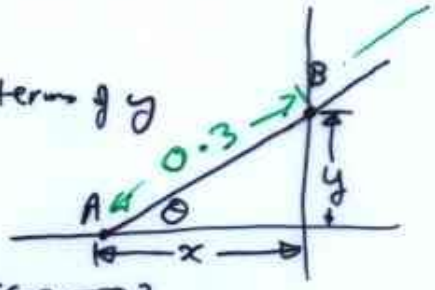
$\int_0^{0.3} 50 \cos\theta \, dy$

we could EXPRESS $\cos(\theta)$ in terms of y

$$\cos(\theta) = \frac{\sqrt{(0.3)^2 - y^2}}{0.3} = \frac{x}{0.3}$$



HOW WOULD SUCH A TERM BE INTEGRATED?

Better to put dy in terms of θ

$$y = 0.3 \sin(\theta)$$

$$\frac{dy}{d\theta} = 0.3 \cos\theta \Rightarrow dy = 0.3 \cos\theta \, d\theta$$

What will Limits Be? $y = 0 \Rightarrow \theta = 0$; $y = 0.3 \Rightarrow \theta = \frac{\pi}{2}$] CAN SEE FROM GEOMETRY OR SUBSTITUTION

So we have

$$U'_{1\to 2} = \int_0^{\frac{\pi}{2}} 15\cos^2\theta \, d\theta + \int_0^{\frac{\pi}{2}} 15 \, d\theta$$

$\cos^2\theta = \frac{1}{2}(1 + \cos 2\theta)$

$$= \frac{15}{2}\int_0^{\frac{\pi}{2}} 1 + \cos(2\theta) \, d\theta + \int_0^{\frac{\pi}{2}} 15 \, d\theta$$

$$= \frac{15}{2}\left[\theta + \frac{\sin 2\theta}{2}\right]_0^{\frac{\pi}{2}} + \left[15\theta\right]_0^{\frac{\pi}{2}}$$

$$U'_{1\to 2} = \frac{15\pi}{4} + \frac{15\pi}{2} = \frac{45\pi}{4} = 11.25\pi$$

$\pi = 3.14$

$$U'_{1\to 2} = 35.3 \text{ J}$$

BRINGING IT ALL TOGETHER

$$U'_{1\to 2} = \Delta T + \Delta V_g$$

$$35.3 = 0.667 v^2 + 11.77 \quad \text{joules}$$

$$\Rightarrow v_A^2 = 35.28 \, (\text{m/s})^2$$

$$\Rightarrow v_A = 5.94 \text{ m/s}$$