PHYSICS

BOOKS - MODERN PUBLISHERS

PHYSICS (HINGLISH)

MATHEMATICAL TOOLS

Solved Example

1. Solve the equation $2x^2 + x - 3 = 0$

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2. Write the first three terms of the expansion $\left(1+q^2\right)^{10}$.

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3. The acceleration due to gravity at a height h is given by $g_h = g\left(\frac{R}{R+h}\right)^2$, where g is the accleeration due to gravity on the surface of earth. For $h << R$, find the value of g using the Binomial theorem.

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4. Find the value of $0.32\overline{58}$

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5. Find the value of $x = 22.89 \times \frac{0.0273}{58.3 \times 0.0021}$.

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6. Find the value of $y = (0.05246)^{1/8}$.

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7. Find the value of $\sin 120^\circ$.

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8. Given that $y = x^2$, find $\frac{dy}{dx}$.

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9. Given that $y = x^5 + x^4 + 7$. Find $\frac{dy}{dx}$.

A. $5x^4 + 4x^3$.

B. $5x^3 + 4x^3$.

C. $2x^4 + 4x^3$.

D. $5x^4 + 4x^4$.

Answer: A

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10. Given that $y = x^2 + 4x^{-\frac{1}{2}} - 3x^{-2}$, find $\frac{dy}{dx}$.

A. $2x - 2x^{-\frac{3}{2}} + 6x^{-3}$

B. $-2x - 2x^{-\frac{3}{2}} + 6x^{-3}$

C. $2x - 2x^{-\frac{1}{2}} + 6x^{-3}$

D. $= -2x - 2x^{-\frac{3}{2}} + 6x^{-2}$

Answer: A

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11. Given that $y = (3x^2 + 7)(6x + 3)$. Find $\frac{dy}{dx}$.

Note : This problem can be solved by using Theorm 5.

Here $u = 3x^2 + 7$ and $v = 6x + 3$.

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12. Obtain the derivative of $\sqrt{1 + x^3}$.

A. $\frac{1}{2}x^2(1 + x^3)^{-\frac{1}{2}}$

B. $\frac{3}{2}x^2(1 + x^3)^{-\frac{1}{2}}$

C. $\frac{1}{2}x^2\left(1+x^1\right)^{-\frac{1}{2}}$

D. $\frac{3}{2}x^2\left(1+x^3\right)^{-\frac{3}{2}}$

Answer: B

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13. Given that $y=\frac{x^2+1}{x-2}$, find $\frac{dy}{dx}$

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14. Obtain the differential coefficient of $\sin 6x$.

A. $\cos 6x$

B. $3 \cos 6x$

C. $6 \cos x$

D. $6 \cos 6x$

Answer: D

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15. Differentiate $x^2 \cos x$.

A. $2x \cos x - x^1 \sin x$.

B. $x \cos x - x^2 \sin x$.

C. $2x \cos x - x^2 \sin x$.

D. $2x \sin x - x^2 \cos x$.

Answer: C

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16. Differentiate $\tan^4 x$.

A. $4\tan^3 x \sec^2 x$

B. $\tan^3 x \sec^2 x.$

C. $4\tan^4 x \sec^2 x.$

D. $4\tan^3 x \sec x.$

Answer: A

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17. If $y = \dfrac{\sin x}{1+\cos x}$ then $\dfrac{dy}{dx} =$

A. (1)/(1+sin x)

B. (sinx)/(1+cos x)

C. $\frac{1}{1+\cos x}$

D. (1)/(1+sin x)

Answer: C

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18. If $x = a\cos\theta$ and $y = b\sin\theta$, find $\frac{dy}{dx}$

A. $-\frac{b}{a}\cot\theta.$

B. $-\frac{a}{b}\cot\theta.$

C. $-\frac{b}{a}\tan\theta.$

D. $-\frac{a}{b}\tan\theta.$

Answer: A

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19. Given that $y = \log(ax + b)$. Find $\frac{dy}{dx}$.

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20. Given that $y = e^{\tan x}$, find $\frac{dy}{dx}$.

