1.6 Piecewise Functions

Math Learning Target:
"I can graph all piecewise functions.
I know how to apply piecewise functions in a problem.
I know how to determine if a function is continuous.
If a function is discontinuous, I know how to describe the discontinuity."

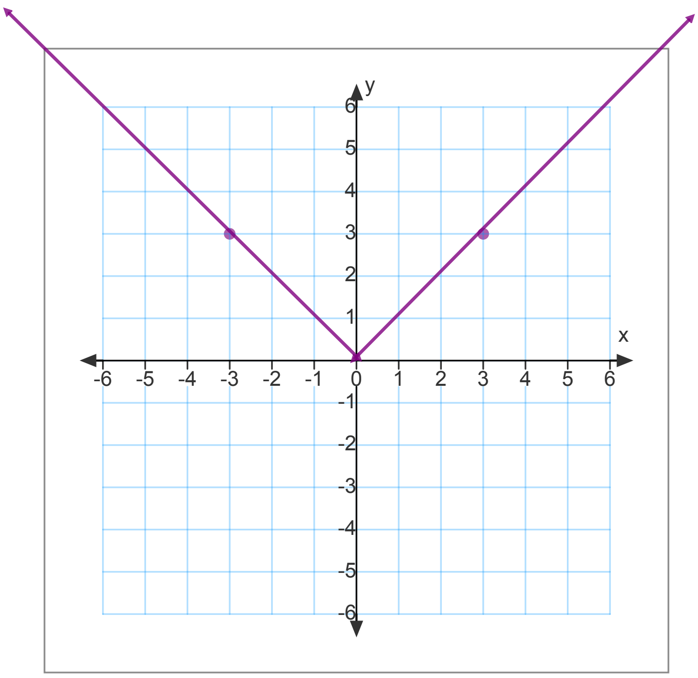
A **piecewise function** is a function defined by using two or more functions, on two or more intervals.

Recall: $f(x) = |x|$ defines the distance the value x is from the origin.

The absolute value function may be expressed as a piecewise function.

$$f(x) = |x| = \begin{cases} x & \text{when } x > 0 \\ -x & \text{when } x \le 0 \end{cases}$$

$\begin{cases} x \geq 0 \\ x < 0 \end{cases}$



if $x = -3$

$f(-3) = -x$
$= -(-3)$
$= 3$

Ex. 1: Graph:

$$f(x)=\begin{cases}-x^2+4 & \text{if } x\le 2\\ 2x+1 & \text{if } x>2\end{cases}$$

if $x=2$

$f(2)=-(2)^2+4$

$=-4+4$

$=0$

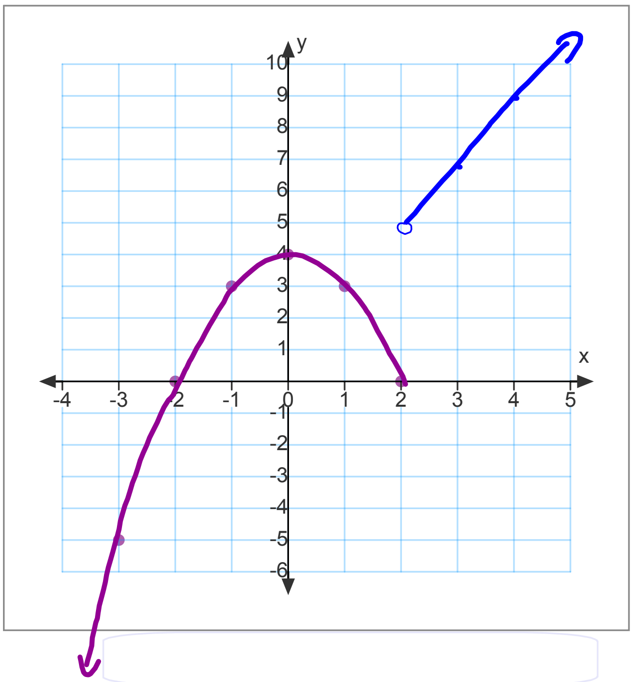
(closed)

$f(2)=2(2)+1$

$=4+1$

$=5$

(open)



Click here for the video: "Continuity of Functions: Photostory"
(*The video is posted in our Google Classroom for your convenience*).

A function is **continuous** when there are no "holes", vertical asymptotes and "jumps" over its entire domain.
If the function is not continuous, it is **discontinuous**.

Ex. 2: Is the function in Ex. 1 continuous? Explain.

No, it is discontinuous because there is a "jump".
i.e, the value of both functions at x=2 is not equal.

Is it possible to use the given parabola and line to make a function that **IS** continuous?

If time: Discuss using GeoGebra

READ: pp. 46-51
Today's entertainment: pp. 51-53 #1bdf, 2bdf, 3a, 4a, 5d, 7, 9, 14, 15

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13. A function g is defined by $g(x) = 4(x - 3)^2 + 1$.

a) Determine an equation for the inverse of $g(x)$.

b) Solve for y in the equation for the inverse of $g(x)$.

c) Graph $g(x)$ and its inverse using graphing technology.

d) At what points do the graphs of $g(x)$ and its inverse intersect?

e) State **restrictions** on the domain or range of g so that its inverse is a function.

f) Suppose that the domain of $g(x)$ is $\{x \in \mathbf{R} \mid 2 \leq x \leq 5\}$. Is the inverse a function? Justify your answer.

a) $g(x) = 4(x-3)^2+1$

$y = 4(x-3)^2+1$

$x = 4(y-3)^2+1$

b) $\frac{x-1}{4} = (y-3)^2$

$\pm\sqrt{\frac{x-1}{4}} + 3 = y$

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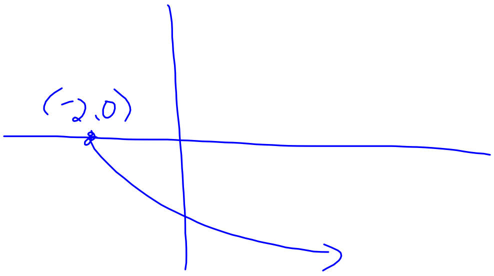
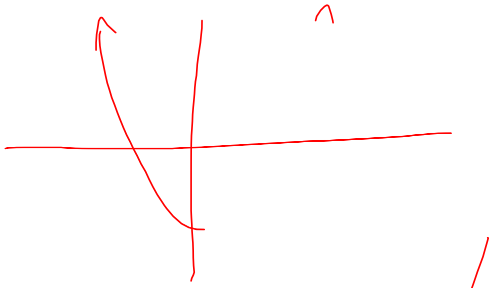
14. A student writes, "The inverse of $y = -\sqrt{x+2}$ is $y = x^2 - 2$." Explain why this statement is not true.





16. John and Katie are discussing inverse relationships. John says, "A function is a rule, and the inverse is the rule performed in reverse order with opposite operations. For example, suppose that you cube a number, divide by 4, and add 2. The inverse is found by subtracting 2, multiplying by 4, and taking the cube root." Is John correct? Justify your answer algebraically, numerically, and graphically. → Yes.

$$f(x) = \frac{x^3}{4} + 2$$

$$x = \frac{y^3}{4} + 2$$

$$4(x-2) = y^3$$

$$\sqrt[3]{4(x-2)} = y$$