)

range: [0, ∞)

end behavior:  $x \rightarrow \infty \quad f(x) \rightarrow \infty$

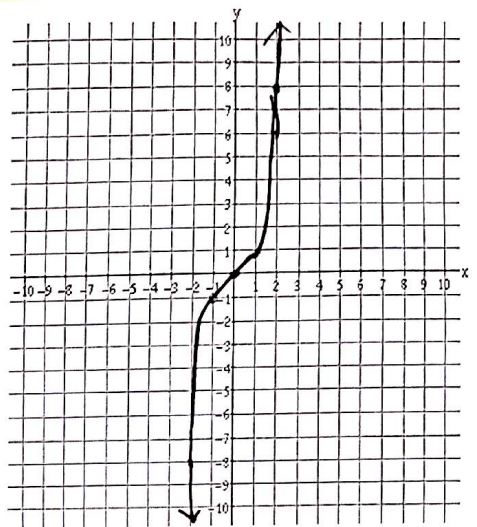
$x \rightarrow -\infty \quad f(x) \rightarrow \infty$

Square Root  
 $f(x) = \sqrt{x}$



relative max: none  
 relative min: none  
 increasing intervals:  $(0, \infty)$   
 decreasing intervals: none  
 domain:  $(0, \infty)$   
 range:  $(0, \infty)$   
 end behavior:  $x \rightarrow \infty$   $f(x) \rightarrow \infty$   
 $x \rightarrow -\infty$   $f(x) \rightarrow$  none

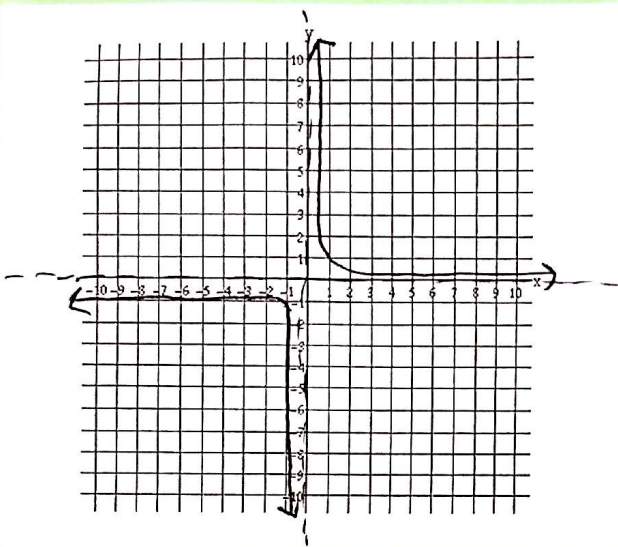
Cubic  
 $f(x) = x^3$



relative max: none  
 relative min: none  
 increasing intervals:  $(-\infty, \infty)$   
 decreasing intervals: none  
 domain:  $(-\infty, \infty)$   
 range:  $(-\infty, \infty)$   
 end behavior:  $x \rightarrow \infty$   $f(x) \rightarrow \infty$   
 $x \rightarrow -\infty$   $f(x) \rightarrow -\infty$

## Rational

$$f(x) = \frac{1}{x}$$



relative max: none

relative min: none

increasing intervals: none

decreasing intervals:  $(-\infty, 0) \cup (0, \infty)$

domain:  $(-\infty, 0) \cup (0, \infty)$

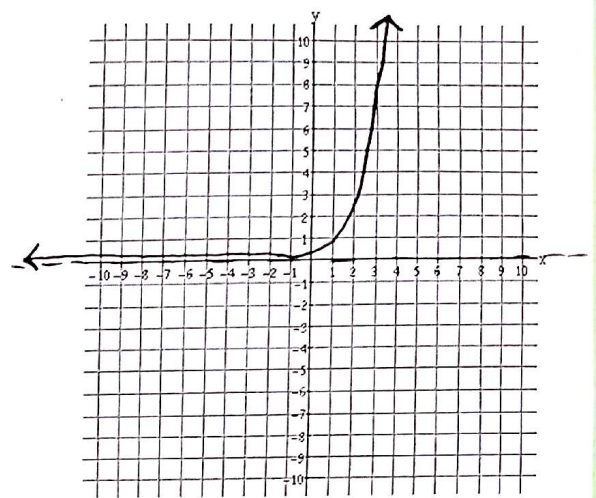
range:  $(-\infty, 0) \cup (0, \infty)$

end behavior:  $x \rightarrow \infty$   $f(x) \rightarrow$  0

$x \rightarrow -\infty$   $f(x) \rightarrow$  0

## Exponential

$$f(x) = e^x$$



relative max: none

relative min: none

increasing intervals:  $(-\infty, \infty)$

decreasing intervals: none

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

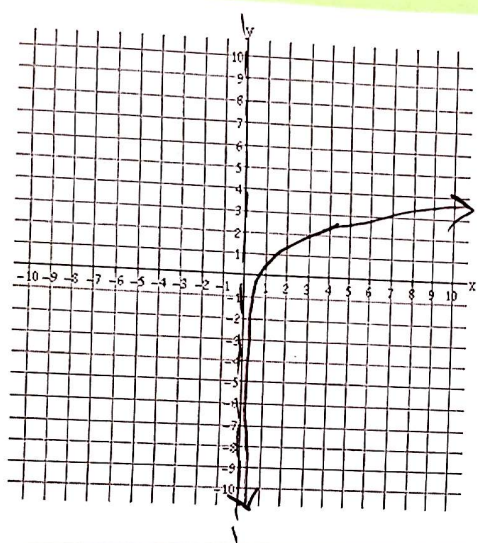
range:  $(0, \infty)$

end behavior:  $x \rightarrow \infty$   $f(x) \rightarrow$   $\infty$

$x \rightarrow -\infty$   $f(x) \rightarrow$  0

## Logarithmic

$$f(x) = \ln x$$



relative max: none

relative min: none

increasing intervals: (0, ∞)

decreasing intervals: none

domain: (0, ∞)

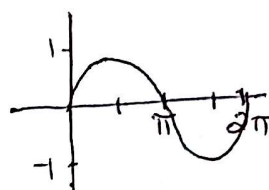
range: (-∞, ∞)

end behavior:  $x \rightarrow \infty$   $f(x) \rightarrow \infty$

$x \rightarrow 0^+$   $f(x) \rightarrow -\infty$

## Trig functions

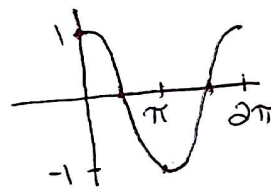
$$f(x) = \sin x$$



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

Range:  $[-1, 1]$

$$f(x) = \cos x$$



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

Range:  $[-1, 1]$

## Transformations:

$$f(x) = \text{flipped stretch } (x \pm \text{left/right})^2 \pm \text{up/down}$$

flipped: begins with a "-"  
symmetrical over x-axis

left: "+"

right: "-"

up: "+"

down: "-"