Function Arithmetic

Add: $(f+g)(x) = f(x) + g(x)$

$f(x) = 3x+7$

$g(x) = x+2$

$(f+g)(x) = (3x+7) + (x+2) = 4x+9$

$(f-g)(x) = (3x+7) - (x+2) = 2x+5$

Sub: $(f-g)(x) = f(x) - g(x)$

Mult: $(fg)(x) = f(x) \cdot g(x)$

$(fg)(x) = (3x+7)(x+2) =$

$$(3x+7)(x+2) = 3x(x+2) + 7(x+2)$$
$$= 3x^2 + 6x + 7x + 14$$
$$= 3x^2 + 13x + 14$$

Div: $\left(f/g\right)(x) = \dfrac{f(x)}{g(x)}$

$$(f/g)(x) = \frac{3x+7}{x+2}$$

$$\frac{3\cancel{(x+5)}}{4\cancel{(x+5)}}$$

only divide out factors of complete products

Composition

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

Pg 116, 117

#1-7 odd

NO DOMAIN

#35-38

f composition g

f compose g

$f(x) = x+2$

$g(x) = 3x+7$

$(f \circ g)(x) = (3x+7) + 2$

$3x+9$

$(g \circ f)(x) = 3(x+2)+7 = 3x+6+7 = 3x+13$

7. $f(x) = \frac{1}{x}$

$g(x) = \frac{1}{x^2}$

Add: $\frac{x \cdot 1}{x \cdot x} + \frac{1}{x^2}$

$\frac{x}{x^2} + \frac{1}{x^2} = \frac{x+1}{x^2}$

Sub: $\frac{x-1}{x^2}$

Mult: $\frac{1}{x^3}$

Div: $\frac{1}{x} \div \frac{1}{x^2} \rightarrow \frac{1}{x} \cdot \frac{x^2}{1} = \frac{x^2}{x} = x$

$\frac{4}{4} \cdot \frac{1}{2} + \frac{3}{8}$

$\frac{4}{8} + \frac{3}{8} = \frac{7}{8}$

$\frac{7}{7} \cdot \frac{1}{5} + \frac{3}{7} \cdot \frac{5}{5}$

$\frac{7}{35} + \frac{15}{35} = \frac{22}{35}$

36. $f(x) = \sqrt[3]{x-1}$ $\quad g(x) = x^3 + 1$

$(f \circ g)(x) = \sqrt[3]{(x^3+1)-1} = \sqrt[3]{x^3} = x$

$(g \circ f)(x) = \left(\sqrt[3]{x-1}\right)^3 + 1 = x - 1 + 1 = x$

38. $f(x) = x^3$ $\quad g(x) = \frac{1}{x}$

$f \circ g = \left(\frac{1}{x}\right)^3$ $\quad g \circ f = \frac{1}{(x^3)}$

Inverses

Hw. pg 128 # 43-50 . Find f^{-1}, ignore any inequalities

49, 50

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

then f and g are inverses

The inverse of f is written f^{-1}.

Ex: $f(x) = \sqrt[3]{x-1}$

$y = \sqrt[3]{x-1}$

$(x)^3 = \left(\sqrt[3]{y-1}\right)^3$

$x^3 = y - 1$

$x^3 + 1 = y = f^{-1}(x)$

1. Replace f(x) with y.
2. Switch x and y.
3. Solve for y.

$f(x) = 3x^2 + 5x - 1$

$g(x) = 4x + 3$

Thurs Oct 29
Test
Transformations.
Arith, Inv

1. $(f \circ g)(x) = 3(4x+3)^2 + 5(4x+3) - 1$

2. $(g \circ f)(x) = 4(3x^2+5x-1) + 3$

No simp.

49. $f(x) = \sqrt{4 - x^2}$

$y = \sqrt{4 - x^2}$

$(y)^2 = \left(\sqrt{4 - y^2}\right)^2$

$x^2 = 4 - y^2$

$-4 \quad -4$

$$\frac{x^2 - 4}{-1} = \frac{-y^2}{-1}$$

$$\sqrt{\frac{x^2 - 4}{-1}} = \sqrt{y^2}$$

$$\sqrt{\frac{x^2 - 4}{-1}} = y \quad \text{ILR}$$

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

50. $f(x) = \sqrt{16 - x^2}$

$y = \sqrt{16 - x^2}$

$x = \sqrt{16 - y^2}$

$(x)^2 = \left(\sqrt{16 - y^2}\right)^2$

$x^2 = 16 - y^2$

$+y^2 \qquad +y^2$

$\longrightarrow x^2 + y^2 = 16$

$-x^2 \qquad -x^2$

$y^2 = 16 - x^2$

$\sqrt{y^2} = \sqrt{16 - \cancel{x}^2}$

$f^{-1}(x) = y = \sqrt{16 - x^2}$

$\neq 4 - x$

$$\sqrt{9+16} \neq 3+4=7$$

$$\sqrt{25} = 5$$

The inverse of $f(x)$ is $f^{-1}(x)$

Only one-to-one functions have inverses.

1-1

1-1 function will __not__ have any points on its graph that are horizontally in line.