
NDA 2 2024
LIVE
MATHS
DIFFERENTIATION
CLASS 1
SSBCrack EXAMS
NAVJYOTI SIR
Crack EXAMS

21 June 2024 Live Classes Schedule

8:00AM	21 JUNE 2024 DAILY CURRENT AFFAIRS	RUBY MA'AM
9:00AM	21 JUNE 2024 DAILY DEFENCE UPDATES	DIVYANSHU SIR

SSB INTERVIEW LIVE CLASSES

9:00AM	MOCK PERSONAL INTERVIEW	ANURADHA MA'AM

AFCAT 2 2024 LIVE CLASSES

2:30PM	STATIC GK - POLITY - CLASS 1	DIVYANSHU SIR
4:00PM	MATHS - STATISTICS - CLASS 2	NAVJYOTI SIR
5:30PM	ENGLISH - WORD SUBSTITUTION - CLASS 1	ANURADHA MA'AM

NDA 2 2024 LIVE CLASSES

11:30AM	GK - ANCIENT HISTORY - CLASS 2	RUBY MA'AM
2:30PM	GS - CHEMISTRY - CLASS 9	SHIVANGI MA'AM
6:30PM	MATHS - DIFFERENTIATION - CLASS 1	NAVJYOTI SIR

CDS 2 2024 LIVE CLASSES

11:30AM	GK - ANCIENT HISTORY - CLASS 2	RUBY MA'AM
2:30PM	GS - CHEMISTRY - CLASS 9	SHIVANGI MA'AM
4:00PM	MATHS - STATISTICS - CLASS 2	NAVJYOTI SIR

SSBCrack EXAMS

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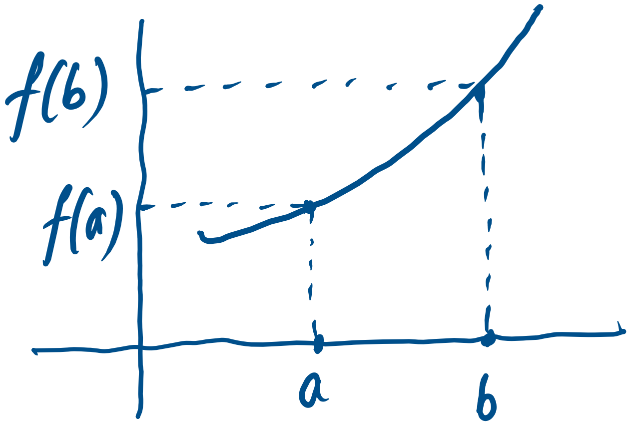
DERIVATIVE OF A FUNCTION



$x \longrightarrow a$ to b

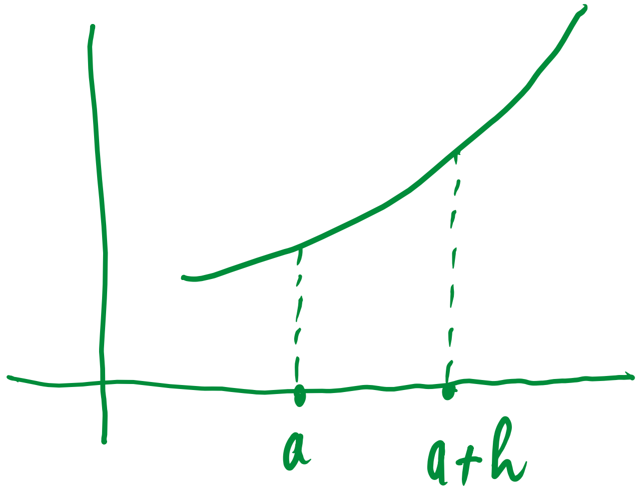
$y \,/\, f(x) \rightarrow f(a)$ to $f(b)$

$$\frac{f(b) - f(a)}{b - a} \quad (b - a \longrightarrow 0) = \text{derivative of } f(x)$$

or,

$$\lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x} = \left(\frac{dy}{dx}\right)$$

