



PHYSICS

BOOKS - PRADEEP PHYSICS (HINGLISH)

MATHEMATICAL TOOLS

Example

1. Find the roots of equation $6x^2 - 13x + 6 = 0$

A. $\frac{18}{14}, \frac{8}{12}$

B. $\frac{18}{12}, \frac{8}{12}$

C. $\frac{18}{12}, \frac{4}{12}$

D. $\frac{8}{12}, \frac{8}{12}$

Answer: B

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2. $x^2 + x - 2 = 0$.

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3. Evaluate $(1001)^{\frac{1}{3}}$ upto six places of decimal.

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4. Differentiate the following w.r.t.x. (i) 2002 (ii) $e^{(-1)}$ (iii) π^2

A. $0, 0, 0$

B. $200, e, \pi e$

C. NOT DEFINED

D. None of the above

Answer: A

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5. Differentiate the following with respect to x.

(i) x^6 (ii) $\frac{1}{x^3}$ (iii) \sqrt{x}

A. $6x^4$, $\frac{-3}{x^4}$, $\frac{1}{2\sqrt{x}}$

B. $6x^5$, $\frac{-3}{x^4}$, $\frac{1}{2\sqrt{x}}$

C. $6x^5$, $\frac{-2}{x^4}$, $\frac{1}{2\sqrt{x}}$

D. $6x^3$, $\frac{-3}{x^4}$, $\frac{1}{2\sqrt{x}}$

Answer: B

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6. Differentiate the following with respect to x.

(i) $4x^3 - 3x^2 + \frac{4}{x^2} - 8$

A. $12x^3 - 6x - 8x^{-3}$

B. $12x^2 - 6x - 8x^{-1}$

C. $12x^2 - 4x - 8x^{-3}$

D. $12x^2 - 6x - 8x^{-4}$

Answer: B



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7. Differentiate the following with respect to x.

(i) $(4x + 2)(5x^2 + 4)$ (ii) $(2x^3 - 3)(2x^{-3} + 1)$



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8. Differentiate the following with respect to x .

(i) $(x^3 + 2x^2 - 4)(4x^5 - x^2 + 1)$ (ii) $\frac{7x^5}{x + 3}$

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9. Differentiate the following with respect to x .

(i) $\sin 2x$ (ii) $\cos 3x$ (iii) $\tan 4x$ (iv) $\sin^3 x$ (v) $x^2 / \tan x$

A. $2 \cos 2x, -3 \sin 3x$

B. $2 \cos 2x, 3 \sin 3x$

C. $2 \cos 2x, -4 \sin 3x$

D. $2 \cos 2x, 3 \sin x$

Answer: A

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10. A particle starts from rest with a uniform acceleration. Its displacement x after t seconds is given in metres by the relation

$$x = 5 + 6t + 7t^2$$

Calculate the magnitude of its (i) initial velocity (ii) velocity at $t = 3$ s (iii) uniform acceleration and (iv) displacement at $t = 5$ s.



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11. The mass of a body is 2.5 Kg. it is in motion and its velocity v

after time t is $v = \frac{t^3}{3} + \frac{t^2}{2} + 1$

Calculate the force acting on the body at the time $t = 3$ s.



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12. The air is filled in a balloon and the volume of balloon increases gradually. Find the rate of increase of volume of balloon with radius when of balloon becomes 30 cm.

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13. A particle is at rest, It starts rotating about a fixed point. Its angle of rotation (θ) with time (t) is given by the relation :

$$\theta = \frac{6t^3}{15} - \frac{t^2}{2}$$

where θ is in radian and t is seconds. Find the angular velocity and angular acceleration of a particle at the end of 6 second.

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14. Evaluate : $\int \left(\frac{1}{ax + b} \right) dx$.

A. $\frac{1}{\alpha} \log_e (a + b) + c$

B. $\frac{1}{(\alpha)^2} \log_e (ax + b)^2 + c$

C. $\frac{1}{\alpha} \log_e (ax + b) + c$

D. $\frac{1}{\alpha} \log_e (ax + b)^2 + c$

Answer: C

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15. Evaluate : $\int \sec^4 x \tan x dx$.

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16. Evaluate $\int (x - \cos x + 1/x)$.

A. $\frac{x^2}{2} - \cos x + \log_e x + C$

B. $\frac{x^2}{2} - \sin x + \log_e x + C$

C. $\frac{x^2}{2} - \sin x + (x^{-2}) + C$

D. $\frac{x^2}{3} - \sin x + \log_e x + C$

Answer: B

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17. Evaluate $\int x \cos x dx$.

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18. Evaluate : $\int x^n \log x dx$.

