



# MATHS

## BOOKS - NAGEEN MATHS (HINGLISH)

### APPLICATIONS OF INTEGRALS

#### Solved Example

1. Find the area of the region bounded by the line  $y = 2x$ , X - axis and ordinate  $x = 2$ .



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2. Find the area of the circle  $x^2 + y^2 = a^2$  with radius  $a$

A.  $\pi a^2$  sq. units

B.  $\pi a^3$  sq. units

C.  $\pi a^4$  sq. units

D.  $\pi a^5$  sq. units

**Answer: A**



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3. Find the area of the region bounded by  $x^2 = 4y$ ,  $y = 2$ ,  $y = 4$  and the  $y$ -axis in the first quadrant.



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4. Find the area bounded by the curve  $y = x(x - 1)(x - 2)$  and the  $x$ -axis.



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5. Find the area of the region bounded by the curve  $y = |x + 1|$ , lines  $x = -4$ ,  $x = 2$  and  $X$ -axis.

A. 5

B. 7

C. 6

D. 9

**Answer:** *D*



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6. Find the area of the region included between the parabolas  $y^2 = 4ax$  and  $x^2 = 4ay$ , where  $a > 0$ .



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7. Find the area bounded by the parabola  $y^2 = 4ax$  and the line  $y = 2ax$ .

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8. Find by integration the area of the region bounded by the curve  $y = 2x - x^2$  and the x-axis.

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9. Find the area of the region in the first quadrant enclosed by the x-axis, the line  $y = x$ , and the circle

$$x^2 + y^2 = 32.$$



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10. Find the ratio of the areas of the portion between the circle  $x^2 + y^2 = a^2$  and straight line

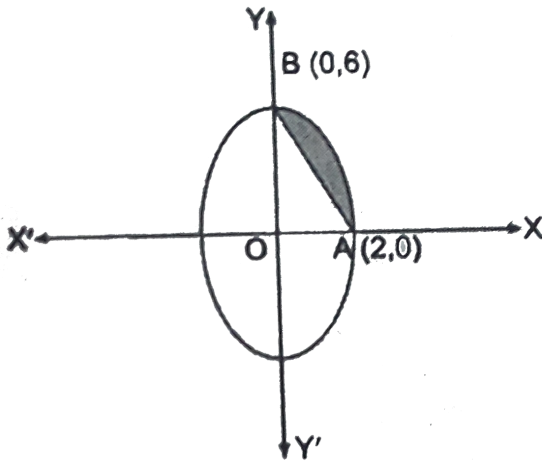
$$x = \frac{a}{2}$$



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11. In the adjoining,  $OABO$  is the region of the ellipse  $9x^2 + y^2 = 36$  which lies in first quadrant. If  $OA = 2$ ,  $OB = 6$ , then find the area of the region

bounded by chord AB and arc AB.



A.  $(3\pi - 8)sq.$  units.

B.  $(3\pi - 7)sq.$  units.

C.  $(3\pi - 6)sq.$  units.

D.  $(3\pi - 9)sq.$  units.

**Answer: C**



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12. Using integration find the area of region bounded by the triangle whose vertices are  $(1, 0)$ ,  $(2, 2)$  and  $(3, 1)$ .

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## Exercise 8 A

1. Using intergration, find the area of the region bounded by the line  $y = mx$ , X-axis and  $x = 2$ .

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2. Find the area of the region bounded by the line  $y = 3x + 2$ , the x-axis and the ordinates  $x = 1$  and  $x = -1$ .



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3. Find the area bounded by the line  $y = x$ , the x-axis and the ordinates  $x = -1$  and  $x = 2$



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4. Find the area of the region bounded by the ellipse

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$



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5. Find the area of the portion of an ellipse

$4x^2 + 9y^2 = 36$ , which is surrounding by the positive direction of x and y-axes.



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6. Using integration, find the area of the region bounded by the curve  $y^2 = 9x$  and lines  $x = 1$  and  $x = 4$ .



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7. Using intergration, find the area of the region bounded by the curve  $y^2 = x$ ,  $x = 1$ ,  $x = 4$  and X-axis.



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8. Using intergration, find the area of the region bounded by the lines  $y = |x + 1|$ ,  $x = -3$ ,  $x = 1$  and X-axis.



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9. Find the area of that region bounded by the curve  $y = \cos x$ , X-axis,  $x = 0$  and  $x = \pi$ .



