Answer all of the following questions.

Calculators and mobile phones are not allowed

1. (a) Find the derivative of (4 Points)

$$y = \ln\left[\log_{10}\left(\sin^{-1}x\right)\right] + x^{\cos^{-1}x}.$$

(a) Evaluate (3 Points)

$$\tan^{-1}\left(\tan\frac{7\pi}{6}\right) + \sin\left[\cos^{-1}\left(-\frac{1}{2}\right)\right].$$

2. Evaluate the following integrals: (5 Points each)

(a) $\int \tanh(\ln x)\,dx$

(b) $\int x\dfrac{\cos x}{\sin^3 x}\,dx$

(c) $\int \dfrac{x+3x^3}{x^4-1}\,dx$

(d) $\int \dfrac{\sin 2x}{2+\cos x}\,dx$

(e) $\int \dfrac{1}{x\sqrt{x^2-2x}}\,dx$

3. Evaluate the following limits: (4 Points each

(a) $\displaystyle\lim_{x\to 0}\dfrac{xe^{3x}-x}{1-\cos 2x}$

(b) $\displaystyle\lim_{x\to\infty}\left(3x+e^x\right)^{2/x}$