MATHS

BOOKS - FULL MARKS MATHS (TAMIL ENGLISH)

APPLICATIONS OF INTEGRATION

Example

1. Estimate the value of $\int_0^{0.5} x^2 dx$ using the Riemann sums corresponding to 5

subintervals of equals witdh and applying (i) left-end rule (ii) right-end rule (iii) the mid-point rule.

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2. Evaluate $\int_0^1 xdx$, as a the limit of a sun.

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3. Evaluate $\int_0^1 x^3 dx$, as the limit of a sum.

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4. Evaluate $\int_1^4 \left(2x^2 + 3\right)$ dx, as the limit of a sum

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5. Evaluate $\int_0^3 \left(3x^2 - 4x + 5\right)$dx.

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6. Evaluate $\int_0^1 \frac{2x+7}{5x^2+9}\,dx$,

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7. Evaluate, $\int_0^1 [2x]dx$ where [.]is the greatest integer funtion .

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8. Evaluate $\int_0^{\frac{\pi}{3}} \frac{\sec x \tan x}{1+\sec^2}$x dx

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9. Evaluate $\int_0^9 \frac{1}{x+\sqrt{x}} dx$.

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10. $\int_1^2 \frac{x dx}{(x+1)(x+2)}$.

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11. Evaluate: $\int_0^{\frac{\pi}{2}} \frac{\cos\theta}{(1+\sin\theta)(2+\sin\theta)} d\theta$.

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12. Evaluate: $\int_0^{\frac{1}{\sqrt{2}}} \frac{\sin^{-1} x}{(1-x^2)^{\frac{3}{2}}} dx.$

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13. Evaluate: $\int_0^{\frac{\pi}{2}} \left(\sqrt{\tan x} + \sqrt{\cot x}\right) dx.$

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14. Evaluate: $\int_0^{1.5} \left[x^2\right] dx$, where [x] is the greatest integor funtion.

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15. Evaluate: $\int_{-4}^{4} |x+3| dx$.

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16. Show that $\int_0^{\frac{\pi}{2}} \frac{dx}{4+5\sin x} = \frac{1}{3}\log_e 2$

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17. Prove that $\int_0^{\frac{\pi}{4}} \frac{\sin 2x dx}{\sin^4 x + \cos^4 x} = \frac{\pi}{4}$

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18. Evaluate:

$$\int_0^{\frac{\pi}{4}} \frac{dx}{a^2 \sin^2 x + b^2 \cos^2 x} = \frac{1}{ab} \tan^{-1}\left(\frac{a}{b}\right),$$

where a,b>0

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19. Evaluate: $\int_0^{\frac{\pi}{4}} \frac{1}{\sin x + \cos x} dx.$

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20. Show that $\int_0^{\pi} g(\sin x)dx = 2\int_0^{\frac{\pi}{2}} g(\sin)dx,$ where $g(\sin x)$ is a function of $\sin x.$

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21. Evaluate $\int_0^{\pi} \frac{x}{1 + \sin x} dx.$

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22. Show that $\int_0^{2\pi} g(\cos x)dx = 2\int_0^{\pi} g(\cos x)dx,$ wher $g(\cos x)$ is a function of $\cos x.$

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23. If $\int(x) = \int(a+b),$ then $\int_0^{2a} \int = \int = (x) = 2\int_0^{a} \int$(x)dx

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24. Evaluate : $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} x \cos x dx.$

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25. Evaluate: $\int_{-\log 2}^{\log 2} e^{-|x|}$ dx.

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26. Evaluate $\int_0^a \frac{f(x)}{f(x)+f(a-x)}$ dx.

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27. Prove that $\int_0^{\frac{\pi}{4}} \log(1+\tan x)dx = \frac{\pi}{8}$ log2.

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28. Show that $\int_0^1 \tan^{-1} x + \tan^{-1}(1-x)dx = \frac{\pi}{2} - \log_e 2$

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29. Evaluate: $\int_2^3 \frac{\sqrt{x}}{\sqrt{5}-x+\sqrt{x}}dx$.

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30. Evaluate $\int_{-\pi}^{\pi} \frac{\cos^2 x}{1+a^x}dx$.

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31. Evaluate $\int_0^{\pi} x^2 \cos nx dx$, where n is positive integer.

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32. Evaluate: $\int_0^1 e^{-2x}\left(1+x-2x^3\right)\mathrm{dx}$.

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33. Evaluate: $\int_0^{2\pi} x^2 \sin nx\,dx$, where n is positive integer.

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34. Evaluate: $\int_{-1}^{1} e^{-\lambda x}\left(1-x^{2}\right) \mathrm{dx}$.

