1. (a) \[ y' = \frac{\sqrt{2x+1} (3) - (3x-2)(\frac{1}{2})(2x+1)^{-\frac{1}{2}}(2)}{2x+1} \]

(b) \[ \ln y = \cos x \ln (\ln x) \]
\[ \frac{y'}{y} = \cos x \left( \frac{1}{\ln x} \right) (-\sin x) \]
\[ y' = (\ln x) \cos x \left( \frac{\cos x}{x \ln x} - \frac{\sin x}{x} \right) \]

(c) \[ y' = x \frac{1}{(1+4x)^2} - 4 + \tan^{-1}(4x) \]

(d) \[ \cos(xy) \left[ xy' + y \right] = 2x - y' \]
\[ y' (x \cos(xy) + 1) = 2x - y \cos(xy) \]
\[ y' = \frac{2x - y \cos(xy)}{x \cos(xy) + 1} \]

2. \( (f(x)g(x))' = \lim_{h \to 0} \frac{f(x+h)g(x+h) - f(x)g(x) + f(x+h)g(x) - f(x)g(x)}{h} \]
\[ = \lim_{h \to 0} \left[ \frac{f(x+h)}{h} \right] g(x) + g(x) \frac{f(x+h) - f(x)}{h} = f(x)g'(x) + g(x)f'(x) \]

If \( f \) is differentiable then it is also continuous \( \forall \lim_{h \to 0} f(x+h) = f(x) \)
3. a. \( f(10) = 100,000 \) means “if the price is $10 per yard, we will sell 100,000 yards.”

\( f'(10) = -3,500 \) means “when the price is $10 per yard, we will sell 3,500 fewer yards for every dollar increase in price.”

6. \( R'(p) = pf'(p) + f(p) \)

\[ R'(10) = 10(-3,500) + 100,000 = 65,000 \]

“When the price is $10 per yard, the revenue will increase $65,000 for every dollar increase in price.”

4. a. \( V = x^3 \)

\[
\frac{dV}{dx} = 3x^2 \implies dV = 3x^2 \, dx
\]

\[
dV \bigg|_{x=25} = 3(25)^2(-2) = 375 \text{ cm}^3
\]

relative error \( \frac{dV}{V} = \frac{375}{(25)^3} = \frac{3}{125} = .024 \)

percent error 2.4%

b. \( S = 6x^2 \)

\[
\frac{dS}{dx} = 12x \implies dS = 12x \, dx
\]

\[
dS \bigg|_{x=25} = 60 \text{ cm}^2
\]

relative error \( \frac{dS}{S} = \frac{60}{6(25)^2} = \frac{2}{125} = .016 \)

percent error 1.6%
5. \[ z^2 = (100+y)^2 + x^2 \]

\[ \frac{dz}{dt} = 2z \left( \frac{dy}{dt} + \frac{dx}{dt} \right) \]

\[ 48 \frac{dz}{dt} = (145)(15) + (30)(10) \]

\[ \frac{dz}{dt} = 16.72 \text{ mph} \]