

1.  $\int \frac{1}{\sqrt{5+4x-x^2}} dx$

2. Solve the differential equation  $x^{-4}y' = 5e^{-y}$

3. Solve the differential equation  $xy' - 4y = x^5 \cos x$

4. Find the **focus** of the **parabola**  $12x = y^2 - 6y + 1$

5. A **hyperbola** has **vertices** at  $(\pm 24, 0)$ , and **asymptotes**  $y = \pm \frac{5}{6}x$ .

(a) Find the **equation** of the hyperbola in **standard** form.

(b) Find the **eccentricity** of the hyperbola.

6. Convert the **polar** equation  $r = 8 \cos \theta - 4 \sin \theta$   
to one in **rectangular** coordinates, and **describe** the graph.

7. A curve is defined parametrically by  $x = 2 \cos t$ ,  $y = 5 \sin t$ .

(a) **Eliminate** the parameter and **identify** the curve.

(b) Find  $\frac{dy}{dx}$  as a function of the **parameter**,  $t$ .

8. (a) Convert  $(x, y) = (-2, 2\sqrt{3})$  to **polar** coordinates.

(b) Convert  $(r, \theta) = (6, \frac{3\pi}{4})$  to **rectangular** coordinates.

9. Convert the **polar** equation  $r = 4 \cos \theta + 6 \sin \theta$  to one in **rectangular** coordinates, and state what the graph is.

10. Consider the **lemniscate**  $r^2 = 8 \sin(2\theta)$  and the **circle**  $r = 2$ .

(a) **Graph** them together, giving **polar coordinates** of the **points of intersection**.  
(Can use polar graph paper.)

(b) Find the **area of the region outside the circle, but inside the lemniscate**.

11. (a) Graph the **lemniscate**  $r^2 = 9 \cos(2\theta)$  and the **circle**  $r = 3\sqrt{2} \sin \theta$  together, giving polar coordinates of the **points of intersection**.

(b) **Set up** an integral or integrals to find the **area of the region inside the circle, but outside the lemniscate**. Do not compute this area.

12. A curve is defined parametrically by  $x = t^3 - 1$ ,  $y = t^6 + 2$

(a) **Eliminate** the parameter and **identify** the curve.

(b) Find  $\frac{dy}{dx}$  as a function of the **parameter**,  $t$ .

(c) **Set up** an integral to find the **arclength** of the portion of the curve from  $t = 1$  to  $t = 3$ . (Evaluation is not required)

13. Find the area of the surface of revolution formed by revolving the portion of the graph of  $y = \frac{1}{2}x^2$  from  $x = 0$  to  $x = 4$ , about the  $y$ -axis.

14. Find the **centroid** of the region bounded by the curves  $y = x^3$  and  $y^2 = 32x$   
Draw an appropriate **diagram**. with coordinates of intersection points.

15. **Consider** the **parabola**  $x^2 - 10x - 12y + 13 = 0$

(a) Complete the square and find the standard form of the equation.

(b) Find the vertex (c) Find the focus (d) Find the equation of the directrix.

16. An **ellipse** has **vertices** at  $(\pm 9, 0)$  and **foci** at  $(\pm 4, 0)$ .

(a) Find the **equation** of the ellipse in **standard** form.

(b) Find the **eccentricity** of the ellipse.

17. A curve is defined parametrically by  $x = 2 \cos^2 t$ ,  $y = 5 \sin t$ .

(a) **Eliminate** the parameter and **identify** the curve.

(b) Find  $\frac{dy}{dx}$  as a function of the **parameter**,  $t$ .

20. Consider the **limaçon**  $r = 4 + 5 \cos(\theta)$  and the **circle**  $r = 6.5$ .

(a) **Graph** them together, giving **polar coordinates** of the **points of intersection**.  
(Can use polar graph paper.)

(b) Find the **area of the region outside the circle, but inside the limaçon**.

21. Solve (a)  $y' = 2xy \cdot \ln y$  (b)  $y' - \frac{3}{x}y = x^3 \sin x$