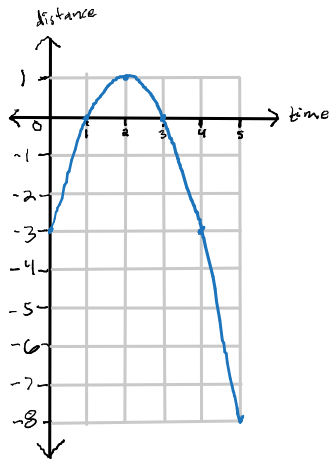
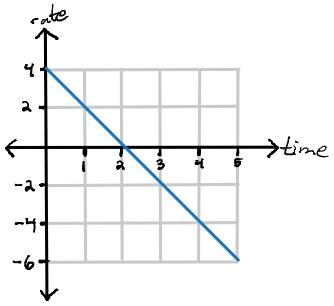
Section 3.5

2.

a.



b. $f'(t) = -2t + 4$



LEFT: $0 \le t < 1$, $3 < t \le 5$

STILL: $t = 1, 3$

RIGHT: $1 < t < 3$

c. $f'(t) = -2t + 4$

$f'(1) = 2 \text{ ft/s}$

$f''(t) = -2$

$f''(1) = -2 \text{ ft/s}^2$

d. $f''(2) = -2 \text{ ft/s}^2$

Section 3.9

1.

$$f(x) = \arcsin\left(e^{\sin(x)}\right) = \arcsin(g(x))$$

$$g(x) = e^{\sin(x)} = e^{h(x)}$$

$$h(x) = \sin(x)$$

$$h'(x) = \cos(x)$$

$$g'(x) = h'(x)\, e^{h(x)} = \cos(x)\, e^{\sin(x)}$$

$$f'(x) = \frac{g'(x)}{\sqrt{1 - g(x)^2}} = \boxed{\frac{\cos(x)\, e^{\sin(x)}}{\sqrt{1 - e^{2\sin(x)}}}}$$

2. $f(t) = \ln(\arctan(t)) = \ln(g(t))$

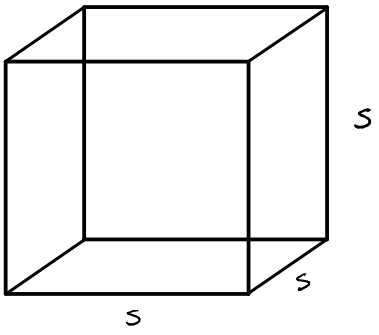
$g(t) = \arctan(t)$

$g'(t) = \dfrac{1}{1+t^2}$

$f'(t) = \dfrac{g'(t)}{g(t)} = \boxed{\dfrac{1}{\arctan(t)} \cdot \dfrac{1}{1+t^2}}$

Section 3.10

1.



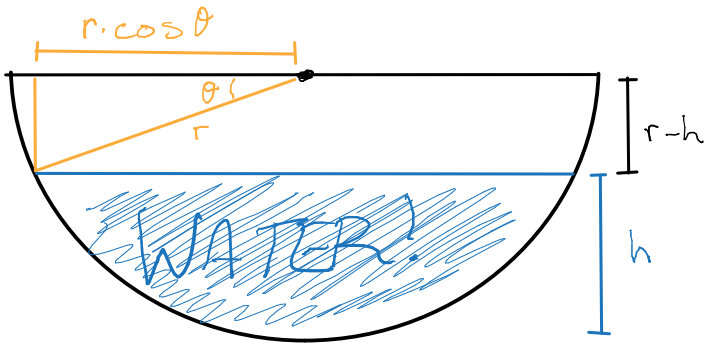
$V = s^3$

$\dfrac{dV}{dt} = 3s^2 \dfrac{ds}{dt}$

$\Rightarrow \dfrac{ds}{dt} = \dfrac{1}{3s^2} \dfrac{dV}{dt}$

$= \boxed{\dfrac{-1}{864} \text{ ft/min}}$

5.



a.

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

$$\frac{dV}{dt} = 2\pi r h \frac{dh}{dt} - \pi h^2 \frac{dh}{dt}$$

$$\Rightarrow \frac{dh}{dt} = \frac{1}{2\pi r h - \pi h^2} \frac{dV}{dt} = \boxed{\frac{1}{25\pi} \text{ m/min}}$$

b.

$$\theta = \arcsin\left(\frac{r-h}{r}\right) \qquad \frac{d\theta}{dt} = -\frac{1}{r\sqrt{1-\left(\frac{r-h}{r}\right)^2}} \frac{dh}{dt}$$

$$SA = \pi r^2 \cos^2(\theta)$$

$$\frac{dSA}{dt} = -2\pi r^2 \sin(\theta)\cos(\theta) \frac{d\theta}{dt}$$

$$= \frac{2\pi r^2 \sin(\theta)\cos(\theta)}{r\sqrt{1-\left(\frac{r-h}{r}\right)^2}} \frac{dh}{dt}$$

$$= \frac{2\pi(100)\left(\frac{1}{2}\right)\cos\left(\arcsin\left(\frac{1}{2}\right)\right)}{10\sqrt{1-\frac{1}{4}}} \left(\frac{1}{25\pi}\right)$$

$$= \boxed{\frac{2}{5} \text{ m}^2/\text{min}}$$