MATHS

BOOKS - SURA MATHS (TAMIL ENGLISH)

APPLICATION OF INTEGRATION

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 the approximate value of $\int_1^{1.5} x^2 dx$ by applying the right-end rule with the parition $\{1.1, 1.2, 1.3, 1.4, 1.5\}$

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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 the following integrals as the limits of sums

$$\int_0^1 (5x + 4)dx$$

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2. Evaluate the following integrals as the limits of sums

$$\int_1^2 (4x^2 - 1)\,dx$$

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Exercise 9 3

1. Evaluate the following definite integrals :

$$\int_3^4 \frac{dx}{x^2 - 4}$$

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2. Evaluate the following definite integrals :

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

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3. Evaluate the following definite integrals :

$$\int_{0}^{1} \sqrt{\frac{1-x}{1+x}} dx$$

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4. Evaluate the following definite integrals :

$$\int_0^{\frac{\pi}{2}} e^x \left(\frac{1+\sin x}{1+\cos x} \right) dx$$

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5. $\int_0^{\frac{\pi}{2}} \sqrt{\cos\theta} \cdot \sin^3\theta d\theta = \ldots$

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6. Evaluate the following definite integrals :

$$\int_0^1 \frac{1-x^2}{(1+x^2)^2} dx$$

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7. Evaluate the following integrals using properties of integration :

$$\int_{-5}^{5} x \cos\left(\frac{e^x - 1}{e^x + 1}\right) dx$$

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8. Evaluate the following integrals using properties of integration :

$$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \left(x^5 + x\cos x + \tan^3 x + 1\right) dx$$

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9. Evaluate the following integrals using properties of integration :

$$\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \sin^2 x dx$$

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10. Evaluate the following integrals using properties of integration :

$$\int_0^{2\pi} x \log\left(\frac{3+\cos x}{3-\cos x}\right) dx$$

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11. Evaluate the following integrals using properties of integration :

$$\int_0^{2\pi} \sin^4 x \cos^3 x dx$$

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12. Evaluate the following integrals using properties of integration :

$$\int_0^1 |5x - 3| dx$$

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13. Evaluate the following integrals using properties of integration :

$$\int_0^{\sin^2 x} \sin^{-1} \sqrt{t} dt + \int_0^{\cos^2 x} \sqrt{t} dt$$

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14. Evaluate the following integrals using properties of integration :

$$\int_0^1 \frac{\log(1+x)}{1+x^2} dx$$

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15. Evaluate the following integrals using properties of integration :

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

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16. Evaluate the following integrals using properties of integration :

$$\int_{\frac{\pi}{8}}^{\frac{3\pi}{8}} \frac{1}{1+\sqrt{\tan x}} dx$$

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17. Evaluate the following integrals using properties of integration :

$$\int_{0}^{\pi} x\left[\sin^2(\sin x)+\cos^2(\cos x)\right] dx$$

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Exercise 9 4

1. Evaluate the following :

$$\int_0^1 x^3 e^{-2x} dx$$

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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 the following :

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

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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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2. Evaluate the following :

$$\int_0^{\frac{\pi}{2}} \frac{dx}{5+4\sin^2 x}$$

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Exercise 9 6

1. Evaluate the following :

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

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2. Evaluate the following :

$$\int_0^{\frac{\pi}{2}} \cos^7 x dx$$

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3. Evaluate the following :

$$\int_0^{\frac{\pi}{4}} \sin^6 2x dx$$

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4. Evaluate the following :

$$\int_0^{\frac{\pi}{6}} \sin^5 3x dx$$

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5. Evaluate the following :

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

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6. Evaluate the following :

$$\int_0^{2\pi} \sin^7 \frac{x}{4} dx$$

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7. Evaluate the following :

$$\int_0^{\frac{\pi}{2}} \sin^3\theta \cos^5\theta d\theta$$

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8. Evaluate the following :

$$\int_0^1 x^2(1-x)^3 dx$$

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Exercise 9 7

1. Evaluate the following :

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

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2. Evaluate the following :

$$\int_0^{\frac{\pi}{2}} \frac{e^{-\tan x}}{\cos^6 x} dx$$

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3. 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. 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. π

Answer: $\frac{\pi}{6}$

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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: $\frac{5}{3}$

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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: 0

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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: $\frac{2}{3}$

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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: 4π

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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: 2

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

A. $\cos x - x \sin x$

B. $\sin x + x \cos x$

C. $x \cos x$

D. $x \sin x$

Answer: $x \cos x$

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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: $\frac{8}{3}$