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**10.** Find the area of that region of the parabola  $y^2 = 4ax$  which lies between X-axis,  $x = 2a$  and the latus rectum.



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**11.** Find the area of the region bounded by the curve  $y = x^2$  and the line  $y = 4$ .



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12. Find the area bounded by the curve  $y^2 = 4ax$  and the lines  $y = 2a$  and  $y$ -axis.

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13. Find the area of the parabola  $y^2 = 4ax$  bounded by its latus rectum.

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14. Using integration, find the area of the region bounded by the parabola  $y^2 = 4x$  and the line

$$x = 4.$$



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15. Find the area enclosed by the parabola  $4y = 3x^2$  and the line  $2y = 3x + 12$ .

A. 27 sq. units.

B. 17 sq. units.

C. 26 sq. units.

D. 28 sq. units.

**Answer: A**



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16. The area between  $x = y^2$  and  $x = 4$  is divided into two equal parts by the line  $x = a$ , find the value of  $a$ .

A.  $a = 4^{4/3}$

B.  $a = 4^{3/2}$

C.  $a = 4^{1/3}$

D.  $a = 4^{2/3}$

**Answer: D**





17. Find the area of the region bounded by: the parabola  $y = x^2$  and the line  $y = x$



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18. Find the area bounded by the curves  $y^2 = 9x$  and  $x^2 = 9y$ .

A. 26 sq. units.

B. 27 sq. units.

C. 28 sq. units.

D. 29 sq. units.

**Answer: B**



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**19.** Using the method of integration find the area of the triangle ABC, coordinates of whose vertices are A(2, 0), B (4, 5) and C (6, 3).



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**20.** Using integration, find the area of the triangle whose vertices are (1, 0), (4, 0) and (4, 4).



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21. Using integration find the area of the triangular region whose sides have equations  $y = 2x + 1$ ,  $y = 3x + 1$  and  $x = 4$



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22. Find the area of the region

$$\{(x, y) : 0 \leq y \leq x^2 + 1, 0 \leq y \leq x + 1, 0 \leq x \leq 2\}.$$



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23. Find the area of the region bounded by the curves  $y^2 = x + 1$  and  $y^2 = -x + 1$ .

A.  $\frac{5}{3}$  sq. units.

B.  $\frac{7}{3}$  sq. units.

C.  $\frac{8}{3}$  sq. units.

D.  $\frac{10}{3}$  sq. units.

**Answer: C**



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**24.** Find the area of the region bounded by the curves  $x^2 + y^2 = 4$  and  $(x - 2)^2 + y^2 = 4$ .

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**25.** Find the smaller area enclosed between line, if  $y = \begin{cases} x, & \text{if } x \geq 0 \\ -x, & \text{if } x < 0 \end{cases}$  and curve  $4x^2 + 9y^2 = 36$

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**26.** The equation of the common tangent to the parabolas  $y^2 = 4ax$  and  $x^2 = 4by$  is given by

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**27.** Using definite integration, find the area of the smaller region bounded by the ellipse  $9x^2 + 16y^2 = 144$  and  $x = 2$ .

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28. The circle  $x^2 + y^2 = 4a^2$  is divided into two parts by the line  $x = \frac{3a}{2}$ . Find the ratio of areas of these two parts.



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## Exercise 8 B Multiple Choice Questions

1. Find the area bounded by the parabola  $y^2 = 4ax$  and the line  $y = 2ax$ .

A.  $3a$  sq. units

B.  $\frac{1}{3a}$  sq. units

C.  $\frac{2}{3a}$  sq. units

D. None of these

**Answer: B**



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2. Examples: Find the area bounded by the parabola

$y^2 = 4ax$  and its latus rectum.

A.  $\frac{8a^2}{3}$  sq. units

B.  $2a^2$  sq. units

C.  $\frac{4a^2}{3}$  sq. units



D. None of these

**Answer: A**



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3. Find the area of the region included between the parabolas  $y^2 = 4ax$  and  $x^2 = 4ay$ , where  $a > 0$ .

