1. The volume of a snowball of radius r is $V(r) = (4/3)\pi r^3$, where r is measured in inches and V is in measured in inches cubed. Explain what $V'(2) \approx 50.265$ means in language your parents could understand.

Starting with a snowball with a 2 inch radius, as we increase the radius the volume grows at a rate of 50.265 cubic inches per inch.

2. If you increase the radius of a snowball from 2 inches to 2.02 inches, estimate the change in volume of the snowball.

$$\Delta r = 2.02 - 2 = 0.02$$

$$\Delta V \approx V'(2) \cdot \Delta r = 50.265 \cdot (0.02) = 1.0053 \text{ cubic inches}$$

3. Compute $\dfrac{d}{dx}\tan(x)$

$$\frac{d}{dx}\tan(x) = \frac{d}{dx}\frac{\sin(x)}{\cos(x)} = \sec^2(x) \text{ by last worksheet}$$

4. Compute $\dfrac{d}{dx}\sec(x)$

$$\frac{d}{dx}\frac{1}{\cos(x)} = \frac{-1\frac{d}{dx}\cos(x)}{\cos^2(x)} = +\frac{\sin(x)}{\cos^2(x)} = \frac{\sin(x)}{\cos(x)}\frac{1}{\cos(x)} = \tan(x)\sec(x)$$

5. Compute the second derivative $\dfrac{d^2}{dx^2}e^x\cos(x)$

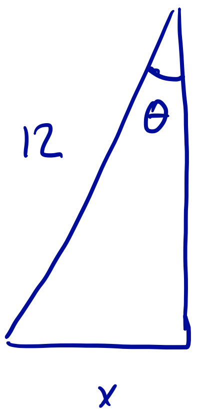
$$\frac{d}{dx}e^x\cos x = e^x\cos(x) - e^x\sin(x) = e^x\left[\cos(x) - \sin(x)\right]$$

$$\frac{d^2}{dx^2}e^x\cos(x) = \frac{d}{dx}e^x\left[\cos(x) - \sin(x)\right] = e^x\left[\cos(x) - \sin(x)\right] + e^x\left[-\sin(x) - \cos(x)\right]$$

$$= -2e^x\sin x$$

6. A 12 foot ladder rests against a wall. Let θ be the angle between the ladder and the wall and let x be the distance from the base of the ladder and the wall.

a. Compute x as a function of θ.

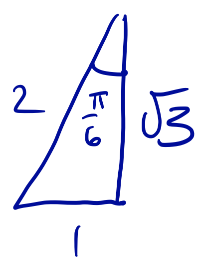


$$\sin\theta = \frac{x}{12}$$

$$x = 12\sin\theta$$

b. How fast does x change with respect to θ when $\theta = \pi/6$?

$$x(\theta) = 12\sin\theta$$



$$x'(\theta) = 12\cos\theta$$

$$x'\left(\frac{\pi}{6}\right) = 12\cos\frac{\pi}{6}$$

$$= 12\cdot\frac{1}{2} = 6.$$