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Friday, December 14, 2018 8:59 AM

10.3 Composite Functions Part 2

Ex. #1 Given $f(x) = \sqrt{x-4}$ and $g(x) = x^2$ find the following composite functions and any restrictions on the domain.

a) $f(g(x))$

$f(g(x)) = f(x^2)$

$f(g(x)) = \sqrt{x^2-4}$

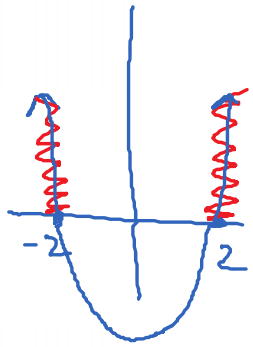
$x^2 - 4 \geq 0$

$(x-2)(x+2) \geq 0$

$x \geq 2 \quad x \leq -2$

or

$|x| \geq 2$



b) $g(f(x))$

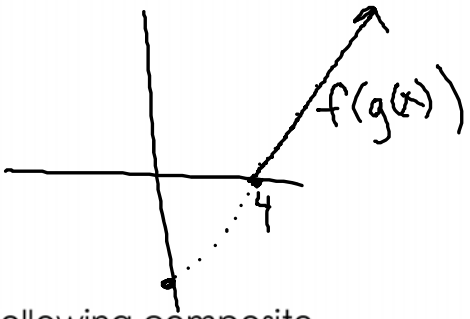
$g(f(x)) = g(\sqrt{x-4})$

$g(f(x)) = (\sqrt{x-4})^2$

$g(f(x)) = x-4$

$x - 4 \geq 0$

$x \geq 4$



Ex. #2: Given $f(x) = \frac{1}{x-2}$ and $g(x) = 3 - x$ find the following composite functions and ~~any~~ restrictions on the domain.

a) $f(g(x))$

$f(g(x)) = f(3-x)$

$f(g(x)) = \frac{1}{(3-x)-2}$

$f(g(x)) = \frac{1}{-x+1}$ $\quad x \neq 1$

b) $g(f(x))$

$g(f(x)) = g(\frac{1}{x-2})$

$g(f(x)) = 3 - \frac{1}{x-2}$

$g(f(x)) = \frac{3(x-2)}{x-2} - \frac{1}{x-2}$

$g(f(x)) = \frac{3x-6-1}{x-2}$

$g(f(x)) = \frac{3x-7}{x-2}$ $\quad x \neq 2$

Ex. #3: Given $f(x) = 2x - 1$ and $g(x) = \sin x$, find $f(g(x))$ and graph the composite function. Domain and Range

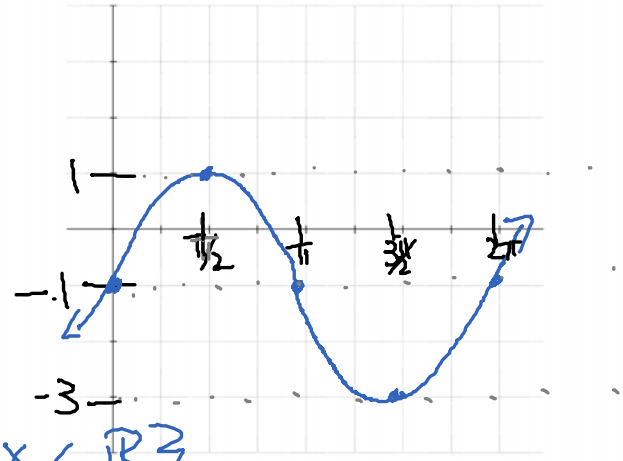
$f(g(x)) = f(\sin x)$

$f(g(x)) = 2(\sin x) - 1$

$f(g(x)) = 2\sin x - 1$

Max $= 2 - 1 = 1$

Min $= -2 - 1 = -3$



domain $\{x \mid x \in \mathbb{R}\}$

Range $\{y \mid -3 \le y \le 1 \quad y \in \mathbb{R}\}$

Ex. #4: Given $f(x) = 3\cos x$ and $g(x) = 2x$, find $f(g(x))$ and graph the composite function.