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35. Evaluate: $\int_{b}^{\infty} \frac{1}{a^{2}+x^{2}} \mathrm{dx}, a>0$,in RR.

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36. Evaluate: $\int_{0}^{\frac{\pi}{2}} \frac{dx}{4 \sin^{2} x+5 \cos^{2} x}$

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37. Evaluate $\int_0^{\frac{\pi}{2}} \left(\sin^2 x + \cos^4 x\right) dx$

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38. Evaluate: $\int_0^{\frac{\pi}{2}} \begin{vmatrix} \cos^4 x & 7 \\ \sin^5 x & 3 \end{vmatrix} dx.$

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39. Find the values of the following: (i) $\int_0^{\frac{\pi}{2}} \sin^5 x \cos^4 x dx$

(ii) $\int_0^{\frac{\pi}{2}} \sin^4 x \cos^6 x dx$

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40. Evaluate: $\int_0^{2a} x^2 \sqrt{2ax - x^2} dx$.

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41. Evaluate: $\int_0^1 x^5 \left(1 - x^2\right)^5 dx$.

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42. Evaluate: $\int_0^1 x^3(1-x)^4 dx$.

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43. Prove that $\int_0^\infty x^n e^{-x} dx = n!$, Where n is a positive integer.

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44. Evaluate : $\int_0^\infty e^{-ax} x^n dx$, where $a > 0$.

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45. Show that $\Gamma(n) = 2\int_0^\infty e^{-x^2} x^{2n-1} dx$.

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46. Evaluate $\int_0^\infty \frac{x^n}{n^x} dx$, where n is a positive integer.

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47. Find the area of the region bounded by the line 6x+5y=30,x-axis and the lines x=-1 and x=3.

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48. Find the area of the region bounded by the line 7x-5y=35,x-axis and the lines x=-2 and x=3.

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

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50. Find the area of the parabola $y^2 = 4ax$ and its latus rectum.

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51. Find the area of the region bounded by y axis and the parabola $x = 5 - 4y - y^2$.

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52. Find the area of the region bounded by x-axis, the sine curve y=sinx, the lines $x = 0$ and $x = 3\pi$.

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53. Find the area of the region bounded by x-axis, the curve $y = |\cos x|$, the lines x=0 and $x = \pi$.

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54. Find the area of the region bounded by the parabolas $y^2 = 4x$ and $x^2 = 4y$.

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55. Find the area of the region bounded between the parabola $x^2 = y$ and the curve y=|x|.

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56. Find the area of the region bounded by $y = \cos x, y = \sin x,$ the lines $x = \frac{\pi}{4}$ and $x = \frac{5\pi}{4}.$

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57. The region enclosed by the circle $x^2 + y^2 = a^2$ is divided into two sgmwnts by the line x=h. Find the area of the smaller segment.

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58. Find the area of the region if the first quadrant bounded by the parabola $y^2 = 4x$, the line x+y=3 and y-axis.

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59. Find by integration, the area of the region bounded by the lines $5x - 2y = 15$, $x + 4 = 0$ and the x-axis.

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60. Using integration find the area of the region bounded by triangle ABC, whose vertices A,B and C are (-1,1),(3,2), and (0,5) respectively.

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61. Using integration find the area of the region which is bounded bt x-axis the tangent and normal to the circle $x^2 + y^2 = 4$ drawn at $(1, \sqrt{3})$.

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62. Find the volume of the sphere of radius a.

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63. Find the volume of a right-circular cone of base radius r and height h.

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64. Find the volume of the spherical cap of height h cut of feom a sphere of radius r.

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65. Find the volume of the solid formed by revolving the region bounded by the parabola $y = x^2$, x-axis, ordinates x=0 and x=1 about the x-axis.

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66. Find the volume of the solid formed by revolving the region bounded by the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$,a>b about the major x-axis,

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67. Evaluate the volume of the solid generated by revolving about y axis the region bounded between the parabola $y^2=x+1$, the y axis and the lines $y=1$ and $y=-1$.

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68. Find, by intregration , the volume of the solid generated by revolving about y-axis the region bounded between the curve $y = \frac{3}{4}\sqrt{x}^2 - 16, x \geq 4$, the y-axis and the lines y=1 and y=6

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69. Find , by integration , the volume of the solid generated by revolving about y axis, the

region bounded by the curve $y = \log x, y = 0, x = 0$ and $y = 2.$

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Exercise 9 1

1. Find an approximate value of $\int_1^{1.5} x dx$ by applying the left-end rule with the partition $\{1.1, 1.2, 1.3, 1.4, 1.5\}$

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2. Find an approximate value of $\int_1^{1.5} x dx$ by applying the left-end rule with the partition $\{1.1, 1.2, 1.3, 1.4, 1.5\}$

A.