DERIVATIVE OF A FUNCTION



$$\lim_{h \to 0} \frac{f(a+h) - f(a)}{a+h-a} = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

$$\left[\frac{dy}{dx} = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h} \right]$$

DIFFERENTIATION OF IMPORTANT FUNCTIONS

$$\frac{d}{dx}(c) = 0, c \text{ is independent of } x$$

$$\frac{d}{dx}(x^n) = nx^{n-1}$$

$x^2 = 2x^{2-1} = 2x^1 = 2x$

$x^6 = 6x^5$

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

$$\frac{d}{dx}(\cos x) = -\sin x$$

$$\frac{d}{dx}(\tan x) = \sec^2 x, \left\{x \neq n\pi + \frac{\pi}{2}\right\}$$

$$\frac{d}{dx}(\cot x) = -\operatorname{cosec}^2 x, \{x \neq n\pi\}$$

$$\frac{d}{dx}(\sec x) = \sec x \tan x, \left\{x \neq n\pi + \frac{\pi}{2}\right\}$$

$$\frac{d}{dx}(\operatorname{cosec} x) = -\operatorname{cosec} x \cot x, \{x \neq n\pi\}$$

$$\frac{d}{dx}(\sin^{-1} x) = \frac{1}{\sqrt{1 - x^2}}, |x| < 1$$

$$\frac{d}{dx}(\cos^{-1} x) = -\frac{1}{\sqrt{1 - x^2}}, |x| < 1$$

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

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

$$\frac{d}{dx}(\sec^{-1} x) = \frac{1}{|x|\sqrt{x^2 - 1}}, |x| > 1 = \frac{1}{x\sqrt{x^2-1}}$$

$$\frac{d}{dx}(\operatorname{cosec}^{-1} x) = -\frac{1}{|x|\sqrt{x^2 - 1}}, |x| > 1 \quad -\frac{1}{x\sqrt{x^2-1}}$$

NDA 2 2024 LIVE CLASS - MATHS - PART 1

$$\frac{d}{dx}\left(x^{-3}\right) = (-3)\,x^{-3-1}$$

$$= -3x^{-4} = \frac{-3}{x^4}$$

$$\rightarrow \frac{d}{dx}\left(x^{n}\right) = nx^{n-1}$$

$$\rightarrow \frac{d}{dx}\left(x^{-n}\right) = \frac{-n}{x^{n+1}}$$

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

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

$$= \frac{1}{2\sqrt{x}}$$

DIFFERENTIATION OF IMPORTANT FUNCTIONS

$$\frac{d}{dx}(a^x) = a^x \log_e a, \quad a > 0.$$

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

$$\frac{d}{dx}(\log_e x) = \frac{1}{x}, (x > 0)$$

$$\frac{d}{dx}(\log_a x) = \frac{1}{x \log_e a}$$

$$\frac{d}{dx}|x| = \frac{x}{|x|} \text{ or } \frac{|x|}{x}, \{x \neq 0\}$$

$$\frac{d}{dx}\sqrt{x} = \frac{1}{2\sqrt{x}}$$

$$\frac{d}{dx} x^x = x^x (1 + \log x)$$

$$\frac{d}{dx}\frac{1}{f(x)} = -\frac{1}{(f(x))^2} \cdot \frac{d}{dx} f(x), \ f(x) \neq 0$$

$|x|$: $-x$ for $x < 0$; x for $x \geq 0$

$\frac{|x|}{x}$

$x > 0 \rightarrow \frac{d}{dx}(|x|) = 1$

$x < 0 \rightarrow \frac{d}{dx}(|x|) = -1$

FORMULAE OF DIFFERENTIATION

$(uv)' = uv' + u'v$

Product Rule

$$\frac{d}{dx}[f(x)g(x)] = f(x)g'(x) + g(x)f'(x)$$

$= g(x)f'(x) + f(x)g'(x)$

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

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

Quotient Rule

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$$

$$\left(\frac{u}{v}\right)' = \frac{vu' - uv'}{v^2}$$

DIFFERENTIABILITY OF FUNCTION

$f(x)$ is differentiable at $x = a$,

$\lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$ & $\lim_{h \to 0} \frac{f(a) - f(a-h)}{h}$ exists

