# Physicsaholics

**DPP – 5 (Basic Maths)**

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Written Solution on Website:- https://physicsaholics.com/note/notesDetalis/70

Q 1. y = x ln x , Find $\frac{dy}{dx}$ ?

(a) x + ln x (b) 1 + ln x (c) ln x (d) x + x ln x

Q 2. y = Sin x . Cos x , Find $\frac{dy}{dx}$ ?

(a) Sin 2x (b) Cos 2x (c) - Cos 2x (d) - Sin 2x

Q3 y = $(Sin\, x + \cos x)^2$ , Find $\frac{dy}{dx}$ ?

(a) Sin 2x (b) Cos 2x (c) 2Sin 2x (d) 2 Cos 2x

Q 4. Differentiate y = $\ln x^2$ w.r.t. 'x':

(a) $\frac{dy}{dx} = \frac{1}{x}$ (b) $\frac{dy}{dx} = 2$

(c) $\frac{dy}{dx} = \frac{2}{x}$ (d) None of these

Q 5. Differentiate y = $e^{x^2}$ w.r.t. 'x':

(a) $\frac{dy}{dx} = 2xe^{x^2}$ (b) $\frac{dy}{dx} = e^{x^2}$

(c) $\frac{dy}{dx} = 2e^{x}$ (d) None of these

Q 6. Differentiate y = $ae^x$ w.r.t. 'x'(where a = constant):

(a) $\frac{dy}{dx} = axe^x$ (b) $\frac{dy}{dx} = a$

(c) $\frac{dy}{dx} = ae^x$ (d) None of these

Q 7. Differentiate $F(x) = (x^2 - 1)(x + 5)$, w.r.t. 'x':

(a) $F'(x) = 3x^2 + 10x - 1$

(b) $F'(x) = x^2 - 10x - 1$

(c) $F'(x) = (2x)(x)$

(d) None of these

Q 8. Differentiate $F(x) = \sin x \cos x$, w.r.t. 'x':

(a) $F'(x) = 1$

(b) $F'(x) = \cos^2 x - \sin^2 x$

(c) $F'(x) = \cos x - \sin x$

(d) None of these

Q 9. Differentiate $y = x^2 \ln x$ w.r.t. 'x':

(a) $\frac{dy}{dx} = x(2\ln x + 1)$ (b) $\frac{dy}{dx} = \ln x + 2x$

(c) $\frac{dy}{dx} = x^2 \ln x + 1$ (d) None of these

Q 10. Differentiate $y = \frac{e^x}{x}$, w.r.t. 'x':

(a) $\frac{dy}{dx} = -\frac{e^x}{x^2}$ (b) $\frac{dy}{dx} = \frac{e^x}{x^2}(x+1)$

(c) $\frac{dy}{dx} = \frac{e^x}{x^2}(x-1)$ (d) None of these

Q 11. Differentiate $y = \frac{\sin x}{\cos x}$, w.r.t. 'x':

(a) $\frac{dy}{dx} = \cos^2 x$ (b) $\frac{dy}{dx} = \frac{\cos^2 x - \sin^2 x}{\cos^2 x}$

(c) $\frac{dy}{dx} = \sec^2 x$ (d) None of these

Q 12. Differentiate $y = \frac{x}{\ln x}$, w.r.t. 'x':

(a) $\frac{dy}{dx} = 1$ (b) $\frac{dy}{dx} = \frac{\ln x - 1}{(\ln x)^2}$

(c) $\frac{dy}{dx} = \frac{1}{(\ln x)^2}$ (d) None of these

Q 13. Differentiate $y = \frac{6x^2}{2-x}$, w.r.t. 'x':

(a) $\frac{dy}{dx} = \frac{24x - 6x^2}{(2-x)^2}$ (b) $\frac{dy}{dx} = \frac{6x^3 - 12x^2 + 24x}{(2-x)^2}$

(c) $\frac{dy}{dx} = \frac{24x}{(2-x)^2}$ (d) None of these

Q 14. Find double derivative of $y = x^3 - x^2 + x - 1$, w.r.t. 'x'

