Pre-Calculus 30 **10.1 and 10.2 Function Operations**

Sum of Functions

$h(x) = f(x) + g(x)$ This can also be written as $h(x) = (f + g)(x)$.

Difference of Functions

$h(x) = f(x) - g(x)$ This can also be written as $h(x) = (f - g)(x)$

Examples

1. Given the functions $f(x) = 2x + 1$ and $g(x) = x^2$, determine the function $h(x) = (f + g)(x)$. Find $h(3)$.

2. Given the functions $f(x) = \sqrt{x-1}$ and $g(x) = x - 2$, determine $h(x) = f(x) - g(x)$.

3. If $h(x) = (f + g)(x)$ and $f(x) = 5x + 2$, determine $g(x)$ when $h(x) = \sqrt{x+7} + 5x + 2$.

Product of Functions

$h(x) = f(x)g(x)$ This can also be written as $h(x) = (f \bullet g)(x)$

Quotient of Functions

$h(x) = \dfrac{f(x)}{g(x)}$ This can also be written as $h(x) = \left(\dfrac{f}{g}\right)(x)$, where $g(x) \neq 0$

Examples Given $f(x) = x^2 + x - 6$ and $g(x) = 2x + 6$, determine the following and state any non-permissible values.

a) $h(x) = (f \bullet g)(x)$

b) $h(x) = \left(\dfrac{g}{f}\right)(x)$

Assignment: Page 483 #1 – 4, 9 – 11 (just parts "a" and "c" of all questions)
Page 496 #1, 6 – 8 (just parts "a" and "c" of all questions)

Pre-Calculus **10.3 Composite Functions (Day 1)**

- We can substitute one function, $f(x)$, into another function, $g(x)$. The result would be $g(f(x))$. This is read "*g* of *f* of *x*".
- The notation for this function composition is $(g \circ f)(x)$ …**not to be confused with multiplication** which is $(g \bullet f)(x)$.

Example: Evaluate for $f(x) = 4x,\ g(x) = x + 6,\ h(x) = x^2$.

1. $f(g(3))$
2. $g(h(-2))$
3. $h(h(2))$

Example: If $f(x) = |x|$ and $g(x) = x + 1$, determine $f(g(-11))$.

Ex. 3, p. 503 Let $f(x) = x + 1$ and $g(x) = x^2$. Determine the equation of each composite function. Sketch the graph and state the domain and range.

a) $y = f(g(x))$

b) $y = f(f(x))$

Assignment: Page 507 #1, 3 – 5

Pre-Calculus30 **10.3 Composite Functions (Day 2)**

A. Composite functions and restrictions – Does *order* matter when composing functions?

Consider $f(x)=\sqrt{x-1}$ and $g(x)=x^2$.

a) Determine $(f\circ g)(x)$.

b) Determine $(g\circ f)(x)$.

domain of *f(x):*

domain of *g(x):*

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

- find the restrictions of *g(x)*and then of *f(g(x))*

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

- find the restrictions of *f(x)*and then of *g(f(x))*

B. Determining the original functions from a composition.

If $h(x)=f(g(x))$, determine $f(x)$ and $g(x)$.

a) $h(x)=(x-2)^2+(x-2)+1$

Look for common elements. What do you see?

b) $h(x)=\sqrt{x^3+1}$

Start with the function inside the radical.

Your Turn If $h(x)=f(g(x))$, determine $f(x)$ and $g(x)$. Here, $h(x)=\sqrt[3]{x}+\dfrac{3}{3+\sqrt[3]{x}}$.

C. Applications (Page 505 Example 5)

A spherical weather balloon is being inflated. The balloon's radius, r, in feet, after t minutes is given by $r = \sqrt{t}$.

a) Express the **volume** of the balloon as a function of time, t. Recall volume of a sphere is $V(r) = \frac{4}{3}\pi r^3$.

Compose the new function.

b) After how many minutes will the volume be 4000 ft^3?

Your Turn. Same base question as above

a) Express the **surface area** of the balloon as a function of time, t. Recall surface area of a sphere is $SA = 4\pi r^2$

b) After how many minutes will the surface area be 180 ft^2?

Assignment: Page 507 #6 – 8, 11a, 14, 16 (show 1 method only), 18