3.9: 24. $\frac{dy}{dt} = 2\cos\left(\frac{\pi}{2}x\right)\left(\frac{\pi}{2}\frac{dx}{dt}\right)$

$x = \frac{1}{3}$

$\frac{dy}{dt} = 2\cos\left(\frac{\pi}{6}\right)\left(\frac{\pi}{2}\sqrt{10}\right) = \frac{\sqrt{30}}{2}\pi$

$\frac{d}{dt}\left(x^2 + y^2 = D^2\right) =$

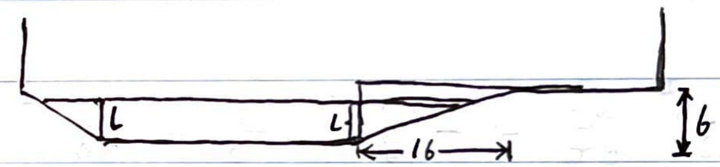
$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 2D\frac{dD}{dt}$

$\{x, y\} = \{\frac{1}{3}, 1\}$ $\quad D = \sqrt{\left(\frac{1}{3}\right)^2 + 1} = \frac{\sqrt{10}}{3}$

$\frac{2}{3}\sqrt{10} + 2\left(\frac{\sqrt{30}}{2}\pi\right) = \frac{2\sqrt{10}}{3}\frac{dD}{dt}$

$\frac{dD}{dt} = \frac{3}{\sqrt{10}}\left(\frac{\sqrt{10}}{3} + \frac{\sqrt{3}\sqrt{10}}{2}\right) = 1 + \frac{3\sqrt{3}}{2}$

3.9: 28.



$= \frac{l}{6} = \frac{x}{16}$

$16l = 6x$

$x = \frac{16l}{6} = \frac{8}{3}l$

$\frac{d}{dt}\left(V = 20\left(\frac{1}{2}l^2 + 12l + \frac{4}{3}l^2\right)\right)$

$\frac{dV}{dt} = 20\left(l\frac{dl}{dt} + 12\frac{dl}{dt} + \frac{8}{3}l\frac{dl}{dt}\right)$

$l = 5$ ft, $\frac{dV}{dt} = 0.8$ ft^3/min

$0.8 = 20\left(5l' + 12l' + \frac{8}{3}\cdot 5l'\right)$

$= 20\left(17l' + \frac{40}{3}l'\right) =$

$\frac{8}{10} = 20\left(\frac{91}{3}l'\right)$

$\frac{1}{20}\cdot\frac{8}{10}\cdot\frac{3}{91} = l' = \frac{3}{91\cdot 100 \div 4} = \frac{3}{2275}$

3.9: 39.

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R} = \frac{1}{80} + \frac{1}{100} = \frac{5}{400} + \frac{4}{400} = \frac{9}{400}$$

$$\frac{d}{dt}\left(\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}\right) =$$

$$\frac{d}{dt}\left(R^{-1} = R_1^{-1} + R_2^{-1}\right) =$$

$$-R^{-2}R' = -R_1^{-2}R_1' - R_2^{-2}R_2' =$$

$$-\left(\frac{9}{400}\right)^2 R' = -\left(\frac{1}{80}\right)^2 R_1' - \left(\frac{1}{100}\right)^2 R_2' =$$

$$\left(\frac{9}{400}\right)^2 R' = \left(\frac{1}{80}\right)^2 R_1' + \left(\frac{1}{100}\right)^2 R_2' =$$

$$\left(\frac{9}{400}\right)^2 R' = \left(\frac{1}{80}\right)^2 0.3 + \left(\frac{1}{100}\right)^2 0.2 =$$

$$\frac{0.3}{80^2} + \frac{0.2}{100^2}$$

$$R' = \left(\frac{0.3}{80^2} + \frac{0.2}{100^2}\right)\left(\frac{400}{9}\right)^2 = \frac{0.3}{80^2}\frac{80^2 \cdot 5^2}{9^2} + \frac{0.2}{100^2}\frac{100^2 4^2}{9^2}$$

$$= \frac{5^2 \cdot 0.3}{9^2} + \frac{4^2 \cdot 0.2}{9^2}$$

$$= (25 \cdot 0.3 + 16 \cdot 0.2)/9^2$$

$$= \frac{107}{810}$$

3.10: 16. $y = \cos \pi x$, $x = \frac{1}{3}$, $dx = -0.02$

$$dy = \left(-\sin(\pi x) \cdot \pi\right) dx$$

$$\left(-\sin\left(\frac{\pi}{3}\right) \cdot \pi\right) dx = -\frac{\sqrt{3}}{2} \cdot \pi \cdot (-0.02)$$

$$= \frac{\sqrt{3}}{2} \cdot \frac{2}{100} \cdot \pi$$

$$= \frac{\sqrt{3}}{100} \pi$$