Calculus 1 Workbook Solutions

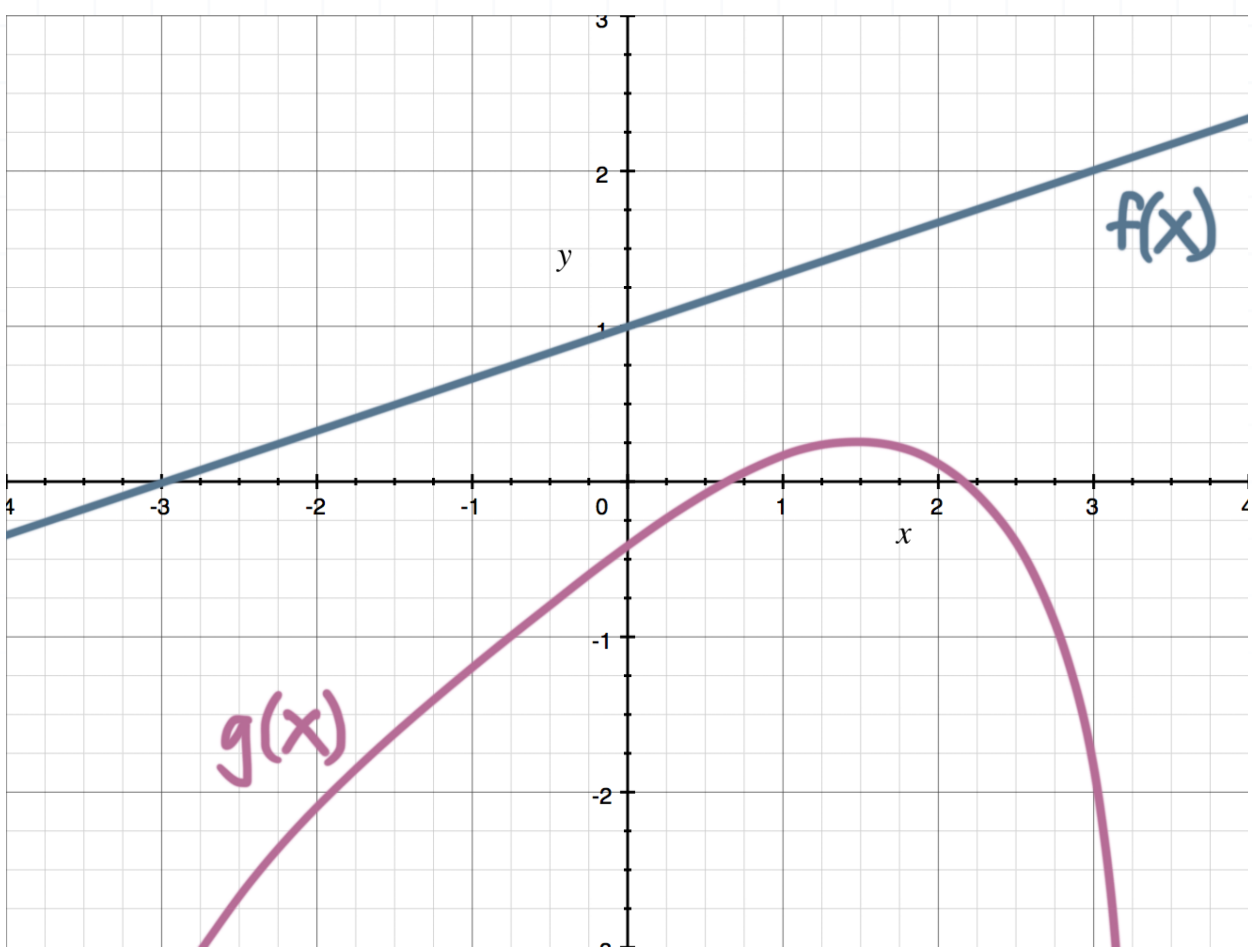
Combinations and composites

krista king MATH

LIMITS OF COMBINATIONS

1. Use limit laws and the graph below to evaluate the limit.

$$\lim_{x \to 3} \left[4f(x) - 3g(x)\right]$$



Solution:

