

1. Evaluate each of the following integrals.

a.  $\int (x + 2)\sqrt{x - 3} dx$

b.  $\int_1^e \frac{(\ln x)^2}{x^4} dx$

c.  $\int_{\sqrt{2}}^2 \frac{dx}{x^2\sqrt{x^2 - 1}}$

d.  $\int \frac{3x^2}{\sqrt{4 - x^2}} dx$

e.  $\int \sin^4 x \cos^3 x dx$

f.  $\int \arcsin x dx$

g.  $\int \frac{dx}{x^3 + 2x^2 + x}$

h.  $\int \frac{x^2 - 2x + 3}{x^3 - 1} dx$

2. Find the limits

a.  $\lim_{x \rightarrow 0^+} \tan x \ln x$

b.  $\lim_{x \rightarrow 0} \frac{e^x - e^{-x} - 2x}{\cos 2x - 1}$

c.  $\lim_{x \rightarrow 0^+} (e^{-2x} + x)^{1/x}$

3. Evaluate the integral, or show that it diverges

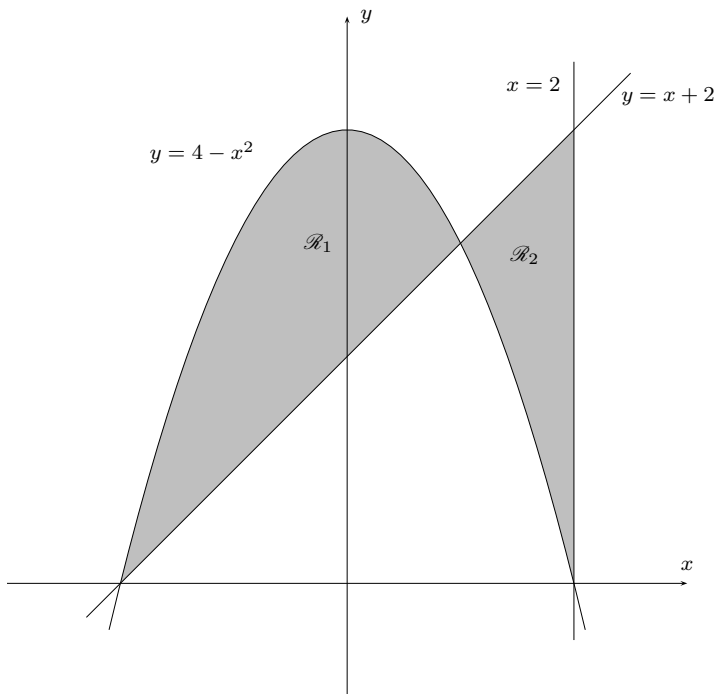
a.  $\int_0^\infty \frac{e^{-2\sqrt{x}} \cos \sqrt{x}}{\sqrt{x}} dx$

b.  $\int_0^\pi \sqrt{\frac{1 + \sin \vartheta}{1 - \sin \vartheta}} d\vartheta$

4. Refer to the graph below for this question.

a. Find the sum of areas of the regions  $R_1$  and  $R_2$ .

b. Find the volume of the solid generated when region  $R_2$  is revolved about  
i. the  $x$ -axis,                      ii. the line  $x = 3$ .



5. Find the limit of the sequence  $\left\{ \frac{\ln(2 + e^n)}{3n} \right\}$ .

6. Find each of the following series. Write out the first four terms explicitly, and indicate the general term using summation notation.

- a. The Taylor series of  $f(x) = x^{2/3}$ , centred at 1.
- b. The Maclaurin series of  $f(x) = \ln(3 - 2x)$ .

7. Determine if 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.  $\sum_{n=1}^\infty \frac{\arctan n}{n^2}$

b.  $\sum_{k=1}^\infty \frac{k!}{e^{k^2}}$

c.  $\sum_{k=0}^\infty \frac{2k - 1}{3k + 5}$

d.  $\sum_{n=1}^\infty \frac{1}{n + \sqrt{n^2 + 1}}$

8. Classify each of the following series as absolutely convergent, conditionally convergent, or divergent. Support your conclusions with sufficient details.

a.  $\sum_{k=1}^\infty \frac{(-1)^k}{\ln k \sqrt[3]{k + 1}}$

b.  $\sum_{n=0}^\infty (-1)^n \frac{n^2 + 2}{n^4 + 3}$

9. Find the interval of convergence of the power series

$\sum_{n=0}^\infty \frac{(5x + 3)^n}{2^n \sqrt{n + 4}}$