(a) $\frac{d^2y}{dx^2} = 3x^2 - 2x + 1$ (b) $\frac{d^2y}{dx^2} = 6x - 2$

(c) $\frac{d^2y}{dx^2} = 6$ (d) None of these

Q 15. Find value of $\frac{d^2y}{dx^2}$ at $x = \frac{\pi}{2}$, if $y = \sin x$:

(a) $\frac{d^2y}{dx^2} = -1$ (b) $\frac{d^2y}{dx^2} = 1$

(c) $\frac{d^2y}{dx^2} = zero$ (d) $\frac{d^2y}{dx^2} = 2$

Q 16. Find $\frac{d^2y}{dx^2}$, if $y = e^x$:

(a) $\frac{d^2y}{dx^2} = xe^x$ (b) $\frac{d^2y}{dx^2} = e^x + 1$

(c) $\frac{d^2y}{dx^2} = e^x$ (d) None of these

Q 17. Find $\frac{d^2y}{dx^2}$, if $y = \ln x$:

(a) $\frac{d^2y}{dx^2} = -x^2$ (b) $\frac{d^2y}{dx^2} = -\frac{1}{x^2}$

(c) $\frac{d^2y}{dx^2} = \frac{1}{x^2}$ (d) None of these

Q18. If $y = x^x$ , $\frac{dy}{dx} = ?$

(a) $x^x$ (b) $x^x(1 + \ln x)$ (c) $x^{x-1}$ (d) $x^{x+1}$

Q19. If $x^3 + y^3 = 2xy$ , find value of $\frac{dy}{dx}$ at (1,1) ?

(a) 1 (b) -1 (c) 2 (d) 3

Q20. If $2x = t^2$ , $y = t^3 + t^2$ . Find $\frac{dy}{dx}$ at t = 1 ?

(a) 2 (b) 3 (c) 4 (d) 5

Q21. $y = \sqrt{\ln x}$, Find $\frac{dy}{dx}$ ?

(a) $\frac{1}{2(\ln x)^{3/2}}$ (b) $\frac{1}{2x(\ln x)^{1/2}}$ (c) $\frac{-1}{2(\ln x)^{3/2}}$ (d) $\frac{1}{(\ln x)^{3/2}}$



# Answer Key

| | | | | |
|---|---|---|---|---|
| **Q.1 b** | **Q.2 b** | **Q.3 d** | **Q.4 c** | **Q.5 a** |
| **Q.6 c** | **Q.7 a** | **Q.8 b** | **Q.9 a** | **Q.10 c** |
| **Q.11 c** | **Q.12 b** | **Q.13 a** | **Q.14 b** | **Q.15 a** |
| **Q.16 c** | **Q.17 b** | **Q.18 b** | **Q.19 b** | **Q.20 d** |
| **Q.21 b** | | | | |

