p. 124 #31

$$y = \frac{\sqrt{x}-1}{\sqrt{x}+1}$$

Domain: $x \geq 0$

$$= \frac{x^{1/2}-1}{x^{1/2}+1}$$

$u: x^{1/2}-1 \quad v: x^{1/2}+1$

$u': \frac{1}{2}x^{-1/2} \quad v': \frac{1}{2}x^{-1/2}$

$$y' = \frac{u'v - uv'}{v^2} = \frac{\frac{1}{2}x^{-1/2}(x^{1/2}+1) - (x^{1/2}-1)\cdot\frac{1}{2}x^{-1/2}}{(x^{1/2}+1)^2}$$

$$= \frac{\frac{1}{2} + \frac{1}{2}x^{-1/2} - \left(\frac{1}{2} - \frac{1}{2}x^{-1/2}\right)}{(x^{1/2}+1)^2}$$

$$= \frac{x^{-1/2}}{(x^{1/2}+1)^2}$$

$$y' = \frac{1}{\sqrt{x}(\sqrt{x}+1)^2}$$

#32 $y = 2\sqrt{x} - \frac{1}{\sqrt{x}}$

$$= 2\cdot x^{1/2} - \frac{1}{x^{1/2}}$$

$$= 2x^{1/2} - x^{-1/2}$$

$$= 2\cdot\frac{1}{2}x^{-1/2} - \left(\frac{-1}{2}x^{-3/2}\right)$$

$$= \frac{1}{\sqrt{x}} + \frac{1}{2\sqrt{x^3}}$$

$\frac{d}{dx}(x^n) = n\cdot x^{n-1}$

#37 normal line

$y = x^3 - 3x + 1 \quad (2,3)$

$y' = 3x^2 - 3\Big|_{x=2}$

$= 3(2)^2 - 3 = 9$ derivative of f @x=2 aka f'(2)

$y = 3 + \left(\frac{-1}{9}\right)(x-2)$

$= 3 - \frac{1}{9}x + \frac{2}{9}$

$y = -\frac{1}{9}x + \frac{29}{9}$

p. 135 #1 "related rates"

$y = x^3$

$\frac{dy}{dx} =$

(a) $V = s^3$

(b) $\frac{dV}{ds} = 3s^2$

(c) $\frac{dV}{ds}\Big|_{s=1} = 3$

$\frac{dV}{ds}\Big|_{s=5} = 75$

(d) V, in^3 s, in $\frac{dV}{ds}$, $\frac{in^3}{in}$

units of a derivative are always $\frac{\text{"y" units}}{\text{"x" units}}$

#13 p. 136

$v(0) = 24$ m/s

$s(t) = 24t - 0.8t^2$

(a) $v(t) =$