

- (4) 1. Find the slope of y when $x = 5/4$.

$$y = \frac{5}{5 + \frac{16}{5}x^2} + 6 \arctan\left(\frac{4}{5}x\right)$$

- (24) 2. Evaluate the integrals. Exact answers only. No decimals.

(a) $\int (xe^{-x^2} + \pi) dx$

(b) $\int \frac{\ln(\ln x)}{x} dx$

(c) $\int \frac{x^3}{\sqrt{9-x^2}} dx$

(d) $\int_0^1 x \arctan(x) dx$

(e) $\int \frac{2x^2 - 3x + 4}{(x-1)(x^2+2)} dx$

(f) $\int \frac{\sec^4(\sin x) \tan^2(\sin x)}{\sec x} dx$

- (8) 3. Evaluate the improper integrals.

(a) $\int_{-10}^{\infty} e^{-x} dx$

(b) $\int_{-2}^0 \frac{1}{(x+1)^3} dx$

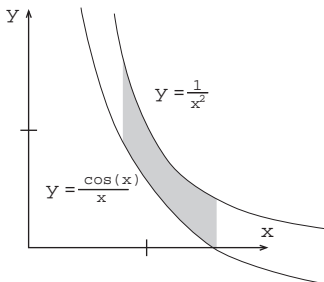
- (8) 4. Evaluate the limits.

(a) $\lim_{x \rightarrow \infty} \left(\frac{1}{x}\right)^x$

(b) $\lim_{x \rightarrow 0} \frac{\arcsin(11x)}{\arcsin(5x)}$

- (4) 5. Compute the area of the region bounded by the curves $y = x^3 - 2x^2 + x + 1$ and $y = -x^2 + x + 1$. (Simplified exact answer only. No decimals.)

- (6) 6. Let \mathcal{R} be the region between the graphs of $y = \frac{\cos(x)}{x}$ and $y = \frac{1}{x^2}$ from $x = \frac{\pi}{4}$ to $x = \frac{\pi}{2}$



- (a) Set up, but do not evaluate the integral required to find the volume of the solid generated by revolving \mathcal{R} about the x -axis.

- (b) Find the volume of the solid generated by revolving \mathcal{R} about the y -axis. (Simplified, exact answer only.)

- (4) 7. Solve the differential equation: $(x+1)y' = -y^2$, subject to the $y(0) = \frac{1}{2}$.

Write your answer as an explicit solution $y(x) = \dots$

- (9) 8. Determine whether the sequence converges or diverges. Justify: If it converges, give its limit. If it diverges, explain why.

(a) $\left\{ \frac{(n+2)!}{n!} \right\}_{n=1}^{\infty}$

(b) $\left\{ \csc\left(\frac{1}{n}\right) - \cot\left(\frac{1}{n}\right) \right\}_{n=1}^{\infty}$

(c) $\left\{ \left(\frac{n}{1+n}\right)^n \right\}_{n=1}^{\infty}$

- (9) 9. Find the exact sum of the series.

(a) $\sum_{n=0}^{\infty} \frac{(-1)^n 2^{n+2}}{3^n}$

(b) $\sum_{n=2}^{\infty} \left[\frac{1}{\ln(n+1)} - \frac{1}{\ln n} \right]$

- (12) 10. Determine whether each of the following series converges or diverges. State the tests you use, and verify that the conditions for using them are satisfied.

(a) $\sum_{n=1}^{\infty} \frac{(n!)^2 2^n}{(2n+1)!}$

(b) $\sum_{n=1}^{\infty} \frac{2 + \cos n}{5^n}$

(c) $\sum_{n=1}^{\infty} \frac{\arctan n}{n^2 + 1}$

(d) $\sum_{n=1}^{\infty} \frac{6 + \ln n}{\sqrt{n}}$

- (6) 11. Label each series as absolutely convergent, conditionally convergent, or divergent. Justify your answers.

(a)
$$\sum_{n=1}^{\infty} (-1)^n \left(\frac{1}{\arctan(n)} \right)^n$$

(b)
$$\sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{n(n+1)}}$$

- (4) 12. Determine the radius and the interval of convergence of the power series:
$$\sum_{n=2}^{\infty} \frac{(-1)^n (x-3)^n}{n \ln n}$$

- (5) 13. Find the Taylor series for $f(x) = \frac{1}{2-x}$ centered at $a = 5$ and state its interval of convergence.