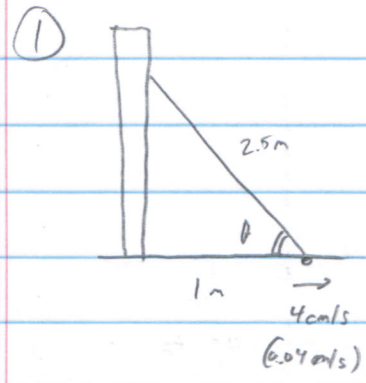


EXER 96
P. 453-4
1-2



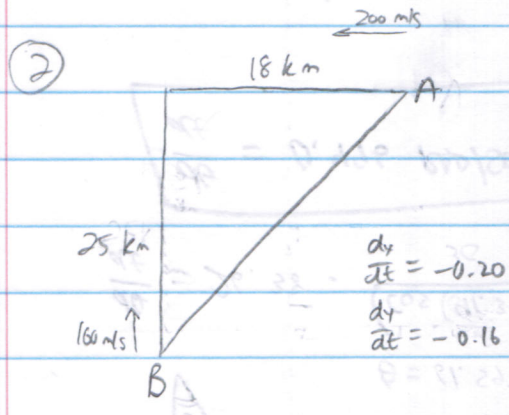
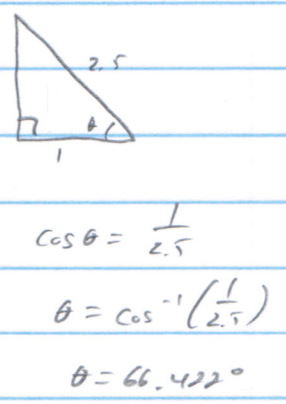
$$\cos \theta = \frac{x}{2.5}$$

$$-\sin \theta \cdot \frac{d\theta}{dt} = \frac{1}{2.5} \cdot \frac{dx}{dt}$$

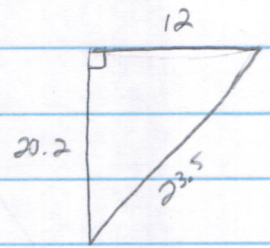
$$-\sin(66.422) \cdot \frac{d\theta}{dt} = \frac{1}{2.5} \cdot 0.04$$

$$\frac{d\theta}{dt} = \frac{1.6}{-\sin(66.422)}$$

$$\frac{d\theta}{dt} = -0.01746 \text{ PER/SEC}$$



9.) @ 0.5 MW (30 SEC)



$$0.2 \times 30 = 6 \leftarrow$$

$$0.16 \times 30 = 4.8 \updownarrow$$

$$x^2 + y^2 = d^2$$

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

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

b.) @ 1 MW (60 SEC)

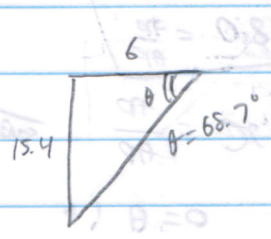
$$0.2 \times 60 = 12$$

$$0.16 \times 60 = 9.6$$

$$12 \cdot (-0.2) + 20.2 \cdot (-0.16) = 23.5 \left(\frac{dd}{dt}\right)$$

$$\frac{dd}{dt} = -0.2397 \text{ km/s}$$

or -240 m/s



$$\frac{d\theta}{dt} = 0.00776 \text{ RAD/SEC}$$

or 0.466 RAD/MIN

$$\tan \theta = \frac{y}{x}$$

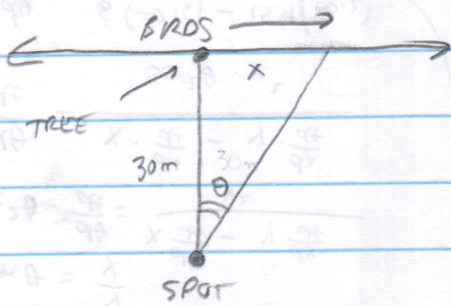
$$\sec^2 \theta \cdot \frac{d\theta}{dt} = \frac{x \frac{dy}{dt} - y \frac{dx}{dt}}{x^2}$$

$$\frac{d\theta}{dt} = \frac{x \cdot \frac{dy}{dt} - y \cdot \frac{dx}{dt}}{\sec^2 \theta \cdot x^2}$$