B.

C.

D.

Answer: 0.855

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3. Find an approximate value of $\int_1^{1.5} (2-x)dx$ by applying the mid-point rule with the partition $\{1.1, 1.2, 1.3, 1.4, 1.5\}$

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Exercise 9 2

1. Evaluate rhe following integrats as the limits of sum: (i) $\int_0^1 (5x+4)\text{dx}$.

(ii) $\int_1^2 \left(4x^2-1\right)\text{dx}$.

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Exercise 9 3

1. Evaluate the following definite integrals :

$$\int_{-1}^{1} \frac{dx}{x^2 + 2x + 5}$$

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Exercise 9 4

1. Evaluate $\int_0^1 xe^{-2x}dx$

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2. Evaluate the following :

$$\int_0^1 \frac{\sin\left(3\tan^{-1}x\right)\tan^{-1}x}{1+x^2}dx$$

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3. Evaluate the following :

$$\int_0^{\frac{1}{\sqrt{2}}} \frac{e^a \sin^{-1}x \sin^{-1}x}{\sqrt{1-x^2}}dx$$

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4. Evaluate : $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} x \cos x dx.$

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Exercise 9 5

1. Evaluate the following :

$$\int_0^{\frac{\pi}{2}} \frac{dx}{1+5\cos^2 x}$$

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Exercise 9 6

1. Evaluate the following :

$$\int_0^{\frac{\pi}{2}} \sin^{10} x dx$$

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Exercise 9 7

1. Evaluate the following :

$$\int_0^\infty x^5 e^{-3x} dx$$

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2. If $\int_0^\infty e^{-ax^2 x^3 dx} = 32, \alpha > 0,$ find α.

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Exercise 9 8

1. Find the area of the region bounded by $3x - 2y + 6 = 0, x = -3, x = 1$ and x -axis.

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2. Find the area of the region bounded by $2x - y + 1 = 0, y = -1, y = 3$ and y -axis.

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3. Find the area of the region bounded by the curve $2 + x - x^2 + y = 0$, x-axis, $x = -3$ and x= 3

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4. Find the area of the region bounded by the line $y = 2x + 5$ and the parabola $y = x^2 - 2x$

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5. Find the area of the region bounded between the curves $y = \sin x$ and $y = \cos x$ and the lines x = 0 and $x = \pi$.

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6. Find the area of the region bounded by $y = \tan x, y = \cot x$ and the line $x = 0, x = \frac{\pi}{2}, y = 0$

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

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8. Father of a family wishes to divide his square field bounded by $x = 0, x = 4, y = 4,$ and $y = 0$ along the curve $y^2 = 4x$ and $x^2 = 4y$ into three equal parts for his wife, daughter and son. Is it possible to divide ? If so, find the area to be divided among them.

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9. The curve $y = (x-2)^2 + 1$ has a minimum point at P.A point Q on the curve is such that the slope of PQ is 2. Find the area bounded by the curve and the chord PQ.

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10. Find the area of the region common to the circle $x^2 + y^2 = 16$ and the parabola $y^2 = 6x$

.

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Exercise 9 9

1. Find,by integration, the volume of the solid generated by revolving about the x-axis, the region enclosed by $y = 2x^2$, $y = 0$ and $x = 1$.

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2. Find, by integration , the volume of the solid generated by revolving about the x-axis, the

region enclosed by $y = e^{-2x}y = 0, x = 0$ and $x = 1$

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3. Find, by integration , the volume of the solid generated by revolving about the y-axis, the region enclosed by $x^2 = 1 + y$ and $y = 3.$

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4. The region enclosed between the graphs of $y = x$ and $y = x^2$ is denoted by R, Find the volume generated when R is rotated through 360° about x - axis.

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5. find the integration, the vol,ume of the container which is in the shape of a right circuler conical frustum as shown in the figure.

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6. A watermelon has an ellipsoid shade which can be obtained by revolving an ellipse with major-axis 20 cm and minor-axis 10 cm about its major-axis. Find its volume using integration.

