

1. Let  $R$  be the region in the first quadrant bounded by the curve  $y = x^3$  and  $y = 2x - x^2$ . Determine the volume of the solid obtained by revolving  $R$  about
  - a. The  $x$ -axis.
  - b. The  $y$ -axis.
  - c. The line  $y = -2$ .
2. Using calculus, find the volume of a cone with height  $h$  and radius of the base  $r$ .
3. Find the area of the region in the first quadrant bounded by  $y = x^2$ ,  $y = 2x^2 - 4x$  and  $y = 0$ .
4. Find the length of the curve  $y = x^{1/2} - \frac{x^{3/2}}{3}$  for  $1 \leq x \leq 3$
5. A cylindrical tank of radius 3 m and length of 10 m is lying on its side on horizontal ground. If this tank is initially full of water (density  $1000 \text{ kg/m}^3$ ), how much work is done to pump all this gasoline to a point 5 ft above the top of the tank?
6. A trough has vertical ends that are equilateral triangles (downward pointing) with sides of length 2 m. If the trough is filled with water, find the force exerted by the water on one end of the trough.
7. Evaluate the following:

a.  $\int \frac{\sin^3 x}{\sqrt{\cos x}} dx.$

b.  $\int x^2 \ln x dx.$

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

d.  $\int \frac{dx}{\sqrt{x^2+16}}$

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

f.  $\int_0^2 \frac{x}{x^2-1} dx$

g.  $\int_2^{\infty} \frac{dx}{x \ln x}$

8. Find the Taylor series for  $f(x) = \frac{1}{4x-3}$  at  $a=1$ .

9. Find the radius and interval of convergence for the power series  $\sum_{k=1}^{\infty} \frac{(2x+3)^k}{k^2 4^k}$ .

10. Determine whether the series  $\sum_{k=1}^{\infty} \frac{(-1)^{k+1} k^2}{k^3 + 1}$  converges absolutely, converges conditionally or diverges.

11. Determine whether the series  $\sum_{k=1}^{\infty} \frac{2k+3}{k^2 + 3k + 1}$  converges or diverges.

12. Determine whether the series  $\sum_{k=1}^{\infty} \frac{\sin(5k)}{1+3^k}$  converges or diverges.

13. Find and sketch the four roots of  $3+3i$ .

14. Find the area of the region enclosed by one loop of the curve  $r = 3\sin 3\theta$ .

15. Find the area of the region within both of the curves  $r = \cos \theta$  and  $r = 1 - \cos \theta$ .

16. For the parametric curve  $x = t^2$ ,  $y = 3\ln t + 2$ , write the equation of the line tangent to the curve at  $t = 1$ .

17. Evaluate the expression

a.  $e^{i\pi/2}$

b.  $\frac{5+3i}{4-2i}$

c.  $(-1-i)^{24}$

d.  $|-3-4i|$