INDIAN SCHOOL DARSAIT

Class XII — **Mathematics Worksheet**

Worksheet # 10 Differentiability # 4

(Chapter – 5: Continuity & Differentiability)

	CLASS WORK
1.	If $x = 3\text{Sin}\,t - \text{Sin}\,3t, \quad y = 3\text{Cos}\,t - \text{Cos}\,3t$, find $\frac{dy}{dx}, \frac{d^2y}{dx^2}$ at $t = \frac{\pi}{3}$
2.	If $x = 2\text{Cos}\,\theta - \text{Cos}\,2\theta, \quad y = 2\text{Sin}\,\theta - \text{Sin}\,2\theta$, find $\frac{dy}{dx}, \frac{d^2y}{dx^2}$ at $t = \frac{\pi}{2}$
3.	If $x = a(\theta + \text{Sin}\,\theta), \quad y = a(1 - \cos\theta)$, find $\frac{dy}{dx}, \frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{2}$
4.	If $x = a(\text{Cos}\,t + t\,\text{Sin}\,t), \quad y = a(\text{Sin}\,t - t\,\text{Cos}\,t)$, find $\frac{dy}{dx}, \frac{d^2y}{dx^2}$.
5.	If $x = a\left(\text{Cos}\,t + \log\tan\left(t/2\right)\right), \quad y = a(1 + \text{Sin}\,t)$, find $\frac{dy}{dx}, \frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{4}$
6.	If $x = \sqrt{a^{\text{Sin}^{-1}t}}, \quad y = \sqrt{a^{\text{Cos}^{-1}t}}$, find $\frac{dy}{dx}$. Hence show that $x^2y_2 + xy_1 - y = 0$
7.	If $x = a\,\text{Cos}\,\theta + b\,\text{Sin}\,\theta, \quad y = a\,\text{Sin}\,\theta - b\,\text{Cos}\,\theta$, prove that i) $\frac{dy}{dx} = -\frac{x}{y}$ ii) $y^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = 0$
8.	If $\text{Sin}\,x = \frac{2t}{1+t^2}$, $\text{Tan}\,y = \frac{2t}{1-t^2}$, find $\frac{dy}{dx}$
9.	Find $\frac{dy}{dx}$ if $x = \frac{a(1-t^2)}{1+t^2}, \quad y = \frac{2bt}{1+t^2}$
10.	For a positive constant a, find $\frac{dy}{dx}$ if $y = a^{t+\frac{1}{t}}$ and $x = \left(t + \frac{1}{t}\right)^a$
11.	If $x = \text{Sin}\,t$, $y = \text{Sin}\,pt$ prove that $(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + p^2y = 0$
12.	If $x = \text{Sin}\,\theta$, $y = \text{Cos}\,p\theta$ prove that $(1-x^2)Y_2 - xY_1 + p^2y = 0$
13.	If $y = A\left[x + \sqrt{x^2+1}\right]^n + B\left[x - \sqrt{x^2+1}\right]^{-n}$, then show that $(x^2+1)\frac{d^2y}{dx^2} + x\frac{dy}{dx} - n^2y = 0$
14.	Differentiate $\text{Tan}^{-1}\left[\frac{\sqrt{1+x^2}-1}{x}\right]$ with respect to $\text{Tan}^{-1}x$
15.	Differentiate $\text{Sin}^{-1}\left[\frac{2x}{1+x^2}\right]$ with respect to $\text{Tan}^{-1}\left[\frac{2x}{1-x^2}\right]$
16.	Differentiate $\text{Tan}^{-1}\left[\frac{\sqrt{1+x^2}-\sqrt{1-x^2}}{\sqrt{1+x^2}+\sqrt{1-x^2}}\right]$ with respect to $\text{Cos}^{-1}x^2$
	HOME WORK
17.	If $x = a(\theta - \text{Sin}\,\theta), \quad y = a(1 + \cos\theta)$, find $\frac{dy}{dx}, \frac{d^2y}{dx^2}$.
18.	Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ if $x = a(\text{Cos}\,\theta + \theta\,\text{Sin}\,\theta), \quad y = a(\text{Sin}\,\theta - \theta\,\text{Cos}\,\theta)$

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19.	If $x=\frac{\text{Sin}^3 t}{\sqrt{\text{Cos}\,2t}}$, $y=\frac{\text{Cos}^3 t}{\sqrt{\text{Cos}\,2t}}$, prove that $\frac{dy}{dx}=-Cot3t$
20.	Find $\frac{dy}{dx}$ if $x=t+\frac{1}{t}$, $y=t-\frac{1}{t}$
21.	If $x=3\text{Cos}\,\theta-2\text{Cos}^3\theta$, $y=3\text{Sin}\,\theta-2\text{Sin}^3\theta$, find $\frac{dy}{dx}$
22.	If $x=\frac{1+\log t}{t^2}$, $y=\frac{3+2\log t}{t}$, find $\frac{dy}{dx}$
23.	Find the value of $\frac{dy}{dx}$ at $\theta=\frac{\pi}{4}$ If $x=ae^{\theta}\left(\text{Sin}\,\theta-\text{Cos}\,\theta\right)$, $x=ae^{\theta}\left(\text{Sin}\,\theta+\text{Cos}\,\theta\right)$
24.	If $y=Ae^{-kt}\,\text{Cos}\left(pt+c\right)$, prove that $\frac{d^2y}{dt^2}+2k\frac{dy}{dt}+n^2y=0$ where $n^2=p^2+k^2$
25.	Differentiate $\text{Tan}^{-1}\left[\frac{\sqrt{1+x^2}-1}{x}\right]$ with respect to $Si\,\text{n}^{-1}\left[\frac{2x}{1+x^2}\right]$
26.	Differentiate $Si\,\text{n}^{-1}\left[\frac{2x}{1+x^2}\right]$ with respect to $\text{Cos}^{-1}\left[\frac{1-x^2}{1+x^2}\right]$
	SELF STUDY
27.	f $x=e^{\theta}\left(\theta+\frac{1}{\theta}\right)$, $y=e^{-\theta}\left(\theta-\frac{1}{\theta}\right)$, find $\frac{dy}{dx}$
28.	If $x=e^{\text{Cos}\,2t}$, $y=e^{\text{Sin}\,2t}$, prove that $\frac{dy}{dx}=\frac{-y\log x}{x\log y}$
29.	If $x=a\,\text{Sin}\,2t\left(1+\text{Cos}\,2t\right)$, $y=b\,\text{Cos}\,2t\left(1-\text{Cos}\,2t\right)$, show that $\frac{dy}{dx}$ at $t=\frac{\pi}{4}$ is $\frac{b}{a}$
30.	If $x=a\,\text{Sec}^3\theta$, $y=a\tan^3\theta$ find $\frac{dy}{dx}$ at $\theta=\frac{\pi}{3}$
31.	If $x=\text{Cos}\,t\left(3-2\text{Cos}^2 t\right)$, $y=\text{Sin}\,t\left(3-2\text{Sin}^2 t\right)$ find $\frac{dy}{dx}$ at $\theta=\frac{\pi}{4}$