We can simplify the limit, and then evaluate both functions at $x = 3$.

$$\lim_{x \to 3} \left[4f(x) - 3g(x)\right]$$

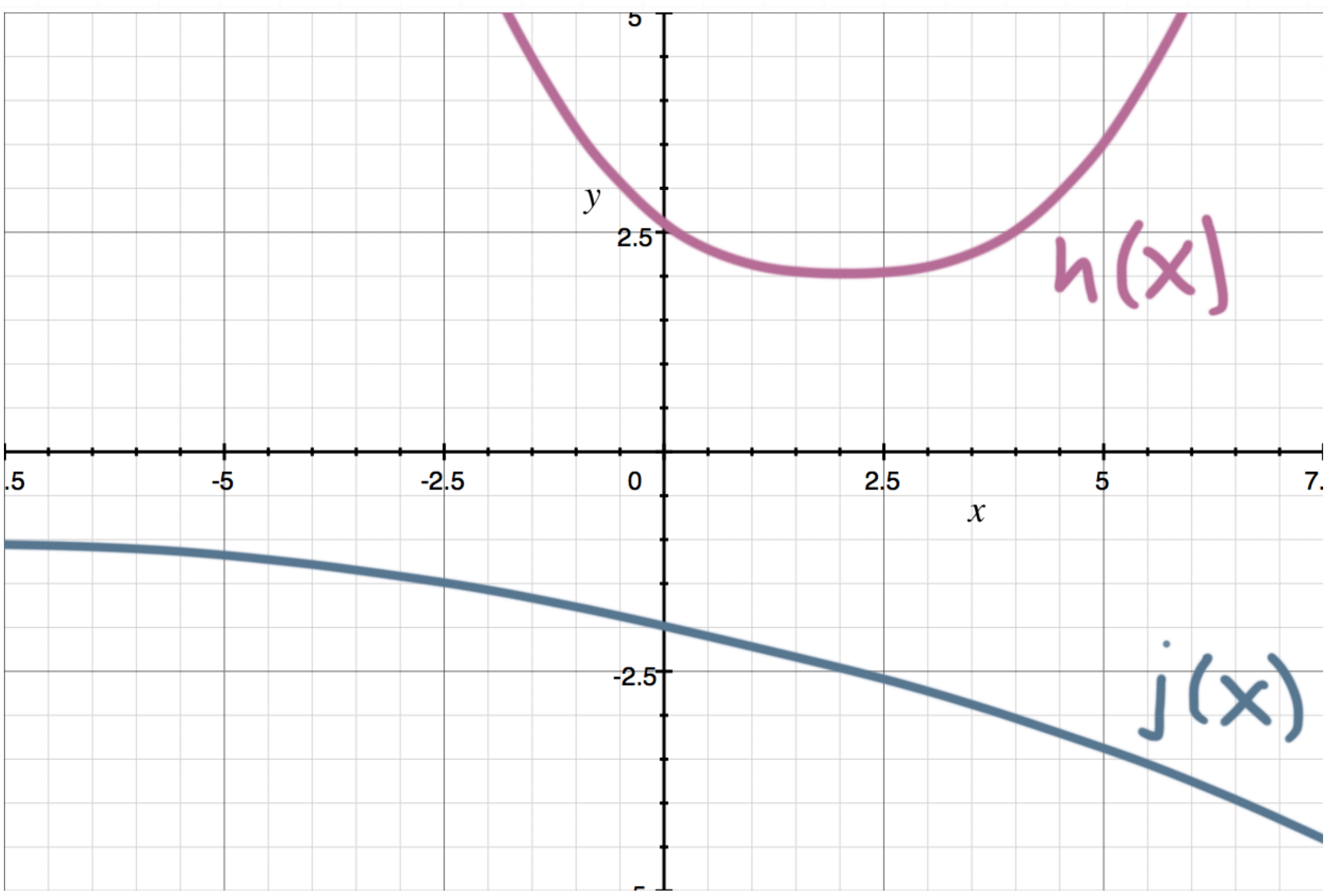
$$4\lim_{x\to 3} f(x) - 3\lim_{x\to 3} g(x)$$

$$4(2) - 3(-2)$$

$$14$$

■ 2. Use limit laws and the graph below to evaluate the limit.