A.  $\frac{16a^2}{3}$  sq. units

B.  $\frac{8a^2}{3}$  sq. units

C.  $\frac{4a^2}{3}$  sq. units

D. None of these

**Answer: A**



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4. Area of the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  is  $\pi ab$

A.  $\frac{1}{4} \pi ab$  sq. units

B.  $\frac{1}{2} \pi ab$  sq. units

C.  $\pi ab$  sq. units

D. None of these

**Answer: C**



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5. The vertices of a triangle are  $(1, 0)$ ,  $(4, 0)$  and  $(4, 4)$ .

Its area is :

A. 4 sq. units

B. 6 sq. units

C. 8 sq. units

D. None of these

**Answer: B**



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6. The area of the region bounded by the circle

$x^2 + y^2 = 1$  and the line  $x + y = 1$  is :

A.  $\left(\frac{\pi}{4} - \frac{1}{2}\right)$  sq. units

B.  $\frac{\pi}{4}$  sq. units

C.  $\frac{1}{2}$  sq. units

D. None of these

**Answer: A**



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7. Find the area of the region bounded by the curve

$y^2 = 4x$  and the line  $x = 3$ .

A.  $4\sqrt{3}$  sq. units

B.  $8\sqrt{3}$  sq. units

C.  $10\sqrt{3}$  sq. units

D. None of these

**Answer: B**



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8. Find the area of the region bounded by: the parabola  $y = x^2$  and the line  $y = x$

A. 1 sq. unit

B.  $\frac{1}{2}$  sq. unit

C.  $\frac{1}{4}$  sq. unit

D. None of these

**Answer: B**



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9. Find the area of the region bounded by: the parabola  $y = x^2$  and the line  $y = x$

A.  $\frac{9}{2}$  sq. units

B.  $\frac{9}{4}$  sq. units

C.  $\frac{9}{8}$  sq. units

D. 9 sq. units

**Answer: A**



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10. Find the area enclosed by the parabola  $4y = 3x^2$  and the line  $2y = 3x + 12$ .

- A. 18 sq. units
- B. 24 sq. units
- C. 27 sq. units
- D. None of these

**Answer: C**

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1. Examples: Find the area of the region bounded by the curve  $y^2 = 2y - x$  and the y-axis.

A.  $\frac{2}{3}$  sq. units

B.  $\frac{4}{3}$  sq. units

C. 2 sq. units

D. None of these

**Answer: B**



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2. Find the area of the region bounded by

$$y = x^2 + 1, y = x, x = 0 \text{ and } y = 2.$$

A.  $\frac{21}{2}$  sq. units

B.  $\frac{15}{2}$  sq. units

C. 9 sq. units

D. None of these

**Answer: A**



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3. The area of region bounded by circles

$x^2 + y^2 = 1$  and  $(x - 1)^2 + y^2 = 1$  is :

A.  $\frac{2\pi}{3}$  sq. units

B.  $\frac{\sqrt{3}}{2}$  sq. units

C.  $\left(\frac{2\pi}{3} - \frac{\sqrt{3}}{2}\right)$  sq. units

D. None of these

**Answer: C**



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4. The area of the region bounded by  $y = |x - 1|$  and  $y = 1$  is

- A. 1 sq. unit
- B. 2 sq. units
- C. 3 sq. units
- D. None of these

**Answer: A**



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5. The area bounded by the curves

$y = xe^x$ ,  $y = xe^{-x}$  and the line  $x = 1$  is

A.  $\frac{1}{e}$  sq. units

B.  $\frac{2}{e}$  sq. units

C.  $\left(1 - \frac{1}{e}\right)$  sq. units

D. None of these

**Answer: B**



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6. The area bounded by the x-axis and the curve

$$y = 4x - x^2 - 3 \text{ is}$$

A.  $\frac{125}{6}$  sq. units

B.  $\frac{125}{3}$  sq. units

C.  $\frac{125}{4}$  sq. units

D.  $\frac{125}{2}$  sq. units

**Answer: A**



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7. The area of the region bounded by the curve

$y = x \sin x$ ,  $x$ -axis,  $x = 0$  and  $x = 2\pi$  is :

A.  $2\pi$  sq. units

B.  $3\pi$  sq. units

C.  $4\pi$  sq. units

D.  $5\pi$  sq. units

**Answer: C**



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8. The area of the loop of the curve

$ay^2 = x^2(a - x)$  is  $4a^2$  sq units (b)  $\frac{8a^2}{15}$  sq units

$\frac{16a^2}{9}$  sq units (d) None of these

A.  $\frac{4a^2}{15}$  sq. units

B.  $\frac{7a^2}{15}$  sq. units

C.  $\frac{8a^2}{15}$  sq. units

D. None of these

**Answer: C**



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9. The area of the region bounded by the curve

