1. The cost of building wooden pencils is given by a function $C(n)$ where C is the cost in dollars and n is the number of pencils, measured in thousands. Explain what $C'(50) = 37.5$ means in language your parents could understand.

Once 50000 pencils have been constructed, the cost of making additional pencils increases at a rate of 37.5 dollars per 1000 pencils.

Compute the derivatives of the following functions.

2. $f(x) = \sqrt{1+x^2}$

$$\frac{d}{dx}\sqrt{1+x^2} = \frac{1}{2\sqrt{1+x^2}} \cdot 2x = \frac{x}{\sqrt{1+x^2}}$$

3. $f(\theta) = \tan(4\theta + 9)$

$$\frac{d}{d\theta}\tan(4\theta+9) = \sec^2(4\theta+9)\cdot\frac{d}{d\theta}(4\theta+9)$$

$$= 4\sec^2(4\theta+9)$$

4. $f(t) = e^{t^2}(1 + \cos(t))$

$$\frac{d}{dt}\left[e^{t^2}(1+\cos(t))\right] = \left(\frac{d}{dt}e^{t^2}\right)(1+\cos t) + e^{t^2}\frac{d}{dt}(1+\cos t)$$

$$= \left(e^{t^2}\frac{d}{dt}t^2\right)(1+\cos t) - e^{t^2}\sin t$$

$$= e^{t^2}\left[2t(1+\cos t) - \sin t\right]$$

5. $f(v) = \sec\left(\frac{1}{1+v^2}\right)$

$$f'(v) = \sec\left(\frac{1}{1+v^2}\right)\tan\left(\frac{1}{1+v^2}\right)\cdot\frac{d}{dv}\left(\frac{1}{1+v^2}\right)$$

$$= \sec\left(\frac{1}{1+v^2}\right)\tan\left(\frac{1}{1+v^2}\right)\frac{-2v}{(1+v^2)^2}$$

$$= -2\sec\left(\frac{1}{1+v^2}\right)\tan\left(\frac{1}{1+v^2}\right)\frac{v}{(1+v^2)^2}$$

6. $f(x) = \cos(x^{1/3}e^x)$

$$\frac{d}{dx}\cos\left(x^{1/3}e^x\right) = -\sin\left(x^{1/3}e^x\right)\frac{d}{dx}x^{1/3}e^x$$

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

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

7. $f(x) = \sqrt{x + e^{x^2}}$

$$f'(x) = \frac{1}{2\sqrt{x+e^{x^2}}}\cdot\frac{d}{dx}\left(x+e^{x^2}\right)$$

$$= \frac{1}{2\sqrt{x+e^{x^2}}}\cdot\left(1+2xe^{x^2}\right)$$