



INDIAN SCHOOL AL WADI AL KABIR

Class XII, Mathematics

Worksheet- Continuity & Differentiability

06 - 04 - 2026

Q.1. Derivative of 2^x with respect to x .

- A. 2^x B. $2^x \log 2$ C. $x \log 2$ D. $2^x(1+x)$

Q.2. If $\sqrt{x} + \sqrt{y} = \sqrt{a}$, then $\frac{dy}{dx}$

- A. $-\frac{\sqrt{x}}{\sqrt{y}}$ B. $\frac{\sqrt{x}}{\sqrt{y}}$ C. $-\frac{\sqrt{y}}{\sqrt{x}}$ D. $\frac{\sqrt{ax}}{\sqrt{y}}$

Q.3. if $y = \log(x + \sqrt{x^2 + a^2})$, then $\frac{dy}{dx}$

- A. $\frac{x}{\sqrt{x^2 + a^2}}$ B. $\frac{\log x}{\sqrt{x^2 + a^2}}$ C. $\frac{2x}{\sqrt{x^2 + a^2}}$ D. $\frac{1}{\sqrt{x^2 + a^2}}$

Q.4. if $y = \log(x)$, then $\frac{d^2y}{dx^2}$

- A. $\frac{x}{\log x}$ B. $\frac{\log x}{x}$ C. $-\frac{1}{x^2}$ D. $\frac{1}{x}$

Q.5. If $x = at^2, y = 3at^3$, then $\frac{dy}{dx}$ at $t = 1$.

- A. 9 B. 9a C. $\frac{9}{2}$ D. $\frac{9}{2a}$

Q6. If $f(x) = \begin{cases} \frac{1 - \cos 4x}{x^2}, & x \neq 0 \\ k, & x = 0 \end{cases}$ is continuous at $x = 0$, then k :

- A. 2 B. 0 C. 4 D. 8

Q7. If $f(x) = \begin{cases} \frac{x^3 - 7x + 6}{x^2 - 9}, & x \neq -3 \\ k, & x = -3 \end{cases}$, then f is continuous when $k =$ ____:

- A. $-\frac{10}{3}$ B. 0 C. 27 D. $\frac{1}{12}$

Q8. If $y = e^{7x} + e^{-7x}$, then $\frac{d^2y}{dx^2}$:

- A $7y$ B $14y$ C $49y$ D $7y^2$

Q9. (A) $\frac{d}{dx}(\log \sin 2x) = \cot 2x$ (R) $\frac{d}{dx}(f(g(x))) = f'(g(x)) \cdot g'(x)$.

- A (A) and (R) are true and R is the correct explanation of (A) B (A) and (R) are true and R is not the correct explanation of (A)
 C (A) is true but (R) is false D (A) is false but (R) is true

Q10. (A) Consider $f(x) = |x| + |x - 1|$. $f(x)$ is not differentiable at $x = 0$ and $x = 1$.

(R) $f(x)$ is differentiable at $x = c$ if LHD = RHD at $x = c$

- A A and (R) are true and R is the correct explanation of (A) B A and (R) are true and R is not the correct explanation of (A)
 C A is true but (R) is false D A is false but (R) is true

Section B- Short answer type (2 marks)

Q11. If $x = t^2, y = t^3$, then find $\frac{d^2y}{dx^2}$.

Q12. Differentiate $\log_7(\log \tan x)$ with respect to x .

Q13 Differentiate with respect to x : $\tan^{-1} \left(\sqrt{\frac{1-\cos x}{1+\cos x}} \right)$.

Q14 Differentiate $\sin^{-1} \left(\frac{2x}{1+x^2} \right)$ with respect to $\tan^{-1} x$

Q15 If $y = \sqrt{\log x + \sqrt{\log x + \sqrt{\log x + \dots}}}$ then show that $(2y - 1) \frac{dy}{dx} = \frac{1}{x}$.

Q16. If $f(x) = \begin{cases} \frac{\sqrt{3}\sin x - \cos x}{x - \frac{\pi}{6}}, & x \neq \frac{\pi}{6} \\ k, & x = \frac{\pi}{6} \end{cases}$ is continuous at $x = \frac{\pi}{6}$, find the value of k .

Q17. Differentiate $\tan^{-1} \left(\frac{\cos x}{1+\sin x} \right)$ with respect to x .