A. $e^{\tan x} \sec^2 x$

B. $e^{x} \sec^2 x$

C. $e^{\tan x}$

D. $e^{\tan x} \sec x$

Answer: A

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21. Evaluated :

(i) $\int x^7 d$, (ii) $\int x^{-7} dx$, (iii) $\int x^{-1} dx$

(iv) $\int x^{5/3}$, (v) $\int x^{-5/4}dx$, (vi) $\int 2^x dx$

(vii) $\int 3\sqrt{x^2}dx$, (vii) $\int \frac{1}{4\sqrt{x^3}}dx$, (ix) $\int \frac{2}{x^2}dx$

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22. Find $\int \left(x^6 + x^{-6}\right)dx$

A. $\frac{x^6}{7} - \frac{x^{-5}}{5}$

B. $\frac{x^7}{7} - \frac{x^{-5}}{5}$

C. $\frac{x^7}{7} - \left(x^{-5}\right)$

D. $\frac{x^6}{7} - \frac{x^{-5}}{5}$

Answer: B

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23. Integrate the following :

$$\int \left(7e^{5x} + 7^x + 3\right) dx.$$

A. $7\frac{e^{5x}}{5} + \frac{7^x}{\log_e 7} + 3x.$

B. $7\left(e^{5x}\right) + \frac{7^x}{\log_e 7} + 3x.$

C. $\frac{e^{5x}}{5} + \frac{7^x}{\log_e 7} + x.$

D. $7\frac{e^{5x}}{5} + \frac{7^x}{\log_e 7} + 3.$

Answer: A

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24. Evaluate $\int \left(5^x + e^{5x}\right) dx$

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25. Integrate the following :

$$\int \left(\sin 6x + \cos 5x + \sec^2 x\right) dx$$

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26. Integrate the following :

$$\int \frac{1}{1+\sin\theta} d\theta$$

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27. Integrate the following :

$$\int x \sin x dx.$$

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28. Integrate the following :

$\int_3^6 (u + at)dt$ where u and a are constants.

A. $3u + (27)a.$

B. $3u + \frac{27}{2}a.$

C. $3u + \frac{25}{2}a.$

D. $9u + \frac{27}{2}a.$

Answer: B

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Practice Problems 1

1. Write the first four terms of the expansion $(1+q)^{-2}$.

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2. Evaluate $(1003)^{1/3}$ upto five places of decimal.

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3. Find the value of $g' = g\left(1 - \frac{2}{291}\right)^{1/2}$

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Practice Problems 2

1. Find the logarithm of the following number :

(i) 5438

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2. Find the logarithm of the following number

:

(ii) 5438

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3. Find the logarithm of the following number

:

(iii) 5438

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4. Find the logarithm of the following number

:

(iv) 5.438

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5. Find the logarithm of the following number

:

(v) 0.5438

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6. Find the logarithm of the following number

:

(vi) 0.05438

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7. Find the logarithm of the following number :

(vii) 0.005438.

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Practice Problems 3

1. Find the value of $\frac{1}{200}\left[6500 \times \frac{981}{0.024}\right]^{1/4}$

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2. Evaluate : $(0.0043)^{1/7}$

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3. Evaluate : $\frac{17.6 \times 0.51}{0.02 \times 3}$

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4. Given that $v = \sqrt{\frac{2GM}{R}}$. Find log v.

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5. Write the following in common logarithms

$W = RT \log eV_2 / V_1$

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6. Expand the following $N = N_0 e^{-\lambda t}$

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Practice Problems 4

1. Find the values of the following allied angles

:

(i) $\sin(-30^\circ)$

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2. Find the values of the following allied angles

:

(ii) $\cos 120^\circ$

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3. Find the values of the following allied angles :

(iii) $\tan 210^\circ$

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4. Find the values of the following allied angles :

(iv) $\sin 300^\circ$

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5. Find the values of the following allied angles

:

(v) $\sin 330^\circ$

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6. Find the values of the following allied angles

:

(vi) $\sin 225^\circ$

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7. Find the values of the following allied angles

:

(vii) $\cos 135^\circ$

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Practice Problems 5

1. Obtian $\frac{dy}{dx}$ for the following :

$y = x^{-3}$

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2. Obtian $\frac{dy}{dx}$ for the following :

$y = x^{7/2}$

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3. Obtian $\frac{dy}{dx}$ for the following :

$y = 5x^4 + 6x^{3/2} + 9x$

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4. Find $\frac{dy}{dx}$ for the following :

