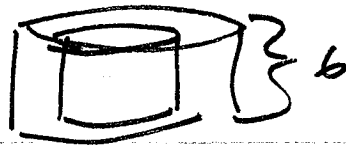
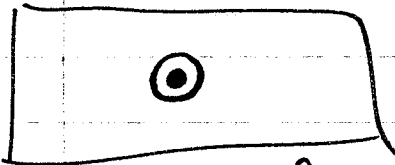


4.6

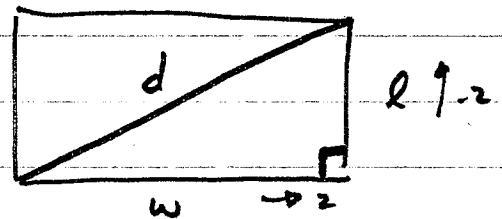
$$\begin{aligned}
 15) \quad V &= \pi r^2 h \\
 V &= 6\pi r^2 \\
 \frac{dV}{dt} &= 12\pi r \frac{dr}{dt} \\
 &= 12\pi (1.9) \left(\frac{.001}{3} \right)
 \end{aligned}$$



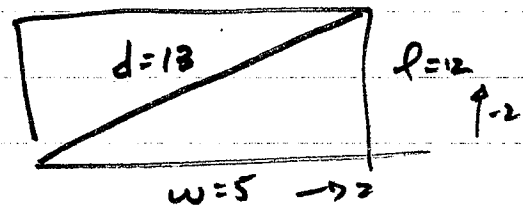
$$\begin{aligned}
 V &= \pi r^2 h \\
 \frac{dV}{dt} &= 2\pi r h \frac{dr}{dt} + \pi r^2 \frac{dh}{dt}
 \end{aligned}$$



$$\begin{aligned}
 9) \quad (a) \quad A &= lw \\
 \frac{dA}{dt} &= \frac{dl}{dt} w + \frac{dw}{dt} l \\
 &= (-2)(5) + (2)(12) \\
 &= 14 \text{ cm}^2/\text{sec}
 \end{aligned}$$

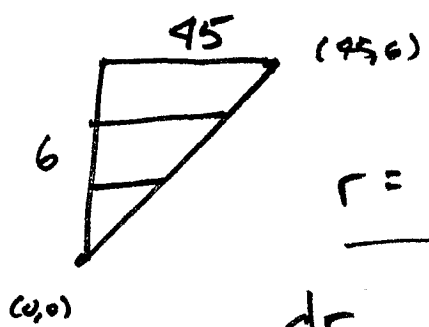
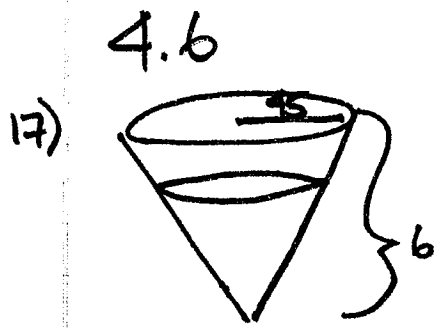


$$\begin{aligned}
 (b) \quad P &= 2l + 2w \\
 \frac{dP}{dt} &= 2 \frac{dl}{dt} + 2 \frac{dw}{dt} \\
 &= 2(-2) + 2(2) = 0 \text{ cm/sec}
 \end{aligned}$$



$$5^2 + 12^2 = d^2$$

$$\begin{aligned}
 (c) \quad d^2 &= l^2 + w^2 \\
 2d \frac{dd}{dt} &= 2l \frac{dl}{dt} + 2w \frac{dw}{dt} \\
 \frac{2(13) \frac{dd}{dt}}{26} &= \frac{2(12)(-2) + 2(5)(2)}{26} = \frac{-28}{26} = -\frac{14}{13} \text{ cm/sec}
 \end{aligned}$$



$$r = \frac{45}{6} h$$

$$\frac{dr}{dt} = \frac{45}{6} \frac{dh}{dt}$$

$$V = \frac{1}{3} \pi r^2 h$$

$$V = \frac{1}{3} \pi \left(\frac{45}{6} h \right)^2 h$$

$\frac{225}{4}$

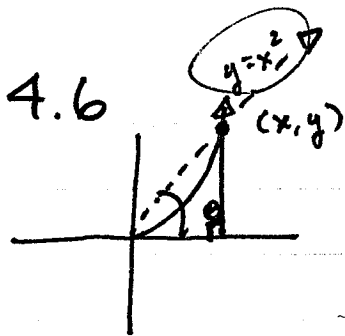
$$V = \frac{2025}{108} \pi h^3$$

$$\frac{dV}{dt} = \frac{6075}{108} \pi h^2 \frac{dh}{dt}$$

$$\frac{-50}{\frac{6075}{108} \pi (5)^2} = \frac{\frac{6075}{108} \pi (5)^2 \frac{dh}{dt}}{\frac{6075}{108} \pi (5)^2}$$