A. $\frac{x}{nm + 1} \left[\log x - \frac{1}{(n + 1)} \right] + C$

B. $\frac{x^{n+1}}{nm + 1} \left[\log x - \frac{1}{(n + 1)} \right] + C$

C. $\frac{x^{n+1}}{n+1} \left[\log x - \frac{1}{(n+1)} \right] + C$

D. $\frac{x^{n+1}}{nm} \left[\log x - \frac{1}{(n+1)} \right] + C$

Answer: B

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19. Evaluate : $\int_1^4 x^3 dx$

A. 63.75

B. 613.75

C. 163.75

D. 630.75

Answer: A

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20. Evaluate : \int_0^2

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21. Evaluate : $\int_a^b \frac{\log x}{x} dx.$

- A. $\frac{1}{2}[(\log b) - (\log a)]$
- B. $\frac{1}{2}[(\log a)^2 - (\log b)^2]$
- C. $\frac{1}{2}[(\log b)^2 - (\log a)^2]$
- D. $[(\log b)^2 - (\log a)^2]$

Answer: C

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22. Evaluate $\int_{40^\circ}^{60^\circ} \frac{d\theta}{(\theta - \theta_0)}$, where $\theta_0 = 20^\circ$

A. 0.931

B. 0.6931

C. 0.61

D. 0.9

Answer: B

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Problems For Practice

1. Solve the following : $10x^2 - 27x + 5 = 0$

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2. Solve the following : $3x^2 - 8x + 5 = 0$

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3. Solve the followings : $9x^2 + 15x + 4 = 0$

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4. Solve the followings : $x^2 + 4x - 5 = 0$

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5. Solve the following equation , $3x^2 + 6x - 9 = 0$

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6. Solve the following : $5x^2 + 4x - 7 = 0$

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7. Solve the equation for x : $4x^2 - 4ax + (a^2 - b^2) = 0$.

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8. Expand using binomial $(1 + 3x)^3$ upto the term having x^3 .

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9. Evaluate $(999)^{1/3}$ upto 4 places of decimal.

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10. Evaluate $\sqrt[26]{26}$ correct upto four places of decimal.

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11. The value of acceleration due to gravity (g) at height h above the surface of earth is given by

$$g' = \frac{gR^2}{(R+h)^2}. \text{ If } h \ll R, \text{ then prove that } g' = g\left(1 - \frac{2h}{R}\right).$$

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12. Simplify the following. Using Binomial theorem

$$E = K \left[\left(1 + \frac{\Delta\theta}{\theta_0} \right)^4 - 1 \right]$$

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13. Evaluate $(1.056)^{1/3}$ correct up to the four places of decimal.

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14. Identify , whether the following equation represent a straight line , parabola or circle:

$$y = 7$$

- A. Straight line
- B. Parabola
- C. Circle
- D. None of the above

Answer: A

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15. Identify , whether the following equation represent a straight line , parabola or circle:

$$Y^2 - 6x + 3y + 5 = 0$$



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16. Identify , whether the following equation represent a straight line , parabola or circle:

$$x^2 + y^2 = 16$$

- A. Straight line
- B. Parabola
- C. Circle
- D. None of the above

Answer: C



17. Find the value of the following :

(a) $\sin(-30^\circ)$ (b) $\cos(-60^\circ)$ (c) $\tan(-45^\circ)$

A. (a) $-1/2$, (b) $1/2$ (c) -1

B. (a) $1/2$, (b) $-1/2$ (c) -1

C. (a) $-1/2$, (b) $1/2$ (c) 1

D. (a) $-1/2$, (b) $-1/2$ (c) -1

Answer: A

18. Find the value of the following :

(a) $\sin 120^\circ$ (b) $\cos 135^\circ$ (c) $\tan 150^\circ$

A. (a) $3/2$ (b) $-1/\sqrt{2}$ (c) $-1/\sqrt{3}$

B. (a) $\sqrt{3}/2$ (b) $-1/\sqrt{2}$ (c) $-1/\sqrt{3}$

C. (a) $\sqrt{3}/2$ (b) $-1/\sqrt{2}$ (c) $-1/3$

D. (a) $\sqrt{3}/2$ (b) $-1/2$ (c) $-1/\sqrt{3}$

Answer: B



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19. Find the value of the following :

(a) $\sin 210^\circ$ (b) $\cos 220^\circ$ (c) $\tan 245^\circ$



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20. If $\sin \theta = 3/5$, find the values of $\cos \theta$ and $\tan \theta$.

A. $\frac{4}{5}; \frac{3}{4}$

B. $\frac{4}{5}; \frac{4}{3}$

C. $\frac{5}{4}; \frac{3}{4}$

D. $\frac{4}{5}; \frac{4}{4}$

Answer: A



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21. An inclined plane rises 1 in 10. if the length of the inclined plane is 5 cm.. Calculate the height of the raised end above the horizontal.



