a) $-16t^2+144t=128$ Set position equation equal to the height

$16(-t^2+9t)=16\cdot 8$

$-t^2+9t=8$

$0=t^2-9t+8$

$0=(t-8)(t-1) \longrightarrow \boxed{t=8,\ t=1}$

b) Need to find when velocity $=0$

$v(t)=-32t+144$

$\longrightarrow v(t)=-32t+144=0$

$16(-2t+9)=0$

$-2t+9=0 \longrightarrow \boxed{t=9/2}$

Plug in to $s(t)$

$s(9/2)=-16(9/2)^2+144(9/2)=-4\cdot 81+72\cdot 9=\boxed{324\text{ ft}}$

c) Find ~~where~~ when height $=0$

$s(t)=-16t^2+144t=0$

$-16t(t-9)=0$

start of flight $\boxed{t=0}$ $\boxed{t=9}$ end of flight

$v(9)=-32(9)+144=\boxed{-144\text{ ft/s}}$

2. a) $y'=8(3x^2-2)^7(6x)$

b) $y'=3t^2\cdot(t^4+5)^{7/2}+\frac{7}{2}\cdot t^3(t^4+5)^{5/2}(4t^3)$

c) $y'=4(e^{2x+1}-2)^3e^{2x+1}\cdot 2$

d) $y'=\frac{1}{2}\left(\frac{\sin(x)}{\sin(3x)}\right)^{-1/2}\left(\frac{\cos(x)\sin(3x)-3\sin(x)\cos(3x)}{[\sin(3x)]^2}\right)$

2 e) $y' = -\sin(9x^{18}) \cdot 9 \cdot 18 \cdot x^{17}$

f) $y' = \sec(e^{3x^2-7})\tan(e^{3x^2-7}) \cdot e^{3x^2-7} \cdot 6x$

3. a) $4\sqrt{x} - 8\sqrt{y} = 6y^{3/2}$

$\rightarrow \quad 4 \cdot \frac{1}{2}(x)^{-1/2} - 8 \cdot \frac{1}{2} y^{-1/2}\frac{dy}{dx} = 6 \cdot \frac{3}{2} y^{1/2} \frac{dy}{dx}$

$2x^{-1/2} - 4y^{-1/2}\frac{dy}{dx} - 9y^{1/2}\frac{dy}{dx} = 0$

$2x^{-1/2} = \left(4y^{-1/2} + 9y^{1/2}\right)\frac{dy}{dx}$

$\rightarrow \quad \boxed{\frac{dy}{dx} = \frac{2x^{-1/2}}{4y^{-1/2} + 9y^{1/2}}}$

b) $(xy)^{4/3} + x^{1/3} = y^6 + 1$

$\frac{4}{3}(xy)^{1/3}\left[y + x\frac{dy}{dx}\right] + \frac{1}{3}x^{-2/3} = 6y^5\frac{dy}{dx}$

$\frac{4}{3}(xy)^{1/3} \cdot y + \frac{4}{3}(xy)^{1/3} \cdot x\frac{dy}{dx} + \frac{1}{3}x^{-2/3} = 6y^5\frac{dy}{dx}$

multiply by 3 and move $\frac{dy}{dx}$ terms to right hand side

$4y(xy)^{1/3} + x^{-2/3} = \left[18y^5 - 4(xy)^{1/3}x\right]\frac{dy}{dx}$

$\rightarrow \quad \frac{dy}{dx} = \frac{4y(xy)^{1/3} + x^{-2/3}}{18y^5 - 4x(xy)^{1/3}}$

4. a) $2y^2 - \sqrt{x} = 4 \quad (16,2)$

$4y\frac{dy}{dx} - \frac{1}{2}x^{-1/2} = 0$

$\frac{dy}{dx} = \frac{x^{-1/2}}{8y}$

Slope at $(16,2)$

$\frac{dy}{dx}(16,2) = \frac{(16)^{-1/2}}{8(2)} = \frac{1}{4}\cdot\frac{1}{16} = \boxed{\frac{1}{64}}$

eqn: $y - 2 = \frac{1}{64}(x-16)$

b) $y^4(1-x) + xy = 2 \ ; \quad x = 1$

Find y value: $y^4(0) + y = 2$

$\boxed{y=2}$

Find $\frac{dy}{dx}$: $4y^3\frac{dy}{dx}(1-x) + y^4(-1) + y + x\frac{dy}{dx} = 0$

$\frac{dy}{dx}\left[4y^3(1-x) + x\right] = y^4 - y$

$\frac{dy}{dx} = \frac{y^4 - y}{4y^3(1-x) + x}$

Slope at $(1,2)$

$\frac{dy}{dx}(1,2) = \frac{16-2}{4\cdot 8(0) + 1} = 14$

Eqn of tangent line

$\boxed{y - 2 = 14(x-1)}$

5. a) $y' = \frac{1}{\ln(3)} \cdot \frac{1}{(x^2+2x)^{3/2}} \cdot \frac{3}{2}(x^2+2x)^{1/2}(2x+2)$

b) $y' = 3\cdot\ln(6x-11) + \frac{3x+7}{6x-11}\cdot 6$

c) $y' = 4\left[\ln|x+1|\right]^3 \frac{1}{x+1}$

5. d) $y' = \ln(10)\cdot 10^x \log(x) + \frac{1}{\ln(10)}\cdot 10^x \cdot \frac{1}{x}$

e) $y' = \ln(5)\, 5^{8x-3} \cdot 8$

f) $y' = -\ln(10)\, 10^{3x^2-4} \cdot 6x$

6. a) $y' = \frac{1}{1+x^{2/3}} \cdot \frac{1}{3} x^{-2/3}$

b) $y' = \dfrac{1\cdot \tan^{-1}(10^x) - x\cdot \frac{1}{1+10^{2x}}\cdot \ln(10)\, 10^{2x}\cdot 2}{\left[\tan^{-1}(10^x)\right]^2}$

c) $y' = 4\left(\sin^{-1}(\sqrt{x-1})\right)^3 \cdot \frac{1}{\sqrt{1-(x-1)}} \cdot \frac{1}{2}(x-1)^{-1/2}$

d) $y' = \dfrac{\left(\sec^{-1}(3x) + \frac{x\cdot 3}{|3x|\sqrt{9x^2-1}}\right)e^{2x} + x\sec^{-1}(3x)\cdot e^{2x}\cdot 2}{(e^{2x})^2}$

7. a) $A = \pi r^2$

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

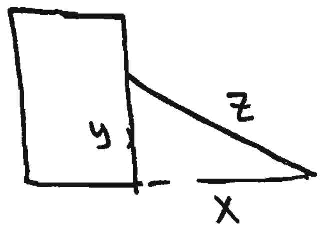
known values

$A = 16\pi$ $\frac{dA}{dt} = ?$

$r = 4$ $dr/dt = 3/2$

Find $\frac{dA}{dt}$: $\frac{dA}{dt} = \pi\cdot 2\cdot 4\cdot \frac{3}{2} = \boxed{12\pi}$

7 b)



z - ladder
y - building
x - ground

$$x^2 + y^2 = z^2$$

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

Known values

$x = 30$ $dx/dt = 3$
$y = 40$ $dy/dt = ?$
$z = 50$ $dz/dt = 0$

to get y: $30^2 + y^2 = 50^2$
$y = 40$

Find dy/dt:

$$2(30)(3) + 2(40)\frac{dy}{dt} = 2(50)(0)$$

$$180 + 80\frac{dy}{dx} = 0$$

$$\frac{dy}{dx} = \frac{-180}{80} = \boxed{-\frac{9}{4}}$$