SECTION 7-1
OPERATIONS ON FUNCTIONS

The following should be review…

Use the two functions shown to compute: $(f + g)(x)$ $(f - g)(x)$ $(f \cdot g)(x)$ $\left(\dfrac{f}{g}\right)(x)$

$$f(x) = 2x^2 - 7x - 4 \quad \& \quad g(x) = x - 6$$

(f+g)	(f-g)	(f•g)
$= (2x^2 - 7x - 4) + (x - 6)$ combine like terms $= 2x^2 - 6x - 10$	$= (2x^2 - 7x - 4) - (x - 6)$ distribute the neg. sign $= 2x^2 - 7x - 10 - x + 6$ $= 2x^2 - 8x - 4$	Box: $2x^2$ -7x -4

(f•g) box:

	$2x^2$	-7x	-4
x	$2x^3$	$-7x^2$	-4x
-6	$-12x^2$	42x	24

$= 2x^3 - 19x^2 + 38x + 24$

We are leaving division out for reasons I won't bother you with.

The following should not be review…

Tyrone has $180 deducted from every paycheck for retirement. He can have these deductions taken before or after taxes are applied to his taxable income. His federal income tax rate is 18%.

Let x = Tyrone's pay
> Write a function r(x) that represents his pay less retirement. $r(x) = x - 180$
> Write a function t(x) that represents his pay less taxes. $t(x) = x - 0.18x$

If Tyrone earns $2200 every pay period, find the difference in his net income if he has the retirement deduction taken before or after taxes.

Retirement first t(r(2200))	Taxes first: r(t(2200))

1) find r(2200) = 2200 − 180
           = $2020
 2) find t(2020) = 2020 − 0.18(2020)
           = 2020 − 363.69
           = $1656.40
	1) find t(2200) = 2200 − 0.18(2200)
	           = 2200 − 396
	           = $1804
	 2) find r(1804) = 1804 − 180
	           = $1624

1656.40 − 1624 = $32.40   Tyrone would receive $32.40 more in net pay if he had his retirement taken out before taxes.

COMPOSITION OF FUNCTIONS

Suppose $f(x) = 8 - 9x$, $g(x) = 2x^2 - 1$ and $h(x) = x - x^2$

Find the following:

1) $(f \circ g)(3)$

$g(3) = 2(3)^2 - 1$
$\quad = 2(9) - 1$
$\quad = 18 - 1$
$\quad = 17$
$f(17) = 8 - 9(17)$
$\quad = 8 - 153$
$\quad = -145$
$(f \circ g)(3) = -145$

2) $h(f(2))$

$f(2) = 8 - 9(2)$
$\quad = 8 - 18$
$\quad = -10$
$h(-10) = -10 - (-10)^2$
$\quad = -10 - 100$
$\quad = -110$
$h(f(2)) = -110$

3) $g[f(h(1))]$

$h(1) = 1 - 1^2$
$\quad = 1 - 1$
$\quad = 0$
$f(0) = 8 - 9(0)$
$\quad = 8 - 0$
$\quad = 8$
$g(8) = 2(8)^2 - 1$
$\quad = 2(64) - 1$
$\quad = 128 - 1$
$\quad = 127$
$g[f(h(1))] = 127$

4) $[f \circ g](x)$

Plug entire g-function into f
$= 8 - 9(2x^2 - 1)$
simplify
$= 8 - 18x^2 + 9$
$= -18x^2 + 17$
$[f \circ g](x) = -18x^2 + 17$

5) $g(f(x))$

Plug entire f-function into g
$= 2(8 - 9x)^2 - 1$
simplify (FOIL)
$= 2(8 - 9x)(8 - 9x) - 1$
$= 2(64 - 72x - 72x + 81x^2) - 1$
$= 2(64 - 144x + 81x^2) - 1$
$= 128 - 288x + 162x^2 - 1$
$= 162x^2 - 288x + 127$
$g(f(x)) = 162x^2 - 288x + 127$

DOES A COMPOSTION OF FUNCTIONS EXIST?
    if so, find its domain and range.

Suppose $f = \{ (7, 8), (5, 3), (9, 8), (11, 4) \}$ and $g = \{ (5, 7), (3, 5), (7, 9), (9, 11) \}$

To find f ∘ g, start with the x-coordinate in the "g" function (5), link it to its y-coordinate (7), find the matching x-coordinate in the "f" function (7), and link it to its y-coordinate (8). i.e. (5, 8)

Find f ∘ g and g ∘ f

f ∘ g
$\{(5, 8), (3, 3), (7, 8), (9, 4)\}$

g ∘ f
$\{(7, ?), (5, 5), (9, ?), (11, ?)\}$
since (5, 5) is the only set of coordinates that exists,
g ∘ f = $\{(5, 5)\}$