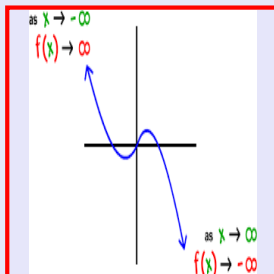


Math 245
Spring 2022
Lecture 17



Linear Function

$$f(x) = mx + b$$

$$y = mx + b$$

output Input

Slope-Int. Form

$$2x + 5y = 10 \quad \text{Standard Form}$$

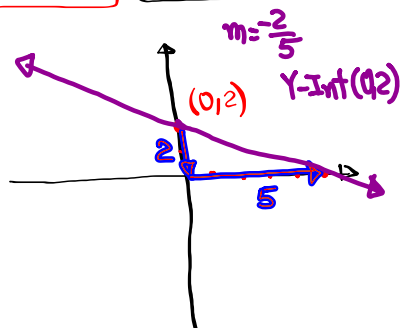
$$5y = -2x + 10$$

$$y = -\frac{2}{5}x + \frac{10}{5} \Rightarrow y = -\frac{2}{5}x + 2$$

Slope-Int

Linear Function

$$f(x) = -\frac{2}{5}x + 2$$



Constant Function

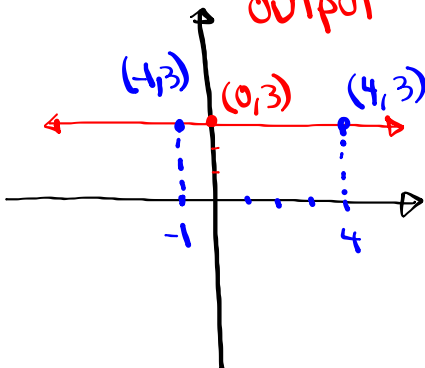
$$f(x) = b$$

$y = b$ Horizontal line
 $m = 0$

Input x
output $y = f(x)$

$$f(x) = 3$$

$$y = 3$$

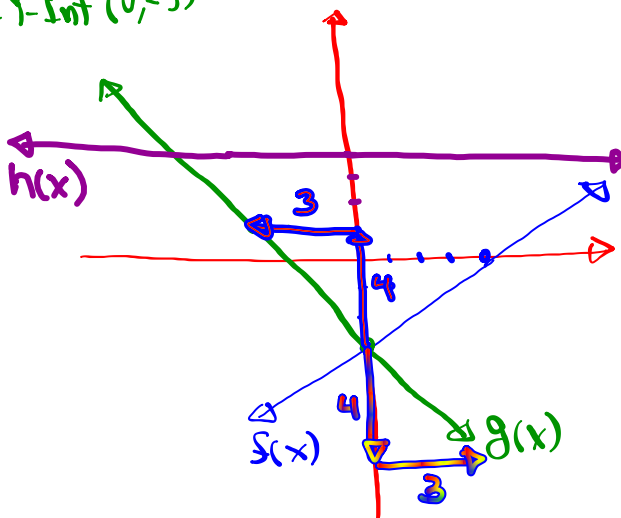


Graph

$$\begin{cases} f(x) = \frac{3}{4}x - 3 \\ g(x) = -\frac{4}{3}x - 3 \\ h(x) = 4 \end{cases}$$

Horizontal line
 $m = 0$

$$\frac{-4}{3} = \frac{4}{-3}$$



Two operations with Functions:

Multiplication

$$(f \cdot g)(x) \\ = f(x) \cdot g(x)$$

Composition

$$(f \circ g)(x) = \\ f(g(x))$$

ex: $f(x) = 3x - 5$, $g(x) = 2x + 3$

find $(f \cdot g)(x) = f(x) \cdot g(x)$

$$= (3x - 5)(2x + 3)$$

$$= 6x^2 + 9x - 10x - 15 = \boxed{6x^2 - x - 15}$$

find $(f \circ g)(x) = f(g(x))$

$$= 3(g(x)) - 5$$

$$= 3(2x + 3) - 5 = 6x + 9 - 5 = \boxed{6x + 4}$$

$$f(x) = 3x + 4 \quad g(x) = 3x - 4$$

1) find $(f \cdot g)(x) = f(x) \cdot g(x)$

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

$$= 9x^2 - \cancel{12x} + \cancel{12x} - 16 = \boxed{9x^2 - 16}$$

2) find $(f \circ g)(x) = f(g(x))$

$$= 3(g(x)) + 4$$

$$= 3(3x - 4) + 4 = 9x - 12 + 4 = \boxed{9x - 8}$$

$$f(x) = 2x + 4 \quad g(x) = \frac{x-4}{2}$$

$$\begin{aligned} \text{Find } (f \circ g)(x) &= f(g(x)) \\ &= 2(g(x)) + 4 \\ &= 2\left(\frac{x-4}{2}\right) + 4 \\ &= \cancel{x-4} + 4 = \boxed{x} \end{aligned}$$

$$\begin{aligned} \text{Find } (g \circ f)(x) &= g(f(x)) \\ &= \frac{\boxed{f(x)} - 4}{2} = \frac{2x+4-4}{2} = \frac{2x}{2} \\ &= \boxed{x} \end{aligned}$$

$$f(x) = x^2 + 10x$$

$$\text{Find } f(-2) = (-2)^2 + 10(-2) = 4 - 20 = \boxed{-16}$$

$$\text{Find } f(-10) = (-10)^2 + 10(-10) = 100 - 100 = \boxed{0}$$

$$\text{Find difference quotient } \frac{f(x+h) - f(x)}{h}$$

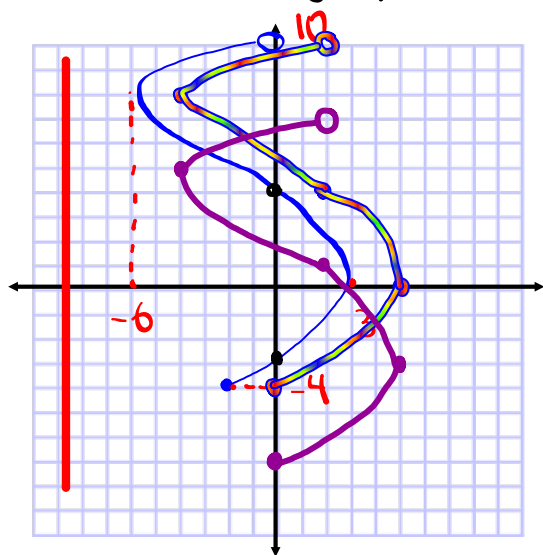
$$\frac{f(x+h) - f(x)}{h} = \frac{(x+h)^2 + 10(x+h) - (x^2 + 10x)}{h}$$

$$\frac{(x+h)(x+h) + 10x + 10h - x^2 - 10x}{h}$$

$$\frac{x^2 + 2xh + xh + h^2 + 10h - x^2 - 10x}{h} = \frac{2xh + h^2 + 10h}{h}$$

$$= \frac{\cancel{h}(2x + h + 10)}{\cancel{h}} = \boxed{2x + h + 10} \quad \text{Set } h=0 \Rightarrow \boxed{2x + 10}$$

Consider the graph below:



1) Domain $[-6, 3]$

2) Range $[-4, 10]$

3) Intercepts

Y-Int $\Rightarrow (0, -3), (0, 4)$

X-Int $\Rightarrow (3, 0)$

4) Function or not?

Explain. **Not a function, by V.L.T.**

5) Move the graph 2 units **right** then 3 units **down**.