



a compilation by  
**O.P. GUPTA (Indira Award Winner)**  
 Useful for CBSE, CUET, JEE & NDA

**Topics :** Continuity & Differentiability

**Max. Marks : 50**

☑ *Select the correct option in the followings. Each question carries 1 mark.*

- Q01. The value of  $\frac{d}{dx}[\sin^{-1}(\cos x)]$  is  
 (a)  $\frac{\pi}{2} - x$  (b)  $-1$  (c)  $1$  (d)  $0$
- Q02. The value of  $\frac{d}{dx}[\log_{10} x]$  is  
 (a)  $\frac{1}{x}$  (b)  $\frac{\log_e 10}{x}$  (c)  $\frac{\log_{10} e}{x}$  (d)  $\frac{x}{\log_e 10}$
- Q03. Let  $f(x) = |x|$ . Then  $Lf'(0) =$   
 (a) Not defined (b)  $0$  (c)  $1$  (d)  $-1$
- Q04. Let  $f(x) = [x]$ , where  $[ ]$  is a greatest integer function. Then  $Rf'(1) =$   
 (a)  $0$  (b)  $1$  (c)  $-1$  (d) Not defined
- Q05. If  $f(x) = \begin{cases} 2 \cos x, & x \neq 0 \\ \log_e k, & x = 0 \end{cases}$  is continuous at  $x = 0$ , then value of  $k$  is  
 (a)  $2$  (b)  $e^2$  (c)  $2^e$  (d)  $\frac{1}{2}$
- Q06. If  $f(x) = \begin{cases} \frac{\sin x}{\cos x} + x \cos x, & x \neq 0 \\ \lambda, & x = 0 \end{cases}$  is continuous at  $x = 0$ , then value of  $\lambda$  is  
 (a)  $0$  (b)  $-1$  (c)  $1$  (d)  $2$
- Q07. Let  $y = \sin t$ ,  $x = t$ . Then  $\frac{dy}{dx}$  is given by  
 (a)  $\sin t$  (b)  $\sec t$  (c)  $-\cos t$  (d)  $\cos t$
- Q08. For  $f(x) = x^x$ ,  $f'(1) =$   
 (a)  $-1$  (b)  $-2$  (c)  $0$  (d)  $1$
- Q09. If  $f(x) = \sin^{-1} \frac{2x}{1+x^2}$ ,  $-1 < x < 1$ , then  $f'(x) =$   
 (a)  $\frac{1}{1+x^2}$  (b)  $\frac{1}{2(1+x^2)}$  (c)  $\frac{2}{1+x^2}$  (d)  $-\frac{2}{1+x^2}$

