

1. Let  $R$  be the region bounded by the curve  $y = (x-2)^2$  and the line  $y = 4$ .
  - a. Find the volume of the solid generated by revolving  $R$  about the  $x$ -axis.
  - b. Find the volume of the solid generated by revolving  $R$  about the  $y$ -axis.
  - c. Find the volume of the solid generated by revolving  $R$  about the line  $x = -1$ .
2. Find the area of the region in the first quadrant bounded by  $y = 5x - 8$ ,  $y = 16 - x^2$  and the  $x$ -axis.
3. Find the arc length of the curve  $y = \frac{1}{3}(x^2 + 2)^{3/2}$  for  $0 \leq x \leq 1$ .
4. A cylindrical storage tank of diameter 4 m and length 8 m is lying on its side. If the tank is half full of water (with density  $1000 \text{ kg/m}^3$ ), find the force exerted by the water on one end of the tank.
5. A conical tank 5 m in diameter and 10 m in height is resting on its base. The tank is filled with water, how much work is required to pump all the water over the top of the tank?

6. Evaluate the following:

- a.  $\int x^2 \cos 3x \, dx$
- b.  $\int \sec^3 x \tan^5 x \, dx$
- c.  $\int \frac{x^2 + 8x - 3}{x^3 + 3x^2} \, dx$
- d.  $\int \frac{x^3}{\sqrt{x^2 + 9}} \, dx$
- e.  $\int \frac{x^2}{(4 - x^2)^{3/2}} \, dx$
- f.  $\int_1^3 \frac{1}{\sqrt[3]{x-2}} \, dx$

7. Write the Taylor series for  $f(x) = \frac{1}{2x-5}$  at  $a = 3$ .

8. Find the radius and interval of convergence for the power series  $\sum_{k=1}^{\infty} \frac{(x+2)^k}{k4^k}$ .

9. Determine whether the series  $\sum_{k=1}^{\infty} \frac{(-1)^{k+1}}{\sqrt[4]{k}}$  converges absolutely, converges conditionally or diverges.
10. Determine whether the series  $\sum_{k=1}^{\infty} \frac{k^2 - 1}{3k^4 + 1}$  converges or diverges.
11. Find the six roots of  $-64i$ .
12. Find the area of the region inside  $r = 4 \cos \theta$  and outside  $r = 2$ .
13. Replace the polar equation  $r = 3 \cos \theta$  with the Cartesian equation. Identify or describe the graph.
14. Find the slope of the line tangent to the curve  $r = 3 \sin \theta$  at  $\theta = \frac{\pi}{4}$ .
15. For the parametric curve  $x = e^{\sqrt{t}}$ ,  $y = t - \ln t^2$ , write the equation of the line tangent to the curve at  $t = 1$ .
16. Evaluate the expression
- $\frac{3 + 2i}{1 + i}$
  - $\left(\frac{1}{2} + \frac{1}{2}i\right)^{15}$
  - $|-1 + 2\sqrt{2}i|$