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Exercise 9 10

1. The value of $\int_0^{\frac{2}{3}} \frac{dx}{\sqrt{4-9x^2}}$ is

A. $\frac{\pi}{6}$

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

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

D. `(pi)

Answer: A

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2. The value of $\int_{-1}^{2} |x| dx$

A. $\frac{1}{2}$

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

C. $\frac{5}{2}$

D. $\frac{7}{2}$

Answer: C

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3. For any value of $n \in Z, \int_0^{\pi} e^{\cos^2 x} \cos^3[(2n+1)x]dx$ is

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

B. (π)

C. 0

D. 2

Answer: C

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4. The value of $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin^2 x \cos x dx$ is

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

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

C. 0

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

Answer: D

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5. The value of $\int_{-4}^{4}\left[\tan^{-1}\left(\frac{x^2}{x^4+1}\right)+\tan^{-1}\left(\frac{x^4+1}{x^2}\right)\right]dx$ is

A. π

B. 2π

C. 3π

D. 4π

Answer: D

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6. The value of $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \left(\frac{2x^7 - 3x^5 + 7x^3 - x + 1}{\cos^2 x} \right) dx$ is

A. 4

B. 3

C. 2

D. 0

Answer: B

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7. If $f(x) = \int_0^x t \cos t dt$, then $\frac{df}{dx}$

A. cos x-xsin x

B. sin x+xcos x

C. xcos x

D. xsin x

Answer: C

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8. The area between $y^2 = 4x$ and its latus rectum is

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

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

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

D. $\frac{5}{3}$

Answer: C

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9. The value of $\int_0^1 x(1-x)^{99}dx$ is

A. $\frac{1}{11000}$

B. $\frac{1}{10100}$

C. $\frac{1}{10010}$

D. $\frac{1}{10001}$

Answer: B

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10. The value of $\int_0^{\pi} \frac{dx}{1+5^{\cos x}}$ is.....

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

B. π

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

D. 2π

Answer: A

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11. The value of $\frac{r(n+2)}{r(n)} = 90$ then n is

A. 10

B. 5

C. 8

D. 9

Answer: D

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12. The value of $\int_0^{\frac{\pi}{6}} \cos^3 3x dx$

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

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

C. $\frac{1}{9}$

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

Answer: B

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13. The value of $\int_0^{\pi} \sin^4 x dx$ is

A. $\frac{3\pi}{10}$

B. $\frac{3\pi}{8}$

C. $\frac{3\pi}{4}$

D. $\frac{3\pi}{2}$

Answer: B

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14. The value of $\int_0^{\infty} e^{-3x}x^2dx$ is

A. $\frac{7}{27}$

B. $\frac{5}{27}$

C. $\frac{4}{27}$

D. $\frac{5}{27}$

Answer: D

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15. If $\int_0^a = \frac{1}{4+x^2}dx = \frac{\pi}{8}$ then a is

A. 4

B. 1

C. 3

D. 2

Answer: D

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16. The volume of solid of revolution of the region bounded by $y^2 = x(a - x)$ about x-axis is

A. $(\pi a)^2$

B. $\frac{\pi a^3}{4}$

C. $\frac{\pi a^3}{5}$

D. $\frac{\pi a^3}{6}$

Answer: D

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17. If $f(x) = \int_1^x \frac{e^{\sin x}}{u} du, x > 1$ and $\int_1^3 \frac{e^{\sin x^2}}{x} dx = \frac{1}{2}[f(a) - f(1)]$, then one of the possible value of a is

A. 3

B. 6

C. 9

D. 5

Answer: C

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18. The value of $\int_0^1 \left(\sin^{-1} x\right)^2 dx$ is

A. $\frac{(\pi)^2}{4} - 1$

B. $\frac{(\pi)^2}{4} + 2$

C. $\frac{(\pi)^2}{4} + 1$

D. $\frac{(\pi)^2}{4} - 2$

Answer: D

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19. The value of $\int_0^a \left(\sqrt{a^2 - x^2}\right)^3 dx$ is..... .

A. $\frac{\pi a^3}{16}$

B. $\frac{3\pi a^4}{16}$

C. $\frac{3\pi a^2}{8}$

D. $\frac{3\pi a^4}{8}$

Answer: B

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20. If $\int_0^x f(t)dt = x + \int_x^1 tf(t)dt$, then the value of f(1) is

A. $\frac{1}{2}$

B. 2

C. 1

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

Answer: A

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Additional Problems

1. Evaluate as the limit of sums : $\int_1^3 (2x^2 + 5)$ dx

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2. Evaluate as the limit of sums: $\int_1^2 (x^2 - 1)\,dx$

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3. Evaluate : $\int_0^2 \left(x^2 + x + 2\right) \mathrm{dx}.$

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4. Evaluate: $\int_{-\pi/4}^{\pi/4} x^3 \sin^2 x \mathrm{dx}$.