- Q10. Total number of points at which the function  $f(x) = e^x \log|x|$  is discontinuous, is  
 (a) 0 (b) 1 (c) 2 (d)  $\mathbb{R} - \{0\}$
- Q11. Value of the constant 'k' so that the function  $f(x) = \begin{cases} \frac{k|x|}{x}, & \text{if } x > 0 \\ 3, & \text{if } x \leq 0 \end{cases}$  is continuous at  $x = 0$ , is  
 (a) -3 (b) 3 (c)  $-\frac{1}{\sqrt{2}}$  (d)  $-\frac{\pi}{4}$
- Q12. Let  $f(x) = \begin{cases} \frac{\log(1+2x) - \log(1-3x)}{x}, & \text{if } x \neq 0 \\ k, & \text{if } x = 0 \end{cases}$  be continuous at  $x = 0$ . Then  $k =$   
 (a) 1 (b) -5 (c) 0 (d) 5
- Q13. If  $x \in \mathbb{R} - (-1, 1)$ , then  $\frac{d}{dx}(\operatorname{cosec}^{-1}x) =$   
 (a)  $-\frac{1}{x\sqrt{1-x^2}}$  (b)  $\frac{1}{x\sqrt{x^2-1}}$  (c)  $-\frac{1}{x\sqrt{x^2-1}}$  (d)  $\frac{1}{x\sqrt{1-x^2}}$
- Q14. If  $\pi < x < 2\pi$ , then  $\frac{d}{dx}\left(\tan^{-1}\sqrt{\frac{1+\cos x}{1-\cos x}}\right) =$   
 (a)  $-\frac{1}{2}$  (b) -1 (c)  $\frac{1}{2}$  (d) 1
- Q15. The function  $f(x) = \begin{cases} 2x-1, & x < \frac{1}{2} \\ 3-6x, & x \geq \frac{1}{2} \end{cases}$  is  
 (a) differentiable at  $x = \frac{1}{2}$  as,  $Lf'\left(\frac{1}{2}\right) = 2 = Rf'\left(\frac{1}{2}\right)$   
 (b) not differentiable at  $x = \frac{1}{2}$  as,  $Lf'\left(\frac{1}{2}\right) = -2 \neq Rf'\left(\frac{1}{2}\right) = 2$   
 (c) not differentiable at  $x = \frac{1}{2}$  as,  $Lf'\left(\frac{1}{2}\right) = 2 \neq Rf'\left(\frac{1}{2}\right) = -6$   
 (d) discontinuous at  $x = \frac{1}{2}$  as,  $f\left(\frac{1}{2}\right) \neq \lim_{x \rightarrow \frac{1}{2}} f(x)$
- Q16. If the function given by  $f(x) = \begin{cases} x^2 + 3x + a, & \text{if } x \leq 1 \\ bx + 2, & \text{if } x > 1 \end{cases}$  is differentiable at  $x = 1$ , then  
 (a)  $a - b + 2 = 0$  (b)  $a + b + 2 = 0$  (c)  $a - b - 2 = 0$  (d)  $a - 2b = 0$

Q17. Let  $f(x) = \begin{cases} \frac{x + \sin x}{\sin(k+1)x}, & \text{if } -\pi < x < 0 \\ 2, & \text{if } x = 0 \\ 2 \frac{e^{\sin \lambda x} - 1}{\lambda x}, & \text{if } x > 0 \end{cases}$  be a continuous function at  $x = 0$ . Then  $k =$

- (a) 0 (b)  $\mathbb{R} - \{0\}$  (c)  $\mathbb{R}$  (d) 1

Q18. If  $f(x) = \begin{cases} \frac{2 - 2 \cos 2x}{x^2}; & x < 0 \\ k; & x = 0 \\ \frac{\sqrt{x}}{\sqrt{4 + \sqrt{x}} - 2}; & x > 0 \end{cases}$  is continuous function at  $x = 0$ , then  $k =$

- (a) 16 (b) -4 (c) 4 (d) 1

Q19. If  $y = x^{e^{-x^2}}$ , then  $\left(\frac{dy}{dx}\right)_{\text{at } x=1}$  is

(a) -e (b) e (c) 0 (d)  $e^{-1}$

Q20. If  $y = \sqrt{\log x + \sqrt{\log x + \sqrt{\log x + \dots \text{ to } \infty}}}$ , then  $(2y - 1) \frac{dy}{dx} =$

- (a) x (b)  $-\frac{x}{2}$  (c)  $\frac{x}{2}$  (d)  $\frac{1}{x}$

Q21. If  $x = a \sec \theta$ ,  $y = b \tan \theta$ , and  $\frac{d^2y}{dx^2} = k \left(\frac{b^4}{a^2 y^3}\right)$ , then  $k$  must be

- (a) 1 (b) -1 (c) 0 (d) 2

Q22. If  $y = \tan^{-1} \frac{3x - x^3}{1 - 3x^2}$ , then  $\frac{dy}{dx} =$

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

Q23. If  $y = \sin t$ , then  $\frac{d^2y}{dt^2}$  at  $t = \frac{\pi}{4}$  is

- (a)  $-\frac{1}{\sqrt{2}}$  (b)  $\frac{1}{\sqrt{2}}$  (c) -1 (d) 1

Q24. For  $\tan y = \frac{2t}{1-t^2}$ ,  $\sin x = \frac{2t}{1+t^2}$ ,  $\frac{dy}{dx} =$

- (a) 2 (b) 0 (c) 1 (d) -1

Q25. If  $x = \cos t$  and  $y = \log t$  then,  $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2$  at  $t = \frac{\pi}{2}$  will be