## Plus leaderboard

Based on educator activity in last 30 days

| | | |
|---|---|---|
| 1 | Prateek Jain | 11.4M mins |
| 2 | Ajay Mishra (Akm) | 6.3M mins |
| 3 | Shubh Karan Choudhary (Skc) | 5.9M mins |
| 4 | Dr Amit Gupta | 5.5M mins |
| 5 | Ramesh Sharda | 4.9M mins |
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| 7 | Shailendra Tanwar | 3.6M mins |
| 8 | Vishal Vivek | 2.7M mins |
| 9 | Garima Goel | 2.7M mins |
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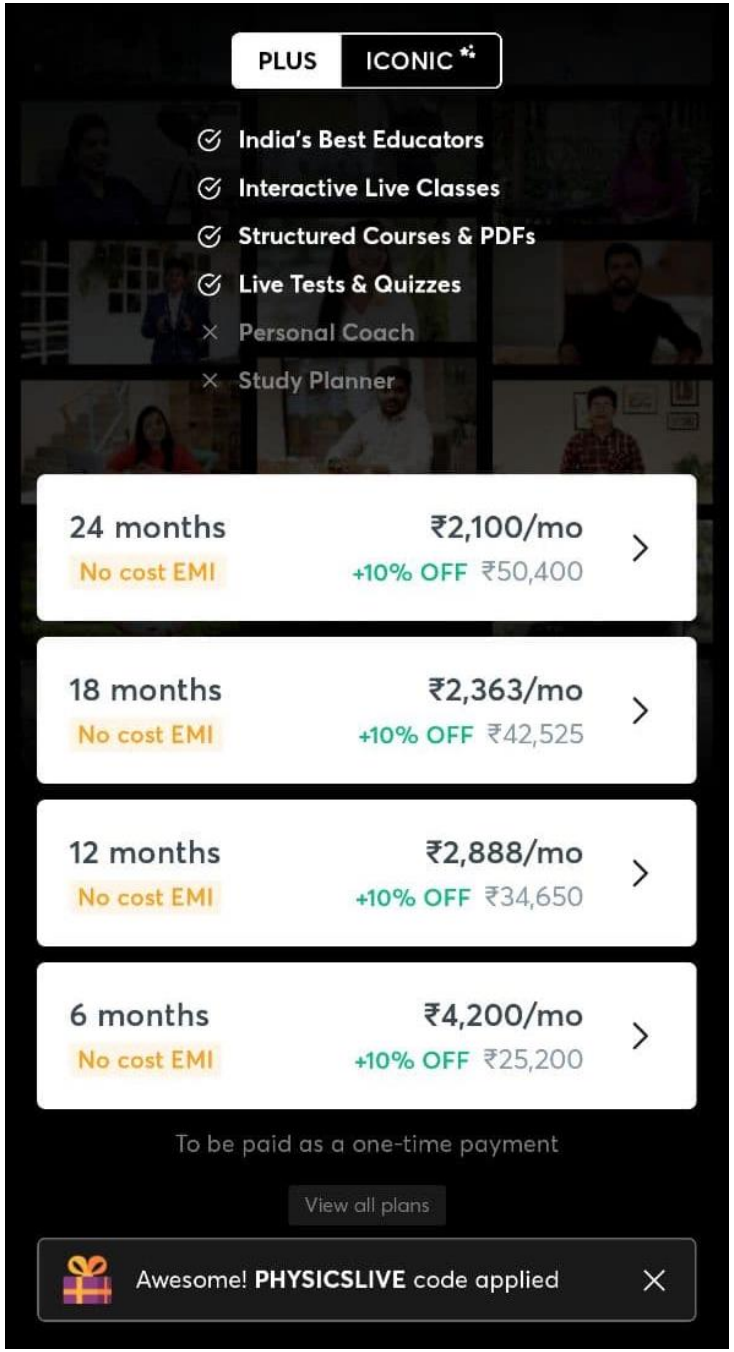

# Written Solution

## DPP-5 Basic Math: Differentiation (Product rule, Quotient rule, Chain rule, Double Derivatives)

**By Physicsaholics Team**

Solution: 1

$$y = x \ln x$$

$$\frac{dy}{dx} = x \frac{d}{dx}(\ln x) + (\ln x) \frac{d}{dx}(x)$$

$$= \left(x \times \frac{1}{x}\right) + (\ln x) \times 1$$

$$= 1 + \ln x$$

Ans (b)

Solution: 2

$$y = \sin x . \cos x$$

$$\frac{dy}{dx} = \sin x . \frac{d}{dx}(\cos x) + \cos x . \frac{d}{dx}(\sin x)$$

$$= \sin x (-\sin x) + \cos x . \cos x$$

$$= -\sin^2 x + \cos^2 x$$

$$= \cos 2x$$

Ans(b)

Solution: 3

$$y = (\sin x + \cos x)^2$$

$$y = \sin^2 x + \cos^2 x + 2 \sin x \cdot \cos x$$

$$y = 1 + 2 \sin x \cdot \cos x$$

$$\frac{dy}{dx} = \frac{d}{dx}(1) + 2\left[\sin x \cdot \frac{d}{dx}(\cos x) + \cos x \frac{d}{dx}(\sin x)\right]$$

$$= 0 + 2\left[-\sin^2 x + \cos^2 x\right]$$

$$= 2 \cos 2x$$

Ans(d)

