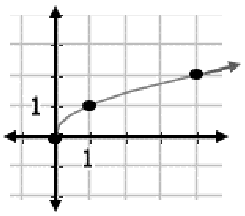
Unit 7 - Special Functions - Study Guide

Square Root Parent Function

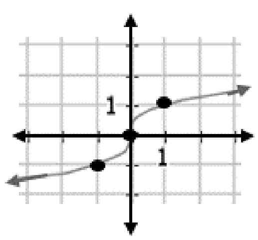
$f(x) = \sqrt{x}$



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

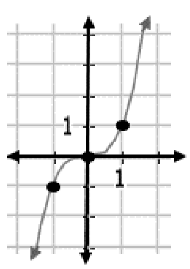
$f(x) = \sqrt[3]{x}$



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

Cubic Parent Function

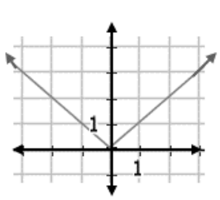
$f(x) = x^3$



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

$f(x) = |x|$



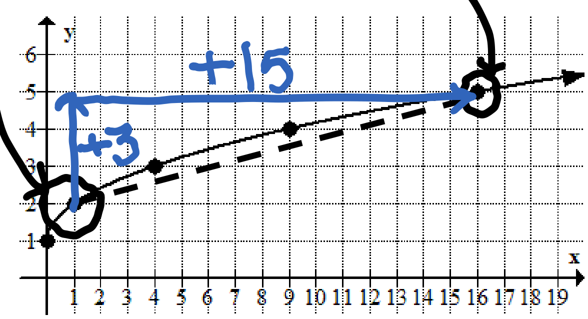
domain: $(-\infty, \infty)$
range: $y \geq 0$
y-intercept: y = 0
zero(s): x = 0
asymptote: none
increasing: $x > 0$
decreasing: $x < 0$

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
- $\dfrac{\textit{change in } y}{\textit{change in } x}$

EXAMPLE:
Given the function $f(x) = \sqrt{x} + 1$, find the average rate of change over the interval $1 \leq x \leq 16$.

→SOLUTION:



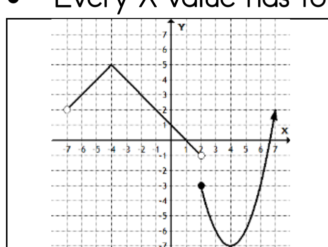
X	Y
1	2
16	5

+15 (X), +3 (Y)

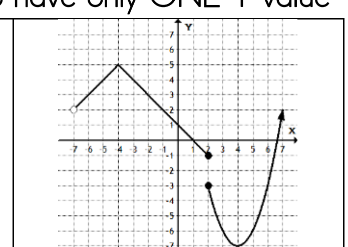
So... → $\frac{3}{15} = \frac{1}{5}$

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

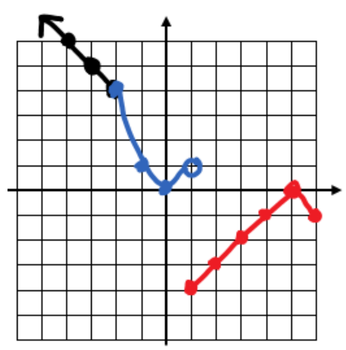
Piecewise Functions

⇨ 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

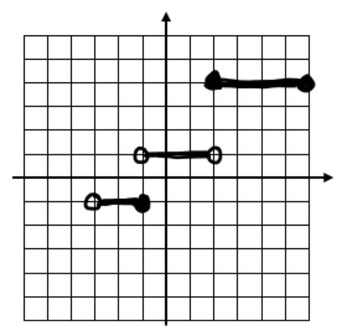
Step Functions

⇨ 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	Exponents
– 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)	– When substituting, always use parenthesis – EX: Find y if $y = x^2 - 1$ when $x = -3$ $y = x^3 - 1 = (-3)^2 - 1 = 9 - 1 = 8$ So $y = 8$ or the point (−3, 8)
Square Roots	**Cube 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)	– 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)