- (a) 2 (b) 0 (c) 1 (d) -1

Q26. If  $y = \cot^{-1} x$ , then

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

Q27. The derivative of  $\tan^{-1}\left(\frac{\sqrt{1-x^2}}{x}\right)$  with respect to  $\cos^{-1}[2x\sqrt{1-x^2}]$ ,  $0 < x \leq \frac{1}{\sqrt{2}}$  is

(a)  $\frac{1}{2}$       (b) 1      (c) 0      (d)  $-\frac{1}{2}$

Q28. If  $x^2 + y^2 = t - \frac{1}{t}$ ,  $x^4 + y^4 = t^2 + \frac{1}{t^2}$  and  $\frac{dy}{dx} = \frac{1}{x^\alpha y^\beta}$ , then  $\alpha + \beta =$

(a) 1      (b) 2      (c) 3      (d) 4

Q29. If  $x = \sqrt{a^{\sin^{-1}t}}$ ,  $y = \sqrt{a^{\cos^{-1}t}}$ , then  $\frac{dy}{dx} =$

(a)  $-\frac{y}{x}$       (b)  $\frac{y}{x}$       (c)  $\frac{x}{y}$       (d)  $-\frac{x}{y}$

Q30. If  $x = 2 \cos \theta - \cos 2\theta$  and  $y = 2 \sin \theta - \sin 2\theta$ , then  $\frac{dy}{dx} =$

(a)  $\tan \frac{\theta}{2}$       (b)  $\tan \frac{3\theta}{2}$       (c)  $\tan 3\theta$       (d)  $\cot \frac{3\theta}{2}$

Q31. If  $x = a \sin pt$  and,  $y = b \cos pt$ . Then  $\frac{d^2y}{dx^2}$  at  $t = 0$  is

(a)  $-\frac{b}{a^2}$       (b)  $\frac{b}{a^2}$       (c)  $\frac{a^2}{b}$       (d)  $-\frac{a^2}{b}$

Q32. If  $e^y(x+1) = 1$  and  $\frac{d^2y}{dx^2} = \left(\frac{dy}{dx}\right)^k$  then  $k =$

(a) 0      (b) 1      (c) 2      (d) 3

Q33. If  $y = \sin^{-1} x$ , then  $(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} =$

(a) 0      (b) 1      (c) 2      (d) 3

Q34.  $\frac{d}{dx}\left[\tan^{-1}\left(\frac{x+1}{x-1}\right) + \tan^{-1}\left(\frac{x-1}{x+1}\right)\right] =$

(a) -1      (b) 1      (c) 2      (d) 0

Q35. If  $y = \log_{\sin x} \sqrt{\sin x}$ , then  $\frac{dy}{dx} =$

(a) 0      (b) 1      (c) 2      (d) -1

Q36. The derivative of  $f(x) = |x-5|$  at  $x = 2$

(a) is 0      (b) is 1      (c) is -1      (d) does not exist

Q37. The derivative of  $\sin(x^2)$  w.r.t.  $x^2$  is

(a)  $-\sin(2x^2)$       (b)  $-2\sin(x^2)$       (c)  $\sin(2x^2)$       (d)  $2\sin(x^2)$