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5. Evaluate $\int_{-1}^{1} \log\left(\frac{3-x}{3+x}\right) dx.$

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6. Evaluate: $\int_{-\pi/2}^{\pi/2} x \sin dx$

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7. Evaluate : $\int_0^1 x(1-x)^n dx$.

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8. Evaluate: $\int_{\pi/6}^{\pi/3} \frac{dx}{1+\sqrt{\cot x}}$.

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9. Evaluate : $\int_0^{2\pi} \frac{\cos x}{\sqrt{4+3\sin x}} dx$

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10. Evaluate: $\int_0^{\pi/4} \frac{\sin^3 x}{\cos^5 x}$ dx

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11. Evaluate: $\int_0^{\pi/2} \sqrt{\sin\theta}\cos^5\theta d\theta$

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12. Evaluate: $\int_0^{\pi/3} \frac{\sec x \tan x}{1+\sec^2 x} \mathrm{dx}$

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13. Evaluate, $\int_0^{\pi/2} \frac{dx}{5+4\sin x}$.

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14. Evaluate: $\int_0^{\pi/4} \frac{dx}{4+5\cos^2 x}$.

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15. Evaluate: $\int_0^{\pi/2} \frac{dx}{4+9\cos^2 x}$

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16. $\int_0^{\frac{\pi}{2}} \sin^7 x dx$ is :

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17. Evaluate $\int_0^{\frac{\pi}{2}} \sin^4 x \cos^2 x dx.$

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18. Find the area of the region bounded by $y^2 = 4ax$ and $x = |y|$.

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19. Find the area of bounded by the curve $y = x^3$ and thr liney=x.

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20. Find the area of the loop and the curve $3ay^2 = x(x-a)^2 1.$

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21. Find the area between the line $y = x + 1$ and the curve $y = x^2 - 1$

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22. The volume of the solid that results when the region enclosed by $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is revolved about the minor axis is :

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23. Find the volume of the solid generated when the region enclosed by $y=\sqrt{x}, y=3$ and $x=0$ is revolved about y axis.

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24. The area bounded by the line y=x, the x-axis , the ordinates x=1,x=2 is .... .

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

B. $\frac{5}{2}$

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

D. $\frac{7}{2}$

Answer: a

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25. The area of the region bounded by the graph of $y = \sin x$ and $y = \cos x$ between x = 0 and $x = \frac{\pi}{4}$ is

A. $\sqrt{2}$

B. $\sqrt{2} - 1$

C. $\sqrt[2]{2} - 2$

D. $\sqrt[2]{2} + 2$

Answer: b

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

A. $\pi b(a - b)$

B. $2\pi a(a - b)$

C. $\pi a(a - b)$

D. $2\pi b(a - b)$

Answer: c

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27. The area bounded by the parabola $y^2 = x$ and its latus rectum is

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

B. $\frac{1}{6}$

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

D. $\frac{8}{3}$

Answer: B

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28. The volume of solid obtained by revolving $\frac{x^2}{9} + \frac{y^2}{16} = 1$ about the minor axis :

A. 48π

B. 64π

C. 32π

D. 128π

Answer: b

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29. The volume when $y = \sqrt{3 + x^2}$ from x = 0 to x = 4 is rotated about x -axis is . . . . . .

A. 100π

B. $\frac{100}{9}\pi$

C. $\frac{100}{3}\pi$

D. $\frac{100}{9}$

Answer: c

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30. the volume generated when the region bounded by `y=x, y=1, x=0, is rotated about y-axis is .....

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

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

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

D. $\frac{2\pi}{3}$

Answer: c

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31. Volume of solid obtained by revolving the area of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$about major and minor axes are in tha ratio.....

A. $b^2:a^2$

B. $a^2:b^2$

C. a:b

D. b:a

Answer: d

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32. The volume generated by rotating the triangle with vertices at (0,0), (3,0) and (3,3) about x-axis is

A. 18π

B. 2π

C. 36π

D. 9π

Answer: d

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33. The length of th arc of the curve $x^{2/3} + y^{2/3} = 4$ is.....

A. 48

B. 24

C. 12

D. 96

Answer: a

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34. The surface area of the solid of revolution of the region bounded by $y = 2x, x = 0$ and $x = 2$ about x-axis is.....

A. $8\sqrt{5}\pi$

B. $2\sqrt{5}\pi$

C. $\sqrt{5}\pi$

D. $4\sqrt{5}\pi$

Answer: a

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35. The curved surface area of a sphere of radius 5, intercepted between two paeallel planes of distance 2 and 4 from the centre is

A. 20π

B. 40π

C. 10π

D. 30π

Answer: a

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