1) a) $f(x) = \ln x$ } $\boxed{f'(x) = \frac{1}{x}}$

b) $f(x) = \log x$ } $\boxed{g'(x) = \frac{1}{x \ln 10}}$

2) $y = \ln(x^3 + \cos x)$ } $\boxed{y' = \frac{3x^2 - \sin x}{x^3 + \cos x}}$

3) $y(t) = \tan t \cdot \ln(\tan t)$

$y(t) = \sec^2 t \cdot \ln(\tan t) + \tan t \cdot \frac{1}{\tan t} \cdot \sec^2 x$

$y'(t) = \sec^2 t \left(\ln(\tan t) + 1 \right)$

4) $y = (2x+1)^{\sin x}$

$\ln y = \sin x \ln(2x+1)$

$\frac{y'}{y} = \cos x \cdot \ln(2x+1) + \sin x \cdot \frac{1}{2x+1} \cdot 2$

$y' = y\left(\cos x \ln(2x+1) + \frac{2\sin x}{2x+1} \right)$

$\boxed{y' = (2x+1)^{\sin x} \left(\cos x \cdot \ln(2x+1) + \frac{2\sin x}{2x+1} \right)}$

5) $s(t) = 2t^3 - 105t^2 + 1500t$

a) $V(t) = 6t^2 - 210t + 1500$

b) $v(5) = 600 \, ft/s$
$v(15) = -300 \, ft/s$
$v(35) = 1500 \, ft/s$

$0 = 6t^2 - 210t + 1500$

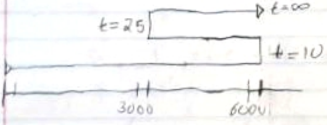
$0 = 6(t^2 - 35t + 250)$

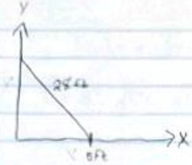
$0 = 6(t-10)(t-25)$

c) Particles at rest at $t = 10, 25$

d) $[0,10)$ increasing, $(10,25)$ decreasing, $(25,\infty)$ increasing

e)



6) 

$\frac{dx}{dt} = 1.2 \text{ ft/s}$, $\frac{dy}{dt} = ?$

$x = 5$, $y = ?$

$5^2 + y^2 = 784$

$\boxed{y = \sqrt{759} \approx 27.55 \text{ ft}}$

$x^2 + y^2 = 784$

$2xx' + 2yy' = 0$

$2(5)(1.2) + 2(\sqrt{759})\, y' = 0$

$2\sqrt{759}\, y' = -12$

$y' = \frac{-12}{2\sqrt{759}} \Big\} \boxed{\frac{dy}{dt} = -\frac{6}{\sqrt{759}} \approx -.22 \text{ ft/s}}$

7) a) $y = 3x^2 - 4x \Big\} \boxed{\frac{dy}{dx} = 6x - 4}$

b) $y = \ln(t^3 + 1) \Big\} \frac{dy}{dt} = \frac{3t^2}{t^3 + 1}$

8) $y = \sqrt{x}$, $x = 4$, $\Delta x = 0.1$, $dy = ?$, $\Delta y = ?$

$\Delta y = f(4 + 0.1) - f(4) \Big\} f(4.1) = \sqrt{4.1}$
$\Big\} f(4) = \sqrt{4}$

$\Delta y = \sqrt{4.1} - \sqrt{4} \Big\} \boxed{\Delta y \approx .025}$

$y' = \frac{1}{2\sqrt{x}}$ $dy = f'(x)\, dx$

$dy = \frac{1}{2\sqrt{4}} \cdot 0.1 \Big\} \boxed{dy \approx .025}$

9) Linear Approximation: $(3.01)^3$ } x^3 at $x=3.01$

$f(a)=3.01^3$ $\qquad\qquad$ $f(a)+f'(a)(x-a)$

$f(a)=27.2709$

$f'(a)=3x^2$

$f'(3.01)=27.1803$

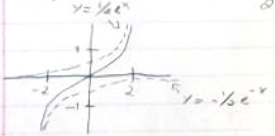
$27.2709+27.1803(x-3.01)$

$27.2709+27.1803x-81.8127$

$f(3.01)=27.1803(3.01)-54.5418$

$f(3.01)\approx 27.27$

10) a) $y=\sinh x$ } $x=\frac{1}{2}e^{x}-\frac{1}{2}e^{-x}$

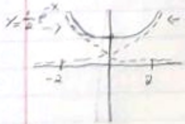


Asymptotes:

$y=\frac{1}{2}e^{x}$

$y=-\frac{1}{2}e^{-x}$

b) $y=\cosh x$ } $x=\frac{1}{2}e^{x}+\frac{1}{2}e^{-x}$



Asymptotes:

$y=\frac{1}{2}e^{x}$

$y=\frac{1}{2}e^{-x}$

11) $\cosh x - \sinh x = e^{-x}$: prove

$$\frac{e^x + e^{-x}}{2} - \frac{e^x - e^{-x}}{2} = e^{-x}$$

$$\frac{e^x + e^{-x} - e^x + e^{-x}}{2} = e^{-x}$$

$$\frac{\cancel{2}e^{-x}}{\cancel{2}} = e^{-x} \Big\} \boxed{e^{-x} = e^{-x}}$$

12) $\cosh(2x) = \cosh^2 x + \sinh^2 x$

$$\frac{e^{2x} + e^{-2x}}{2} = \left(\frac{e^x + e^{-x}}{2}\right)^2 + \left(\frac{e^x - e^{-x}}{2}\right)^2$$

$$\frac{e^{2x} + e^{-2x}}{2} = \frac{(e^x)^2 + \cancel{2e^xe^{-x}} + (e^{-x})^2}{4} + \frac{(e^x)^2 - \cancel{2e^xe^{-x}} + (e^{-x})^2}{4}$$

$$\frac{e^{2x} + e^{-2x}}{2} = \frac{\cancel{2}e^{2x} + \cancel{2}e^{-2x}}{\cancel{4}2} \Big\} \boxed{\frac{e^{2x} + e^{-2x}}{2} = \frac{e^{2x} + e^{-2x}}{2}}$$

13) a) $y = \cosh x \Big\} \cosh x = \dfrac{e^x + e^{-x}}{2} \Big\} \boxed{\cosh x' = \dfrac{e^x - e^{-x}}{2} = \sinh x}$

b) $y = \sinh x \Big\} \sinh x = \dfrac{e^x - e^{-x}}{2} \Big\} \boxed{\sinh x' = \dfrac{e^x + e^{-x}}{2} = \cosh x}$

14) $y = \cosh(x^3)$ $\quad \frac{dy}{dx}(\cosh(x^3)) \frac{dy}{dx}(x^3)$

$\boxed{y' = \sinh(x^3)\, 3x^2}$