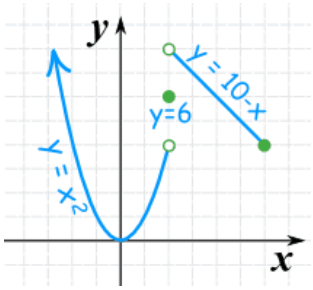
1.06 - Piecewise Functions

Learning Goals

- 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 or 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.

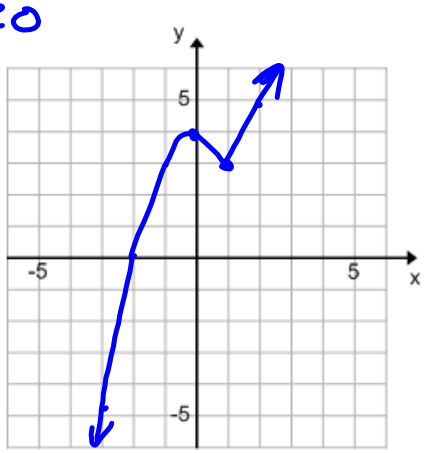
Recall: From the lesson on the absolute value function, we can look at $f(x) = |x|$ as 2 different linear functions: $f(x) = \begin{cases} x & , x \geq 0 \\ -x & , x < 0 \end{cases}$

$f(x) = \begin{cases} -x, & \text{if } x < 0 \\ x, & \text{if } x \geq 0 \end{cases}$

Example 1

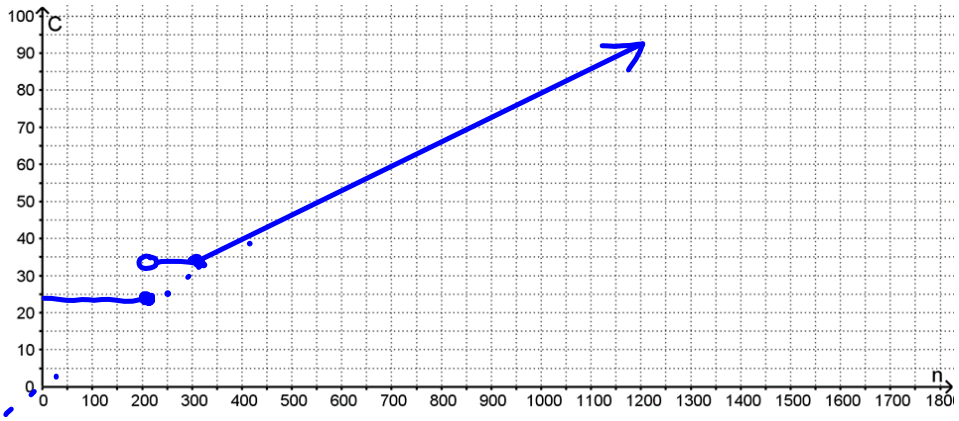
Graph:

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



Example 2

A cell phone company charges $25 per month with 200 minutes included. For more than 200 and up to 300 minutes the charge is $35. After that they charge 5 cents for each additional minute. Write a function for the monthly cost and graph it.



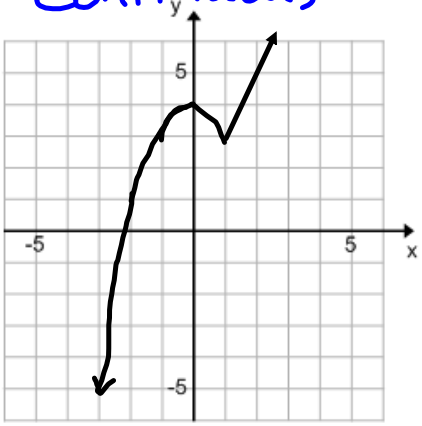
$f(x) = \begin{cases} 25, & \text{if } 0 \leq x \leq 200 \\ 35, & \text{if } 200 < x \leq 300 \\ 35 + (x - 300)0.05, & \text{if } x > 300 \end{cases}$

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**.

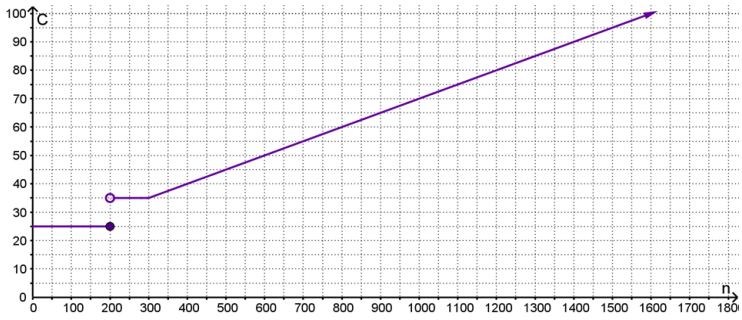
Example 3:

Are the functions from example 1 and 2 continuous or discontinuous?

Continuous



Discontinuous



Example 4:

Algebraically (i.e. without graphing) determine if the function below is continuous

$$f(x) = \begin{cases} x^3 - 1 & , if\, x \leq 2 \\ -x + 9 & , if\, x > 2 \end{cases}$$

Take the equations and plug in the boundry point. If they result in the same value, it is continuous!

$f(2) = (2)^3 - 1$ $\quad$ $f(2) = -2 + 9$

$= 8 - 1$ $\quad$ $= 7$

$= 7$

$\therefore$ continuous!

Practice:

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