1 Evaluate ONE of these integrals:

\[(a) \quad \int_0^{\ln(25)} x e^{-x^2/2} \, dx \quad (b) \quad \int_0^{1/2} \frac{e^{\arctan(2x)}}{1 + 4x^2} \, dx\]

2 Evaluate ONE of these antiderivatives:

\[(a) \quad \int \ln(3x + 2) \, dx \quad (x > 0) \quad (b) \quad \int \arctan(2x) \, dx\]
3 The region \( \mathcal{R} \) consists of the region bounded by the lines \( x = 0, y = 0, \) and \( x = \pi/2, \) and the graph of the sine function. Set up, but do not evaluate, BOTH OF the integrals which give the volume of the region swept out by revolving \( \mathcal{R} \) about the line

(a) \( y = 2 \)

(b) \( x = 2 \)

4 Evaluate \( \int_0^{\pi/3} \cos(3x)^2 \, d\theta \)
5. Evaluate $\displaystyle \sum_{n=0}^{\infty} \frac{3}{4^n}$

6. Grenderby is about to make a trigonometric substitution into an integral involving $x^2 + 9$. He’s looking ahead to writing the final answer in terms of $x$. Assuming he uses $\theta$ in his substitution, give the values of the following in terms of $x$:

(a) $\sin(\theta) =$
(b) $\cos(\theta) =$
(c) $\tan(\theta) =$
(d) $\sec(\theta) =$
(e) $\sin(2\theta) =$
7. Show steps in computing the antiderivative: \[ \int \frac{3x^2 + 8}{x^3 - 4x^2 + 4x} \, dx \]
8. Show steps in in computing the interval of convergence for \( \sum_{n=1}^{\infty} \frac{(-2)^n x^n}{\sqrt{n}} \). Be explicit in accounting for the endpoints.

9. Compute the cubic Taylor polynomial, centered on \( x = 1/2 \), for \( f(x) = \cos(\pi x) \)
10. Do at least one of the following. Show steps. It's best to do complete problems rather than just a little bit on several.

If you need more paper, raise your hand. Maybe the instructor will notice, and bring you some paper.

Be sure to put your name on extra sheets you submit for grading.

(a) Compute the volume of the region in problem 3(b).

(b) Determine the convergence behavior of \( \sum_{n=1}^{\infty} \left( 1 - \frac{1}{n} \right)^n \) and \( \sum_{n=1}^{\infty} \left( 1 - \frac{1}{n} \right)^{n^2} \).

(c) Use \( \Sigma \) notation to express the complete Taylor series, centered on \( x = 3 \), for \( f(x) = \frac{1}{1 + x} \).

(d) Determine the total length of the curve traced out by the parametric equations \( x = \sin(t)^2 \) and \( y = \cos(t)^2 \).

(e) Compute the limit of the sequence

\[ a_n = n - \sqrt{n^2 + 32n + 1} \]

(f) Evaluate the antiderivative: \( \int \frac{1}{\sqrt{x^2 + 9}} \, dx \).

(g) Show all steps in evaluating \( \int_1^{\infty} xe^{-2x} \, dx \).

(h) Compute steps in computing an \( n = 4 \) Simpson’s-Rule approximation to \( \int_0^{12} x^3 \, dx \). Show a comparison of your approximation with the exact value.