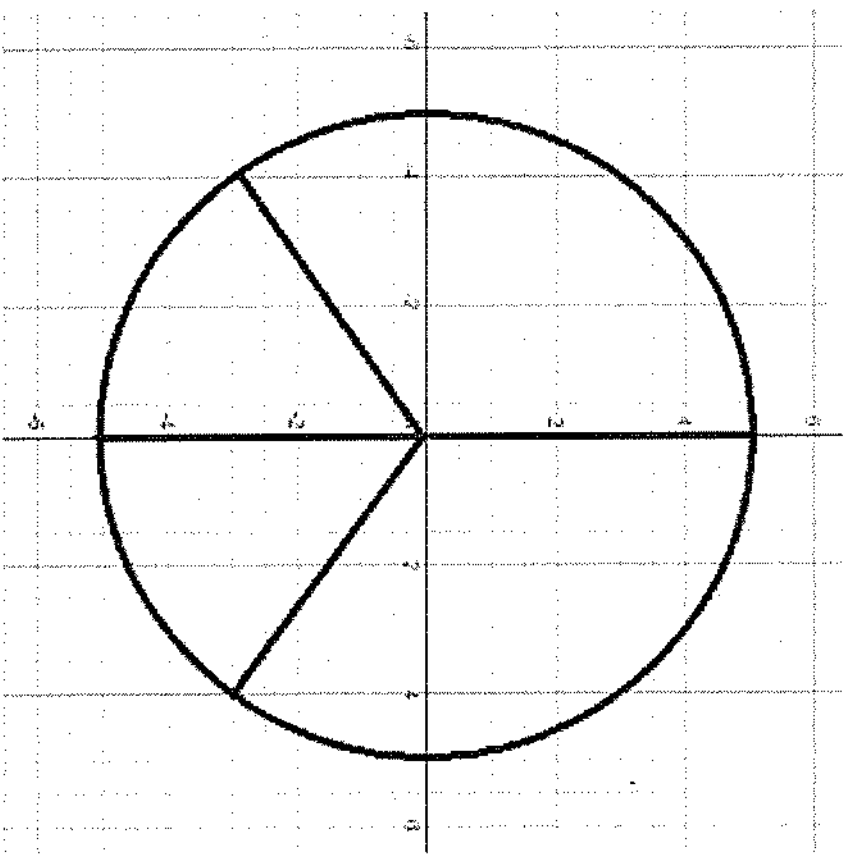


# Piecewise Functions Notes

Piecewise Function

$$g(x) = \begin{cases} \frac{1}{4}x & \text{if } -4 \leq x \leq 0 \\ \pm \sqrt{25 - x^2} & \text{if } -5 \leq x \leq 5 \\ -\frac{3}{4}x & \text{if } 0 \leq x \leq 4 \\ \text{all real numbers} & \text{if } x = 0 \end{cases}$$

all real numbers between -5 and 5



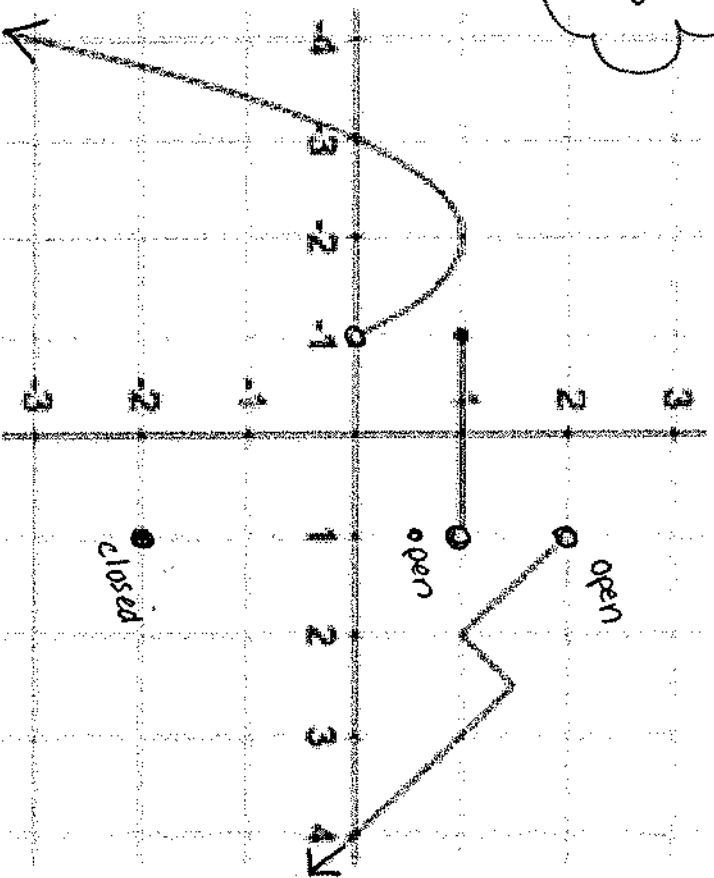
This is a tremendous function... (even if it fails the vertical line test!)



