3. Find:

$$\frac{d}{dx}\left(\frac{e^x}{3x+2}\right)$$

$$= \frac{(3x+2)\frac{d}{dx}(e^x) - e^x\frac{d}{dx}(3x+2)}{[3x+2]^2}$$

$$= \frac{(3x+2)e^x - e^x(3)}{[3x+2]^2}$$

$$= \frac{e^x[3x+2-3]}{[3x+2]^2} = \frac{e^x(3x-1)}{(3x+2)^2}$$

$$\left(\frac{3x^2-\sqrt{x}}{x}\right)'$$

$$= \frac{x(3x^2-x^{1/2})' - (3x^2-x^{1/2})(x)'}{(x)^2}$$

$$= \frac{x(6x-\frac{1}{2}x^{-1/2}) - (3x^2-x^{1/2})(1)}{x^2}$$

$$= \frac{6x^2-\frac{1}{2}x^{1/2}-3x^2+x^{1/2}}{x^2}$$

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

or $[(3x^2-x^{1/2})(x^{-1})]'$

product rule: $(3x^2-x^{1/2})(x^{-1})' + x^{-1}(3x^2-x^{1/2})'$

$= (3x^2-x^{1/2})(-x^{-2}) + x^{-1}(6x-\frac{1}{2}x^{-1/2})$

$= \frac{3x^2-x^{1/2}}{-x^2} + \frac{6x-\frac{1}{2}x^{-1/2}}{x}$

4. Consider the function $f(x) = \frac{6x}{1+3x^2}$.

(a) Find the equation of the line tangent to f when $x = 3$

looking for $y = mx+b$

m = slope of line tangent to f when $x=3$

$= f'(3)$

from ✱

$$= \frac{(1+3(3)^2)6-6(3)6(3)}{(1+3(3^2))^2}$$

$$= \frac{28\cdot 6-18\cdot 18}{28^2} \approx -.199$$

✱ finding $f'(x)$:

$$f'(x) = \frac{(1+3x^2)(6x)'-(6x)(1+3x^2)'}{(1+3x^2)^2}$$

$$= \frac{(1+3x^2)6-6x(6x)}{(1+3x^2)^2}$$

passes thru $(3, f(3)) = \left(3, \frac{6(3)}{1+3(3)^2}\right) \approx (3, .6$

so $.643 = (-.199)(3)+b$

$\Rightarrow b \approx 1.24$ so $y = -.199x + 1.24$

(b) Find where the function f has a horizontal tangent line.

Find x so that

slope of line tangent to f at x = slope of horizontal line

$\Rightarrow f'(x) = 0$ (from ✱)

$$\Rightarrow \frac{(1+3x^2)6-6x(6x)}{(1+3x^2)^2} = 0$$

$$\Rightarrow \frac{6+18x^2-36x^2}{(1+3x^2)^2} = 0$$

$$\Rightarrow \frac{6-18x^2}{(1+3x^2)^2} = 0$$

$\Rightarrow 6-18x^2 = 0$

$\Rightarrow 6 = 18x^2$

$\Rightarrow \frac{1}{3} = x^2$

$\Rightarrow x = \pm\sqrt{\frac{1}{3}}$