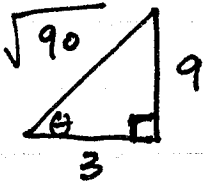
$\approx -1.132 \text{ cm/min}$

25)



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

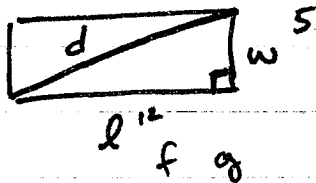
$$\tan \theta = \frac{x^2}{x}$$



1 RADIANS / SEC

$$\begin{aligned} \tan \theta &= x \\ \sec^2 \theta \frac{d\theta}{dt} &= \frac{dx}{dt} \\ \left(\frac{\sqrt{90}}{3}\right)^2 \frac{d\theta}{dt} &= 10 \\ \frac{90}{9} \frac{d\theta}{dt} &= 10 \\ 10 \frac{d\theta}{dt} &= 10 \\ \frac{d\theta}{dt} &= 1 \end{aligned}$$

9)



(a) $A = lw$

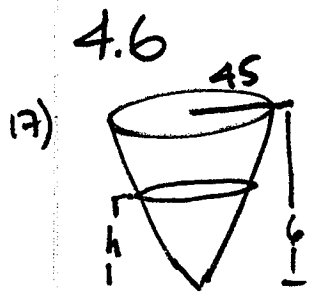
$$\begin{aligned} \frac{dA}{dt} &= \frac{dl}{dt} w + \frac{dw}{dt} l \\ &= (-2)(5) + (2)(12) \\ &= \boxed{14 \text{ cm}^2/\text{SEC}} \end{aligned}$$

(b) $P = 2l + 2w$

$$\begin{aligned} \frac{dP}{dt} &= 2 \frac{dl}{dt} + 2 \frac{dw}{dt} \\ &= 2(-2) + 2(2) \\ &= \boxed{0 \text{ cm/SEC}} \end{aligned}$$

(c) $d^2 = w^2 + l^2$

$$\begin{aligned} 2d \frac{dd}{dt} &= 2w \frac{dw}{dt} + 2l \frac{dl}{dt} \\ \frac{2(13) \frac{dd}{dt}}{26} &= \frac{2(5)(2) + 2(12)(-2)}{26} = \frac{-28}{26} = \boxed{\frac{-14}{13} \text{ cm/SEC}} \end{aligned}$$



$$(a) V = \frac{1}{3} \pi r^2 h$$

$$V = \frac{1}{3} \pi \left(\frac{45}{6} h \right)^2 h$$

$$V = \frac{2025}{108} \pi h^3$$

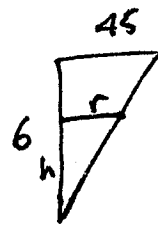
$$\frac{dV}{dt} = \frac{2025}{36} \pi h^2 \frac{dh}{dt}$$

$$50 = \frac{2025}{36} \pi (5)^2 \frac{dh}{dt}$$

$$\frac{50 \cdot 36}{2025 \pi \cdot 25} = \frac{dh}{dt}$$

$$.01 \text{ m/min} = \frac{dh}{dt}$$

$$1.132 \text{ cm/min} \quad \text{ANS}$$



$$\frac{r}{45} = \frac{h}{6}$$

$$r = \frac{45}{6} h$$

$$(b) \frac{dr}{dt} = \frac{45}{6} \frac{dh}{dt}$$

$$\frac{dr}{dt} = \frac{45}{6} \text{ ANS}$$

$$\frac{dr}{dt} = 8.488 \text{ cm/min}$$

DECREASING 8.488 cm/min

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

$$(a) \frac{dV}{dt} = 4 \pi r^2 \frac{dr}{dt}$$

$$\frac{100\pi}{100\pi} = \frac{4\pi(5)^2 \frac{dr}{dt}}{100\pi}$$

$$1 = \frac{dr}{dt}$$

$$1 \text{ FT/MIN}$$

$$(b) S = 4\pi r^2$$

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

$$= 8\pi(5)(1)$$

$$= 40\pi \text{ FT}^2/\text{MIN}$$