$\lim_{x \to a} f'(x) = l$,

LHL RHL

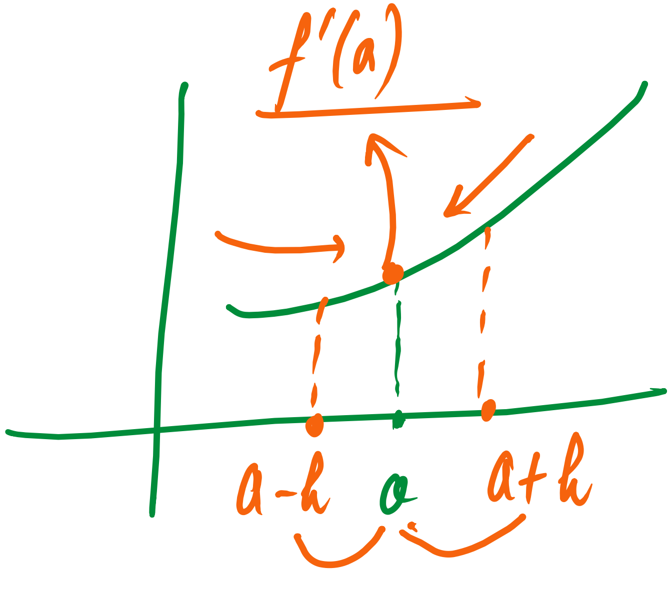
LHL $\to \lim_{x \to a^-} f'(x)$

RHL $\to \lim_{x \to a^+} f'(x)$

DIFFERENTIABILITY OF FUNCTION

Right hand derivative Right hand derivative of $f(x)$ at $x = a$, denoted by $f'(a+0)$ of $f'(a^+)$, is the $\lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$.

Left hand derivative Left hand derivative of $f(x)$ at $x = a$, denoted by $f'(a-0)$ or $f'(a^-)$, is the $\lim_{h \to 0} \frac{f(a-h) - f(a)}{-h}$. $= \frac{f(a) - f(a-h)}{h}$



QUESTION

Let $f : R \to R$ be defined as

$f(x) = \sin(|x|)$

Which one of the following is correct?

(a) f is not differentiable only at 0 ✓

(b) f is differentiable at 0 only

(c) f is differentiable everywhere ✓

(d) f is non-differentiable at many points ✓

$f(x) = \sin|x|$ = $\sin x$, $x \geq 0$; $\sin(-x) = -\sin x$, $x < 0$

$f'(x)$ = $\cos x$, $x \geq 0$; $-\cos x$, $x < 0$

At $x = 0$,

LHD → 1

RHD → −1

LHD ≠ RHD,

At all points (x) where, $\cos x = 1$, $f(x)$ is not differentiable.

NDA 2 2024 LIVE CLASS - MATHS - PART 1

CHAIN RULE

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

$$\frac{dy}{dx} = \begin{pmatrix}\text{Differentiate outer function} \\ \text{Keep the inside the same}\end{pmatrix}\begin{pmatrix}\text{Differentiate inner function}\end{pmatrix}$$

$$\frac{d}{dx}\left[(f(x))^n\right] = n(f(x))^{n-1} \cdot f'(x)$$

$$\frac{d}{dx}\left[f(g(x))\right] = f'(g(x))g'(x)$$

$$y = \sin(\sqrt{x})$$

$$\frac{dy}{dx} = \cos\sqrt{x} \cdot \left(\frac{1}{2\sqrt{x}}\right) = \frac{1}{2\sqrt{x}} \cdot \cos\sqrt{x}$$

$$y = \tan^3 x$$

$$\frac{dy}{dx} = 3(\tan^2 x)\frac{d}{dx}(\tan x)$$

$$= 3\tan^2 x \sec^2 x$$

EXAMPLE

What is the derivative of sin (sin x) ?

