Handout 1

MATH 140 Lab: Section 1

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Note: This handout covers some problems from Pre-Calculus and College Algebra

Instruction: Work in groups to solve the following mathematical problems, and I want from each group one person to volunteer as a representative to present the solution of (one problem)/(one part of problem) on our class board. <u>DON'T AFRAID TO MAKE MISTAKES BECAUSE WE LEARN FROM OUR MISTAKES!</u>

$= -8x^4 + 24x^2 - 15$

Problem 1: Given: $f(x) = -2x^2 + 3$ and $g(x) = \sqrt{2x+1}$

Find the following:

a. $(f+g)(1)$
b. $(f \circ g)(x)$
c. $(g \circ f)(x)$
d. $(f \circ f)(x)$
e. $(g \circ f)(-3)$
f. $\frac{f(b+h)-f(b)}{h}$

(f) $\frac{f(b+h)-f(b)}{h} = \frac{-2(b+h)^2+3-(-2b^2+3)}{h} =$

$= \frac{-2(b^2+2bh+h^2)+3-2b^2-3}{h} = \frac{\cancel{-2b^2}-4bh-2h^2+\cancel{3}+\cancel{2b^2}-\cancel{3}}{h}$

$= \frac{-4bh-2h^2}{h} = \frac{-2\cancel{h}(2b+h)}{\cancel{h}} = \boxed{-4b-2h}$

(a) $(f+g)(x) = f(x) + g(x) = -2x^2 + 3 + \sqrt{2x+1}$

$(f+g)(1) = -2(1)^2 + 3 + \sqrt{2(1)+1} = -2 + 3 + \sqrt{3} = \boxed{1+\sqrt{3}}$

(b) $(f \circ g)(x) = f(g(x)) = -2(\sqrt{2x+1})^2 + 3 = -2(2x+1) + 3$

$= -4x - 2 + 3 = \boxed{-4x+1}$

(c) $(g \circ f)(x) = g(f(x)) = \sqrt{2(-2x^2+3)+1} = \sqrt{-4x^2+6+1} = \boxed{\sqrt{-4x^2+7}}$

(d) $(f \circ f)(x) = f(f(x)) = -2(-2x^2+3)^2 + 3 = -2(4x^4 - 12x^2 + 9) + 3 =$

$= -8x^4 + 24x^2 - 18 + 3 =$

(e) $(g \circ f)(-3) \Rightarrow (g \circ f)(x) = \sqrt{-4x^2+7} \Rightarrow (g \circ f)(-3) = \sqrt{-4(9)+7} = \sqrt{-36+7} = \sqrt{-29}$

So, it's undefined because square root of a negative number is undefined.

Problem 2: Find the domain for the following functions:

a. $f(x) = \frac{|x|}{x}$
b. $f(x) = \frac{x}{x^2+1}$
c. $f(x) = \sqrt{4 - x^2}$

ⓐ f(x) is an absolute value function that is defined for all x, but we have a denominator which is x. As we know it shouldn't be zero because it will be undefined. Hence, the domain of $\frac{|x|}{x}$ is $(-\infty,\infty)/\{0\}$.

ⓑ $f(x) = \frac{x}{x^2+1}$ is NOT defined when the denominator is zero $\Rightarrow x^2+1 \neq 0$. This means that $x^2+1>0$ because x^2 and 1 are non-negative numbers. Hence, the domain of $\frac{x}{x^2+1}$ is $(-\infty,\infty)$.

ⓒ $4-x \geq 0 \Rightarrow 4 \geq x^2$

$\Rightarrow \sqrt{4} \geq \sqrt{x^2}$

$\Rightarrow 2 \geq |x|$ because the square root of x^2 is $|x|$ always.

Hence, $|x| \leq 2$ which implies that the domain will be $[-2,2]$.

Problem 3: Find the proportionality constant for each of the following:

a. y is directly proportional to x. If $x = 3$, then $y = 24$.
b. m is inversely proportional to the square of n. If $n = 6$, then $m = 14$.
c. a is jointly proportional to x and y and inversely proportional to z. If $x = 2$, $y = 3$, and $z = 5$, then $a = 50$.

(a) $y = kx$ find $k = ?$ Given $x = 3$ and $y = 24$

$\Rightarrow 24 = k(3) \Rightarrow \boxed{k = \frac{24}{3} = 8}$

Thus, $y = 8x$.

(b) $m = \frac{k}{n^2}$ find $k = ?$ Given $n = 6$ and $m = 14$.

$\Rightarrow \frac{14}{1} = \frac{k}{36} \Rightarrow \boxed{k = (36)(14) = 504}$

Thus, $m = \frac{504}{n^2}$

(c) $a = \frac{kxy}{z}$ find $k = ?$ Given $x = 2$, $y = 3$ and $z = 5$
$a = 50$.

$\Rightarrow \frac{50}{1} = \frac{k(2)(3)}{5} \Rightarrow 6k = 250 \Rightarrow \boxed{k = \frac{\cancel{250}^{125}}{\cancel{6}_{3}} = \frac{125}{3}}$

Thus, $a = \frac{125xy}{3z}$