

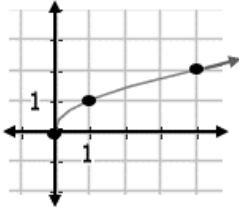
# Unit 7 - Special Functions - Study Guide



## Square Root Parent Function

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

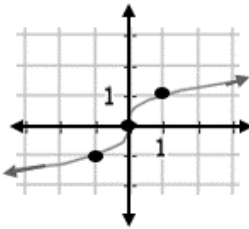
domain:  $x \geq 0$   
 range:  $y \geq 0$   
 y-intercept:  $y = 0$   
 zero(s):  $x = 0$   
 asymptote: none  
 increasing:  $x \geq 0$   
 decreasing: never



## Cube Root Parent Function

$$f(x) = \sqrt[3]{x}$$

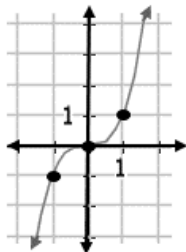
domain:  $(-\infty, \infty)$   
 range:  $(-\infty, \infty)$   
 y-intercept:  $y = 0$   
 zero(s):  $x = 0$   
 asymptote: none  
 increasing:  $(-\infty, \infty)$   
 decreasing: never



## Cubic Parent Function

$$f(x) = x^3$$

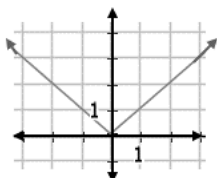
domain:  $(-\infty, \infty)$   
 range:  $(-\infty, \infty)$   
 y-intercept:  $x = 0$   
 zero(s):  $y = 0$   
 asymptote: none  
 increasing:  $(-\infty, \infty)$   
 decreasing: never



## Absolute Value Parent Function

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

domain:  $(-\infty, \infty)$   
 range:  $y \geq 0$   
 y-intercept:  $y = 0$   
 zero(s):  $x = 0$   
 asymptote: none  
 increasing:  $x > 0$   
 decreasing:  $x < 0$



## Average Rate of Change

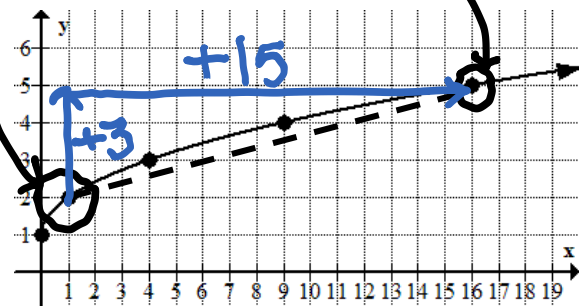
- MAKE A TABLE!!!
- Need: TWO POINTS
- Find the points from a table, graph or substitution
- The SLOPE of a line that passes through TWO POINTS of a function
- $\frac{\text{change in } y}{\text{change in } x}$

EXAMPLE:

Given the function  $f(x) = \sqrt{x} + 1$ , find the average rate of change over the interval

$$1 \leq x \leq 16$$

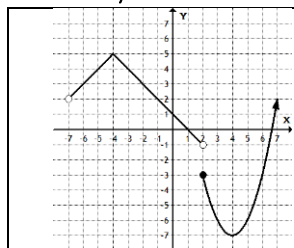
→ SOLUTION:



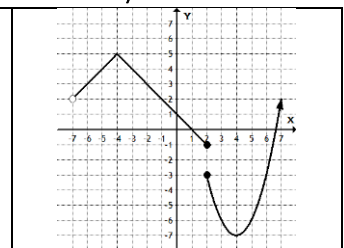
$$\begin{array}{c|c} x & y \\ \hline 1 & 2 \\ 16 & 5 \end{array} \quad \text{so...} \quad \frac{3}{15} = \frac{1}{5}$$

## Is it a Function?

- Every X value has to have only ONE Y value



YES: every x-value has exactly one y-value



NO: the x-value of 2 has two y-values: -1 and -3

## Piecewise Functions

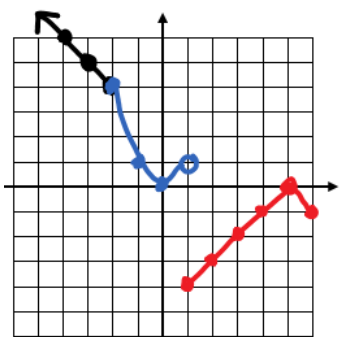
⇒ Be careful of

- open points
  - does NOT include
  - < *or* >
- closed points
  - DOES include
  - $\leq$  *or*  $\geq$

⇒ Can be linear or non-linear

EX: Graph the function:

$$f(x) = \begin{cases} -x + 2 & -\infty < x \leq -2 \\ x^2 & -2 < x < 1 \\ |x - 5| & 1 \leq x \leq 6 \end{cases}$$



Then find:

$$f(1) = -4$$

$$f(-2) = 4$$

$$f(5) = 0$$

$$f(0) = 0$$

## Step Functions

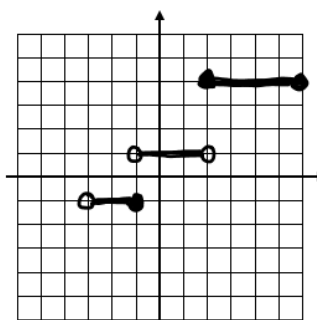
⇒ Be careful of

- open points
  - does NOT include
  - < *or* >
- closed points
  - DOES include
  - $\leq$  *or*  $\geq$

⇒ horizontal lines that look like steps

EX: Find the equation of the function.

$$f(x) = \begin{cases} -1 & -3 < x \leq -1 \\ 1 & -1 < x < 2 \\ 4 & 2 \leq x \leq 6 \end{cases}$$



Then find:

$$f(2) = 4$$

$$f(4.6) = 4$$

$$f(-1) = -1$$

## Evaluating Functions Tips

### Absolute Values

- The distance a number is from zero
- EX: Find  $y$  if  $y = |x + 5|$  when  $x = -9$   
 $y = |x + 5| = |-9 + 5| = |-4| = 4$   
 So  $y = 4$  or the point  $(-9, 4)$

### Square Roots

- **CAN'T** take the square root of a negative
- EX: Find  $y$  if  $y = \sqrt{x} - 3$  when  $x = 25$   
 $y = \sqrt{x} - 3 = \sqrt{25} - 3 = 5 - 3 = 2$   
 So  $y = 2$  or the point  $(25, 2)$

### Exponents

- When substituting, always use parenthesis
- EX: Find  $y$  if  $y = x^2 - 1$  when  $x = -3$   
 $y = x^2 - 1 = (-3)^2 - 1 = 9 - 1 = 8$   
 So  $y = 8$  or the point  $(-3, 8)$

### Cube Roots

- **CAN** take the square root of a negative
- EX: Find  $y$  if  $y = \sqrt[3]{x} + 1$  when  $x = -8$   
 $y = \sqrt[3]{x} + 1 = \sqrt[3]{-8} + 1 = -2 + 1 = -1$   
 So  $y = -1$  or the point  $(-8, -1)$