

1. Find $\frac{dy}{dx}$ Do not simplify your answer.

(a) $y = x \arctan x$

(b) $y = \frac{\operatorname{arcsec} \sqrt{x}}{e^{2x}}$

2. Evaluate the following integrals.

(a) $\int \frac{3}{x^2} \left(1 - \frac{1}{x}\right)^3 dx$

(b) $\int \frac{x^2 - 5x + 2}{x - 1} dx$

(c) $\int \frac{dx}{\sqrt{1 - 9x^2}}$

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

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

(f) $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{\sqrt{x^2 + 2}}$

(g) $\int \sin^2 5x \cos^2 5x dx$

(h) $\int e^{2x} \sin x dx$

3. Calculate the following limits.

(a) $\lim_{x \rightarrow \pi} \frac{\sin^2 x}{1 + \cos 3x}$

(b) $\lim_{x \rightarrow 0^+} x^{\sin x}$

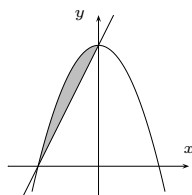
4. Determine convergence or divergence for

(a) $\int_{-\infty}^0 \frac{dx}{x^2 + 9}$,

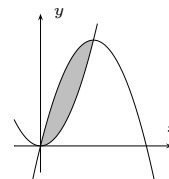
(b) $\int_0^2 \frac{dx}{(x - 2)^2}$.

5. Find the volume of the solid generated when the region bounded by the given curves is revolved about the x -axis.

$y = 4 - x^2 \quad y = 2x + 4$



6. Use the method of shells to set up a definite integral which expresses the volume of the solid generated when the region bounded by the graphs of $y = x^2$ and $y = 4x - x^2$ is revolved about the y -axis. Do not evaluate the integral.



7. Given the sequence $\left\{ \frac{2n - 1}{n + 1} \right\}_{n=1}^{\infty}$.

- (a) Write out the first four terms of the sequence.
- (b) Is this sequence monotonic? Justify your answer.
- (c) Is this sequence convergent? Justify your answer.
- (d) Find s_4 , the fourth partial sum of the associated series.

8. Give an example of

- (a) an increasing sequence,
- (b) a decreasing sequence, and
- (c) a sequence that is neither increasing nor decreasing.

9. Determine whether the following series converge or diverge. State which test you are using and give sufficient details to show that you are using the test correctly.

(a) $\sum_{k=1}^{\infty} \frac{k^2 + k}{2k^3 + 1}$ (b) $\sum_{k=1}^{\infty} \frac{3 - \frac{1}{k}}{2^k}$ (c) $\sum_{k=2}^{\infty} \frac{1}{k \ln k}$

10. Are the following series absolutely convergent, conditionally convergent, or divergent? Justify your answer.

(a) $\sum_{k=1}^{\infty} \frac{(-1)^{k+1} k^2}{k!}$ (b) $\sum_{k=1}^{\infty} \frac{(-1)^k}{\arctan k}$ (c) $\sum_{k=1}^{\infty} \frac{(-1)^k}{\sqrt{k}}$

11. Find the radius and interval of convergence of

$$\sum \frac{(-1)^k (x + 2)^k}{3^k}$$

12. Find the Maclaurin polynomial of degree four of $f(x) = e^{-3x}$.