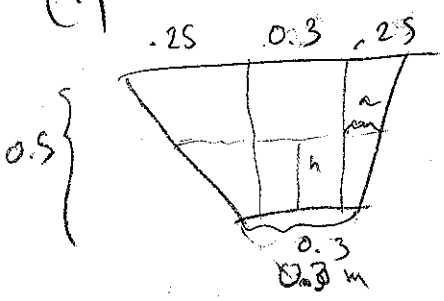
(1)



I know $\frac{dV}{dt}$ Want $\frac{dh}{dt}$

Volume of trapezoid with height h

is $\frac{1}{2}(2a+0.3+0.3)\,h \cdot 10$

base1 base2 height

Now $\frac{a}{h} = \frac{.15}{.5} \Rightarrow a = \frac{h}{2}$

$V = \frac{1}{2}(h+0.6)h \cdot 10$

$\frac{dV}{dt} = \frac{d}{dt}(5h^2 + 3h)$

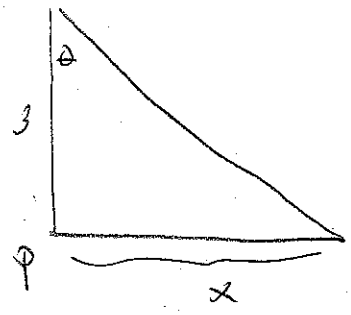
$= 10h\frac{dh}{dt} + 3\frac{dh}{dt}$

$0.2 = 10 \cdot 0.3\frac{dh}{dt} + 3\frac{dh}{dt}$

$\frac{0.2}{6} = \frac{dh}{dt}$

$\frac{1}{30}\frac{m}{s} = \frac{dh}{dt}$

(2)



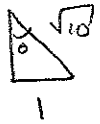
I know $\frac{d\theta}{dt} = 4(2\pi) = 8\pi$ rad/min

I want $\frac{dx}{dt}$

$x = 3\tan\theta$

$\frac{dx}{dt} = 3\sec^2\theta \frac{d\theta}{dt}$

When $x = 1$



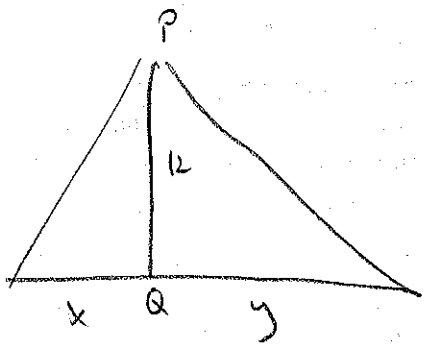
$\sec\theta = \frac{\sqrt{10}}{3}$

$\frac{dx}{dt} = 3 \cdot \frac{10}{9} (8\pi)$

$= \frac{80\pi}{3}$ km/min.

(2)

(3)



I know $\frac{dx}{dt}$ I want $\frac{dy}{dt}$

$$\sqrt{x^2+12^2} + \sqrt{y^2+12^2} = 39$$

$$2x\left(x^2+12^2\right)^{-\frac{1}{2}}\frac{dx}{dt} + 2y\left(y^2+12^2\right)^{-\frac{1}{2}}\frac{dy}{dt} = 0.$$

When $x=5$,

$$\sqrt{25+144} + \sqrt{y^2+12^2} = 39$$

$$13 + \sqrt{y^2+12^2} = 39$$

$$\sqrt{y^2+12^2} = 26$$

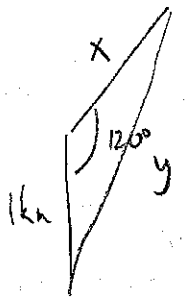
$$y^2 = 26^2 - 12^2 = \sqrt{532}$$

So

$$2(-5)\left(25+12^2\right)^{-\frac{1}{2}}(-2) + 2\sqrt{532}\left(532+12^2\right)^{-\frac{1}{2}}\frac{dy}{dt} = 0$$

$$\Rightarrow \frac{dy}{dt} = \frac{-10}{\sqrt{133}} \text{ ft/s}$$

4)



I know $\frac{dx}{dt} = 300 \frac{km}{hr}$

I want $\frac{dy}{dt}$

Law of cosines:

$y^2 = x^2 + 1 - 2x\cos 120$

$y^2 = x^2 + x + 1$

$2y\frac{dy}{dt} = 2x\frac{dx}{dt} + \frac{dx}{dt}$

@ 1 minute

$x = \frac{300}{60} = 5km$

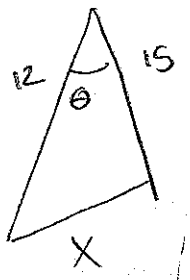
$y = \sqrt{5^2 + 5 + 1}$

$= \sqrt{31}$

$2\sqrt{31}\frac{dy}{dt} = 10\frac{dx}{dt} + \frac{dx}{dt}$

$\frac{dy}{dt} = \frac{1650}{\sqrt{31}} \frac{km}{hr}$

(5)



I know $\frac{d\theta}{dt}$ I want $\frac{dx}{dt}$

$\frac{d\theta}{dt} = \frac{\pi}{90}$ radians

$x^2 = 12^2 + 15^2 - 2 \cdot 12 \cdot 15 \cos\theta$

$= 369 - 360\cos\theta$

$2x\frac{dx}{dt} = 360\sin\theta\frac{d\theta}{dt}$

@ 60°

$x^2 = 369 - 360\cos(60°)$

$x = \sqrt{189}$

$2\cdot\sqrt{189}\frac{dx}{dt} = 360\cdot\frac{\sqrt{3}}{2}\cdot\frac{\pi}{90}$

$\frac{dx}{dt} = \frac{\sqrt{7}\pi}{21}$