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§ 6.1 Composite Functions

$x \rightarrow$ [g] $\rightarrow g(x) \rightarrow$ [f] $\rightarrow f(g(x))$

composite function

$x \rightarrow$ [f takes an input x, multiplies by 3, subtracts 9, and then outputs result] $\rightarrow f(x)$

$x \rightarrow 3x - 9$

$4x+8 \rightarrow$ [f takes an input x, multiplies by 3, subtracts 9, and then outputs result] $\rightarrow 3(4x+8) - 9$

"$g(x)$" $\rightarrow$

$= 12x + 24 - 9$

$= 12x + 15$

$f(g(x)) = 12x + 15$

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

same

"f compose g" of x = "f of g of x"

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

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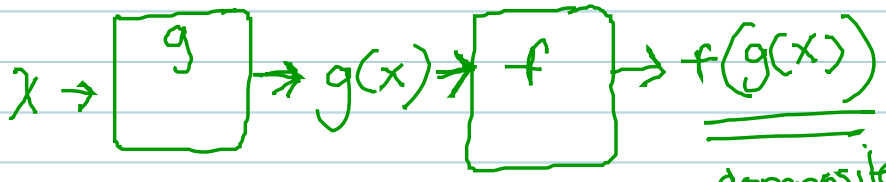
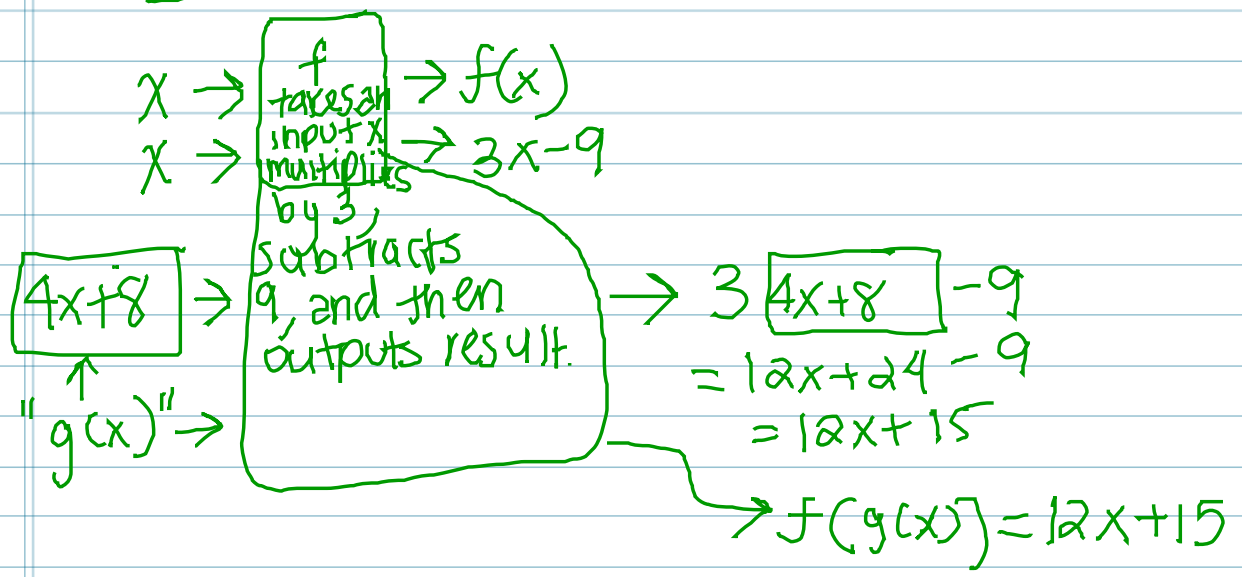
§6.1 composite functions



composite function



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

↑ same ↑

"f compose g" of x = "f of g of x"

