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Std :- 12th A Subject- Maths - I Date :- 11.4.21

Q1) A]

① If $P \to q$ is an implication, then the implication $\sim q \to \sim p$ is called as contrapositive.

→ (b) contrapositive.

② If $A = \begin{bmatrix} 6 & 0 \\ p & q \end{bmatrix}$ is a scalar matrix then the value of p and q are 0 and 6.

→ (b) 0 and 6

③ If $y = \sqrt[3]{(3x^2+8x-6)^5}$ then $\frac{dy}{dx} =$

→ (a) $\frac{5}{3}(6x+8)(3x^2+8x-6)^{3/2}$

④ ~~Slope of the tangent~~ normal to the curve $2x^2+3y^2=5$ at the points $(1,1)$ on it is

→ (c) $\frac{3}{2}$

5) If $\int \frac{x+2}{2x^2+6x+5}dx = p\int \frac{4x+6}{2x^2+6x+5}dx + \frac{1}{2}\int \frac{1 \cdot dx}{2x^2+6x+5}$ then $p =$?

→ (c) $\log \frac{1}{4}$

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(6) $\int_2^3 \frac{x}{x^2-1} dx = \frac{1}{2} \log \frac{8}{3}$

→ (c) $\frac{1}{2} \log \frac{8}{3}$

Q1 B]

(1) A homogeneous differential equation is solved by substituting $y = vx$ and integrating it.

→ False

(2) $y^2 = 4ax$ is the standard form of parabola when curve lies on x-axis.

→ True

(3) The Area of a portion below x-axis is negative.

→ True

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Q1 C]

(1) $\int_1^2 \frac{1}{2x+3}\,dx = \frac{1}{2}\log\frac{7}{5}$

(2) $\int 5^{6x+9}\,dx = 3.2.$

(3) If $y = x^2$ then $\frac{d^2y}{dx^2}$ is 2.

Q2) A]

1) $xy = \log(xy)$

~~diff~~ $xy = \log x + \log y$

diff w.r.t x

$$\frac{d}{dx}(xy) = \frac{d}{dx}(\log x) + \frac{d}{dx}(\log y)$$

$$x\frac{d}{dx}y + y\frac{d}{dx}x = \frac{1}{x} + \frac{1}{y}\frac{dy}{dx}$$

$$x\frac{dy}{dx} + y = \frac{1}{x} + \frac{1}{y}\frac{dy}{dx}$$

$$x\frac{dy}{dx} - \frac{1}{y}\frac{dy}{dx} = \frac{1}{x} - y$$

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$$\frac{dy}{dx}\left[x - \frac{1}{y}\right] = \frac{1}{x} - y$$

$$\frac{dy}{dx}\left[\frac{xy - 1}{y}\right] = \frac{1 - xy}{x}$$

$$\frac{dy}{dx} = -\left[\frac{1 - xy}{x} \times \frac{y}{xy - 1}\right]$$

$$\frac{dy}{dx} = -\frac{y}{x}$$

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Q2A| 3) $\int_0^1 \frac{x^2+3x+2}{\sqrt{x}}\,dx$

$\rightarrow$ $I = \int_0^1 \frac{x^2+3x+2}{\sqrt{x}}\,dx$

$= \int_0^1 \frac{x^2+3x+2}{x^{1/2}}\,dx$

$= \int_0^1 (x^2+3x+2)\cdot x^{-1/2}\,dx$

$= \int_0^1 (x^2 \cdot x^{-1/2} + 3x^{1-1/2} + 2x^{-1/2})\,dx$

$= \int_0^1 (x^{2-\frac{1}{2}} + 3x^{1-\frac{1}{2}} + 2x^{-1/2})\,dx$

$= \int_0^1 (x^{3/2} + 3x^{1/2} + 2x^{-1/2})\,dx$

$= \int_0^1 x^{3/2}\,dx + \int_0^1 3x^{1/2}\,dx + \int_0^1 2x^{-1/2}\,dx$

$= \left[\frac{x^{5/2}}{\frac{5}{2}}\right]_0^1 + \left[\frac{3x^{3/2}}{\frac{3}{2}}\right]_0^1 + \left[\frac{2x^{1/2}}{\frac{1}{2}}\right]_0^1$

$= \left[\frac{x^{5/2}}{\frac{5}{2}}\right]_0^1 + 3\left[\frac{x^{3/2}}{\frac{3}{2}}\right]_0^1 + 2\left[\frac{x^{1/2}}{\frac{1}{2}}\right]_0^1$

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$$= \frac{2}{5}\left[x^{5/2}\right]_0^1 + \cancel{3}\cdot\frac{2}{\cancel{3}}\left[x^{3/2}\right]_0^1 + 2\cdot 2\left[x^{1/2}\right]_0^1$$

$$= \frac{2}{5}\left[(1)^{5/2} - 0^{5/2}\right] + 2\left[(1)^{3/2} - 0^{3/2}\right] + 4\left[(1)^{1/2} - 0^{1/2}\right]$$

$$= \frac{2}{5}\left[[1-0] + 2[1-0] + 4[1-0]\right]$$

$$= \frac{2}{5}(1) + 2 + 4$$

$$= \frac{2}{5} + 2 + 4$$

$$= \frac{2}{5} + 6$$

$$= \frac{2+30}{5}$$

$$= \frac{32}{5}$$

Q2 B] 2) $p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$

① p	② q	③ r	④ $q \wedge r$	⑤ $p \vee (q \wedge r)$	⑥ $p \vee q$	⑦ $p \vee r$	⑧ $(p \vee q) \wedge (p \vee r)$
T	T	T	T	T	T	T	T
T	T	F	F	T	T	T	T
T	F	T	F	T	T	T	T
T	F	F	F	T	T	T	T
F	T	T	T	T	T	T	T
F	T	F	F	F	T	F	F
F	F	T	F	F	F	T	F
F	F	F	F	F	F	F	F