$y = ax^2 + bx + c$

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5. Find $\frac{dy}{dx}$ for the following :

$$y = 3x^5 - 3x - \frac{1}{x}$$

A. $15x^4 - 3 + \frac{1}{x^2}$

B. $15x^4 - 3 + \frac{1}{x^1}$

C. $3x^4 - 3 + \frac{1}{x^2}$

D. $15x^4 - 3 + \frac{2}{x^2}$

Answer: A

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6. Obtian $\frac{dy}{dx}$ for the following :

$(9x^3 - 8x + 7)(3x^5 + 5)$

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7. Obtian $\frac{dy}{dx}$ for the following :

(i) $(3 - 4x^2)^2$

(ii) $\sqrt{(3 + x^2)}$

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8. Obtian $\frac{dy}{dx}$ for the following :

(i) $\frac{1+x}{x}$

(ii) $\frac{1}{(1+x)^2}$

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9. Obtian $\frac{dy}{dx}$ for the following :

$\frac{x^2+2}{x^3+5}$

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10. Obtian $\frac{dy}{dx}$ for the following :

$$\frac{1-\sqrt{x}}{1+\sqrt{x}}$$

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11. Given that $x^2 + y^2 = 9$

show that $\frac{dy}{dx}.\frac{dx}{dy} = 1.$

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12. Given that $s = t^2 + 2t + 3$. Find $\frac{ds}{dt}$.

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13. Given that $y = 6t$ and $x = 9t^2$. Find $\frac{dy}{dx}$.

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14. If $s = ut + \frac{1}{2}at^2$, where u and a are constants. Obtain the value of $\frac{ds}{dt}$.

A. $u + \left(\frac{1}{2}\right)at$

B. $u + at$

C. $u + at^2$

D. $u^2 + at$

Answer: B

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15. The area 'A' of a blot of ink is growing such that after 't' second.

$A = 3t^2 + \frac{t}{5} + 7$

Calculate the rate of increase of area after five seconds.

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16. The area of a circle is given by $A = \pi r^2$, where r is the radius. Calculate the rate of increase of area w.r.t radius.

A. πr

B. $2\pi r$

C. 2π

D. $2r$

Answer: B

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Practice Problems 6

1. Differentiate the following :

(i) $\tan 6x$

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2. Differentiate the following :

(ii)$\sec(ax + b)$

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3. Differentiate the following :

(iii) $\cot \sqrt{x}$

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4. Differentiate the following :

(i) $\cos^2 x$

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5. Differentiate the following :

(ii) $\sin^2(ax+b)$

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6. Differentiate the following :

(iii) $\sin(ax+b)^2$

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7. Differentiate the following :

(i) $x^2 \cos x$

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8. Differentiate the following :

(ii) $(1+x)\sin x$

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9. Differentiate the following :

(iii) $\cos^2 x \sin x^2$

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10. Differentiate the following :

$\sin\left(x^2+1\right)$

A. $x\cos\left(x^2+1\right)$

B. $2x\cos\left(x^2+1\right)$

C. $2x\cos\left(x^1+1\right)$

D. $\cos\left(x^2+1\right)$

Answer: B

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11. Differentiate the following :

(ii) $\sin x^3$

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12. Differentiate the following :

(iii) $\sin\left(3x^3 + 7\right)$

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13. Differentiate the following :

(i) $\frac{\theta}{\tan\theta}$

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14. Differentiate the following :

(ii) $\frac{\cos\theta}{\theta+\sin\theta}$

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15. Differentiate the following :

(iii) $-\dfrac{\tan\theta}{\tan\theta+\sec\theta}$

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16. Given that $x=a\tan\theta, y=b\sec\theta$. Find $\dfrac{dy}{dx}$.

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Practice Problems 7

1. Obtain the differential coefficient of the following:

$$\frac{1+x}{1-x}$$

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2. Obtain the differential coefficient of the following:

$$\log(3x+4)^2$$

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3. Obtain the differential coefficient of the following:

$\log(\cos x)$

A. $\tan x$

B. $-\tan x$

C. $-\cos x$

D. $-\sin x$

Answer: B

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4. Obtain the differential coefficient of the following:

$\log(\tan x + \sec x)$

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5. Obtain the differential coefficient of the following:

$$\frac{\log x}{1 + \log x}$$

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6. Obtain the differential coefficient of the following:

(i) e^{nx} (ii) a^{nx}

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Practice Problems 8

1. Obtain the following integrals :

(i) $\int x^{15} dx$

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2. Obtain the following integrals :