# Piecewise Functions

A piecewise function is a function defined by multiple sub-functions.

1 or more pieces



• MUST PASS  
the VLT

ex. Evaluate.

3 pieces

Domain of each  
↓  
piece

$$f(x) = \begin{cases} -2, & x < 4 \\ \frac{3}{5}x - 5, & 4 \leq x < 6 \\ x, & x \geq 6 \end{cases}$$

Pick the correct  
one piece!

a)  $f(0)$

$$f(x) = -2$$

↑

$$x=0 \quad f(0) = \boxed{-2}$$

$$x < 4$$

c)  $f(6)$

$$f(x) = x$$

↑

$$x=6 \quad f(6) = \boxed{6}$$

$$x \geq 6$$

b)  $f(5)$

$$f(x) = \frac{3}{5}x - 5$$

↑

$$x=5 \quad f(5) = \frac{3}{5} \left( \frac{5}{1} \right) - 5$$

$$= \frac{15}{5} - 5$$

$$4 \leq x < 6$$

$$= \frac{15}{5} - 5 = \boxed{-2}$$

$$x < 4$$

d)  $f(-1)$

$$f(x) = -2$$

↑

$$x=-1 \quad f(-1) = \boxed{-2}$$

$$x < 4$$

ex. Evaluate.

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

2 pieces

Domain of  
↓ each piece

a)  $f(-6)$      $f(x) = x+2$

$x = -6$      $f(-6) = -6+2$   
 $x \leq 1$      $= \boxed{-4}$

c)  $f(2)$      $f(x) = -3x+1$

$x = 2$      $f(2) = -3(2)+1$   
 $x > 1$      $= -6+1$   
 $= \boxed{-5}$

b)  $f(1)$      $f(x) = x+2$

$x = 1$      $f(1) = 1+2$   
 $x \leq 1$      $= \boxed{3}$

d)  $f(4)$      $f(x) = -3x+1$

$x = 4$      $f(4) = -3(4)+1$   
 $x > 1$      $= -12+1$   
 $= \boxed{-11}$

ex: Evaluate.

$$f(x) = \begin{cases} 8x - 1, & x < 0 \\ -18, & 0 \leq x < 5 \\ 3x^2, & x \geq 5 \end{cases}$$

a)  $f(-3)$

$$f(x) = 8x - 1$$

$$x = -3$$

$$f(-3) = \underline{8(-3) - 1}$$

$$x < 0$$

$$= -24 - 1 \\ = \underline{\underline{-25}}$$

c)  $f(0)$

$$f(x) = -18$$

$$x = 0$$

$$f(0) = \underline{\underline{-18}}$$

$$0 \leq x < 5$$

ex: Evaluate.

$$g(x) = \begin{cases} |2x-1|, & x > 6 \\ 1, & x = 6 \\ \frac{1}{x}, & 1 < x < 6 \\ x^3, & x = 1 \end{cases}$$

a)  $g(5)$   
 $x=5$   
 $1 < x < 6$   
 $g(x) = \frac{1}{x}$   
 $g(5) = \left| \frac{1}{5} \right|$

\* c)  $g(0)$   
 $x=0$

Undefined/no  
solution  
b/c 0 is not in  
the domain

b)  $g(1)$   
 $x=1$   
 $g(x) = x^3$   
 $g(1) = (1)^3$   
 $= \boxed{1}$

d)  $g(10)$   
 $x=10$

$g(x) = |2x-1|$   
 $g(10) = |2(10)-1|$   
 $= |20-1|$   
 $= |19|$   
 $= \boxed{19}$

ex. Evaluate.

$$f(x) = \begin{cases} \sqrt{1 - (x+4)^2}, & -5 \leq x < -4 \\ x+3, & -4 \leq x \leq 0 \\ -|x-4|, & x > 0 \end{cases}$$

$$-5 \leq x < -4$$

$$-4 \leq x \leq 0$$

$$x > 0$$

\* a)  $f(-5)$

$$x = -5$$

$$-5 \leq x < -4$$

$$f(x) = \sqrt{1 - (x+4)^2}$$

$$f(-5) = \sqrt{1 - [(-5)+4]^2}$$

$$= \sqrt{1 - [-1]^2}$$

$$= \sqrt{1 - (1)}$$

$$= \sqrt{0}$$

$$= \boxed{0}$$

b)  $f(-4)$

$$x = -4$$

$$-4 \leq x \leq 0$$

$$f(x) = x+3$$

$$f(-4) = -4+3$$

$$= \boxed{-1}$$

\* c)  $f(-1)$

$$x = -1$$

$$-4 \leq x \leq 0$$

$$f(x) = x+3$$

$$f(-1) = -1+3$$

$$= \boxed{2}$$

\* d)  $f(2)$

$$x = 2$$

$$x > 0$$

$$f(x) = -|x-4|$$

$$f(2) = -|2-4|$$

$$= -|-2|$$

$$= -(2)$$

$$= \boxed{-2}$$