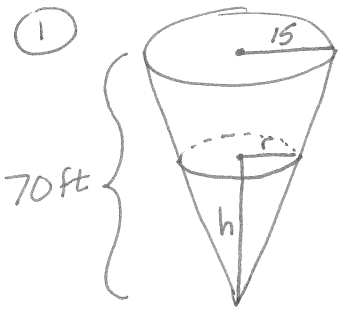
(1)



Particular Info:

$\frac{dv}{dt} = -67$

$h = 35$

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

Primary Eq:

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

$V = \frac{1}{3}\pi\left(\frac{3}{14}h\right)^2 h$

$V = \frac{3}{196}\pi h^3$

Secondary Eq:

$\frac{r}{h} = \frac{15}{70}$

$r = \frac{3}{14}h$

$\frac{dv}{dt} = \frac{9}{196}\pi h^2 \frac{dh}{dt}$

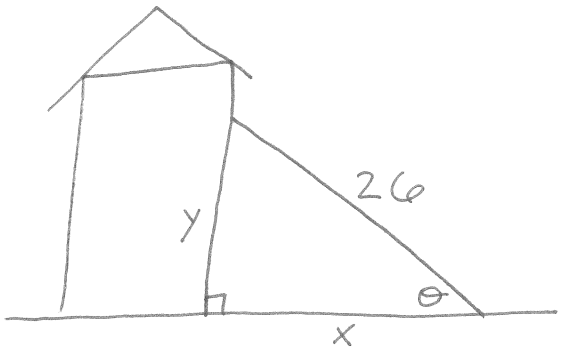
$-67 = \frac{9}{196}\pi(35)^2 \frac{dh}{dt}$

$\frac{dh}{dt} = -\frac{2068}{225\pi}$ ft/s

$= \frac{-1.1911}{\pi}$ ft/s

$= -.3791$ ft/s

2)



Particular Info:

$\frac{dx}{dt} = -1.8$

$y = 10$

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

Primary Eq:

$x^2 + y^2 = 26^2$

$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$

$2(24)(-1.8) + 2(10)\frac{dy}{dt} = 0$

Sec Eq (at the moment $y = 10$):

$x^2 + 10^2 = 26^2$

$x = 24$

$$\frac{dy}{dt} = 4.32 \text{ ft/s}$$

B) $\sin\theta = \frac{y}{26}$

$\frac{d\theta}{dt}\cos\theta = \frac{1}{26}\frac{dy}{dt}$

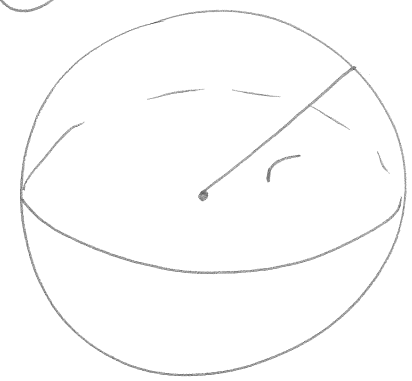
Sec Eq: (when $y = 10$)

$\cos\theta = \frac{24}{26} = \frac{12}{13}$

$\frac{d\theta}{dt}\left(\frac{12}{13}\right) = \frac{1}{26}(4.32)$

$$\frac{d\theta}{dt} = .18 \text{ °/sec}$$

(3)



Particular Info:

$\frac{dv}{dt} = 2.4$

$\frac{dv}{dt} = \frac{da}{dt}$

Primary Eq:

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

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

$2.4 = 4\pi (2)^2 \frac{dr}{dt}$

$\frac{dr}{dt} = \frac{.15}{\pi}$ in/s

$= .0477$ in/s

Secondary Eq (to find r at this moment)

$\frac{dv}{dt} = 4\pi r^2 \frac{dr}{dt}$ $\quad a = 4\pi r^2$

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

$4\pi r^2 \frac{dr}{dt} = 8\pi r \frac{dr}{dt}$

$r = 0$ (2)

↑ not in domain

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(4)

Particular Info:

$\frac{dr}{dt} = 2.6$

$r = 8.9$

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

Primary Eq:

$a = \pi r^2$

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

$\frac{da}{dt} = 2\pi (8.9)(2.6)$

$\frac{da}{dt} = 46.28\pi$ in^2/s

$= 145.3929$ in^2/s

⑤ $s(t) = 2t^3 - 21t^2 + 60t + 15$

a) $\begin{cases} v(t) = 6t^2 - 42t + 60 \\ a(t) = 12t - 42 \end{cases}$

b) $v(t) = 0$

$t = 2 \text{ sec}, 5 \text{ sec}$

c) $v(t)$: + | 2 | − | 5 | +

Right: $v(t) > 0$ on $[0, 2) \cup (5, \infty)$ to the
∴ the particle is moving to the right on $[0, 2) \cup (5, \infty)$.

Left: $v(t) < 0$ on $(2, 5)$
∴ the particle is moving to the left on $(2, 5)$

d) $a(t) = -18$

$t = 2 \text{ sec}$

$v(2) = 0 \text{ ft/s}$

e) $a(t) = v(t)$

$t = 2.6972 \text{ sec}, 6.3028 \text{ sec}$

$s(2.6972) = 63.303 \text{ ft}$
$s(6.3028) = 59.698 \text{ ft}$

f) Displacement:

$s(8) - s(0) = $ **160 ft**

Total distance:

$s(0) = 15$

$s(2) = 67$

$s(5) = 40$

$s(8) = 175$

$|s(2) - s(0)| + |s(5) - s(2)| + |s(8) - s(5)|$

$52 + 27 + 135$

214 ft

g) **$s(0) = 15 \text{ ft}$**
$v(0) = 60 \text{ ft/s}$
$a(0) = -42 \text{ ft/s}^2$

h) $\dfrac{s(10) - s(0)}{10 - 0} =$

$\dfrac{515 - 15}{10} = $ **50 ft/s**

6) a) $s(t) = -16t^2 + 104t + 78$

$v(t) = -32t + 104$

$a(t) = -32$

b) $s(t) = 0$

$t = 7.1791$ sec

c) $v(7.1791) =$ -125.7312 ft/s

d) $v(t) = 0$

$t = 3.25$ sec

$s(3.25) =$ 247 ft

e) $s(0) = 78$

$s(3.25) = 247$

$s(7.1791) = 0$

$|247 - 78| + |0 - 247|$

$169 + 247$

416 ft