$$\frac{d\theta}{dt} = \frac{6(-0.16) - 15.4(-0.2)}{\sec^2 \theta \cdot (6)^2}$$

96 (cont) ③

P. 451 #3



$$\tan \theta = \frac{x}{30}$$

$$\sec^2 \theta \cdot \frac{d\theta}{dt} = \frac{1}{30} \cdot \frac{dx}{dt}$$

$$\frac{d\theta}{dt} = \frac{dx}{dt} \cdot \frac{\cos^2 \theta}{30}$$

996 m/s

a) $\theta = 0$

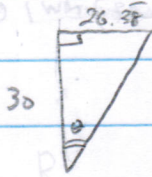
METERS

$$\frac{d\theta}{dt} = 26.38 \cdot \frac{(\cos 0)^2}{30}$$

$$\frac{d\theta}{dt} = 0.880 \text{ RAD/SEC}$$

$$95 \text{ km} \left(\frac{1000 \text{ m}}{1 \text{ km}} \right) \left(\frac{1 \text{ hr}}{60 \text{ min}} \right) \left(\frac{1 \text{ min}}{60 \text{ sec}} \right) = 26.38 \text{ m/s}$$

b) @ 1 sec.



$$\tan \theta = \frac{26.38}{30}$$

$$\theta = \tan^{-1} \left(\frac{26.38}{30} \right)$$

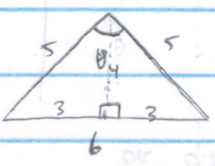
$$\theta = 61.5977^\circ$$

$$\frac{d\theta}{dt} = 26.38 \cdot \frac{(\cos(61.5977^\circ))^2}{30}$$

$$\frac{d\theta}{dt} = 0.496 \text{ RAD/SEC}$$

96 (CONT.)
 1.454 #4,5

4



$$\sin\left(\frac{\theta}{2}\right) = \frac{3}{5}$$

$$\frac{\theta}{2} = 73.74^\circ$$

$$\sin\left(\frac{\theta}{2}\right) = \frac{5/2}{5}$$

$$\sin\left(\frac{\theta}{2}\right) = \frac{5}{10}$$

$$\cos\left(\frac{\theta}{2}\right) \cdot \frac{1}{2} \cdot \frac{d\theta}{dt} = \frac{1}{10} \cdot \frac{ds}{dt}$$

$$\frac{d\theta}{dt} = \frac{1}{5 \cdot \cos\left(\frac{\theta}{2}\right)} \cdot \frac{ds}{dt}$$

a.) $\frac{d\theta}{dt} = \frac{1}{5\left(\frac{4}{5}\right)} \cdot (-0.1)$

$$\frac{d\theta}{dt} = -0.025 \text{ RAD/SEC}$$

OR $c^2 = a^2 + b^2 - 2ab \cos \theta$

$$c^2 = 50 - 50 \cos \theta$$

$$2c \frac{dc}{dt} = 50 \sin \theta \cdot \frac{d\theta}{dt}$$

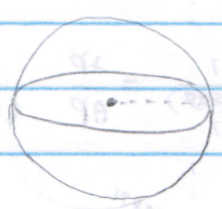
b.) $10(-0.1) = 50 \sin 60^\circ \cdot \frac{d\theta}{dt}$

$$\frac{d\theta}{dt} = -0.023 \text{ RAD/SEC}$$

$$12(-0.1) = 50 \sin 73.74 \cdot \frac{d\theta}{dt}$$

$$\frac{d\theta}{dt} = -0.025 \text{ RAD/SEC}$$

5



a.) $V = \frac{4}{3} \pi r^3$

$$\frac{dV}{dt} = 4\pi r^2 \cdot \frac{dr}{dt} \Rightarrow \frac{dr}{dt} = -\frac{1}{2\pi r^2}$$