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22. Simplify the following :

(i) $(0.0036)^{1/5}$ (ii) $(0.056)^{2/3}$ (iii) $10^{-1/5}$

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23. Simplify the following :

(i) $(0.05246)^{1/8} - 2.6055$ (ii) $\frac{3.142 \times (80.2)^{1/2}}{(9.8)^{1/2}}$

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24. Find antilog of (i) - 2.6674 (ii) - 3.01 (iii) -0.3467

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25. Differentiate the following w.r.t.x

(i) π^2 (ii) e^2 (iii) -14

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26. Differentiate the following w.r.t.x

(1) $(3x + 5)$ (ii) x^{-2} (iii) $x^{3/2}$ (iv) $\sqrt{x} - \frac{1}{\sqrt{x}}$ (v) $\frac{1}{(x + 2)}$



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27. Differentiate the following w.r.t.x

(i) $3x^{5/2}$ (ii) $(4x)^{1/3}$ (iii) $\frac{6}{\sqrt{x}}$ (iv) $x \sin nx$



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28. Differentiate the following w.r.t.x

(i) $(5x^2 + 6)(2x^3 + 4)$ (ii) $\sqrt{x}(x^2 + 7)$ (iii) $(x^2 + 3)(x^4 - 9)$



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29. Differentiate the following w.r.t.x

(i) $\frac{2}{(3x + 1)}$ (ii) $\frac{3x + 5}{4x + 6}$

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30. Differentiate the following w.r.t.x

$\sin 3x$ (ii) $\cos^2 x$ (iii) $\sin x^3$

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31. Differentiate the following w.r.t.x and find the value when $x = 9$.

(i) $\sin 5x$ (ii) $\tan 5x$ (iii) $\cos 5x$

A. (i) $5/\sqrt{3}$ (ii) 5 (iii) $-5/\sqrt{3}$

B. (i) $25/\sqrt{2}$ (ii) 5 (iii) $-5/\sqrt{2}$

C. (i) $5/\sqrt{2}$ (ii) 10 (iii) $-5/\sqrt{2}$

D. (i) $5/\sqrt{2}$ (ii) 10 (iii) $-7/\sqrt{3}$

Answer: C

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32. Differentiate the following w.r.t., x

(i) $\tan^3 x$ (ii) $\frac{\cos x}{(1 - \sin x)}$ (iii) $\sin(ax + b)^2$

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33. If $x = a(\theta + \sin \theta)$ and $y = a(1 - \cos \theta)$, find dy/dx .

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34. If $x = at^3$ and $y = bt^2$, find $\frac{dy}{dx}$.

A. 0

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

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

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

Answer: C



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



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36. If the displacement x of a particle (in metre) is related with time (in second) according to relation

$$x = 2t^3 - 3t^2 + 2t + 2$$

find the position, velocity and acceleration of a particle at the end of 2 seconds.

A. $10m$; $14m / s$; $10m / s^2$

B. $18m$; $14m / s$; $18m / s^2$

C. $14m$; $112m / s$; $18m / s^2$

D. $10m$; $14m / s$; $18m / s^2$

Answer: D

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37. A particle starts from rest and its angular displacement (in red) is given by $\theta = \frac{t^2}{20} + \frac{t}{5}$, calculate the angular velocity at the end of $t = 4$ second.

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38. A metallic disc is being heated. Its area A (in m^2) at any time t (in sec) is given by

$$A = 5t^2 + 4t + 8$$

Calculate the rate of increase of area at $t = 3\text{ s}$.



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39. A particle starts from origin with uniform acceleration. Its displacement after t seconds is given in metres by the relation

$$x = 2 + 5t + 7t^2$$

Calculate the magnitude of its (i) initial velocity (ii) velocity at $t = 4$ s (iii) uniform acceleration (iv) displacement at $t = 5$ s.



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40. if the displacement of the particle at an instant is given by

$$y = r \sin(\omega t - \theta)$$

where r is amplitude of oscillation. ω is the angular velocity and $-\theta$ is the initial phase of the particle, then find the particle velocity and particle acceleration.



