I- Calculate the following integrals: **(35pts-5pts each)**

1) $\int \frac{3^x + 4^x}{5^x} dx$

2) $\int \frac{dx}{(4 - x^2)^{3/2}}$

3) $\int \frac{\ln x}{x^5} dx$

4) $\int x \cos x \sin x dx$

5) $\int (\tan x)^5 dx$

6) $\int \frac{x^5 + 1}{(x^3)(x + 3)} dx$

7) $\int \frac{3}{4 + x^{1/3}} dx$

II- Find the following derivatives: **(10pts-5pts each)**

1) $y = x \sec^{-1} x - \sqrt{1 - x^2} + 2\sqrt{x - 1} \sec^{-1} \sqrt{x}$

2) $y = \left(\frac{2x4^x}{\sqrt{x^2 + 1}} \right)^3 (\tan x)^2 \frac{(5x + 4)^3}{(2x - 1)^2}$

III- Solve the following: **(10pts-5pts each)**

1) Using the shell method, find the volume of the solid generated by revolving about the y-axis, the region bounded by: $y = x^2$ & $y = \sqrt{x}$.

2) Find the length of the curve $y = \ln(\sec x)$ from $x = 0 to\ x = \frac{\pi}{4}$

IV_ Solve for *x*: **(10pts-5pts each)**

1) $(\ln x)^3 - 5(\ln x)^2 + 6 \ln x = 0$

2) $\dfrac{e^{5x+4}}{e^{3x-2}} = e^{2x+4}$

V- **(10pts-5pts each)**Test the following integrals for convergence. If they converge, find their limits:

a. $\int_0^{\infty} x(1+x)^{-5}\,dx$

b. $\int_1^{\infty} \dfrac{1}{x\left(\sqrt{\ln x}+\ln^2 x\right)}\,dx$

VI- **(5pts)** Solve for x when $\sin\left(\tan^{-1}\dfrac{x}{\sqrt{x^2+1}}\right)=\dfrac{2}{6}$

VII- **(10pts-5pts each)** Evaluate the following integrals:

a) $\int_1^e \int_1^e \int_1^e (\ln x \ln y \ln z)\,dz\,dy\,dx$

b) $\int_0^1 \int_x^1 e^{\frac{x}{y}}\,dy\,dx$

VIII- Solve the following problems: **(10pts-5pts each)**

a. Find the acute angle between the 2 vectors:

$\vec{u} = 2\vec{i} - \vec{j}$ & $\vec{v} = 4\vec{i} + \dfrac{3}{2}\vec{j}$

b. Find the unit vector(s) that are parallel and normal to the vector $\vec{v} = \vec{i} - 4\vec{j}$