$$\lim_{x\to 4}\frac{h(x)}{j(x)}$$



Solution:

We can simplify the limit, and then evaluate both functions at $x = 4$.

$$\lim_{x\to 4} \frac{h(x)}{j(x)}$$

$$\frac{\lim_{x\to 4} h(x)}{\lim_{x\to 4} j(x)}$$

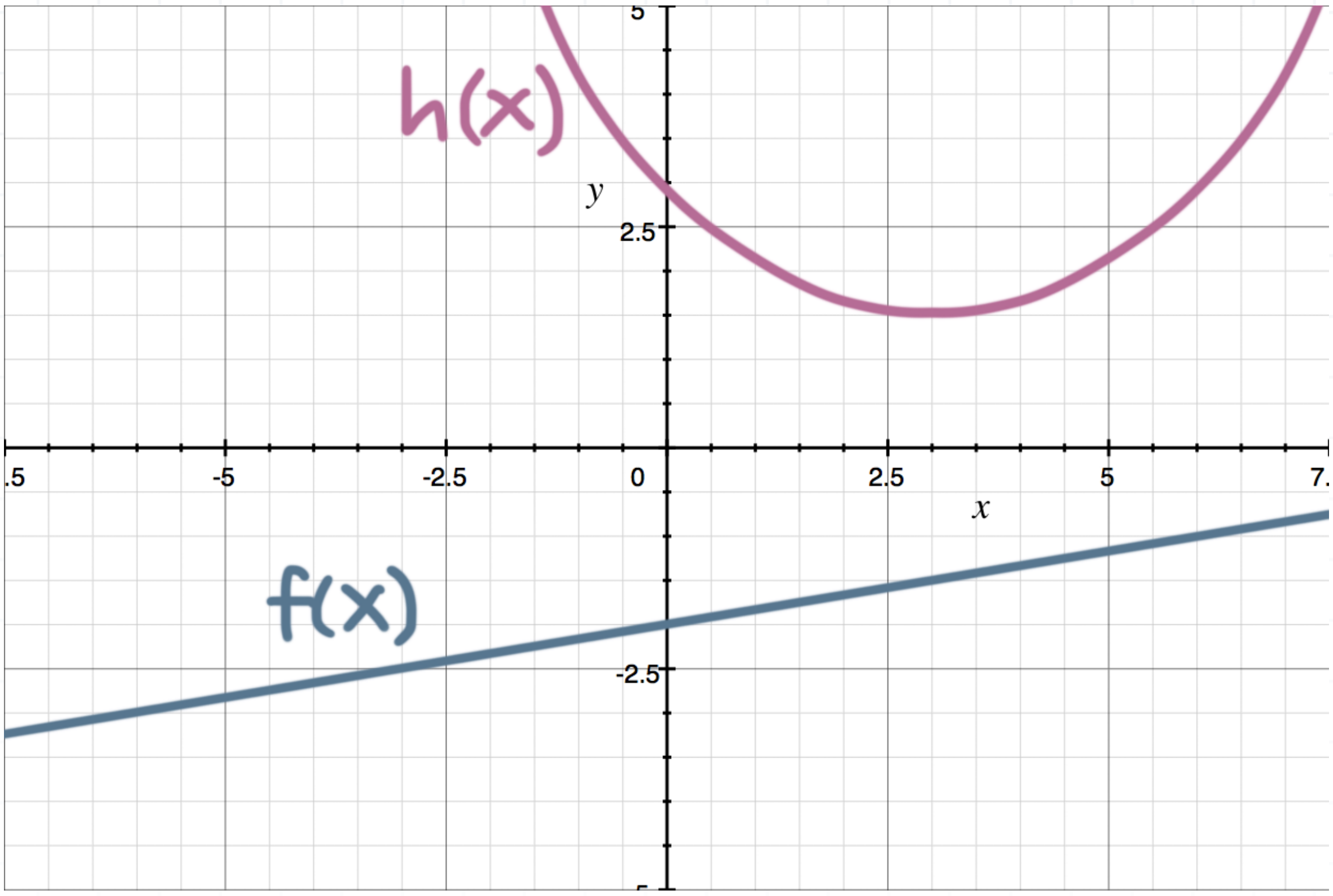
$$\frac{\frac{5}{2}}{-3}$$

$$\frac{5}{2} \cdot \frac{1}{-3}$$

$$-\frac{5}{6}$$