Solution: 4

$$y = \ln(x^2)$$

$$\frac{dy}{dx} = \frac{1}{x^2}\left(\frac{d}{dx}(x^2)\right)$$

$$\frac{dy}{dx} = \frac{1}{x^2}(2x)$$

$$\boxed{\frac{dy}{dx} = \frac{2}{x}}$$

Ans. c

Solution: 5

$$y = e^{x^2}$$

$$\frac{dy}{dx} = e^{x^2} \frac{d}{dx}(x^2)$$

$$\frac{dy}{dx} = e^{x^2}(2x)$$

$$\boxed{\frac{dy}{dx} = 2x e^{x^2}}$$



Ans. a

Solution: 6

$$y = a e^x$$

$$\frac{dy}{dx} = a\left(\frac{d}{dx}(e^x)\right) + e^x\left(\frac{d}{dx}(a)\right)$$

$$\frac{dy}{dx} = a e^x + 0$$

$$\boxed{\frac{dy}{dx} = a e^x}$$



Ans. c

Solution: 7

$$F(x) = (x^2-1)(x+5)$$

$$F'(x) = (2x)(x+5) + (x^2-1)(1)$$

$$= (2x)(x+5) + x^2 - 1$$

$$= 2x^2 + 10x + x^2 - 1$$

$$\boxed{F'(x) = 3x^2 + 10x - 1}$$

Ans. a

Solution: 8

$$F(x) = \sin x \cdot \cos x$$

$$F'(x) = \frac{d}{dx}(\sin x)(\cos x) + \sin x \cdot \frac{d}{dx}(\cos x)$$

$$= \cos x \cdot \cos x + \sin x (-\sin x)$$

$$\boxed{F'(x) = \cos^2 x - \sin^2 x}$$



Ans. b

Solution: 9

$$y = x^2 \ln x$$

$$\frac{dy}{dx} = (2x)\ln x + x^2\left(\frac{1}{x}\right)$$

$$\boxed{\frac{dy}{dx} = x(2\ln x + 1)}$$



Ans. a

Solution: 10

$$y = \frac{e^x}{x}$$

$$\frac{dy}{dx} = \frac{x\left(\frac{d}{dx}e^x\right) - e^x\left(\frac{d}{dx}(x)\right)}{x^2}$$

$$\frac{dy}{dx} = \frac{xe^x - e^x}{x^2}$$

$$\boxed{\frac{dy}{dx} = \frac{e^x}{x^2}(x-1)}$$

Ans. c

Solution: 11

$$y = \frac{\sin x}{\cos x}$$

$$\frac{dy}{dx} = \frac{\cos x\left(\frac{d}{dx}\sin x\right) - \sin x\left(\frac{d}{dx}\cos x\right)}{(\cos x)^2}$$

$$\frac{dy}{dx} = \frac{\cos x(\cos x) - \sin x(-\sin x)}{(\cos x)^2}$$

$$\frac{dy}{dx} = \frac{\cos^2 x + \sin^2 x}{(\cos x)^2}$$

$$\boxed{\frac{dy}{dx} = \frac{1}{\cos^2 x} = \sec^2 x}$$

Ans. c

Solution: 12

$$y = \frac{x}{\ln x}$$

$$\frac{dy}{dx} = \frac{\ln(x)\left(\frac{d}{dx}(x)\right) - x\left(\frac{d}{dx}(\ln x)\right)}{(\ln x)^2}$$

