

ALG III

10/23/17

Function Composition

$$(6x^4 - 25x^3 + 27x^2 + 1x - 15) \div (2x - 5)$$

$$\begin{array}{r}
 \overline{3x^3 - 5x^2 + 1x + 3} \\
 2x-5 \overline{) 6x^4 - 25x^3 + 27x^2 + 1x - 15} \\
 \underline{3x^3(2x-5) \rightarrow 6x^4 - 15x^3} \\
 -10x^3 + 27x^2 \\
 \underline{-10x^3 + 25x^2} \\
 2x^2 + 1x \\
 \underline{2x^2 - 5x} \\
 6x - 15 \\
 \underline{6x - 15} \\
 0
 \end{array}$$

Warm Up:

Given $g(x) = x + 2$ $f(x) = 2x^2 + 5x + 2$

Find:

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

$(x+2)(2x^2+5x+2)$
 $2x^2(x+2) + 5x(x+2) + 2(x+2)$
 $2x^3 + 4x^2 + 5x^2 + 10x + 2x + 4$
 $\rightarrow 2x^3 + 9x^2 + 12x + 4$

$\left(\frac{f}{g}\right)(x)$
 $\begin{array}{r} 2x+1 \\ x+2 \overline{) 2x^2+5x+2} \\ \underline{2x^2+4x} \\ x+2 \\ \underline{x+2} \\ 0 \end{array}$

$(g \circ f)(-3)$ $\left(\frac{f}{g}\right)(1)$

$2(-3)^2 + 5(-3) + 2$ $2(1) + 1$
 $2(-7) + 9(-3) + 2$ 3
 $-54 + 81 - 36 + 2$
 -5

Function Composition: Substituting one function into another.

$g(x) = x + 2$ $f(x) = 2x^2 + 5x + 2$

Notation: $(f \circ g)(x)$ Not to be confused with multiplication!!

$f(g(x))$

$2(g(x))^2 + 5(g(x)) + 2$
 $2(x+2)^2 + 5(x+2) + 2$
 $2(x^2 + 4x + 4) + 5x + 10 + 2$
 $2x^2 + 8x + 8 + 5x + 12$
 $2x^2 + 13x + 20$

$$g(x) = x + 2 \quad f(x) = 2x^2 + 5x + 2$$

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

$$g(f(x))$$

$$(f(x)) + 2$$

$$2x^2 + 5x + 2 + 2$$

$$2x^2 + 5x + 4$$

EX #1 $g(x) = 3x^2$ $h(x) = 2x + 3$

Find:

$$(h \circ g)(x)$$

$$2(3x^2) + 3$$

$$6x^2 + 3$$

$$(g \circ g)(x) \quad 3(gx)^2$$

$$3(3x^2)^2$$

$$3(9x^4) = 27x^4$$

$$(h \circ h)(x)$$

$$2(h(x)) + 3$$

$$2(2x + 3) + 3$$

$$4x + 6 + 3$$

$$4x + 9$$

$$(g \circ h)(x)$$

$$3(2x + 3)^2$$

$$3(4x^2 + 12x + 9)$$

$$12x^2 + 36x + 27$$

EX #2 $p(x) = -2x^2$ $q(x) = 3x + 3$

Find:

$(p \circ q)(-1)$
 \parallel
 0

$p(q(x)) = -2(3x+3)^2$
 $= -2(9x^2 + 18x + 9)$
 $= -18x^2 - 36x - 18$

$\rightarrow f(q(-1)) = -18(-1)^2 - 36(-1) - 18$
 $= -18 + 36 - 18 = 0$

$(q \circ p)(-1)$
 \uparrow
 -3

$q(p(x)) = 3(-2x^2) + 3$
 $= -6x^2 + 3$

$q(p(-1)) = -6(-1)^2 + 3$
 $= -6 + 3 = -3$

EX #2 $p(x) = -2x^2$ $q(x) = 3x + 3$

Find:

$(p \circ q)(-1)$

$p(q(-1)) = p(3(-1) + 3)$
 $= p(0)$
 $= -2(0)^2 = 0$

$(q \circ p)(-1)$

$q(p(-1)) = q(-2(1)^2)$
 $q(-2)$
 $3(-2) + 3$
 $= -6 + 3 = -3$

$$\text{EX \#2} \quad p(x) = -2x^2 \quad q(x) = 3x + 3$$

Homework pg. 263 #35-50