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

$(f \circ g)(x) = f(g(x))$ put into f then to g

x	g(x)
-1	5
0	7
1	6
2	4
3	3
4	~~4~~
5	6
6	7
7	7

$g(x)$

$g(-1) = 5$

$g(0) = 7$

$g(1) = 6$

$g(2) = 4$

$g(3) = 3$

$g(5) = 6$

$g(6) = 7$

$g(7) = 7$

(38) Find $(f \circ g)(4)$ and $(g \circ f)(-1)$

$(f \circ g)(4)$

$f(g(4))$

$g(4) = 4 \rightarrow x = 4$

$= f(4)$ look at graph

$= -4$

(38) $(g \circ f)(-1)$

$g(f(-1))$ ← look at graph

$g(1)$ ← look at table

$= \boxed{6}$

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(10) $f(x) = 5x^2 - 4 \quad g(x) = 7 - \frac{1}{2}x^2$

Find

$(g \circ g)(0)$

$g(g(0))$

inside out

$g\left(g(0) = 7 - \frac{1}{2}(0)^2\right)$

$g(7) = 7 - \frac{1}{2}(7)^2$

$g(7) = \boxed{-17.5}$

$(f \circ f)(x)$

$f(f(x))$

$f(5x^2 - 4) = 5(5x^2 - 4)^2 - 4$

$= 5(5x^2 - 4)(5x^2 - 4) - 4$

$= 5(25x^4 - 20x^2 - 20x^2 + 16) - 4$

$= 125x^4 - 200x^2 + 80 - 4$

$= \boxed{125x^4 - 200x^2 + 76}$

$x \to \boxed{f} \to f(x) \to \boxed{F} \to f(f(x))$

$x \to \quad \to 5x^2-4 \to \quad \to 125x^4-200x^2+76$

*Remember steps to Find the domain

(14) Find the domain of the composite function $f \circ g$

$f(x)=\frac{8}{x-2}$ and $g(x)=\frac{3}{x}$

$(f \circ g)(x)$

$= f(g(x))$

$= f\left(\frac{3}{x}\right) = \frac{8}{\left(\frac{3}{x}\right)-2}$ STOP simplify later

$$\frac{8}{\frac{3}{x}-2}$$

Domain of

$$\frac{8}{\frac{3}{x}-2}$$

Domain $\left\{ x \mid x \text{ is real}, x \neq 0, x \neq \frac{3}{2} \right\}$

1. start with all real #s
2. Even radical N/A Ex: $\sqrt{}$, $\sqrt[4]{}$, $\sqrt[6]{}$, ...
3. denominator = 0

$\frac{3}{x} - 2 = 0 \to \frac{3}{x} = \frac{2}{1}$

$2x = 3 \cdot 1$

$\frac{2x}{2} = \frac{3}{2}$

$x = \frac{3}{2}$ BAD

$\frac{3}{x}$ $x=0$ BAD

(38) Find $C(p)$ and its domain

$p :=$ price
$x :=$ quantity sold

Demand Eqn: $p = -\frac{1}{9}x + 200$ for $0 \le x \le 1800$

Cost Eqn: $C(x) = \frac{\sqrt{x}}{200} + 600$

$$C\left(-\frac{1}{9}x + 200\right) = \frac{\sqrt{-\frac{1}{9}x + 200}}{200} + 600$$

$$p = -\frac{1}{9}x + 200$$
$$-200 \qquad -200$$

$$(9)\ p - 200 = -\frac{1}{9}x\,(9)$$

$$\frac{9p - 1800}{-1} = \frac{-1x}{-1}$$

$$-9p + 1800 = x$$

$$C(p) = \frac{\sqrt{-9p + 1800}}{200} + 600$$

Domain?

Step 2

$$-9p + 1800 \ge 0$$
$$-1800 \qquad -1800$$
$$\frac{-9p}{-9} \ge \frac{-1800}{-9}$$

↑ sign changes

$p \le 200$

$0 < p \le 200$

$[0, 200]$

{Domain $p \mid p$ is real, $0 \le p \le 200$}

(20) Find the domain of the composite function $g \circ f$ $f(x) = x^2$ and $g(x) = x^2 + 6$

$(g \circ f)(x)$

$g(f(x))$

$g(x^2) = (x^2)^2 + 6$

$g(x^2) = x^4 + 6$

All real #'s $\boxed{(-\infty, \infty)}$