

TEST 2

Time: 70min

1. Evaluate:

a) $\int x e^x dx$, b) $\int_0^{\pi/2} \cos^2 \theta d\theta$.

2. Compute $\int_1^\infty \frac{1}{x} dx$, and use your result to determine whether or not the harmonic series $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots$ converges.

3. Compute the volume of the solid obtained by rotating the ellipse $x^2/a^2 + y^2/b^2 = 1$ around the x-axis.

4. A cylindrical tank has height $20ft$ and radius $5ft$. Suppose the tank is filled with a liquid which weighs 10 pounds per cubic feet. Calculate the total work required to empty the tank.

5. Use Taylor series to decide which of the two functions $y = e^{-x}$, and $y = \frac{1}{(1+x)}$ is larger over the interval $(-1, 1)$. Compute the radius of convergence for each series.

6. **(Bonus)** Choose ONE of the following two questions:

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A. Compute the total work required to move an object infinitely far from the surface of the earth, and find the escape velocity.

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B. Compute the Taylor polynomials for $\arctan x$ and find a series for π (*Hint* $\frac{d}{dx} \arctan x = \frac{1}{1+x^2}$).

Each problem is worth 10 pts.