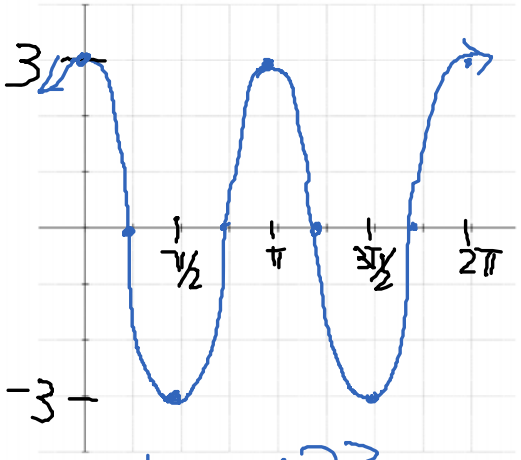
$f(g(x)) = f(2x)$

$f(g(x)) = 3\cos(2x)$

$f(g(x)) = 3\cos 2x$

Period $= \frac{2\pi}{b}$

Period $= \frac{2\pi}{2} = \pi$



domain $\{x \mid x \in \mathbb{R}\}$

Range $\{y \mid -3 \le y \le 3 \quad y \in \mathbb{R}\}$

If two functions are inverses of each other then $f(g(x)) = x$ and $g(f(x)) = x$

Ex. #5: Verify that $f(x) = 3^{x+1}$ and $g(x) = \log_3 x - 1$ are inverses of each other.

$f(g(x)) = f(\log_3 x - 1)$

$f(g(x)) = 3^{\log_3 x - 1 + 1}$

$f(g(x)) = 3^{\log_3 x}$

$f(g(x)) = x$

$g(f(x)) = g(3^{x+1})$

$g(f(x)) = \log_3 3^{x+1} - 1$

$g(f(x)) = (x+1)\log_3 3 - 1$

$g(f(x)) = (x+1)(1) - 1$

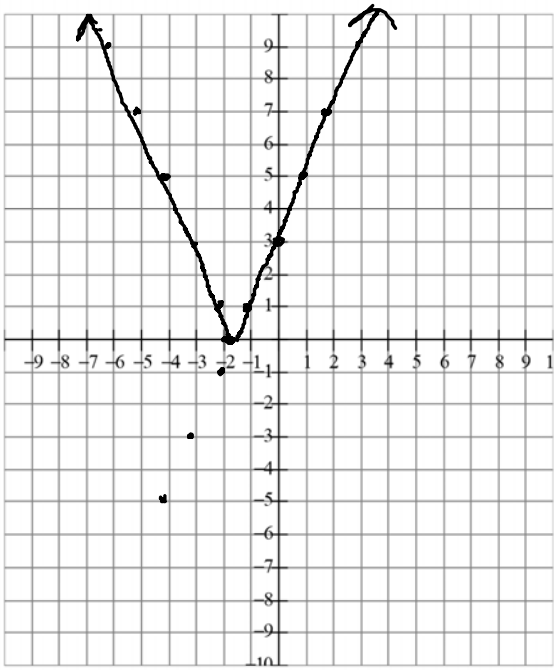
$g(f(x)) = x + 1 - 1$

$g(f(x)) = x$

Ex. #6: Given $f(x) = |x + 3|$ and $g(x) = 2x$, find $f(g(x))$ and graph the composite function.

$f(g(x)) = f(2x)$

$f(g(x)) = |2x + 3|$



$y = 2x + 3$

$0 = 2x + 3$

$-3 = 2x$

$-3/2 = x$

$\{x \mid x \in \mathbb{R}\}$

$\{y \mid y \geq 0, y \in \mathbb{R}\}$