$$-2 = 4\pi (12)^2 \cdot \frac{dr}{dt}$$

$$\frac{dr}{dt} = -\frac{1}{288\pi} \text{ OR } -0.0011 \text{ cm/min}$$

b.) $SA = 4\pi r^2$

$$\frac{dr}{dt} = -\frac{1}{2\pi(4)^2} = -\frac{1}{32\pi}$$

$$\frac{dS}{dt} = 8\pi r \cdot \frac{dr}{dt}$$

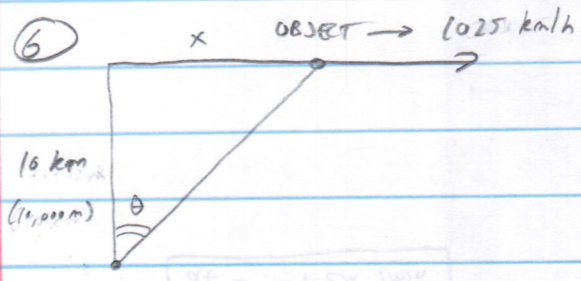
$$\frac{dS}{dt} = 8\pi(4) \cdot -\frac{1}{32\pi}$$

$$\frac{dS}{dt} = -1 \text{ cm}^2/\text{min}$$

0.1°/sec

96 (CONT.)

p. 454 #6,7



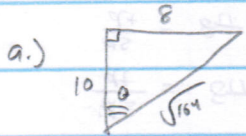
$$\tan \theta = \frac{x}{10}$$

$$\sec^2 \theta \cdot \frac{d\theta}{dt} = \frac{1}{10} \cdot \frac{dx}{dt}$$

$$\frac{d\theta}{dt} = \frac{\cos^2 \theta}{10} \cdot \frac{dx}{dt}$$

0.995°/sec
1.65°/sec

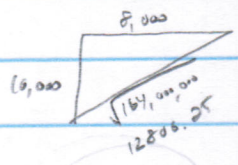
SCIENTIST



$$\frac{d\theta}{dt} = \left(\frac{10}{\sqrt{164}}\right)^2 \cdot \frac{1}{10} \cdot 1025$$

$$\frac{d\theta}{dt} = 62.5 \text{ RAD/HR OR } 1.04 \text{ RAD/MIN OR } (0.995^\circ/\text{sec})$$

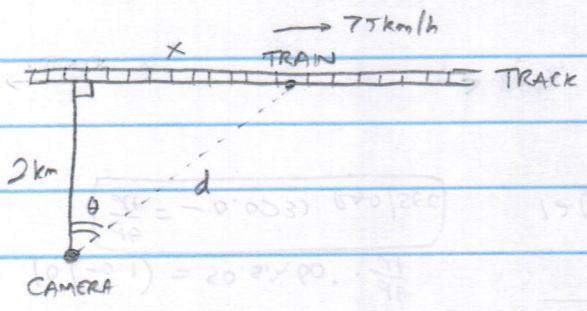
OR IN METERS PER SEC



$$\frac{d\theta}{dt} = \left(\frac{10,000}{\sqrt{164,000,000}}\right)^2 \cdot \frac{1}{10,000} \cdot 1,025,000$$

$$b.) \frac{d\theta}{dt} = \frac{(\cos \theta)^2}{10} \cdot 1,025 = 102.5 \text{ RAD/HR OR } 1.708 \text{ RAD/MIN OR } 1.63^\circ/\text{sec}$$

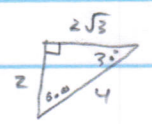
7



$$a.) x^2 + 4 = d^2$$

$$2x \cdot \frac{dx}{dt} = 2d \cdot \frac{dd}{dt}$$

$$4\sqrt{3} \cdot 75 = 8 \cdot \frac{dd}{dt}$$



$$\frac{dd}{dt} = \frac{75\sqrt{3}}{2} \text{ OR } 64.95 \text{ km/h}$$

$$b.) \cos \theta = \frac{2}{d}$$

$$-\sin \theta \cdot \frac{d\theta}{dt} = -\frac{2}{d^2} \cdot \frac{dd}{dt}$$

$$-\frac{\sqrt{3}}{2} \cdot \frac{d\theta}{dt} = -\frac{2}{16} \cdot \frac{75\sqrt{3}}{2}$$

$$\frac{d\theta}{dt} = 9.375 \text{ RAD/HR}$$

$$\sin \theta = \frac{x}{d}$$

$$\cos \theta \cdot \frac{d\theta}{dt} = \frac{d \cdot \frac{dx}{dt} - x \cdot \frac{dd}{dt}}{d^2}$$