The above table col. ⑤ and ⑧ are same the given statement pattern is equivallent

$\therefore p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$

Q3 A] ① $\displaystyle\int_1^2 \frac{3x}{9x^2-1}\,dx$

$\rightarrow$ $I = \displaystyle\int_1^2 \frac{3x}{9x^2-1}\,dx$

Put $9x^2-1 = t$

diff. w.r.t. x

$9(2x) = \dfrac{dt}{dx}$

$$18x = \frac{dt}{dx}$$

$$x\,dx = \frac{dt}{18}$$

When $x = 1$, $t = 8$

$x = 2$, $t = 35$

$$I = 3\int_{8}^{35} \frac{\frac{1}{18}}{t}\,dt$$

$$= 3 \cdot \frac{1}{18} \int_{8}^{35} \frac{1}{t}\,dt$$

$$= \frac{1}{6} \int_{8}^{35} \frac{1}{t}\,dt$$

$$= \frac{1}{6}\left[\log t\right]_{8}^{35}$$

$$= \frac{1}{6}\left[\log 35 - \log 8\right]$$

$$I = \frac{1}{6}\log\left(\frac{35}{8}\right)$$

Q3A] 2]

$$D = \left(\frac{P+6}{P-3}\right)$$

diff w.r.t P

$$\frac{dD}{dP} = \frac{(P-3)\frac{d}{dP}(P+6) - (P+6)\frac{d}{dP}(P-3)}{(P-3)^2}$$

$$= \frac{(P-3)(1+0) - (P+6)(1-0)}{(P-3)^2}$$

$$= \frac{\cancel{P} - 3 - \cancel{P} + 6}{(P-3)^2}$$

$$= \frac{-9}{(P-3)^2}$$

$$n = \frac{-P}{\left(\frac{P+6}{P-3}\right)} \cdot \frac{-9}{(P-3)^2}$$

$$n = \frac{9P}{(P+6)(P-3)}$$

$$n = \frac{9 \times 4}{(4+6)(4-3)} = \frac{36}{10} = 3.6$$

elasticity of demand at $p = 4$ is 3.6

Q3] B]
2)

$x^2 + y^2 = 6^2$

Area of the circle $= 4\int_0^a y\,dx$

$y^2 = 36 - x^2$

$y = \sqrt{36 - x^2}$ $\qquad a^2 = 36$, $a = 6$

$I = 4\int_0^6 \sqrt{36 - x^2}\,dx$

$= \int\sqrt{a^2 - x^2}\,dx = \frac{x}{2}\sqrt{a^2 - x^2} + \frac{a^2}{2}\sin^{-1}\left(\frac{x}{a}\right)$

$= 4\left[\frac{x}{2}\sqrt{6^2 - x^2} + \frac{6^2}{2}\sin^{-1}\left(\frac{x}{6}\right)\right]_0^6$

$= 4\left[\frac{6}{2}\sqrt{36 - 6^2} + \frac{6^2}{2}\sin^{-1}\left(\frac{6}{6}\right)\right] - \left[\frac{0}{2}\sqrt{36 - 0^2} + \frac{6^2}{2}\sin^{-1}\left(\frac{0}{2}\right)\right]_0^6$

$= 4\left[0 + \frac{6^2}{2}\sin^{-1}\left(\frac{6}{6}\right) - \left[0\sqrt{0} + \frac{36}{2}\sin^{-1} 0\right]\right]$

$4\left[\left[\frac{36}{2}\sin^{-1}(1)\right] - \left[\frac{36}{2}\sin^{-1}(0)\right]\right]$

$= a^2 \cdot \frac{36}{2} \left[\sin^{-1}(1) - \sin^{-1}(0) \right]$

$= 72 \left[\frac{\pi}{2} - 0 \right]$

$= 72 \cdot \frac{\pi}{2}$

$= 36\pi$ sq. units

Q3 c]

2]

→ $P \leftrightarrow q$ and $P \rightarrow q$ both are true if p and q has truth value $\boxed{T}$ $\boxed{T}$ or $\boxed{T}$ $\boxed{T}$

$P \vee q$

i) If both P and q are true then $P \vee q =$

$\boxed{T} \vee \boxed{T} = \boxed{T}$

ii) If both P and q are false the $P \vee q =$

$\boxed{F} \vee \boxed{F} = \boxed{F}$

iii) If both P and q are True the $P \wedge q =$

$\boxed{T} \wedge \boxed{T} = \boxed{T}$

iv) If both P and q are False the $P \wedge q =$

$\boxed{F} \wedge \boxed{F} = \boxed{F}$