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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: $\frac{1}{10100}$

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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: $\frac{\pi}{2}$

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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: 9

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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: $\frac{2}{9}$

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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: $\frac{3\pi}{8}$

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

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

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

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

D. $\frac{2}{27}$

Answer: $\frac{2}{27}$

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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: 2

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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. πa^3

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

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

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

Answer: $\frac{\pi a^3}{6}$

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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: 9

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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: $\frac{\pi^2}{4} - 2$

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

A. $\frac{\pi a^2}{16}$

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

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

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

Answer: $\frac{3\pi a^4}{16}$

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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: $\frac{1}{2}$

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Government Exam Questions

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

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

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3 Marks

1. By using the properties of definite integrals, evaluate $\int_0^3 |x-1|dx$

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

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5 Marks

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

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2. 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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3. Prove that $\int_0^{\frac{\pi}{2}} \sin 2x \log(\tan x) dx = 0$

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4. Find the area bounded by$x = at^2, y = 2at$ between the ordinates corresponding to t =1 and t= 2

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5. Show that the area under the curve $y = \sin x$ and $y = \sin 2x$ between x = 0 and $x = \frac{\pi}{3}$ and x -axis are as $2:3$

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6. Using integration, find the area of the triangle with sides $y = 2x + 1, y = 3x + 1$ and $x = 4$

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7. Find the volume of the solid generated by the revolution of the loop of the curve $x = t^2, y = t - \frac{t^3}{3}$ about x -axis

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Additional Question

1. The value of $\int_0^{\frac{\pi}{2}} \frac{dx}{1 + \tan x}$ is

A. π

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

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

D. 0

Answer: D

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2. The value of $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sqrt{\frac{1-\cos 2x}{2x}} dx$ is

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

B. 2

C. 0

D. 1

Answer: 2

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3. $\int_{1}^{\sqrt{3}} \frac{dx}{1+x^2} is$

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

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

C. $\frac{\pi}{12}$

D. $-\frac{\pi}{6}$

Answer: $\frac{\pi}{12}$

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4. If $\int_0^{2a} f(x)dx = 2\int_0^a f(x)$ then

A. $f(2a - x) = -f(x)$

B. $f(2a - x) = f(x)$

C. $f(x)$ is odd

D. f(x) is even

Answer: $f(2a - x) = f(x)$

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5. The value of $\int_{-\pi}^{\pi} \sin^3 x \cos^3 x dx$ is

A. 0

B. π

C. 2π

D. 4π

Answer: 0

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6. The area enclosed by the curve $y = \frac{x^2}{2}$, the x-axis and the lines $x = 1, x = 3$, is

A. 4

B. $8\frac{2}{3}$

C. 13

D. $4\frac{1}{3}$

Answer: $4\frac{1}{3}$

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7. The area bounded by the parabola $y = x^2$ and the line $y = 2x$ is

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

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

C. $\frac{51}{3}$

D. $\frac{20}{3}$

Answer: $\frac{4}{3}$

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8. The ratio of the volumes generated by revolving the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$ about major and minor axes is

A. $4:9$

B. $9:4$

C. $2:3$

D. $3:2$

Answer: $2:3$

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9. $\int_0^\infty e^{-mx} x^7 dx$ is

A. $\frac{\lfloor m}{7^m}$

B. $\frac{\lfloor 7}{m^7}$

C. $\frac{\lfloor m}{7^{m+1}}$

D. $\frac{\lfloor 7}{m^8}$

Answer: $\frac{\lfloor 7}{m^8}$

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10. If $\int_0^a f(x)dx + \int_0^a f(2a-x)dx =$

A. $\int_0^a f(x)dx$

B. $2\int_0^a f(x)dx$

C. $\int_0^{2a} f(x)dx$

D. $\int_0^{2a} f(a-x)dx$

Answer: $\int_0^{2a} f(x)dx$

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Fill In The Blanks

1. $\int_{-1}^{1} x dx = \ldots\ldots\ldots\ldots\ldots$

A. -1

B. 1

C. 0

D. 2

Answer: 0

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2. $\int_0^{2a} f(x)dx = 2\int_0^{a} f(x)dx$ if

A. $f(2a - x) = f(x)$

B. $f(a - x) = f(x)$

C. $f(x) = -f(-x)$

D. $f(-x) = f(x)$

Answer: $f(2a - x) = f(x)$

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

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

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

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

D. $\frac{16}{3}$

Answer: $\frac{8}{3}$

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4. The area of the ellips $\frac{x^2}{9} + \frac{y^2}{4} = 1$ is

.....