(a) cos (cos x) (b) cos (sin x)

(c) cos (sin x)cos$x$ (d) cos (cos x)cos$x$

$= \sin(\sin x)$ Let $u = \sin x$

$= \sin u$ $\frac{du}{dx} = \cos x$

$= \cos u \cdot \frac{du}{dx}$

$= \cos u \cdot \cos x$

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

EXAMPLE

What is the derivative of $\sin(\sin x)$?

(a) $\cos(\cos x)$

(b) $\cos(\sin x)$

(c) $\cos(\sin x)\cos x$

(d) $\cos(\cos x)\cos x$

Ans: (c)

PARAMETRIC FORM

To find $\frac{dy}{dx}$ in such a case,

$$\frac{dy}{dx} = \frac{dy/dt}{dx/dt}$$

$x = t^2$

$y = \cos t$

$$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = -\frac{\sin t}{2t} = -\frac{1}{2t}(\sin t)$$

EXAMPLE

Find $\frac{dy}{dx}$, if $x = a(\theta - \sin\theta)$ and $y = a(1 - \cos\theta)$

θ

$\frac{dy}{d\theta} = a(0 - (-\sin\theta)) = a\sin\theta$

$\frac{dx}{d\theta} = a(1 - \cos\theta) = a(1 - \cos\theta)$

$\frac{dy}{dx} = \left(\frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}}\right) = \frac{a\sin\theta}{a(1-\cos\theta)} = \frac{\sin\theta}{1-\cos\theta} = \cot\theta/2$

x

$\frac{d}{dx}(cx^2)$

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

$= c(2x)$

IMPLICIT FUNCTION

$f(x, y)$

$$xy + \sin x = 2$$

$$x\frac{dy}{dx} + y(1) + \cos x = 0$$

$$\left\{\frac{dy}{dx} = \frac{-\cos x - y}{x}\right\}$$

EXAMPLE

If $x^2 + 2xy + y^3 = 4$, find $\frac{dy}{dx}$

$$2x + 2\left(x\frac{dy}{dx} + y(1)\right) + 3y^2\left(\frac{dy}{dx}\right) = 0$$

$$\frac{dy}{dx}\left(2x + 3y^2\right) = -2y - 2x$$

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

DIFFERENTIATION BY SUBSTITUTION

Expressions	Substitutions
$a^2 + x^2$	$x = a \tan\theta$
$a^2 - x^2$	$x = a \sin\theta$ or $x = a \cos\theta$
$x^2 - a^2$	$x = a\sec\theta$ or $x = a\ \text{cosec}\,\theta$
$\frac{a+x}{a-x}$ or $\frac{a-x}{a+x}$	$x = a \tan\theta$
$\sqrt{\frac{a+x}{a-x}}$ or $\sqrt{\frac{a-x}{a+x}}$	$x = a \cos\theta$
$\frac{2x}{1+x^2}$ or $\frac{2x}{1-x^2}$	$x = \tan\theta$

EXAMPLE

$\sin(\phi) = \phi$

derivative of $\sin^{-1}\left(\frac{\sqrt{1+x}+\sqrt{1-x}}{2}\right)$ *wrt x*

$x = \cos 2\theta$ | $\cos^{-1}x = 2\theta$

$\theta = \frac{1}{2}\cos^{-1}x$

$1+x = 1+\cos 2\theta = 2\cos^2\theta$

$1-x = 1-\cos 2\theta = 2\sin^2\theta$

$\sin^{-1}\left(\frac{\sqrt{2\cos^2\theta}+\sqrt{2\sin^2\theta}}{2}\right)$

$\sin^{-1}\left(\frac{1}{\sqrt{2}}\left(\cos\theta+\sin\theta\right)\right)$

$= \sin^{-1}\left(\frac{1}{\sqrt{2}}\cos\theta + \frac{1}{\sqrt{2}}\sin\theta\right) = \sin^{-1}\left(\sin 45^\circ\cos\theta + \cos 45^\circ\sin\theta\right)$

$= \sin^{-1}\left(\sin(45^\circ+\theta)\right) = 45^\circ+\theta = \frac{\pi}{4}+\theta = \left\{\frac{\pi}{4}+\frac{1}{2}\cos^{-1}x\right\}$

