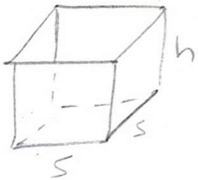
[2]



$$\left.\frac{ds}{dt}\right|_{s=10\,ft} = \frac{1}{2}\,\frac{ft}{hr}$$

WANT $\left.\frac{dh}{dt}\right|_{s=10\,ft}$

$\frac{1}{2}$ $\boxed{s^2 h = 1200\ ft^3}$ $\longrightarrow$ $s = 10\,ft$; so $\boxed{\begin{array}{l}(10\,ft)^2 h = 1200\,ft^3 \\ h = 12\,ft\end{array}}$ $\frac{1}{2}$

1 $\boxed{\left(2s\frac{ds}{dt}\right)h + s^2\frac{dh}{dt} = 0}$

1 $\boxed{2(10\,ft)\left(\frac{1}{2}\frac{ft}{hr}\right)(12\,ft) + (10\,ft)^2\left.\frac{dh}{dt}\right|_{s=10\,ft} = 0}$

$$120\,\frac{ft^3}{hr} + 100\,ft^2\left.\frac{dh}{dt}\right|_{s=10\,ft} = 0$$

$$\left.\frac{dh}{dt}\right|_{s=10\,ft} = \frac{-120\,\frac{ft^3}{hr}}{100\,ft^2} = \boxed{-\frac{6}{5}\,\frac{ft}{hr}}$$ $\frac{1}{2}$

THE SAND IS $\boxed{\text{FALLING BY } \frac{6}{5} \text{ FEET PER HOUR}}$ $\frac{1}{2}$

[3] $y = (1+\arctan t^2)^{\sec 2t}$

$$\boxed{\ln y = \sec 2t \ln(1+\arctan t^2)} \quad \frac{1}{2}$$

$$\frac{1}{2} \quad \boxed{\frac{1}{y}\frac{dy}{dt}} = \boxed{(\sec 2t \tan 2t)(2)\ln(1+\arctan t^2)} \quad 1$$

$$\boxed{+(\sec 2t)\left(\frac{1}{1+\arctan t^2}\right)\left(\frac{1}{1+(t^2)^2}\right)(2t)} \quad 1$$

$$= 2\sec 2t \tan 2t \ln(1+\arctan t^2) + \frac{2t\sec 2t}{(1+t^4)(1+\arctan t^2)}$$

$$f'(t) = \frac{dy}{dt} = \boxed{(1+\arctan t^2)^{\sec 2t}\left(2\sec 2t \tan 2t \ln(1+\arctan t^2) + \frac{2t\sec 2t}{(1+t^4)(1+\arctan t^2)}\right)} \quad 1$$

[4] $f(0.5) = \cos^{-1} 0.5 = \cos^{-1}\frac{1}{2} = \frac{\pi}{3}$

$$f'(x) = -\frac{1}{\sqrt{1-x^2}} \longrightarrow f'(0.5) = -\frac{1}{\sqrt{1-\left(\frac{1}{2}\right)^2}} = -\frac{1}{\frac{\sqrt{3}}{2}} = -\frac{2}{\sqrt{3}}$$

$$f(x) \approx f(0.5) + f'(0.5)(x-0.5) \quad \text{IF } x \approx 0.5$$

$$= \frac{\pi}{3} - \frac{2}{\sqrt{3}}(x-0.5)$$

$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$

$$\cos^{-1} 0.48 = f(0.48) \approx \boxed{\frac{\pi}{3}} \boxed{-\frac{2}{\sqrt{3}}} \boxed{(0.48-0.5)}$$

$$= \frac{\pi}{3} - \frac{2}{\sqrt{3}}(-0.02)$$

$$= \frac{\pi}{3} + \frac{\cancel{2}}{\sqrt{3}}\frac{\cancel{2}}{\cancel{100}_{25}}$$

$\frac{1}{2}$ $$\boxed{= \frac{\pi}{3} + \frac{1}{25\sqrt{3}} = \frac{25\pi + \sqrt{3}}{75}}$$ EITHER IS OK

[5] [a] $3 = \frac{15}{3-x} \longrightarrow 9-3x=15 \longrightarrow x=-2$

$y^2 - xy = 15$

$1\frac{1}{2}$ $\boxed{2y\frac{dy}{dx} - y - x\frac{dy}{dx} = 0}$

$\frac{1}{2}$ $\boxed{2(3)\frac{dy}{dx}\Big|_{(-2,3)} - 3 - (-2)\frac{dy}{dx}\Big|_{(-2,3)} = 0}$

$8\frac{dy}{dx}\Big|_{(-2,3)} = 3 \longrightarrow \frac{dy}{dx}\Big|_{(-2,3)} = \boxed{\frac{3}{8}}$ $\frac{1}{2}$

$\boxed{y-3 = \frac{3}{8}(x+2)}$ $\frac{1}{2}$

[b] $\boxed{\dfrac{dy}{dx} = \dfrac{y}{2y-x}}$ $\frac{1}{2}$

$$\frac{d^2y}{dx^2} = \boxed{\frac{\left(\frac{dy}{dx}\right)(2y-x) - y\left(2\frac{dy}{dx}-1\right)}{(2y-x)^2}} \quad 2$$

$$= \frac{-x\frac{dy}{dx} + y}{(2y-x)^2}$$

$$= \boxed{\frac{\frac{-xy}{2y-x} + y}{(2y-x)^2}} \quad 1$$

$$= \frac{-xy + y(2y-x)}{(2y-x)^3}$$

$$= \boxed{\frac{2y^2 - 2xy}{(2y-x)^3}} \quad 1$$

$$= \frac{2(y^2-xy)}{(2y-x)^3} = \boxed{\frac{30}{(2y-x)^3}} \quad 1$$

[c] $\frac{dy}{dx} = \boxed{\frac{y}{2y-x} = 0 \longrightarrow y = 0}$ 1

$\boxed{0 = \frac{15}{0-x} \quad \text{NO POSSIBLE } X}$ $\frac{1}{2}$

SO, NO HORIZONTAL T. L.