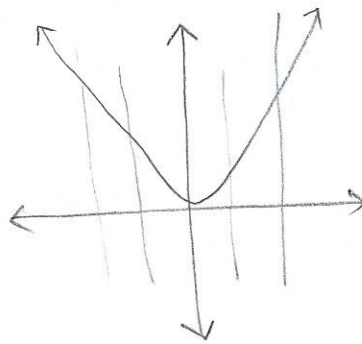
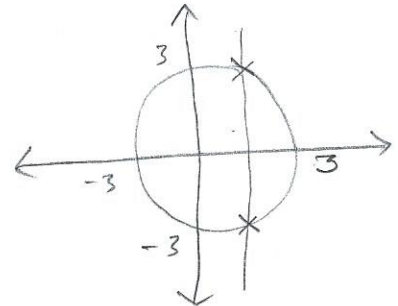


16.2 Functions

Vertical line test - your graph is a function if every vertical line crosses the graph at no more than one point.



Function  
 Domain:  $(-\infty, \infty)$   
 Range:  $[0, \infty)$



Not a function  
 Domain:  $[-3, 3]$   
 Range:  $[-3, 3]$

$f(x) = y$   
 name of the function  
 Not a function if  
 $y^m, y^4, y^6, \dots$

inequality symbols - not a function

Function

$$f(x) = \frac{x+7}{2x-1}$$

$$y = \frac{x+7}{2x-1}$$

$$y = \frac{8}{1}$$

Domain:  $(-\infty, \frac{1}{2}) \cup (\frac{1}{2}, \infty)$   
 not including  $\frac{1}{2}$

We need to exclude whatever makes the denominator

$$2x + 1 = 0$$

$$\frac{2x}{2} = \frac{-1}{2}$$

$$x = -\frac{1}{2}$$

\*  $k(t) = \sqrt{t+4}$  ← can't be negative

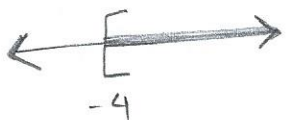
$$y = \sqrt{t+4}$$

$$\sqrt{y^2} = \pm \sqrt{t+4}$$

$$y = \pm \sqrt{t+4}$$

Domain:  $t+4 \geq 0$

$$\begin{array}{r} -4 \quad -4 \\ \hline t \geq -4 \\ [-4, \infty) \end{array}$$



\*  $f(x) = x^2 - 3x$

Domain:  $(-\infty, \infty)$

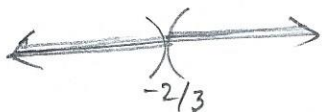
Write the domain.

①  $f(x) = \frac{2x+1}{3x+2}$

Exclude:  $3x+2=0$

$$x = -2/3$$

Domain:  $(-\infty, -2/3) \cup (-2/3, \infty)$



②  $g(x) = \sqrt{x-2}$

$$x-2 \geq 0$$

$$x \geq 2$$

Domain:  $[2, \infty)$

③

$h(x) = x+6$

Domain:  $(-\infty, \infty)$

## Evaluating functions

$$f(x) = -4x - 1$$

Find  $x$

$$\begin{aligned} f(5) &= -4(5) - 1 \\ &= -20 - 1 \end{aligned}$$

$$\begin{array}{cc} f(5) &= -21 \\ \uparrow & \quad \uparrow \\ x & \quad y \end{array}$$

$$g(x) = 3x^2 - 3x$$

$$\begin{aligned} g(-4) &= 3(-4)^2 - 3(-4) \\ &= 3(16) - 3(-4) \\ &= 48 + 12 \\ &= 60 \end{aligned}$$

## Piecewise function

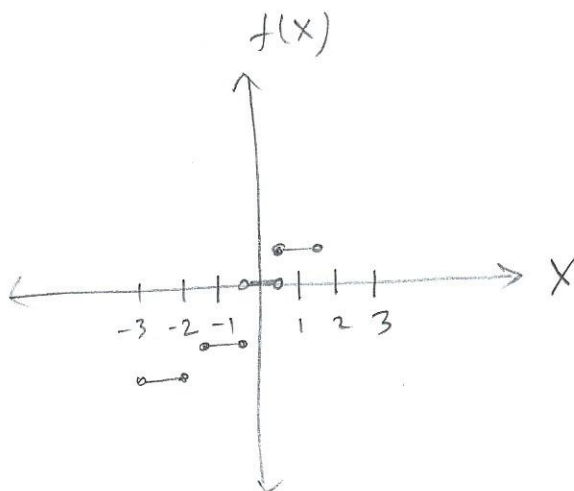
$f$  is defined on the interval from  $(-2.5, 1.5)$  as follows:

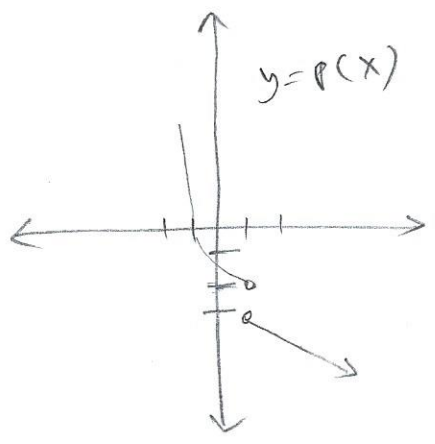
$$f(x) = \begin{cases} -2 & \text{if } -2.5 < x \leq -1.5 \\ -1 & \text{if } -1.5 < x \leq -0.5 \\ 0 & \text{if } -0.5 < x < 0.5 \\ 1 & \text{if } 0.5 \leq x < 1.5 \end{cases}$$

$$\begin{array}{c} x \\ \downarrow \\ f(0.5) = -1 \end{array}$$

$$f(0.2) = 0$$

$$f(0.5) = 1$$





$p(2) = -4$   
 $p(1) = -3$

$Ax + By = C$

$y = mx + b$   
 slope  $\nearrow$   $\nwarrow$  y-intercept

Write an equation in slope-intercept form of the line that goes through  $(4, -3)$  with  $m = \frac{3}{2}$   
 $x_1, y_1$

point-slope formula

$y - y_1 = m(x - x_1)$

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

$y + 3 = \frac{3}{2}(x - 4)$

$y + 3 = \frac{3}{2}x - 6$   
 $-3$   $-3$

$y = \frac{3}{2}x - 9$

$\frac{3}{2}(-4) = \frac{-12}{2} = -6$

Write an equation of the line that goes through  $(-6, 7)$  with  $m = \frac{-3}{2}$ . Write the final answer in slope intercept form:  $y = mx + b$

$y - y_1 = m(x - x_1)$

$y - 7 = \frac{-3}{2}(x - (-6))$

$y - 7 = \frac{-3}{2}(x + 6)$

$y - 7 = -\frac{3}{2}x - 9$   
 $+7$   $+7$

$y = -\frac{3}{2}x - 2$

Two lines that are parallel have the same slope.

Two lines that are perpendicular have slopes that are opposite reciprocals of each other.

$$m = \frac{3}{2} \quad m_{\perp} = -\frac{2}{3}$$

$$m = -\frac{2}{5}$$

$$y = -\frac{2}{5}x + 5$$

$$m_{\perp} = \frac{5}{2}$$

$$m_{\parallel} = -\frac{2}{5}$$