Q38. If  $f(x) = x+1$ , then  $\frac{d}{dx}[(f \circ f)(x)] =$

- (a) 0 (b) 1 (c) 2 (d) -1
- Q39. The differential coefficient of  $f(\ln x)$  where  $f(x) = \ln x$  is  
 (a)  $(x \ln x)^{-1}$  (b)  $x \ln x$  (c)  $(\ln x)^{-1}$  (d)  $x \ln x^{-1}$
- Q40. Given that  $f(x) = \sqrt{x \log_e x}$ , then the value of  $f'(e)$  is  
 (a)  $\sqrt{e}$  (b)  $\frac{1}{e}$  (c)  $e$  (d)  $\frac{1}{\sqrt{e}}$
- Q41. If  $e^y(x+1) = 1$ , then  $\frac{dy}{dx} =$   
 (a)  $e^y$  (b)  $-e^y$  (c)  $-e^{-y}$  (d)  $e^{-y}$
- Q42. The function  $f(x) = [x]$ , where  $[x]$  is the greatest integer function that is less than or equal to  $x$ , is continuous at  
 (a) 4 (b) -2 (c) 1.5 (d) 1
- Q43. If  $y^2(2-x) = x^3$ , then  $\left(\frac{dy}{dx}\right)_{(1,1)}$  is equal to  
 (a) 2 (b) -2 (c) 3 (d)  $-\frac{3}{2}$
- Q44. If  $y = e^{-x}$ , then  $\frac{d^2y}{dx^2}$  is equal to  
 (a)  $-y$  (b)  $y$  (c)  $x$  (d)  $-x$
- Q45. If  $x = t^2 + 1$ ,  $y = 2at$ , then  $\frac{d^2y}{dx^2}$  at  $t = a$  is  
 (a)  $-\frac{1}{a}$  (b)  $-\frac{1}{2a^2}$  (c)  $\frac{1}{2a^2}$  (d) 0
- Q46. The function  $f(x) = \begin{cases} x^2 & \text{for } x < 1 \\ 2-x & \text{for } x \geq 1 \end{cases}$  is  
 (a) not differentiable at  $x = 1$   
 (b) differentiable at  $x = 1$   
 (c) not continuous at  $x = 1$   
 (d) neither continuous nor differentiable at  $x = 1$

Question numbers 47 to 50 are Assertion and Reason based questions. Two statements are given, one labelled **Assertion (A)** and the other labelled **Reason (R)**. Select the correct answer from the codes (a), (b), (c) and (d) as given below.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).  
 (b) Both Assertion (A) and Reason (R) are true and Reason (R) is **not** the correct explanation of Assertion (A).  
 (c) Assertion (A) is true but Reason (R) is false.  
 (d) Assertion (A) is false but Reason (R) is true.
- Q47. **Assertion (A)** : If  $y = \sin(2 \sin^{-1} x)$ , then  $(1-x^2)y_2 = xy_1 - 4y$ .

**Reason (R)** :  $\frac{d}{dx} \left[ \log \left( \frac{1+x}{1-x} \right) \right] = \frac{2}{1-x^2}$ .

Q48. **Assertion (A)** : The function  $f: \mathbb{R} \rightarrow \mathbb{R}$  given by  $f(x) = -|x - 1|$  is continuous but not differentiable at  $x = 1$ .

**Reason (R)** : If a function  $f(x)$  is discontinuous at  $x = c$ , then it may or may not be differentiable at this point  $x = c$ .

Q49. **Assertion (A)** : If  $\sec^{-1}\left(\frac{1+x}{1-y}\right) = a$ , then  $\frac{dy}{dx} = \frac{y+1}{x-1}$ .

**Reason (R)** :  $\frac{d}{dx}[\sec^{-1} x] = \frac{1}{x\sqrt{x^2-1}}$ , where  $x \in \mathbb{R} - [-1, 1]$ .

Q50. **Assertion (A)** : If  $x = e^t \sin t, y = e^t \cos t$ , then the value of  $\frac{dy}{dx}$  at  $t = \frac{\pi}{4}$  is 0.

**Reason (R)** : Second order derivative of a function  $y$  w.r.t.  $x$  can be denoted as  $\frac{d^2y}{dx^2} = \frac{d}{dx}\left(\frac{dy}{dx}\right)$ .

We have released Set of 2 Books for CBSE XII (Academic session 2023-24).

**1. MATHMISSION FOR XII**

- ☑ COMPLETE THEORY & EXAMPLES
- ☑ SUBJECTIVE TYPE QUESTIONS
- ☑ COMPETENCY FOCUSED QUESTIONS
  - ✦ Multiple Choice Questions
  - ✦ Assertion-Reason Questions
  - ✦ Case-Study Questions
  - ✦ Passage-Based Questions

**2. SOLUTIONS OF MATHMISSION**

- ☑ Step-by-step Detailed Solutions (For all Exercises of MATHMISSION)

This document contains MCQs for Mathematics (041) of class XII.

✦ **Answers / Solutions** shall be available on **YouTube channel** – Mathematicia By O.P. Gupta  
You can share this document with other students!

✍ *With a lot of Blessings!*

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