LOGARITHMIC DIFFERENTIATION

$$y = x^x$$

$$\log y = x \log x$$

$$\{\log a^m = m \log a\}$$

$$\frac{1}{y}\frac{dy}{dx} = x\left(\frac{1}{x}\right) + \log x(1)$$

$$\frac{dy}{dx} = (1 + \log x)\, y$$

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

① $y = f(x)$

② $f(x, y) = 0$

③ $x =$ ____ (substitution)

④ $\{x^x \,/\, y^x \,/\, x^y$

(Logarithmic)

EXAMPLE

If $x^y = e^{x-y}$, then $\frac{dy}{dx}$ is equal to which one of the following?

(a) $\frac{(x-y)}{(1+\log x)^2}$ (b) $\frac{y}{(1+\log x)}$

(c) $\frac{(x+y)}{(1+\log x)}$ (d) $\frac{(\log x)}{(1+\log x)^2}$

$\log_e e = 1$

$y \log x = (x-y) \log e$

$y \log x = x - y$

$y\left(\frac{1}{x}\right) + \log x \left(\frac{dy}{dx}\right) = 1 - \frac{dy}{dx}$

$\frac{dy}{dx} = \frac{1 - y/x}{1 + \log x} = \frac{x-y}{x(1+\log x)}$

$= \frac{y \log x}{x(1+\log x)}$

SSBCrack EXAMS

Q) If $y = e^{\frac{1}{2}\log(1+\tan^2 x)}$, then $\frac{dy}{dx}$ is equal to

(a) $\frac{1}{2}\sec^2 x$ (b) $\sec^2 x$

(c) $\sec x \tan x$ (d) $e^{\frac{1}{2}\log(1+\tan^2 x)}$

SSBCrack EXAMS

Q) If $y = e^{\frac{1}{2}\log(1+\tan^2 x)}$, then $\frac{dy}{dx}$ is equal to

(a) $\frac{1}{2}\sec^2 x$

(b) $\sec^2 x$

(c) $\sec x \tan x$

(d) $e^{\frac{1}{2}\log(1+\tan^2 x)}$

Ans: (c)

Q) If $y = 2^x \cdot 3^{2x-1}$, then $\frac{dy}{dx}$ is equal to

(a) $(\log 2)(\log 3)$

(b) $(\log 18)$

(c) $(\log 18^2)\, y^2$

(d) $(\log 18)\, y$

SSBCrack EXAMS

Q) If $y = 2^x \cdot 3^{2x-1}$, then $\frac{dy}{dx}$ is equal to

(a) $(\log 2)(\log 3)$

(b) $(\log 18)$

(c) $(\log 18^2)\, y^2$

(d) $(\log 18)\, y$

Ans: (d)

SSBCrack EXAMS

Q) What is the derivative of $\frac{\sec x + \tan x}{\sec x - \tan x}$?

(a) $2 \sec x (\sec x + \tan x)$

(b) $2 \sec^2 x (\sec x + \tan x)^2$

(c) $2 \sec x (\sec x + \tan x)^2$

(d) $\sec x (\sec x + \tan x)^2$

Q) What is the derivative of $\dfrac{\sec x + \tan x}{\sec x - \tan x}$?

(a) $2 \sec x (\sec x + \tan x)$

(b) $2 \sec^2 x (\sec x + \tan x)^2$

(c) $2 \sec x (\sec x + \tan x)^2$

(d) $\sec x (\sec x + \tan x)^2$

Ans: (c)

DIFFERENTIATION OF FUNCTION w.r.t OTHER FUNCTION

Let $u = f(x)$ and $v = g(x)$ be two functions of x. Then, to find the derivative of $f(x)$ *wrt* $g(x)$, *i.e.*, to find $\frac{du}{dv}$ we use the following formula $\frac{du}{dv} = \frac{du/dx}{dv/dx}$

EXAMPLE

differentiation of $\log \sin x$ *wrt* $\sqrt{\cos x}$

$u = \log \sin x$

$v = \sqrt{\cos x}$

$$\left(\frac{du}{dv}\right) = \frac{\left(\frac{du}{dx}\right)}{\left(\frac{dv}{dx}\right)} = \frac{\frac{1}{\sin x} \cdot \cos x}{\frac{1}{2\sqrt{\cos x}} \cdot (-\sin x)} = -\frac{2(\cos x)^{3/2}}{\sin^2 x}$$

— x —

SUCCESSIVE DIFFERENTIATION

Let $y = f(x)$ be a function of x, then $\frac{dy}{dx}$ is called first derivative of a function and derivative of first derivative, $\frac{d^2y}{dx^2}$ is called second derivative of original function and so on.

