8d. $y = \tan^{-1}(e^x)$ use $\frac{d}{dx}[\arctan u] = \frac{u'}{1+u^2}$

$$y' = \frac{e^x}{1+(e^x)^2} = \frac{e^x}{1+e^{2x}}$$

13. $f(x) = y = x^3$ $[0,3]$

the function is continuous on $[0,3]$

and differentiable on $(0,3)$

$$ARC = \frac{f(b)-f(a)}{b-a} = \frac{f(3)-f(0)}{3-0} = \frac{3^3-0^3}{3} = \frac{27-0}{3} = 9$$

$\exists$ a $c \in (0,3)$ such that $f'(c) = 9$

$f'(x) = 3x^2$ $\quad f'(c) = 3c^2$

$$f'(c) = 9$$
$$\frac{3c^2}{3} = \frac{9}{3}$$
$$c^2 = 3$$
$$c = \pm\sqrt{3}$$
$$c = \sqrt{3}$$

19 $h(t) = -16t^2 + 64t + 80$

The object hits the ground when the height is zero

$h(t) = 0$

$-16t^2 + 64t + 80 = 0$

$-16(t^2 - 4t - 5) = 0$

$-16(t-5)(t+1) = 0$

$t - 5 = 0 \quad t + 1 = 0$

$t = 5 \quad t = -1$

The velocity of the object can be found by taking the derivative of the position function.

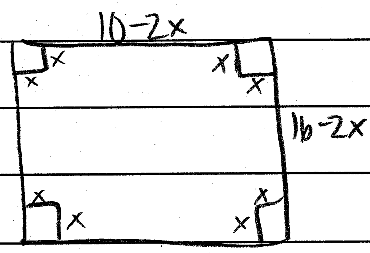
$h(t) = -32t + 64$

$h(5) = -32(5) + 64$

$= -160 + 64$

$= -96$ ft/sec

27.



$V = \text{Volume} = (10-2x)(16-2x)x$

$= (160 - 20x - 32x + 4x^2)x$

$= (160 - 52x + 4x^2)x$

$= 160x - 52x^2 + 4x^3$

$V' = 160 - 104x + 12x^2$

$= 12x^2 - 104x + 160$

$= 4(3x^2 - 26x + 40)$

$= 4(3x - 20)(x - 2)$

$V' = 0$

$4(3x-20)(x-2) = 0$

$3x - 20 = 0 \quad x - 2 = 0$

$3x = 20 \quad x = 2$ maximum volume

$x = \frac{20}{3}$

$f''(2) = \text{negative} \leftarrow$ concave down