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41. Intergrate the following with respect to x

(i) $3\sqrt{x^5}$ (ii) $\sqrt{x} - \frac{1}{\sqrt{x}}$ (iii) $\left(\sqrt{x} + \frac{1}{x}\right)^2$

A. (i) $\frac{6}{7}x^{\frac{7}{2}} + C$ (ii) $\frac{2}{3}x^{3/2} - 2x^{1/2} + C$ (iii) $\frac{x}{2} - \left(\frac{1}{x}\right) + 4x^{\frac{1}{2}}$

B. (i) $\frac{6}{7}x^{\frac{7}{2}} + C$ (ii) $\frac{2}{3}x^{3/2} - 2x^{1/2} + C$ (iii)

$$\frac{x^2}{2} - \left(\frac{1}{x}\right) + 4x^{\frac{1}{2}}$$

C. (i) $\frac{3}{7}x^{\frac{7}{2}} + C$ (ii) $\frac{2}{3}x^{3/2} - 2x^{1/2} + C$ (iii)

$$\frac{x^3}{2} - \left(\frac{1}{x}\right) + 4x^{\frac{1}{2}}$$

$$\text{D. (i) } \frac{6}{7}x^{\frac{1}{2}} + C \quad (\text{ii) } \frac{2}{3}x^{3/2} - 3x^{1/2} + C \quad (\text{iii) } \frac{x^2}{2} - \left(\frac{1}{x}\right) + 4x^{\frac{1}{2}}$$

Answer: B

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42. Integrate the following functions w.r.t.x and find withinj the limits $x = 2$ to 4.

(i) x^3 (ii) \sqrt{x} (iii) x^{-1} (iv) $x^{-1/2}$

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43. Evaluate the following intergrals

$$\int_{-\pi/2}^{+\pi/2} \cos x dx$$

A. 1

B. 0

C. 2

D. -1

Answer: C

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44. Evaluate the following intergrals

(i) $\int_{15}^{30} \cos(4x - 3)dx$ (ii) $\int_0^{30} \cos 5x dx$ (iii) $\int_0^{30} \cos 5x dx$ (iv) $\int_0^{10} \sec^2(3x + 6)dx$

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45. Evaluate w.r.t.x , (i) $\int x \log x dx$ (ii) $\int \left(x^2 - \cos x + \frac{1}{x} \right) dx$

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46. Evaluate (i) $\int_0^{\pi/4} \sin x \cos x dx$ (ii) $\int_0^{\pi/2} (1 + \cos x)^{1/2} dx$ (iii) $\int_0^{\pi/2} (1 + \sin x)^{1/2} dx$ (iv) $\int_0^{\pi/4} (1 - \cos 2x)^{1/2} dx$

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47. Evaluate $\int_R^{\infty} \frac{GMm}{x^2} dx$

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48. Evaluate $\int_{40}^{50} \frac{d\theta}{\theta - \theta_0}$, where $\theta_0 = 30^\circ C$, a constant temperature of surroundings.

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49. Evaluate : (a)

$$\int_u^v dv = \int_0^t adt(b) \int_0^s ds = \int_0^t udt + \int_0^t adt(c) \int_u^{vg} u dv = \int_0^s ads$$

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50. Find the (i) surface area (ii) volume of the cylinder of length 10 cm and radius 2cm.

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51. Find the (i) surface area and (ii) volume of a shpere of radius 5cm.

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52. Find the (i) surface area (ii) volume of the rectangular body of dimension 30 cm xx10 cm xx5 cm.

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53. Find the volume of the cone of height 10 cm and radius of the base 3 cm.

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MCQ

1. In the quadratic equation, $pqx^2 - (p^2 + q^2)x + pq = 0$, the value of x are

A. $\frac{p+q}{p}, \frac{p+q}{q}$

B. $\frac{p - q}{p}, \frac{-q}{q}$

C. $\frac{p}{q}, \frac{q}{p}$

D. $\frac{pq}{p + q}, \frac{pq}{p - q}$

Answer: C



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2. An inclined plane rises 1 in 10. if the length of the inclined plane is 5 cm.. Calculate the hight of the reised end above the horizontal.

A. 0.1 m

B. 0.25 m

C. 0.5 m

D. 1.0 m

Answer: C



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3. The equation $x^2 - 8x + 2y + 7 = 0$, represents

- A. a straight line
- B. parabola
- C. circle
- D. ellipse

Answer: B



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4. When $x = 4$, the derivative of \sqrt{x} is

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

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

C. 2

D. 4

Answer: B



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5. The value of $\int_0^{10} \left(x + \frac{1}{x} \right) dx$ is

A. 51

B. 52.3

C. 101

D. 103.3

Answer: B



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Fill In The Blanks

1. $(a + b)^2 + (a - b)^2 = \dots$

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2. $n!$ (i. e. , factorial n) =

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3. $\cos^2 \theta - \cot^2 \theta = 1 + \dots$

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4. $\lim_{t \rightarrow 0} \sin t = \dots$ (in radian) $t \rightarrow 0$

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5. $\int \cos x dx = \dots$

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