The process of differentiating a function more than once is called successive differentiation.

$f'(x)$ — first derivative — $\frac{dy}{dx}$

$f''(x)$ — second " — $\frac{d^2y}{dx^2}$

$f'''(x)$ ⟶ $\frac{d^3y}{dx^3}$

$y = x^4$

$y' = 4x^3$

$y'' = 4(3x^2) = 12x^2$

$y''' = 12(2x) = 24x$

$y'''' = 24$

IMPORTANT RESULT

$$\frac{d^n}{dx^n}(\sin x) = \sin\left(x + \frac{n\pi}{2}\right)$$

$$\frac{d^n}{dx^n}(\cos\ x) = \cos\left(x + \frac{n\pi}{2}\right)$$

DIFFERENTIATION OF DETERMINANT

To differentiate a determinant, we differentiate one row (or column) at a time, keeping others unchanged.

If $$y = \begin{vmatrix} f(x) & g(x) & h(x) \\ p(x) & q(x) & r(x) \\ u(x) & v(x) & w(x) \end{vmatrix}$$

$$\therefore \quad \frac{dy}{dx} = \begin{vmatrix} f'(x) & g'(x) & h'(x) \\ p(x) & q(x) & r(x) \\ u(x) & v(x) & w(x) \end{vmatrix} + \begin{vmatrix} f(x) & g(x) & h(x) \\ p'(x) & q'(x) & r'(x) \\ u(x) & v(x) & w(x) \end{vmatrix}$$

$$+ \begin{vmatrix} f(x) & g(x) & h(x) \\ p(x) & q(x) & r(x) \\ u'(x) & v'(x) & w'(x) \end{vmatrix}$$

EXAMPLE

$$f(x)=\begin{vmatrix} x^3 & x^2 & 3x^2 \\ 1 & -6 & 4 \\ p & p^2 & p^3 \end{vmatrix}$$, here p is a constant, then $\frac{d^3 f(x)}{dx^3}$ is

(a) proportional to x^2
(b) proportional to x
(c) proportional to x^3
(d) a constant

EXAMPLE

$$f(x)=\begin{vmatrix} x^3 & x^2 & 3x^2 \\ 1 & -6 & 4 \\ p & p^2 & p^3 \end{vmatrix}$$, here p is a constant, then $\frac{d^3 f(x)}{dx^3}$ is

(a) proportional to x^2

(b) proportional to x

(c) proportional to x^3

(d) a constant

Ans: (d)

SSBCrack EXAMS

Q) If $e^y + xy = e$, then what is the value of $\frac{d^2y}{dx^2}$ at $x = 0$?

(a) e^{-1}
(b) e^{-2}
(c) e
(d) 1

$x = 0 \longrightarrow e^y + 0 = e$

$e^y = e^1$

$\Rightarrow y = 1$

$e^y \cdot \frac{dy}{dx} + \left(x\frac{dy}{dx} + y\right) = 0$

{At $x = 0$, $y = 1$}

$\frac{dy}{dx} = -\frac{y}{(e^y + x)}$

at $x = 0 \Rightarrow \left(\frac{-y}{e^y}\right)$

$\frac{d^2y}{dx^2} = -\frac{\left[(e^y + x)\left(\frac{dy}{dx}\right) - y\left(e^y \cdot \frac{dy}{dx} + 1\right)\right]}{(e^y + x)^2}$

at $x = 0$

{$x = 0$, $y = 1$}

$= -\frac{\left[(e^y)\left(\frac{-y}{e^y}\right) - y\left(e^y \cdot \left(\frac{-y}{e^y}\right) + 1\right)\right]}{e^{2y}}$

$= -(-y + y^2 - y)/e^{2y} = (1/e^2) = e^{-2}$

SSBCrack EXAMS

Q) If $e^y + xy = e$, then what is the value of $\frac{d^2y}{dx^2}$ at $x = 0$?

