

Name: \_\_\_\_\_

### 3.4 Chain Rule

**Chain Rule:**

Let  $z = g(x)$  and  $y = f(z)$ , so  $y = f(g(x))$ .

$$\frac{dy}{dx} =$$

$$\frac{d}{dx}f(g(x)) =$$

1. Consider the function  $f(x) = (3x^4 - 5)^3 - 2$ . Rewrite  $f(x)$  as a composition of functions, where  $f(x) = v(u(x))$ . Find  $v(x)$  and  $u(x)$ . Are these the only possibilities?
2. Compute derivatives for the following functions. Assume  $a$ ,  $b$ , and  $c$  are constants:

(a)  $f(x) = \sqrt{3x^2 - 5x + 3}$

(e)  $g(t) = (1 - e^{2\sqrt{t}})^{19}$

(b)  $t(x) = (x^3 + x)^{-1}$

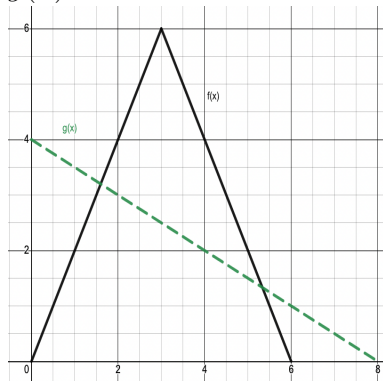
(f)  $y(m) = \sqrt{e^{2m} + \sqrt{e^{3m}}}$

(c)  $k(t) = e^{4t}$

(g)  $f(w) = (bw^a + c)e^{w^b}$

(d)  $h(y) = \sqrt{e^{-\frac{y}{7}} + 5}$

3. The function  $f(x)$  is shown as the piecewise function with solid lines. The function  $g(x)$  is the dotted line. Find the following:



(a)  $\frac{d}{dx}f(g(1))$

(b)  $\frac{d}{dx}e^{f(2)}$

4. For  $t$  in years since 2010, daily oil consumption in China, in thousands of barrels, was approximated by

$$B = 8938e^{0.05t}.$$

(a) Is daily oil consumption increasing or decreasing with time?

(b) How fast is oil consumption changing in 2020?