BYJU'S Home Learning Program

Topic covered:

- **Mathematical Tools (Session - 2) - NEET**

Daily Practice Problems

1. If the value of $\log_{10} 2 = 0.3$ and $\log_{10} 3 = 0.5$, then find the value of $\log_{10} 6$.

2. Given that $y = 4 \times 10^{2x}$, express x in terms of y, giving an exact simplified answer in terms of logarithmic base 10.

3. Find the derivative of function $y = x \cos x$.

4. If $y = \sin x$ and $x = 3t$, then $\frac{dy}{dt}$ will be
   a. $9 \cos(x)$
   b. $\cos(x)$
   c. $3 \cos(3t)$
   d. $-\cos x$

5. If $y = \sin(\ln x)$, then $\frac{dy}{dx}$ will be
   a. $\frac{\cos(\ln x)}{x}$
   b. $-\sin(\ln x)$
   c. $\cos(\ln x)$
   d. $\sin \frac{\ln x}{x}$

6. If $y = x^3$, then $\frac{d^2y}{dx^2}$ is
   a. $6x^2$
   b. $6x$
   c. $3x^2$
   d. $3x$

7. If $y = \sin x$, then $\frac{d^2y}{dx^2}$ will be
   a. $\cos x$
   b. $\sin x$
   c. $-\sin x$
   d. $2 \sin x$

8. If $S = ut + \frac{1}{2}at^2$, where S is displacement, u is initial velocity (constant), a is acceleration (constant) and t is time taken, then differentiation of S w.r.t. t will be
   a. $u + \frac{at}{2}$
   b. $u + at$
   c. $u + 2at$
   d. $\frac{ut^2}{2} + \frac{at^3}{6}$

9. If velocity of particle is given by $v = 2t^4$, then its acceleration $\left(\frac{dv}{dt}\right)$ at any time t will be given by
   a. $8t^3$
   b. $8t$
   c. $-8t^3$
   d. t^2

10. Find the derivative of $y = (x^2 + 1)(x^3 + 3)$.

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Answer Key

Question Number	1	2	3	4	5
Answer Key	0.8	$x = \frac{1}{2}\log_{10}\frac{y}{4}$	$\cos x - x\sin x$	(c)	(a)

Question Number	6	7	8	9	10
Answer Key	(b)	(c)	(b)	(a)	$5x^4 + 3x^2 + 6x$

Solutions

1. $\log_{10} 6 = \log_{10}(2 \times 3) = \log_{10} 2 + \log_{10} 3 = 0.8$

2. $y = 4 \times 10^{2x}$
   $\frac{y}{4} = 10^{2x}$
   We know,
   If $y = a^x$, then $x = \log_a y$
   So, $2x = \log_{10} \frac{y}{4}$
   $x = \frac{1}{2} \log_{10} \frac{y}{4}$

3. $y = x \cos x$
   $\frac{dy}{dx} = \cos x + x\,(-\sin x) = \cos x - x \sin x$

4. (c)
   $y = \sin x,\quad x = 3t$
   $\frac{dy}{dx} = \cos x,\quad \frac{dx}{dt} = 3$
   $\frac{dy}{dt} = \frac{dy}{dx} \times \frac{dx}{dt} = 3 \cos x = 3 \cos(3t)$
   Alternative:
   Replace the value of x in $\sin x$ by $3t$
   $y = \sin(3t)$
   $\frac{dy}{dt} = 3 \cos(3t)$

5. (a)
   $y = \sin(\ln x)$
   $\frac{dy}{dx} = \frac{\cos(\ln x)}{x}$

6. (b)
   $y = x^3$
   $\frac{dy}{dx} = 3x^2$
   $\frac{d^2y}{dx^2} = 6x$

7. (c)
   $y = \sin x$
   $\frac{dy}{dx} = \cos x$
   $\frac{d^2y}{dx^2} = -\sin x$

8. (b)

$S = ut + \frac{1}{2}at^2$

$\frac{dS}{dt} = u + \frac{1}{2}a \times 2t = u + at$ (This is the velocity of particle at any time t)

9. (a)

$v = 2t^4$

$a = \frac{dv}{dt} = 2 \times 4t^3 = 8t^3$

10. From the product rule with $u = x^2 + 1$ and $v = x^3 + 3$, we find

$$\frac{d}{dx}[(x^2 + 1)(x^3 + 3)] = (x^2 + 1)(3x^2) + (x^3 + 3)(2x)$$
$$= 3x^4 + 3x^2 + 2x^4 + 6x$$
$$= 5x^4 + 3x^2 + 6x$$

Alternative:

$y = (x^2 + 1)(x^3 + 3) = x^5 + x^3 + 3x^2 + 3$

$\frac{dy}{dx} = 5x^4 + 3x^2 + 6x$