- Q18. If $y = \sin^{-1}x$, then show that $(1 - x^2)y_2 - xy_1 = 0$
- Q19. If $e^y(x + 1) = 1$, then prove that $\frac{dy}{dx} = -e^y$
- Q20. Differentiate $2^{\cos^2 x}$ with respect to $\cos^2 x$.
- Q21. If $y = p\cos ux + q\sin ux$, then prove that $\frac{d^2y}{dx^2} + u^2y = 0$
- Q22. Differentiate x^x with respect to $x \log x$.
- Q23. If $x^y = y^x$, then find $\frac{dy}{dx}$
- Q24. Differentiate $y = \sin^{-1}(3x - 4x^3)$ with respect to x if $x \in \left[-\frac{1}{2}, \frac{1}{2}\right]$
- Q25. Differentiate $\frac{5^x}{x^5}$ with respect to x .
- Q26. Show that the derivative of $\tan^{-1}(\sec x + \tan x)$, $\left[-\frac{\pi}{2} < x < \frac{\pi}{2}\right]$ with respect to x is equal to $\frac{1}{2}$.

Section C -Long answer type (3 Marks)

- Q.27 If $y\sqrt{x^2 + 1} = \log(\sqrt{x^2 + 1} - x)$, then show that $(x^2 + 1)\frac{dy}{dx} + xy + 1 = 0$
- Q28. If $e^y(x + 1) = 1$, then show that $\frac{d^2y}{dx^2} = \left(\frac{dy}{dx}\right)^2$
- Q29. If $x = e^{\frac{x}{y}}$, then prove: $\frac{dy}{dx} = \frac{x - y}{x \log x}$.
- Q30. Differentiate with respect to x : $(\log x)^x + x^{\log x}$
- Q31. If $y = (x + \sqrt{x^2 + a^2})^n$, prove that $\frac{dy}{dx} = \frac{ny}{\sqrt{x^2 + a^2}}$.
- Q32. If $f(x) = \begin{cases} 3ax + b, & \text{if } x > 1 \\ 11, & \text{if } x = 1 \\ 5ax - 2b, & \text{if } x < 1 \end{cases}$ is continuous at $x=1$, find the values of a and b .

Q33. If $y = x + \tan x$, then prove that

$$\cos^2 x \frac{d^2 y}{dx^2} - 2y + 2x = 0$$

Section D (5 Marks)

Q34. Find $\frac{dy}{dx}$ if $x^y + y^x + x^x = a^b$

Q35. If $x^p y^q = (x + y)^{p+q}$, then prove: $\frac{dy}{dx} = \frac{y}{x}$ and $\frac{d^2 y}{dx^2} = 0$

Q36. If $y^x = e^{y-x}$, then prove: $\frac{dy}{dx} = \frac{(1 + \log y)^2}{\log y}$.

Q37. If $x\sqrt{1+y} + y\sqrt{1+x} = 0$, then prove: $\frac{dy}{dx} = -\frac{1}{(1+x)^2}$

Q38. If $y = \cos x^2 + \cos^2 x + \cos^2(x^2) + \cos(x^x)$, find $\frac{dy}{dx}$.

Q39. If $\sqrt{1-x^2} + \sqrt{1-y^2} = a(x-y)$, then prove that $\frac{dy}{dx} = \sqrt{\frac{1-y^2}{1-x^2}}$.

Q40. If $x = a \left(\cos \theta + \log \tan \frac{\theta}{2} \right)$ and $y = \sin \theta$, then find $\frac{d^2 y}{dx^2}$ at $\theta = \frac{\pi}{4}$.

ANSWER KEY

Q1.	B	Q2	C	Q3	D	Q4	C
Q5.	C	Q6	D	Q7	A	Q8	C
Q9.	D	Q10	A	Q11	$\frac{d^2y}{dx^2} = \frac{3}{4t}$	Q12	$\frac{dy}{dx} = \frac{\sec^2 x}{\log 7 \cdot \tan x \cdot \log(\tan x)}$
Q13.	$\frac{dy}{dx} = \frac{1}{2}$	Q14	$\frac{du}{dv} = 2$	Q16	2	Q17	$\frac{dy}{dx} = -\frac{1}{2}$
Q20.	$\frac{du}{dv} = 2^{\cos^2 x}$	Q22	$\frac{du}{dv} = x^x$	Q23	$\frac{dy}{dx} = \frac{y(x \log y - y)}{x(y \log x - x)}$		
Q24	$\frac{dy}{dx} = \frac{3}{\sqrt{1-x^2}}$	Q25	$\frac{dy}{dx} = \frac{\log 5 \cdot 5^x x - 5^{x+1}}{x^6}$				
Q30.	$\frac{dy}{dx} = (\log x)^x \left[\log(\log x) + \frac{1}{\log x} \right] + x^{\log x} \left(\frac{2 \log x}{x} \right)$				Q32	a= 3 b=2	
Q34.	$\frac{dy}{dx} = - \left(\frac{yx^{y-1} + y^x \log y + x^x (1 + \log x)}{x^y \log x + xy^{x-1}} \right)$						
Q38	$\frac{dy}{dx} = -2x \cdot \sin x^2 - \sin 2x - 2x \cdot \sin(2x^2) - \sin(x^x) \cdot x^x (1 + \log x).$						
