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.

When the snowball has a radius of 2 inches, increasing the radius increases the volume at a rate of 50.26 in^3/in.

2. Compute $\dfrac{d}{dx}\cot(x)$

$$\frac{d}{dx}\cot(x) = \frac{d}{dx}\frac{\cos(x)}{\sin(x)} = \frac{\left(\frac{d}{dx}\cos(x)\right)\sin(x) - \cos(x)\frac{d}{dx}\sin(x)}{\sin^2(x)}$$

$$= \frac{-\sin^2(x) - \cos^2(x)}{\sin^2(x)} = \frac{-1}{\sin^2(x)} = -\csc^2(x)$$

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

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

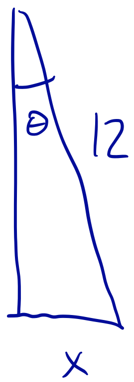
4. Compute the second derivative $\dfrac{d^2}{dx^2}e^x\cos(x)$

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

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

5. 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.

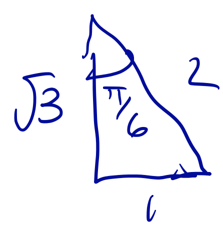


$$\frac{x}{12} = \sin(\theta)$$

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

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

$$\frac{dx}{d\theta} = 12\cos(\theta)$$



at $\theta = \pi/6$, $\frac{dx}{d\theta} = 12\cos(\pi/6)$

$$= 12\frac{\sqrt{3}}{2}$$

$$= 6\sqrt{3}$$