■ 3. Use limit laws and the graph below to evaluate the limit.

$$\lim_{x\to 0} \left[2f(x) \cdot 3h(x)\right]$$



Solution:

We can simplify the limit, and then evaluate both functions at $x = 0$.

$$\lim_{x\to 0}\left[2f(x)\cdot 3h(x)\right]$$

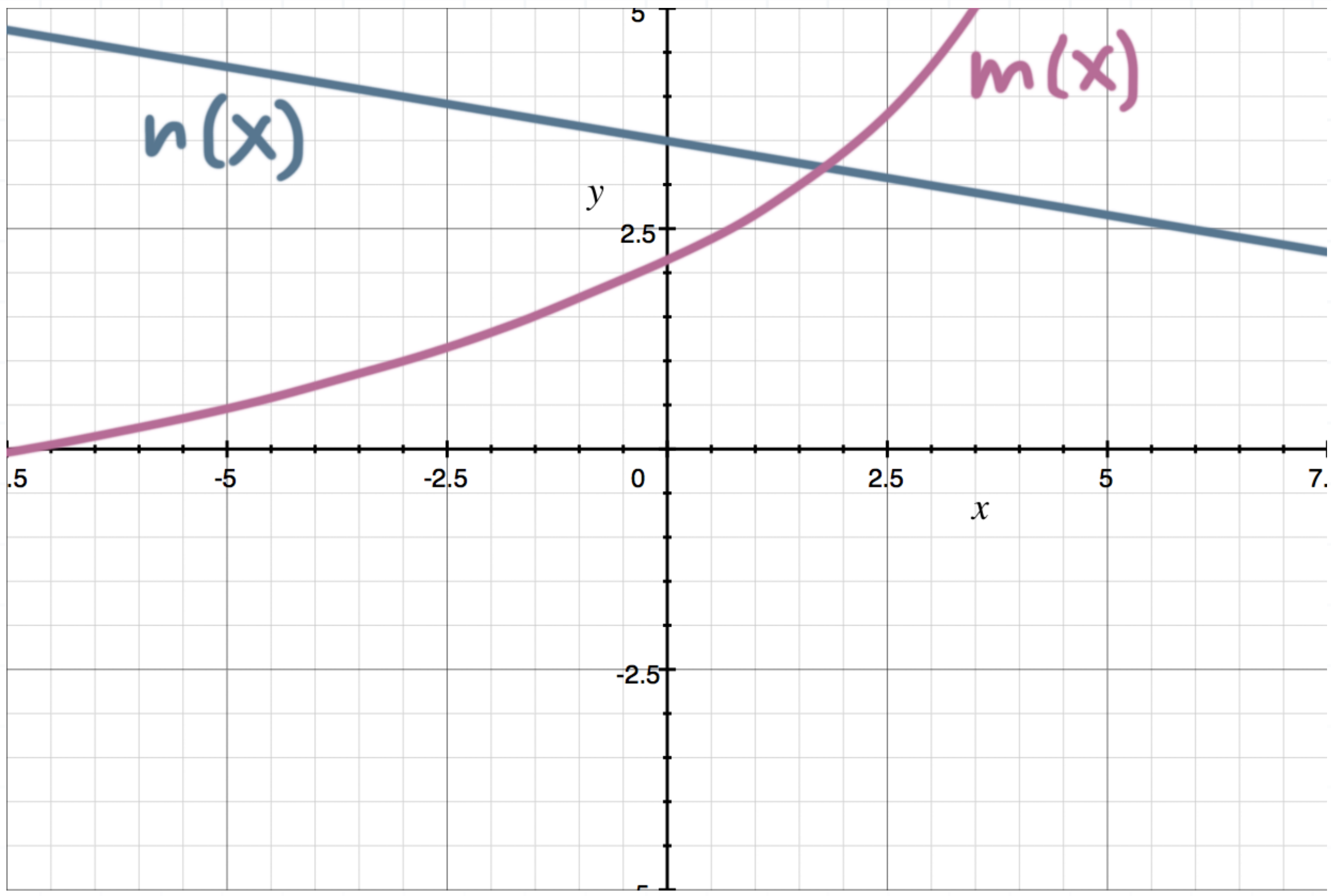
$$2\lim_{x\to 0} f(x)\cdot 3\lim_{x\to 0} h(x)$$