(ii) $\int t^7 dt$

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3. Obtain the following integrals :

(iii) $\int x^{1/2} dx$

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4. Obtain the following integrals :

(iv) $\int x^{-15} dx$

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5. Obtain the following integrals :

dx.`

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6. Integrate the following :

(i) $\int (3x^{-7} + x^{-1})\,dx$

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7. Integrate the following :

(ii) $\int (8 + x)\,dx.$

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8. Find $\int \left(x + \frac{1}{x}\right)\,dx.$

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9. Evaluate $\int e^{3x+4}dx.$

A. $\frac{e^{3x+4}}{4}$

B. $\frac{e^{3x+4}}{3}$

C. $\left(e^{3x+4}\right)$

D. $\frac{e^{x}}{3}$

Answer: B

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10. Find $\int \left(e^{-5x} + 3\right) dx.$

A. $-\dfrac{e^{-5}}{5} + 3$

B. $-\dfrac{e^{-5}}{5} + 3x$

C. $\dfrac{e^{-5}}{5} + 3x$

D. $-\dfrac{e^{-5}}{5} + 0$

Answer: B

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11. Obtain the following integrals :

$$\int 6^t dt$$

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12. Obtain the following integrals :

$$\int \left(6^4 + 9^6\right) dx.$$

A. $\left(6^4 + 9^6\right) x$

B. $\left(6^4 + 9^6\right)$

C. 0

D. $\left(6^5+9^7\right)x$

Answer: A

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Practice Problems 9

1. Integrate the following :

$$\int \cos^2\theta d\theta$$

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2. Integrate the following :

$$\int \tan^2 \theta d\theta.$$

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3. Integrate the following :

$$\int \frac{1}{1-\sin x} dx$$

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4. Integrate the following :

(ii) $\int \frac{1}{1-\cos x} dx$

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5. $\int \left(t - \cos \omega t + \frac{1}{t} \right) dt$

A. $\frac{t^2}{2} - \frac{\sin \omega t}{\omega} + t$

B. $\frac{t^2}{2} - \frac{\sin \omega t}{\omega} + \log t.$

C. $\frac{t^2}{2} - (\sin \omega t) + \log t.$

D. $\frac{t^2}{2} - \frac{\cos \omega t}{\omega} + \log t.$

Answer: B

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6. Evaluate $\int \tan x dx$.

A. $-\log \sin x$.

B. $\log \cos x$.

C. $-\log \cos x$.

D. $\log \sec x$.

Answer: C

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7. Find $\int \sin^3 x \cos x dx.$

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8. Evaluate $\int \tan^2 \theta \sec^2 \theta d\theta.$

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9. Integrate (i) $\frac{4x^3}{1+x^4}$

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10. Integrate (ii) $\frac{x}{1+x^2}$.

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11. Evalutate $\int x^3 \sin x^4 dx$.

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12. Integrate $\frac{1}{x^3}\cos.\ \frac{1}{x^2}$.

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13. Evaluate $\int \theta^{-\frac{1}{2}} \sin \theta^{\frac{1}{2}} d\theta.$

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Practice Problems 10

1. Evaluate the following :

$$\int_0^{\pi/2} \sin\theta d\theta$$

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2. Evaluate the following :

$$\int_0^{\infty} x^{-1/2} dx$$

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3. Evaluate the following :

$$\int_5^6 e^x dx$$

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4. Evaluate the following :

$$\int_{-\pi/2}^{\pi/2} \cos\theta d\theta$$

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5. Evaluate $\int_{R}^{\infty} \frac{GMm}{x^2} dx$

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6. Find the value of $\int_{u}^{v} Mvdv$

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7. Evaluate $\int_{r_1}^{r_2} \left(r - \eta \frac{q_0 q}{r^2} \right) dr$

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8. Find $\int_0^{\pi/2} (1 - \cos\theta)^{1/2} d\theta$

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9. Evaluate $\int_0^{\infty} \frac{dt}{t}$

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10. Evalueta

$$\int_0^T E_0 I_0 \sin \omega t \sin(\omega t + \phi) dt$$

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11. Evalueta

$$\int_0^T I_0 \sin \omega t dt$$

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12. Evalueta

$$\int_0^{T/2} I_0 \sin \omega t dt$$

Given that $\omega T = 2\pi$.

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