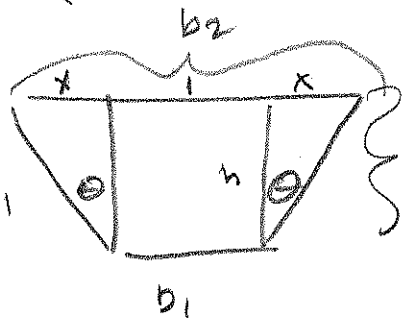
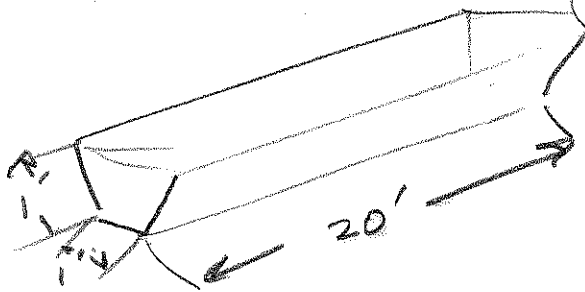


Applications § 4.5

§ 4.5 WS



Volume = Area of end times length

$$= \frac{1}{2}(b_1 + b_2) 20 h$$

$$= 10(b_1 + b_2) h$$

$$= 10(1 + b_2) h$$

$$= 10(1 + 1 + 2x) \cos \theta$$

$$= 10(2 + 2\sin \theta) \cos \theta$$

$$\Rightarrow V = 20(1 + \sin \theta) \cos \theta$$

$$\Rightarrow V = 20[\cos \theta + \sin \theta \cos \theta]$$

$$\Rightarrow \frac{dV}{d\theta} = 20[-\sin \theta + \cos^2 \theta - \sin^2 \theta]$$

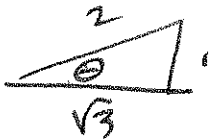
$$= 20[-\sin \theta + 1 - \sin^2 \theta - \sin^2 \theta]$$

$$= 20[-2\sin^2 \theta - \sin \theta + 1]$$

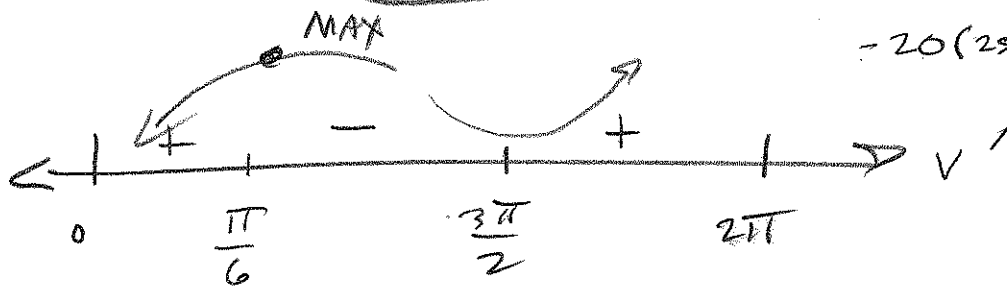
$$= -20[2\sin^2 \theta + \sin \theta - 1]$$

$$= -20[2\sin \theta - 1][\sin \theta + 1] \stackrel{\text{SET}}{=} 0$$

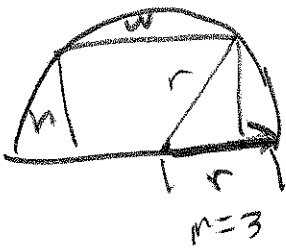
$$\Rightarrow \sin \theta = \frac{1}{2} \quad \text{OR} \quad \sin^{-1} \theta = 1$$



$$\Rightarrow \theta = \frac{\pi}{6} = 30^\circ \text{ maximizes volume}$$



$$-20(2\sin\theta - 1)(\sin\theta + 1)$$



Maximize $hw = A$

$$\left(\frac{1}{2}w\right)^2 + h^2 = r^2$$

$$\frac{1}{4}w^2 + h^2 = r^2 = 3^2$$

$$\frac{1}{4}w^2 = r^2 - h^2$$

$$w^2 = 4(r^2 - h^2)$$

$$= 4(9 - h^2)$$

$$w = \sqrt{4(9 - h^2)}$$

So

$$hw =$$

$$h(2(9 - h^2)^{\frac{1}{2}})$$

$$A = 2h(9 - h^2)^{\frac{1}{2}}$$

$$\frac{dA}{dh} = 2(9 - h^2)^{\frac{1}{2}} + 2h\left(\frac{1}{2}(9 - h^2)^{-\frac{1}{2}}\right)(-2h) = 2\sqrt{9 - h^2}$$

$$= 2\sqrt{9 - h^2} + \frac{-2h^2}{\sqrt{9 - h^2}}$$

$$= \frac{2(9 - h^2) - 2h^2}{\sqrt{9 - h^2}} = \frac{18 - 2h^2 - 2h^2}{\sqrt{9 - h^2}} = \frac{18 - 4h^2}{\sqrt{9 - h^2}} = 0$$

$$\Rightarrow \cancel{2h^2 - h - 18 = 0}$$

$$\frac{-4h^2 + 18}{\sqrt{9-h^2}}$$

$$\stackrel{\text{SET}}{=} 0$$

$$4h^2 = 18$$

$$h^2 = \frac{9}{2}$$

$$h = \pm \frac{3}{\sqrt{2}} = \pm \frac{3\sqrt{2}}{2}$$

$$\Rightarrow h = \frac{3\sqrt{2}}{2}$$

$$\text{So } w = 2\sqrt{9 - \left(\frac{3\sqrt{2}}{2}\right)^2}$$

$$= 2\sqrt{9 - \frac{9 \cdot 2}{4}}$$

$$= 2\sqrt{\frac{2 \cdot 9}{4}}$$

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

$$= 3\sqrt{2} = w$$

$$\frac{36-18}{4}$$

$$= \frac{18}{4} = \frac{2 \cdot 9}{4}$$

And Area is

$$\left(3\sqrt{2}\right) \left(\frac{3\sqrt{2}}{2}\right) = \frac{9 \cdot 2}{2} = 9$$

Area
Not asked