$$2(-2)\cdot 3(3)$$

$$-36$$

■ 4. Use limit laws and the graph below to evaluate the limit.

$$\lim_{x\to-3}\left[\frac{5m(x)}{n(x)}-\frac{4m(x)}{n(x)}\right]$$



Solution:

We can simplify the limit, and then evaluate both functions at $x=-3$.

$$\lim_{x\to-3}\left[\frac{5m(x)}{n(x)}-\frac{4m(x)}{n(x)}\right]$$

$$\frac{5\lim_{x\to-3}m(x)}{\lim_{x\to-3}n(x)}-\frac{4\lim_{x\to-3}m(x)}{\lim_{x\to-3}n(x)}$$

$$\frac{5(1)}{4}-\frac{4(1)}{4}$$

$$\frac{1}{4}$$

LIMITS OF COMPOSITES

■ 1. What is $\lim_{x\to 3} f(g(x))$ if $f(x)=4x$ and $g(x)=6x-9$?

Solution:

If f is continuous at $x=3$, then

$$\lim_{x\to 3} f(g(x)) = f\left(\lim_{x\to 3} g(x)\right)$$

$$\lim_{x\to 3} f(g(x)) = f\left(\lim_{x\to 3} 6x-9\right)$$

$$\lim_{x\to 3} f(g(x)) = f(6(3)-9) = f(9) = 4(9) = 36$$

■ 2. What is $\lim_{x\to -4} f(g(x))$ if $f(x)=2x^2$ and $g(x)=2x-1$?

Solution:

If f is continuous at $x=-4$, then

$$\lim_{x\to -4} f(g(x)) = f\left(\lim_{x\to -4} g(x)\right)$$

$$\lim_{x \to -4} f(g(x)) = f\left(\lim_{x \to -4} 2x - 1\right)$$

$$\lim_{x \to -4} f(g(x)) = f(2(-4) - 1) = f(-9) = 2(-9)^2 = 162$$

■ 3. What is $\lim_{x \to \frac{\pi}{2}} f(g(x))$ if $f(x) = \sin x$ and $g(x) = x/2$?

Solution:

If f is continuous at $x = \pi/2$, then

$$\lim_{x \to \frac{\pi}{2}} f(g(x)) = f\left(\lim_{x \to \frac{\pi}{2}} g(x)\right)$$

$$\lim_{x \to \frac{\pi}{2}} f(g(x)) = f\left(\lim_{x \to \frac{\pi}{2}} \frac{x}{2}\right)$$

$$\lim_{x \to \frac{\pi}{2}} f(g(x)) = f\left(\frac{\frac{\pi}{2}}{2}\right) = f\left(\frac{\pi}{4}\right) = \sin\frac{\pi}{4} = \frac{\sqrt{2}}{2}$$

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