$y = \sin 2x$ ,  $y$ -axis and  $y = 1$  is :

A. 1 sq. unit

B.  $\frac{1}{2}$  sq. unit

C.  $\frac{1}{4}$  sq. unit

D.  $\left(\frac{\pi}{4} - \frac{1}{2}\right)$  sq. unit

**Answer: B**



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10. Find the area common to the circle

$$x^2 + y^2 = 16a^2 \quad \text{and} \quad \text{the parabola}$$

$$y^2 = 6ax, a > 0.$$

A.  $\frac{a^2}{3} (4\pi + \sqrt{3})$  sq. units

B.  $\frac{2a^2}{\sqrt{3}} \left( 1 + 4\frac{\pi}{\sqrt{3}} \right)$  sq. units

C.  $\frac{2a^2}{3} (4\pi + \sqrt{3})$  sq. units

D. None of the above

**Answer: B**



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## Exercise 8 1

1. Find the area of the region bounded by the curve  $y^2 = x$  and the lines  $x = 1$ ,  $x = 4$  and the x-axis.



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2. Find the area of the region bounded by  $y^2 = 9x$ ,  $x = 2$ ,  $x = 4$  and the x-axis in the first quadrant.



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3. Find the area of the region bounded by  $x^2 = 16y$ ,  $y = 1$ ,  $y = 4$  and the  $y$ -axis in the first quadrant.



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4. Find the area of the region bounded by the ellipse

$$\frac{x^2}{16} + \frac{y^2}{9} = 1.$$



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5. Find the area of the region bounded by the ellipse

$$\frac{x^2}{4} + \frac{y^2}{9} = 1$$



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6. Find the area of the region in the first quadrant

enclosed by x-axis, line  $x = \sqrt{3}y$  and the circle

$$x^2 + y^2 = 4.$$



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7. Find the area of the smaller part of the circle

$$x^2 + y^2 = a^2 \text{ cut off by the line } x = \frac{a}{\sqrt{2}}$$



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8. The area between  $x = y^2$  and  $x = 4$  is divided into two equal parts by the line  $x = a$ , find the value of  $a$ .



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9. Find the area of the region bounded by the parabola  $y = x^2$  and  $y = |x|$ .





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10. Using integration, find the area bounded by the curve  $x^2 = 4y$  and the line  $x = 4y - 2$ .



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11. Find the area of the region bounded by the curve  $y^2 = 4x$  and the line  $x = 3$ .



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12. Area lying in the first quadrant and bounded by the circle  $x^2 + y^2 = 4$  and the lines  $x = 0$  and  $x = 2$  is

A.  $\pi$

B.  $\frac{\pi}{2}$

C.  $\frac{\pi}{3}$

D.  $\frac{\pi}{4}$

**Answer: A**



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13. Area of the region bounded by the curve  $y^2 = 4x$ , y-axis and the line  $y = 3$  is (A) 2 sq. units (B)  $\frac{9}{4}$  sq. units (C)  $6\sqrt{3}$  sq. units (D) none of these

A. 2

B.  $\frac{9}{4}$

C.  $\frac{9}{3}$

D.  $\frac{9}{2}$

**Answer: B**



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## Exercise 8 2

1. Find the area of the circle  $4x^2 + 4y^2 = 9$  which is interior to the parabola  $x^2 = 4y$ .



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2. Find the area bounded by curves  $(x - 1)^2 + y^2 = 1$  and  $x^2 + y^2 = 1$ .



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3. Find the area of the region bounded by the curves

$$y = x^2 + 2, y = x, x = 0 \text{ and } x = 3.$$



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4. Using integration find the area of region bounded

by the triangle whose vertices are

$$(1, 0), (1, 3) \text{ and } (3, 2).$$



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5. Using integration find the area of the triangular region whose sides have equations  $y = 2x + 1$ ,  $y = 3x + 1$  and  $x = 4$



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6. Smaller area enclosed by the circle  $x^2 + y^2 = 4$  and the line  $x + y = 2$  is (A)  $2(\pi - 2)$  (B)  $\pi - 2$  (C)  $2\pi - 1$  (D)  $2(\pi + 2)$

