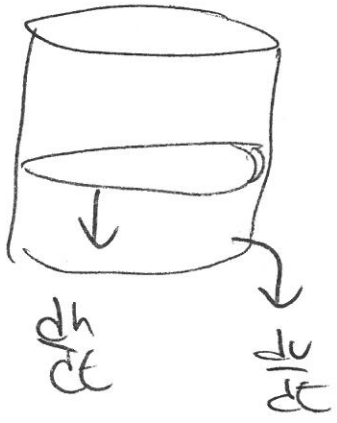
VERSION 24

Given $\frac{dV}{dt} = -24 \frac{cm^3}{min}$ $\quad \frac{dr}{dt} = 0$ $\quad r = ?$ $\quad r = 20cm$

$d = 40$ cm

$\frac{dh}{dt} = ?$

$V = \pi r^2 h$



$$\frac{dV}{dt} = 2\pi r h \frac{dr}{dt} + \pi r^2 \frac{dh}{dt}$$

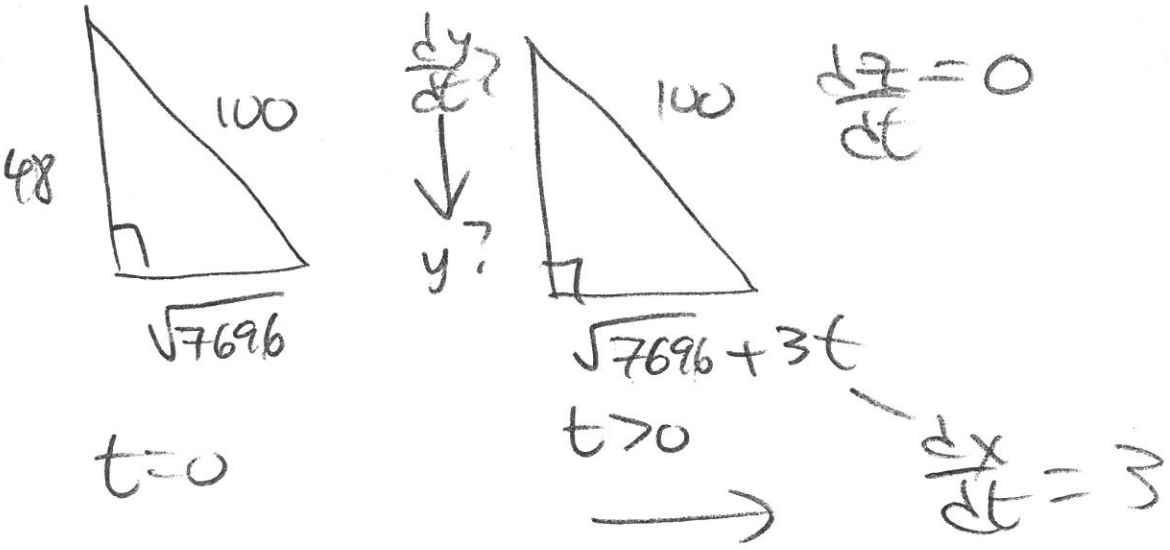
$$-24 = 2\pi(40)h(0) + \pi(40)^2 \frac{dh}{dt}$$

$$-24 = 0 + 20^2 \pi \frac{dh}{dt}$$

$$\frac{dh}{dt} = \frac{-24}{20^2\pi} \frac{cm}{sec} = \frac{-24}{400\pi} \frac{cm}{sec} = \frac{-3}{50\pi} \frac{cm}{sec}$$

$$\approx -0.0191 \frac{cm}{sec}$$

VERSION 24 #2 cont



$x(t) = \sqrt{7696} + 3t$

$y(t) = \sqrt{100^2 - (\sqrt{7696}+3t)^2}$

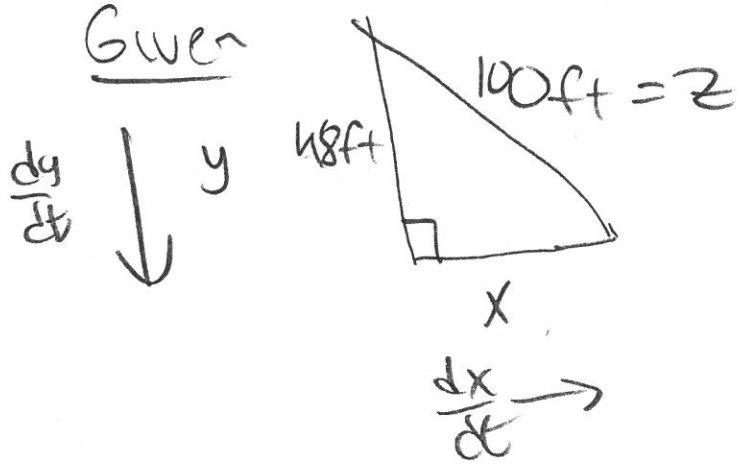
Recall $\frac{dy}{dt} = \frac{-3(x(t))}{y(t)} = \frac{-3(\sqrt{7696}+3t)}{\sqrt{100^2-(\sqrt{7696}+3t)^2}}$

$\left.\frac{dy}{dt}\right|_{t=4} = \frac{-3(x(4))}{y(4)} = \frac{-3(\sqrt{7696}+12)}{\sqrt{100^2-(\sqrt{7696}+12)^2}}$