(a) e^{-1}

(b) e^{-2}

(c) e

(d) 1

Ans: (b)

SSBCrack EXAMS

Q) If $x = 3\tan t$ and $y = 3\sec t$, then the value of $\frac{d^2y}{dx^2}$ at $t = \frac{\pi}{4}$, is

(a) $\frac{1}{6}$

(b) $\frac{1}{6\sqrt{2}}$

(c) $\frac{1}{3\sqrt{2}}$

(d) $\frac{3}{2\sqrt{2}}$

Q) If $x = 3\tan t$ and $y = 3\sec t$, then the value of $\frac{d^2y}{dx^2}$ at $t = \frac{\pi}{4}$, is

(a) $\frac{1}{6}$

(b) $\frac{1}{6\sqrt{2}}$

(c) $\frac{1}{3\sqrt{2}}$

(d) $\frac{3}{2\sqrt{2}}$

Ans: (b)

Q) For $x \in \left(0, \frac{1}{4}\right)$, if the derivative of

$\tan^{-1}\left(\frac{6x\sqrt{x}}{1-9x^3}\right)$ is $\sqrt{x} \cdot g(x)$, then $g(x)$ equals

(a) $\frac{9}{1+9x^3}$ (b) $\frac{3x\sqrt{x}}{1-9x^3}$ (c) $\frac{3x}{1-9x^3}$ (d) $\frac{3}{1+9x^3}$

SSBCrack EXAMS

Q) If $x = \dfrac{1 - t^2}{1 + t^2}$ and $y = \dfrac{2t}{1 + t^2}$, then $\dfrac{dy}{dx}$ is equal to

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

Q) If $x = \dfrac{1-t^2}{1+t^2}$ and $y = \dfrac{2t}{1+t^2}$, then $\dfrac{dy}{dx}$ is equal to

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

Ans: (c)

SSBCrack EXAMS

Q) $y = A\sin(\log x) + B\cos(\log x)$.

What is the value of $x\dfrac{d}{dx}\left(x\dfrac{dy}{dx}\right)$?

(a) 0 (b) 1 (c) y (d) $-y$

Q) $y = A\sin(\log x) + B\cos(\log x)$.

What is the value of $x\dfrac{d}{dx}\left(x\dfrac{dy}{dx}\right)$?

(a) 0 (b) 1 (c) y (d) $-y$

Ans: (d)

What is the sum of the first 50 terms of the series

$(1\times3)+(3\times5)+(5\times7)+\ldots$?

(a) 1,71,650 (b) 26,600

(c) 26,650 (d) 26,900

$(1\times3)+(3\times5)+(5\times7)+\ldots$

$(2n-1)(2n+1)$

n = 1 n = 2 n = 3

$a_n = (2n-1)(2n+1) = (2n)^2 - (1)^2$

$= 4n^2 - 1$

$S_n = \sum a_n$

$S_n = \sum(4n^2 - 1)$

$= \sum 4n^2 - \sum 1$

$= 4\sum_{1}^{50} n^2 - \sum_{1}^{50} 1$

$= 4(1^2 + 2^2 + 3^2 + \ldots 50^2) - (1+1+1+\ldots (50 \text{ times}))$

$= \frac{4(50)(51)(101)}{6} - 50$

$$1^2 + 2^2 + \dots n^2 = \frac{n(n+1)(2n+1)}{6}$$

$$= \frac{\overset{25}{\cancel{50}} \times \overset{17}{\cancel{51}} \times 101}{\cancel{6}\ \cancel{2}} = 25(100+1) \times 17$$

$$= 2525 \times 17$$

$$= \underline{42925}$$

$$4 \times 42925 - 50$$

$$= \quad 0$$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