A.  $2(\pi - 2)$

B.  $\pi - 2$

C.  $2\pi - 1$

D.  $2(\pi + 2)$

**Answer: B**



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7. Area lying between the curves  $y^2 = 4x$  and

$y = 2x$  is (A)  $\frac{2}{3}$  (B)  $\frac{1}{3}$  (C)  $\frac{1}{4}$  (D)  $\frac{3}{4}$

A.  $\frac{2}{3}$

B.  $\frac{1}{3}$

C.  $\frac{1}{4}$

D.  $\frac{3}{4}$

**Answer:**



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## Miscellaneous Exercise

1. Find the area under the given curves and given lines:(i)  $y = x^2$ ,  $x = 1$ ,  $x = 2$  and x-axis(ii)  $y = x^4$ ,  $x = 1$ ,  $x = 5$  and x-axis



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2. Find the area between the curves  $y = x$  and  $y = x^2$ .



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3. Find the area of the region lying in the first quadrant and bounded by  $y = 4x^2$ ,  $x = 0$ ,  $y = 1$  and  $y = 4$ .



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4. Sketch the graph of  $y = |x + 3|$  and evaluate

$$\int -60|x + 3|dx.$$



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5. Find the area between the x-axis and the curve

$$y = \sin x \text{ from } x = 0 \text{ to } x = 2\pi$$



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6. Find the area enclosed between the parabola

$$y^2 = 4ax \text{ and the line } y = mx.$$



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7. Find the area enclosed by the parabola  $4y = 3x^2$  and the line  $2y = 3x + 12$ .

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8. Find the area of the smaller region bounded by the ellipse  $\frac{x^2}{9} + \frac{y^2}{4} = 1$  and the line  $\frac{x}{3} + \frac{y}{2} = 1$

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9. Find the area of the smaller region bounded by

the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  and the line  $\frac{x}{a} + \frac{y}{b} = 1$



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10. Find the area of the region enclosed by the

parabola  $x^2 = y$ , the line  $y = x + 2$  and

the x-axis.



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11. Using the method of integration find the area bounded by the curve  $|x| + |y| = 1$  [Hint: The required region is bounded by lines  $x + y = 1$ ,  $x - y = 1$ ,  $x + y = -1$  and  $-x - y = 1$ ].



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12. Find the area bounded by curves  $\{(x, y) : y \geq x^2 \text{ and } y = |x|\}$



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**13.** Using the method of integration find the area of the triangle ABC, coordinates of whose vertices are A(2, 0), B (4, 5) and C (6, 3).



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**14.** Using the method of integration find the area of the region bounded by lines:

$$2x + y = 4, 3x - 2y = 6 \text{ and } x - 3y + 5 = 0$$



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15. Find the area of the region

$$\{(x, y) : y^2 \leq 4x, 4x^2 + 4y^2 \leq 9\}$$



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16. The area (in square units) bounded by the curve

$y = x^3$ , the x-axis and the ordinates at

$x = -2$  and  $x = 1$  is

A.  $-9$

B.  $\frac{-15}{4}$

C.  $\frac{15}{4}$

D.  $\frac{17}{4}$

**Answer: D**



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17. The area bounded by the curve  $y = x|x|$ , x-axis and the ordinates  $x = 1$  is given by

[Hint :  $y = x^2$  if  $x > 0$  and  $y = -x^2$  if  $x < 0$ ].

A. 0

B.  $\frac{1}{3}$

C.  $\frac{2}{3}$

D.  $\frac{4}{3}$

**Answer: C**



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**18.** The area of the circle  $x^2 + y^2 = 16$  exterior to the parabola  $y^2 = 6x$  is

A.  $\frac{4}{3}(4\pi - \sqrt{3})$

B.  $\frac{4}{3}(4\pi + \sqrt{3})$

C.  $\frac{4}{3}(8\pi - \sqrt{3})$

D.  $\frac{4}{3}(8\pi + \sqrt{3})$

**Answer: C**



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**19.** Find the area bounded by the y-axis,  $y = \cos x$ , and  $y = \sin x$  when  $0 \leq x \leq \frac{\pi}{2}$ .

A.  $2(\sqrt{2} - 1)$

B.  $\sqrt{2} - 1$

C.  $\sqrt{2} + 1$

D.  $\sqrt{2}$

**Answer: B**





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