$\approx -40.505 \frac{ft}{sec}$

24 Version (#2)

Given



$x = ?$ $\quad \frac{dx}{dt} = +3\frac{ft}{sec}$

$y = 48ft \quad \frac{dy}{dt} = ?$

$z = 100 \quad \frac{dz}{dt} = 0$

$$x^2 + y^2 = z^2$$

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

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

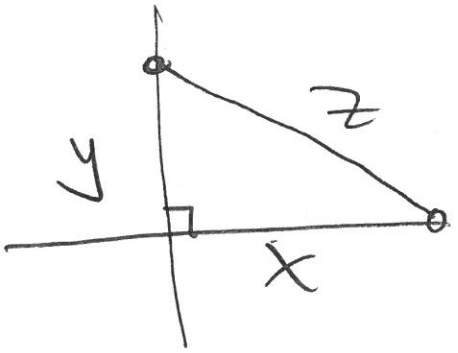
$$x(t)(3) + y(t)\frac{dy}{dt} = 100(0)$$

$$3x(t) + \frac{dy}{dt}y(t) = 0$$

$$\frac{dy}{dt}[y(t)] = -3x(t)$$

$$\boxed{\frac{dy}{dt} = \frac{-3x(t)}{y(t)}}$$

VERSION 24 #3



Given

$x(t) = 45t$ $\quad \frac{dx}{dt} = 45_{mp}$

$y(t) = 56t$ $\quad \frac{dy}{dt} = 56_{mp}$

$z(t) = \sqrt{(45t)^2 + (56t)^2}$

$$x^2 + y^2 = z^2 \longrightarrow x\frac{dx}{dt} + y\frac{dy}{dt} = z\frac{dz}{dt}$$

$$\longrightarrow (45t)45 + (56t)(56) = \sqrt{(45t)^2 + (56t)^2}\frac{dz}{dt}$$

$$\rightarrow \boxed{\frac{45^2 t + 56^2 t}{\sqrt{45^2 t^2 + 56^2 t^2}} = \frac{dz}{dt}}$$

$$\left.\frac{dz}{dt}\right|_{t=1.5} = \frac{45^2(1.5) + 56^2(1.5)}{\sqrt{45^2(1.5)^2 + 56^2(1.5)^2}}$$

$$= \frac{7741.5}{\sqrt{11612.25}}$$

$$\boxed{\frac{dz}{dt} \approx 71.840 \text{ mph}}$$

Version 24 #4 cont

$$\left.\frac{dz}{dt}\right|_{t=\frac{4}{3}} = \frac{60^2\left(\frac{4}{3}-\frac{4}{3}\right)+65^2\left(\frac{4}{3}+\frac{1}{2}\right)}{\sqrt{60^2\left(\frac{4}{3}-\frac{4}{3}\right)^2+65^2\left(\frac{4}{3}+\frac{1}{2}\right)^2}}$$

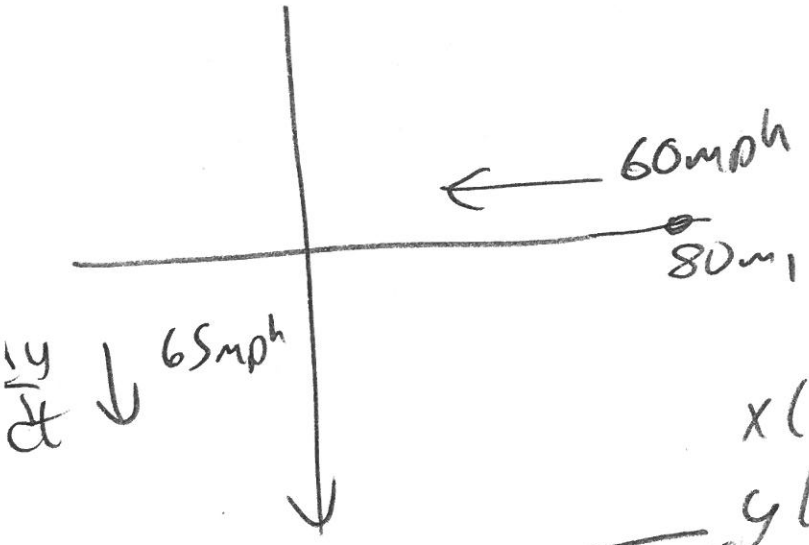
$$= \frac{0+65^2\left(\frac{11}{6}\right)}{\sqrt{0+65^2\left(\frac{11}{6}\right)^2}}$$

$$= \boxed{65 \text{ mph}}$$

VERSION 24 #4

$t_{semi} = t$

$t_{car} = t + \frac{1}{2}$



When $t = \frac{4}{3}$ hr semi at restaurant

$x(t) = 80 - 60t$

$y(t) = 65(t + \frac{1}{2})$

$z(t) = \sqrt{60^2(\frac{4}{3} - t)^2 + 65^2(t+\frac{1}{2})^2}$ $z(t) = \sqrt{x(t)^2 + y(t)^2}$

$= \sqrt{(80-60t)^2 + (65(t+\frac{1}{2}))^2}$

$\frac{dx}{dt} = -60\text{mph}$

$\frac{dy}{dt} = 65\text{mph}$

$z^2 = x^2 + y^2$

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

$\frac{dz}{dt} = \frac{(80-60t)60 + 65(t+\frac{1}{2})65}{\sqrt{60^2(\frac{4}{3}-t)^2 + 65^2(t+\frac{1}{2})^2}}$

$= \frac{60^2(\frac{4}{3}-t) + 65^2(t+\frac{1}{2})}{\sqrt{60^2(\frac{4}{3}-t)^2 + 65^2(t+\frac{1}{2})^2}}$