# Math 111 Quiz #8 Answers

1. (2 pts.) For the function $f(x) = 3x^2 + 1$, simplify the quantity $\frac{f(x+h)-f(x)}{h}$.

Note: $$\begin{aligned} f(x+h) &= 3(x+h)^2 + 1 \\ &= 3(x^2 + 2xh + h^2) + 1 \\ &= 3x^2 + 6xh + 3h^2 + 1 \end{aligned}$$

$$\frac{f(x+h)-f(x)}{h} = \frac{3x^2+6xh+3h^2+1-(3x^2+1)}{h} = \frac{6xh+3h^2}{h} = \boxed{6x + 3h}$$

2. Here are some possible answers. Each can be composed to give us $F(x)$.

- $\boxed{v(x) = \sqrt{x^5+2}, \quad u(x) = 8 + x}$
- $\boxed{v(x) = x^5 + 2, \quad u(x) = 8 + \sqrt{x}}$
- $\boxed{v(x) = x^5, \quad u(x) = 8 + \sqrt{x+2}}$

3. Use the functions $f(x) = x - 4$ and $g(x) = x^2 + x - 12$ for parts (a) and (b) below.

(a) You could find a formula for $h(x)$ by multiplying $f(x)$ and $g(x)$ and then plug in $x = 0$, but I am going to find $f(0)$ and $g(0)$ instead because it is easier.

$h(0) = f(0) \cdot g(0) = -4(-12) = \boxed{48}$

(b) $\frac{f(x)}{g(x)} = \frac{x-4}{x^2+x-12}$ This will only be defined when the denominator is not equal to zero.

Solving $x^2 + x - 12 = 0 \quad \Rightarrow \quad (x+4)(x-3) = 0 \quad \Rightarrow \quad x = -4, x = 3$

So, the domain is $\boxed{x \neq -4, \ x \neq 3.}$

4. (a) Since $4x^{-2}$ has the power $-2$, so we can rewrite it as $\frac{4}{x^2}$. This gives a graph with a vertical asymptote of $x = 0$. The function will always be positive. (The 4 will simply stretch $x^{-2}$ by a factor of 4 vertically.) So, this matches graph $\boxed{\text{IV.}}$

(b) Since $7x^{1/3} = 7\sqrt[3]{x}$, we are looking for a graph of an odd root. (The 7 will simply stretch $x^{1/3}$ by a factor of 7 vertically.) So, this matches graph $\boxed{\text{I.}}$

(c) Since $-5x^7$ has a whole odd power, we are looking for a graph that is S-shaped like $x^3$. (The -5 will stretch $x^7$ by a factor of 5 vertically and reflect it over the $x$-axis.) So, this matches graph $\boxed{\text{II.}}$