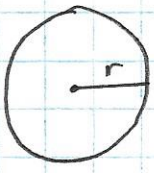
Related Rates 2

1)



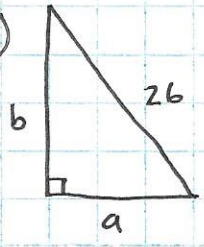
MOMENT	RATES
$r = 60$ ft	$\frac{dr}{dt} = 2$ ft/sec

$A = \pi r^2$

$\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$

$\frac{dA}{dt} = 2\pi(60)(2) = 240\pi$ ft^2/sec

2)



MOMENT	Rates
$a = 10$	$\frac{da}{dt} = 3$
$b = 24$	$\frac{db}{dt} = r$

$a^2 + b^2 = 26^2$

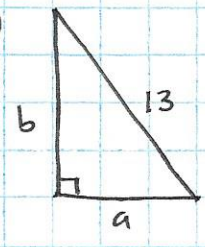
$2a\frac{da}{dt} + 2b\frac{db}{dt} = 0$

$10(3) + 24r = 0$

$24r = -30$

$r = -\frac{5}{4}$ ft/sec (C)

3)



MOMENT	RATES
$a = 5$ ft	$\frac{da}{dt} = -\frac{1}{2}$ ft/sec
$b = 12$ ft.	$\frac{db}{dt} = ?$

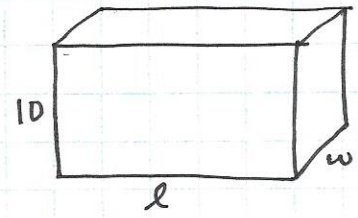
$a^2 + b^2 = 169$

$2a\frac{da}{dt} + 2b\frac{db}{dt} = 0$

$5\left(-\frac{1}{2}\right) + 12\frac{db}{dt} = 0$

$\frac{db}{dt} = \frac{5/2}{12} = \frac{5}{24}$ ft/sec

4)



MOMENT	RATES
$\ell = 8$ in	$\frac{d\ell}{dt} = 2$ in/sec
$w = 6$ in	$\frac{dw}{dt} = -4$ in/sec

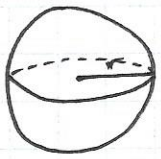
$V = 10\ell \cdot w$

$$\frac{dV}{dt} = 10\ell \frac{dw}{dt} + 10w \frac{d\ell}{dt}$$

$$\frac{dV}{dt} = 10(8)(-4) + 10(6)(2)$$

$$\frac{dV}{dt} = -200 \text{ in}^3/\text{sec}$$

5)



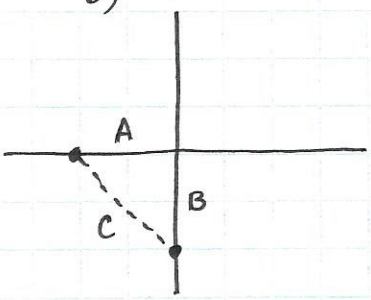
MOMENT	RATES
$d = 80$ mm	$\frac{dr}{dt} = -2$ mm/sec
$r = 40$ mm	

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

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

$$\frac{dV}{dt} = 4\pi (40)^2 (-2) = -12800\pi \text{ mm}^3/\text{sec}$$

6)



MOMENT	RATES
$A = 45$	$\frac{dA}{dt} = 20$
$B = 15$	$\frac{dB}{dt} = -15$
$C = \sqrt{45^2 + 15^2}$	

$A^2 + B^2 = C^2$

$$2A \frac{dA}{dt} + 2B \frac{dB}{dt} = 2C \frac{dC}{dt}$$

$$45(20) + 15(-15) = \sqrt{45^2 + 15^2} \frac{dC}{dt}$$

$$\frac{dC}{dt} = 14.230 \text{ mph}$$

7) $f(x) = \cos x - x$

$f(0) = \cos 0 - 0 = 1 > 0$

$f(1) = \cos 1 - 1 < 0$

Since $f(0) > 0$ & $f(1) < 0$, $f(x) = 0$ in $[0,1]$ by IVT.

8) $\lim_{x \to 5} \frac{x^3 - 125}{x - 5} = \frac{0}{0}$

Using L'Hopital's Rule

$\lim_{x \to 5} \frac{3x^2}{1} = 75$