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NOTES: Section 6.3 – Perform Function Operations and Composition

Goals: #1 - I can add, subtract, multiply, and divide functions and state their domain.

#2 - I can evaluate compositions of functions and state their domain.

Homework: Lesson 6.3 Worksheet 

Notes:

So far, we have learned how to add, subtrcat, multiply, and divide polynomial functions. These operations can be defined for any number of functions.

f(x) g(x)

Let f and g be any two functions. We can peform the four basic operations on f and g.

Addition	$f(x) + g(x)$
Subtraction	$f(x) - g(x)$
Multiplication	$f(x) \cdot g(x)$
Division	$\frac{f(x)}{g(x)}$

The domain consists of the x-values that are in the domains of BOTH f and g.

Example #1: Perform the following operations on f and g.

1. Let $f(x) = 4x^{1/2} - 1$ and $g(x) = -9x^{1/2} + 3$. Find the following.

a. $f(x) + g(x)$

$(4x^{1/2} - 1) + (-9x^{1/2} + 3)$

$\boxed{-5x^{1/2} + 2}$

b. $f(x) - g(x)$

$(4x^{1/2} - 1) - (-9x^{1/2} + 3)$

$\boxed{13x^{1/2} - 4}$

c. the domains of $f + g$ and $f - g$

$4\sqrt{x}$

f: all nonnegative real #s

g: all nonnegative real #s

$-9\sqrt{x}$

$\boxed{f+g \text{ \& } f-g\text{: all nonnegative real \#s}}$

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You practice: Perform the following operations on f and g.

1. Let $f(x) = 5x^{1/3} + 1$ and $g(x) = -11x^{\frac{1}{3}} - 4$. Find the following.

   a. $f(x) + g(x)$

   $(5x^{1/3} + 1) + (-11x^{1/3} - 4)$

   $-6x^{1/3} - 3$

   b. $f(x) - g(x)$

   $(5x^{1/3} + 1) - (-11x^{1/3} - 4)$

   $16x^{1/3} + 5$

   $5\sqrt[3]{x}$

   c. the domains of $f + g$ and $f - g$

   f: all real #s

   g: all real #s

   $-11\sqrt[3]{x}$

   f+g ; f-g: all real #s

Example #2: Perform the following operations on f, g, and h.

2. Let $f(x) = 6x$, $g(x) = x^{3/4}$, and $h(x) = -2x^{1/2}$. Find the following.

   a. $f(x) \cdot g(x)$

   $(6x)(x^{3/4})$

   $6x^{4/4 + 3/4}$

   $6x^{7/4}$

   b. $f(x) \cdot h(x)$

   $(6x)(-2x^{1/2})$

   $-12x^{2/2 + 1/2}$

   $-2x^{3/2}$

   c. the domains of $f \cdot g$ and $f \cdot h$

   f: all real #s

   g: all real nonnegative #s

   h: all real nonnegative #s

   f·g ; f·h: all real nonnegative #s

   d. $\frac{f(x)}{g(x)}$

   $\frac{6x}{x^{3/4}}$

   $6x^{4/4 - 3/4}$

   $6x^{1/4}$

   e. $\frac{f(x)}{h(x)}$

   $\frac{6x}{-2x^{1/2}}$

   $-3x^{2/2 - 1/2}$

   $-3x^{1/2}$

   f. the domains of $\frac{f}{g}$ and $\frac{f}{h}$

   $\frac{f}{g}$; $\frac{f}{g}$: all real nonnegative #s

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You practice: Perform the following operations on f, g, and h.

1. Let $f(x) = 8x$, $g(x) = 2x^{5/6}$, and $h(x) = -x^{1/3}$. Find the following.

b. $f(x) \cdot g(x)$

$(8x)(2x^{5/6})$

$16x^{6/6+5/6}$

$\boxed{16x^{11/6}}$

b. $f(x) \cdot h(x)$

$(8x)(-x^{1/3})$

$-8x^{3/3+1/3}$

$\boxed{-8x^{4/3}}$

c. the domains of $f \cdot g$ and $f \cdot h$

f: all real #s
g: all real nonnegative #s
h: all real #s:

$f \cdot g$: all real nonnegative #s
$f \cdot h$: all real #s

d. $\frac{f(x)}{g(x)}$

$\frac{8x}{2x^{5/6}}$

$4x^{6/6-5/6}$

$\boxed{4x^{1/6}}$

e. $\frac{g(x)}{h(x)}$

$\frac{2x^{5/6}}{-x^{1/3}}$

$-2x^{5/6-2/6}$

$-2x^{3/6}$

$\boxed{-2x^{1/2}}$

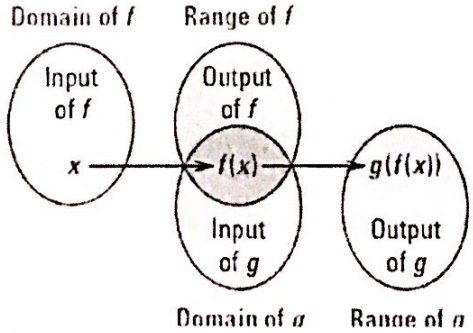
f. the domains of $\frac{f}{g}$ and $\frac{g}{h}$

$\frac{f}{g}$: $\frac{g}{h}$: all real nonnegative #s

Notes:

Another operation that can be performed within two functions is composition.

The composition of a function g with a function f is: $g(f(x))$



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Example #4: Perform the following operations on f, g, and h.

1. Let $f(x) = 3x - 8$, $g(x) = 2x^2$, and $h(x) = \frac{1}{x+1}$. Find the following.

a. $f(g(x))$

$f(2x^2)$

$3(2x^2) - 8$

$\boxed{6x^2 - 8}$

D: all real #s

b. $g(h(x))$

$g\left(\frac{1}{x+1}\right)$

$2\left(\frac{1}{x+1}\right)^2$

$2 \cdot \frac{1}{(x+1)^2}$

$\boxed{\frac{2}{(x+1)^2}}$

D: all real #s, $x \neq -1$

c. $h(f(x))$

$h(3x-8)$

$\frac{1}{(3x-8)+1}$

$\boxed{\frac{1}{3x-7}}$

D: all real #s, $x \neq -1$

d. $g(g(x))$

$g(2x^2)$

$2(2x^2)^2$

$2(4x^4)$

$\boxed{8x^4}$

D: all real #s

e. the domains of each composition

f: all real #s

g: all real #s

h: all real #s, $x \neq -1$

You practice: Perform the following operations on f, g, and h.

1. Let $f(x) = 5x - 2$, $g(x) = -x^2$, and $h(x) = \frac{x-2}{4}$. Find the following.

a. $f(g(x))$

$f(-x^2)$

$5(-x^2) - 2$

$\boxed{-5x^2 - 2}$

D: all real #s

b. $g(h(x))$

$g\left(\frac{x-2}{4}\right)$

$-\left(\frac{x-2}{4}\right)^2$

$\boxed{\frac{-(x-2)^2}{16}}$

D: all real #s

c. $h(f(x))$

$h(5x-2)$

$\frac{(5x-2)-2}{4}$

$\boxed{\frac{5x-4}{4}}$

D: all real #s

d. $g(g(x))$

$g(-x^2)$

$-(-x^2)^2$

$-(x^4)$

$\boxed{-x^4}$

D: all real #s

e. the domains of each composition

f: all real #s

g: all real #s

h: all real #s