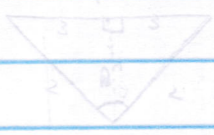
$$\frac{1}{2} \cdot \frac{d\theta}{dt} = \frac{4 \cdot 75 - 2\sqrt{3} \cdot \frac{75\sqrt{3}}{2}}{16}$$

$$\frac{d\theta}{dt} = \frac{300 - 225}{8}$$

$$\frac{d\theta}{dt} = 9.375 \text{ RAD/HR}$$

OR 0.1492°/sec

0.1°/sec

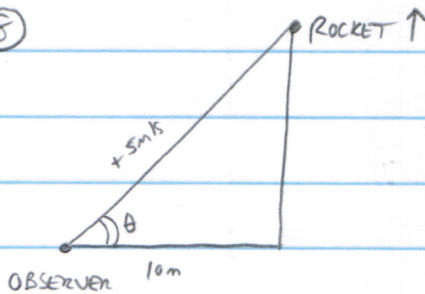


8

96 (CONT.)

4.55 # 8, 9

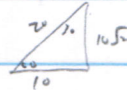
8



$$\cos \theta = \frac{10}{d} \quad \text{or} \quad \cos \theta = 10d^{-1}$$

$$-\sin \theta \cdot \frac{d\theta}{dt} = -10d^{-2} \cdot \frac{dd}{dt}$$

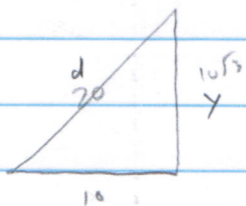
$$\frac{d\theta}{dt} = \frac{50}{d^2 \sin \theta}$$



a.) $\frac{d\theta}{dt} = \frac{50}{400 \sin 60^\circ}$

$$\frac{d\theta}{dt} = 0.144 \text{ RAD/SEC} \quad \text{or} \quad 8.27^\circ/\text{sec}$$

b.)



$$10^2 + y^2 = d^2$$

$$2y \cdot \frac{dy}{dt} = 2d \cdot \frac{dd}{dt}$$

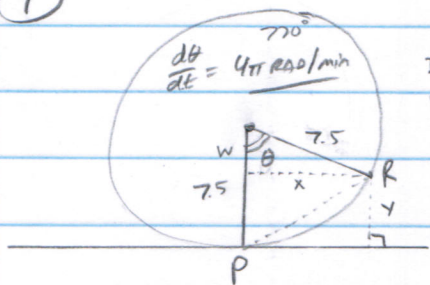
$$y \cdot \frac{dy}{dt} = d \cdot \frac{dd}{dt}$$

$$10\sqrt{3} \cdot \frac{dy}{dt} = 20 \cdot 5$$

$$\frac{dy}{dt} = \frac{10}{\sqrt{3}}$$

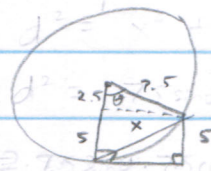
$$\frac{dy}{dt} = 5.77 \text{ m/s}$$

9



DIAM = 15 m
RADIUS = 7.5 m

$$\frac{d\theta}{dt} = 44 \text{ RAD/min}$$



$$\theta = \cos^{-1}\left(\frac{2.5}{7.5}\right)$$

$$\theta = 70.52878^\circ$$

$$x^2 + 2.5^2 = 7.5^2$$

$$x^2 + 5^2 = d^2$$

$$x = 7.0710678$$

$$50 + 25 = d^2$$

$$\sin \theta = \frac{x}{7.5}$$

$$\cos \theta = \frac{w}{7.5}$$

$$x = 7.5 \sin \theta$$

$$w = 7.5 \cos \theta$$

$$y = 7.5 - 7.5 \cos \theta$$

$$d = 5\sqrt{3}$$

$$d^2 = x^2 + y^2$$

$$d^2 = (7.5 \sin \theta)^2 + (7.5 - 7.5 \cos \theta)^2$$

$$d^2 = 56.25 \sin^2 \theta + 56.25 (1 - \cos \theta)^2$$

$$2d \frac{dd}{dt} = 112.5 \sin \theta \cos \theta \cdot \frac{d\theta}{dt} + 112.5 (1 - \cos \theta) (\sin \theta) \cdot \frac{d\theta}{dt}$$

$$10\sqrt{3} \cdot \frac{dd}{dt} = 444.28829 + 888.576587$$

$$\frac{dd}{dt} = 76.95 \text{ m/min} \quad \text{or} \quad 1.28 \text{ m/sec}$$