

1. Find $\frac{dy}{dx}$ for

(a) $y = \ln(\arctan(x^3))$

(b) $y = x \arcsin(2x) + \operatorname{arcsec}(e^x)$

2. Evaluate the following integrals.

(a) $\int \sin^5(2x) \cos^3(2x) dx$

(b) $\int \frac{dx}{x(x+2)}$

(c) $\int x \arctan x dx$

(d) $\int \frac{x^3 dx}{\sqrt{4x^2 - 9}}$

(e) $\int \frac{e^x dx}{7 + e^{2x}}$

(f)* $\int \frac{dx}{\sqrt{x^2 - 9}}$

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

(The last two problems—marked with an asterisk—have been altered to better suit the current course.)

3. Calculate the following limits.

(a) $\lim_{x \rightarrow 1} \frac{x - e^{x-1}}{(x-1)^2}$

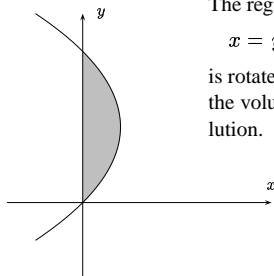
(b) $\lim_{x \rightarrow \infty} \left(\frac{x-1}{x+2} \right)^x$

4. Evaluate or show divergence.

(a) $\int_{\frac{1}{2}}^{\infty} \left(\frac{1}{x} - \frac{2}{2x+1} \right) dx$

(b) $\int_{-1}^2 \frac{x+1}{(x(x+2))^{4/3}} dx$

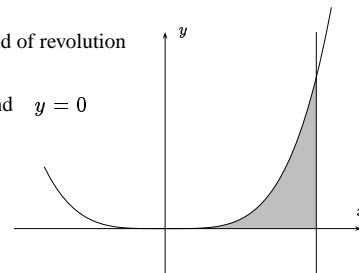
5. (a)



The region bounded by
 $x = y - y^2$ and $x = 0$

is rotated about the y -axis. Find
the volume of the solid of revolu-
tion.

(b) Find the volume of the solid of revolution
if the region bounded by
 $y = x^4$, $x = 1$ and $y = 0$
is rotated about the y -axis.



6. (a) Given $\left\{ \frac{2n}{2n^2 - 1} \right\}$. (Justify your answers.)

(i) Is this sequence monotonic?

(ii) Is this sequence bounded?

(iii) Does it have a limit?

(b) Test these sequences for convergence. If they converge, find $\lim_{n \rightarrow \infty} a_n$.

(i) $\left\{ \frac{\cos n}{\ln n} \right\}$

(ii) $\left\{ \frac{e^n}{n} \right\}$

(c) Determine by using an appropriate test whether these series converge.

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

(ii) $\sum_{n=1}^{\infty} \left(\frac{2}{n} - \frac{1}{n^2} \right)$

(iii) $\sum_{n=1}^{\infty} \frac{\sqrt{2n+3}}{5n^2-2}$

(iv) $\sum_{n=1}^{\infty} \frac{\ln n}{n}$

7. Are the following series divergent, absolutely convergent, or conditionally convergent? State which tests are used in each case.

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

(b) $\sum_{n=1}^{\infty} \frac{(-1)^n (n!)^2}{(2n)!}$

8. Find the interval of convergence of

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

9. Find the first five non-zero terms of the Maclaurin series expansion of

$$f(x) = \sqrt{3x+4}$$

centered at $x = 0$.