



MATHS

BOOKS - NAGEEN PRAKASHAN ENGLISH

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



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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.

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6. Find the area of the region included between the parabolas

$$y^2 = 4ax \text{ and } x^2 = 4ay, \text{ where } a > 0.$$

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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

$$\text{curve } y = 2x - x^2 \text{ and the x-axis.}$$

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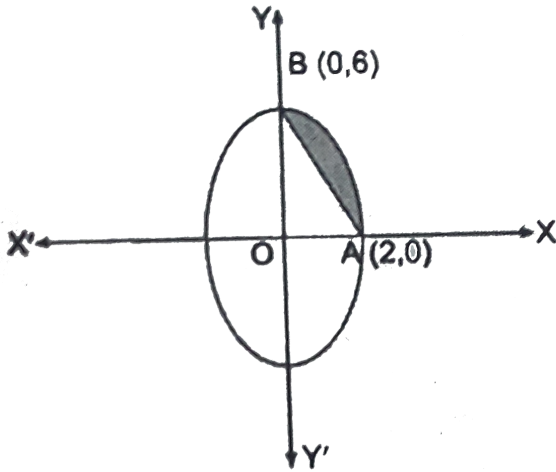
10. Find the ratio of the areas of the portion between the circle $x^2 + y^2 = a^2$ and straight line $x = \frac{a}{2}$



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

then find the area of the region bounded by chord AB and arc AB.



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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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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 integration, 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 integration, 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. Area of the region bounded by the curve $y = \cos x$ between $x = 0$ and $x = \pi$ is



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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

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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 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

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

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 lines, 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. Find the equation of common tangent of $y^2 = 4ax$ and $x^2 = 4by$.

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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. 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

$$y^2 = 4ax \text{ and } x^2 = 4ay, \text{ where } a > 0.$$

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. Find the area enclosed by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

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

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

C. πab 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. $\left(\frac{\pi}{2} - \frac{1}{2}\right)$ 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 $y = |x|$.

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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Exercise 8 C Questions For Competitive Examinations

1. 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 $y = x^2 + 1$, $y = x$, $x = 0$ 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. Find the area of the region enclosed between the two circles

$$x^2 + y^2 = 1 \text{ and } (x - 1)^2 + y^2 = 1.$$

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 the curve $y = |x - 1|$ 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 $y = 4x - y^2 - 3$ 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. 2π sq. units

B. 3π sq. units

C. 4π sq. units

D. 5π sq. units

Answer: C



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8. The area of the loop of the curve $ay^2 = x^2(a - x)$ is

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: D



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10. find the area common to the circle $x^2 + y^2 = 16a^2$ and the parabola $y^2 = 6ax$. Or Find the area of the region $\{(x, y) : y^2 \leq 6ax\}$ and $\{(x, y) : x^2 + y^2 \geq 16a^2\}$.

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

B. $\frac{4a^2}{3} (4\pi + \sqrt{3})$ 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 area enclosed by ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$

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5. Find area enclosed by ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$



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6. Prove that the area in the first quadrant enclosed by the axis, the line $x = \sqrt{3}y$ and the circle $x^2 + y^2 = 4$ is $\pi/3$.



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7. Find the area of the smaller part of the circle $x^2 + y^2 = a^2$ 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. Find the area bounded by the curve $x^2 = 4y$ and the straight 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) π (B) $\frac{\pi}{2}$ (C) $\frac{\pi}{3}$ (D)

$\frac{\pi}{4}$

A. π

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 2 b. $\frac{9}{4}$ c. $\frac{9}{3}$ d. $\frac{9}{2}$

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 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 $y = x^2 + 2$, $y = x$, $x = 0$ and $x = 3$.



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4. Find the area region bounded by the triangle whose vertices are $(-1, 1)$, $(0, 5)$ and $(3, 2)$, using integration.



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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. $2(\pi + 2)$

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. $\frac{3}{4}$

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 $y = |x + 3|$. Evaluate $\int_{-6}^0 |x + 3| dx$. What does the value of this integral represent on the graph?



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5. Find the area between the x-axis and the curve $y = \sin x$ from $x = 0$ to $x = 2\pi$

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6. Find the area of the region enclosed by the parabola $y^2 = 4ax$ 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

$$\frac{x^2}{9} + \frac{y^2}{4} = 1 \text{ and the line } \frac{x}{3} + \frac{y}{2} = 1.$$

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9. Find the area of the smaller region bounded by the ellipse

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

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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: $2x + y = 4$, $3x - 2y = 6$ 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. Area bounded by the curve $y = x^3$, the x -axis and the ordinates $x = -2$ 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 $x = -1$ & $x = 1$ is:

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

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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