$$\frac{dy}{dx} = \frac{\ln x - x\left(\frac{1}{x}\right)}{(\ln x)^2}$$

$$\boxed{\frac{dy}{dx} = \frac{\ln x - 1}{(\ln x)^2}}$$



Ans. b

Solution: 13

$$y = \frac{6x^2}{2-x}$$

$$\frac{dy}{dx} = \frac{(2-x)(12x) - 6x^2(0-1)}{(2-x)^2}$$

$$\frac{dy}{dx} = \frac{24x - 12x^2 + 6x^2}{(2-x)^2}$$

$$\boxed{\frac{dy}{dx} = \frac{24x - 6x^2}{(2-x)^2}}$$



Ans. a

Solution: 14

$$y = x^3 - x^2 + x - 1$$

$$\frac{dy}{dx} = 3x^2 - 2x + 1$$

$$\boxed{\frac{d^2y}{dx^2} = 6x - 2}$$



Ans. b

Solution: 15

$$y = \sin x$$

$$\frac{dy}{dx} = \cos x$$

$$\frac{dy}{dx} = -\sin x$$

at, $x = \pi/2$

$$\left(\frac{dy}{dx}\right)_{x=\pi/2} = -\sin\left(\frac{\pi}{2}\right)$$

$$\boxed{\left(\frac{dy}{dx}\right)_{x=\pi/2} = -1}$$

Ans. a

Solution: 16

$$y = e^x$$

$$\frac{dy}{dx} = \frac{d(e^x)}{dx} = e^x$$

$$\frac{d^2y}{dx^2} = \frac{d}{dx}(e^x) = e^x$$

$$\therefore \boxed{\frac{d^2y}{dx^2} = e^x}$$



Ans. c

Solution: 17

$$y = \ln x$$

$$\frac{dy}{dx} = \frac{1}{x} = x^{-1}$$

$$\frac{d^2y}{dx^2} = (-1)\,x^{-1-1}$$

$$\frac{d^2y}{dx^2} = (-1)x^{-2}$$

$$\boxed{\frac{d^2y}{dx^2} = -\frac{1}{x^2}}$$



Ans. b

Solution: 18

$$y = x^x$$

$$\Rightarrow \ln y = \ln(x^x) = x \ln x$$

$$\Rightarrow \frac{d}{dx}(\ln y) = \frac{d}{dx}(x \ln x)$$

$$\Rightarrow \frac{1}{y}\frac{dy}{dx} = x\frac{d}{dx}(\ln x) + (\ln x)\frac{d}{dx}(x)$$

$$\Rightarrow \frac{dy}{dx} = y\left[x \times \frac{1}{x} + \ln x \times 1\right]$$

$$= x^x[1 + \ln x]$$

ANS(b)

Solution: 19

$$x^3 + y^3 = 2xy$$

$$\Rightarrow \frac{d}{dx}(x^3) + \frac{d}{dx}(y^3) = 2\frac{d}{dx}(xy)$$

$$\Rightarrow 3x^2 + 3y^2\frac{dy}{dx} = 2\left[x\frac{dy}{dx} + y\frac{dx}{dx}\right]$$

$$\Rightarrow \frac{dy}{dx}\cdot(3y^2 - 2x) = 2y - 3x^2$$

$$\frac{dy}{dx} = \frac{2y - 3x^2}{3y^2 - 2x}$$

at (1, 1) $\frac{dy}{dx} = \frac{2-3}{3-2} = -1$

Ans (b)

Solution: 20

$$2x = t^2 \Rightarrow 2\frac{dx}{dt} = 2t \Rightarrow \frac{dx}{dt} = t$$

$$y = t^3 + t^2 \Rightarrow \frac{dy}{dt} = 3t^2 + 2t$$

$$\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{3t^2 + 2t}{t} = 3t + 2$$

at $(1, 1)$

$$\frac{dy}{dx} = 3 + 2 = 5$$

Ans(d)

Solution: 21

$$y = \sqrt{\ln x}$$

$$\Rightarrow y^2 = \ln x$$

$$\Rightarrow \frac{d}{dx}(y^2) = \frac{d}{dx}(\ln x)$$

$$\Rightarrow 2y\frac{dy}{dx} = \frac{1}{x}$$

$$\Rightarrow \frac{dy}{dx} = \frac{1}{2xy} = \frac{1}{2x\sqrt{\ln x}}$$



Ans. b

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