A. 6π

B. 36π

C. $6\pi^2$

D. $36\pi^2$

Answer: 6π

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5. The volume generated by the curve $y^2 = 16x$ from x = 2 to x= 3 rotating about x - axis . . .. cu. Units

A. 72π

B. $\frac{256 \times 19}{2}\pi$

C. 40π

D. 80π

Answer: 40π

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6. $\int_a^b f(x)dx =$

A. $2\int_0^a f(x)dx$

B. $\int_a^b f(a-x)dx$

C. $\int_b^a f(b-x)dx$

D. $\int_a^b f(a+b-x)dx$

Answer: $\int_a^b f(a+b-x)dx$

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7. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{\sin x}{2+\cos x} dx = ...$

A. 0

B. 2

C. $\log 2$

D. log 4

Answer: 0

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8. $\int_0^{\frac{\pi}{4}} \cos^3 2x dx = \ldots\ldots\ldots\ldots$

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

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

C. 0

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

Answer: $\frac{1}{3}$

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9. $\int_0^{\frac{\pi}{2}} \frac{\sin x - \cos x}{1 + \sin x \cos x} dx = \ldots\ldots\ldots\ldots$

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

B. 0

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

D. π

Answer:

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

A. 100π

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

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

D. $\frac{100}{3}$

Answer: $\frac{100\pi}{3}$

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Choose The Incorrect Answer

1. $\int_0^{\frac{\pi}{2}} \frac{\cos^{\frac{5}{3}} x}{\cos^{\frac{5}{3}} x + \sin^{\frac{5}{3}} x} dx =$

A. $\int_0^{\frac{\pi}{2}} \frac{\cos^{\frac{5}{3}}\left(\frac{\pi}{2} - x\right)}{\cos^{\frac{5}{3}}\left(\frac{\pi}{2} - x\right) + \sin^{\frac{5}{3}}\left(\frac{\pi}{2} - x\right)} dx =$

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

C. $\int_0^{\frac{\pi}{2}} \frac{\sin^{\frac{5}{3}} x}{\cos^{\frac{5}{3}} x + \sin^{\frac{5}{3}} x} dx$

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

Answer: B

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

A. $2\int_0^{\frac{1}{4}} ydx$

B. $2\int_0^{\frac{1}{4}} \sqrt{x}dx$

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

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

Answer: $\frac{2}{3}$

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3. 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. $\int_0^{\frac{\pi}{4}} (\cos x - \sin x) dx$

B. $[\sin x + \cos x]_0^{\frac{\pi}{4}}$

C. $\int_0^{\frac{\pi}{4}} (\sin x - \cos x) dx$

D. $\sqrt{2} - 1$

Answer: $\int_0^{\frac{\pi}{4}} (\sin x - \cos x) dx$

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4. $\int_a^b f(x) dx =$

A. $\int_a^b f(y) dy$

B. $-\int_a^b f(x) dx$

C. $\int_a^b f(a+b-x) dx$

D. $\int_0^a f(a-x) dx$

Answer: $\int_0^a f(a-x)dx$

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

A. 36π

B. 9π

C. $\frac{1}{3}\pi 3^2 \times 3$

D. Volume of the cone with r = 3, h = 3

Answer:

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2 Marks

1. Prove that $\int_0^{\frac{\pi}{2}} \log(\tan x)dx = 0$

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2. Evaluate $\int_0^1 \frac{e^x}{1+e^{2x}} dx$

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3. Evaluate $\int_1^2 \frac{3x}{9x^2-1} dx$

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4. Find the area of the region enclosed by the curve $y = \sqrt{x} + 1$, the axis of x and the lines $x = 0, x = 4$.

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5. Find the volume of the solid obtained by revolving the area of the triangle whose sides are $x = 4, y = 0$ and $3x - 4y = 0$ about x - axis

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3 Marks

1. Evaluate $\int_0^{\frac{\pi}{2}} \frac{\sqrt{\cot x}}{\sqrt{\cot x} + \sqrt{\tan x}} dx$

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2. Evaluate $\int_{-1}^{1} \log\left(\frac{2-x}{2+x}\right) dx$

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

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4. Evaluate $\int_0^1 \sqrt{9-4x^2}dx$

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

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