Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No......................................

Faculty of Agriculture

End Sem Examination Dec 2024

AG3RC02 Elementary Mathematics

Programme: B.Sc. (Hons.) Branch/Specialisation: Agriculture

Duration: 3 Hrs. **Maximum Marks: 50**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

			Marks	BL	PO	CO	PSO
Q.1	i.	The slope of line passing through the points (3,2) and (-1,4) is: (a) -3/2 (b) ½ (c) 2/3 (d) 1/4	**1**	3	1	2	
	ii.	The distance between points (3,2) and (4,2) is: (a) 2 (b) 1 (c) 4 (d) -3	**1**	3	1	2	
	iii.	The centre of circle $(x+5)^2+(y-3)^2=36$: (a) (2,4) (b) (1,4) (c) (4,1) (d) None of these	**1**	3	1	2	
	iv.	The radius of circle $(x+5)^2+(y+1)^2=9$ (a) 0 (b) 1 (c) 2 (d) 3	**1**	3	1	2	
	v.	The derivative of e^{-x} is: (a) - e^{-x} (b) e^{x} (c) - e^{x} (d) 1	**1**	2	1	1	
	vi.	The second derivative of x^3 is: (a) $3x^2$ (b) $6x$ (c) 6 (d) 0	**1**	2	1	1	
	vii.	$\int cos2x\, dx$ will be: (a) $\frac{sin2x}{2}$ (b) $cos2x$ (c) $2x$ (d) $sin2x$	**1**	2	1	1	
	viii.	$\int e^{2x}dx$ will be: (a) $\frac{e^{2x}}{2}$ (b) e^{2x} (c) $\frac{e^{3x}}{3}$ (d) 0	**1**	2	1	1	

ix.	Let A be a square matrix of order 3×3 then $\lvert kA\rvert$ is equal to: (a) k $\lvert A \rvert$ (b) $k^2\lvert A\rvert$ (c) $k^3\lvert A\rvert$ (d) $3k\lvert A\rvert$	**1**	2	1	1
x.	$If \begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$ then x is equal to: (a) 6 (b) ± 6 (c) -6 (d) 0	**1**	3	1	2
Q.2	Attempt any two:				
i.	Find the equation of line passing through (-2, 3) with slope -4.	**4**	3	1	2
ii.	Find the equation of line passing through the points (1, -1) and (3, 5).	**4**	3	1	2
iii.	Find the equation of a line perpendicular to the line x-2y+3=0 and passing through the point (1, -2).	**4**	3	1	2
Q.3	Attempt any two:				
i.	Find the centre and radius of circle $x^2+y^2+8x+10y-8=0$	**4**	3	1, 2	2
ii.	Find the equation of circle with centre (-3, 2) and radius 4.	**4**	3	1, 2	2
iii.	Find the equation of circle which passes through the point (2, -2) and (3, 4) and whose centre lies on the line x+y=2.	**4**	3	1, 2	2
Q.4	Attempt any two:				
i.	Find the derivative of tan(2x+3).	**4**	3	1	2
ii.	Examine the continuity of the function- $f(x)=2x^2-1$ at x=3	**4**	4	1, 2	3
iii.	Compute the derivative of sinx by first principle.	**4**	3	1, 2	2
Q.5	Attempt any two:				

i.	Evaluate the following- $\int_2^3 x^5 dx$	**4**	3	1	2
ii.	Evaluate the following- $\int tan^2(2x-3)dx$	**4**	3	1	2
iii.	Evaluate the following- $\int Sin2xCos3\, xdx$	**4**	3	1	2
Q.6	Attempt any two:				
i.	Find the inverse of the matrix A where, $A=\begin{bmatrix} 2 & 3 & 4 \\ 4 & 6 & 8 \\ 1 & 1 & 1 \end{bmatrix}$	**4**	3	1, 2	2
ii.	If $A = \begin{bmatrix} 2 & -5 \\ 6 & -2 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 2 \\ -1 & 0 \end{bmatrix}$ then find the value of 5A-2B.	**4**	3	1, 2	2
iii.	If $A = \begin{bmatrix} 2 & -3 & 0 \\ 2 & -5 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ then find A^2.	**4**	3	1, 2	2

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Q1

i $-1/2$ +1

ii 1 1

iii None of these 1

iv 3 1

v $-e^{-x}$ 1

vi $6x$ 1

vii $\sin 2x/2$ 1

viii $e^{2x}/2$ 1

ix $k^3|A|$ 1

x ± 6 1

Q2

i Find the equation of line passing through (−2, 3) with slope −4.

Sol We know that

equation of line passing through point (x_0, y_0) with slope m is

$$y - y_0 = m(x - x_0)$$ +1

Here

slope $m = -4$

point $(x_0, y_0) = (-2, 3)$ +1

Hence $x_0 = -2$, $y_0 = 3$

Putting the values

$$(y-3) = -4(x-(-2))$$ +1

$$(y-3) = -4(x+2)$$

$y - 3 = -4x - 8$

$y + 4x - 3 + 8 = 0$

$\Rightarrow y + 4x + 5 = 0$

+1

Hence, the required equation is $y + 4x + 5 = 0$ Ans

ii (Q3)

Sol Given

centre $= (-3, 2)$

radius $r = 4$

+1

Then equation of the circle is

$(x - h)^2 + (y - k)^2 = r^2$ +1

$(x + 3)^2 + (y - 2)^2 = 4^2$ Ans +2

iii

Sol. Let the required line by

$y = mx + c$ +1

and $x - 2y - 3 = 0$ are perpendicular

$\Rightarrow m_1 \times m_2 = -1$ +1

$\Rightarrow m_1 = m$, $m_2 \Rightarrow y = \frac{1}{2}(x - 3)$ +1

$\Rightarrow m_2 = 1/2$

$\therefore m(1/2) = -1$

$\therefore m = -2$

line passes through $(1, -2)$ -1

$y = -2x + c$

$-2 = -2(1) + c$

$c = 0$

$\therefore y = -2x$ +1

$\therefore$ The required line equation is $y = -2x$ Ans

Q2(ii)

Sol Given

equation of line passes through points $(1,-1)$ and $(3,5)$ is

$y = mx + c$

$m = \frac{y_2 - y_1}{x_2 - x_1}$ +1

$\Rightarrow m = \frac{5+1}{3-1} = 3$ +1

Now equation of line is

$y = 3x + c$ —— (1) +1

and $(1,-1)$ satisfy this equation so

$-1 = 3 + c$ $[c = -4]$

from equ (1)

$y = 3x - 4$ Ans +1

Q2(i)

Sol Given equation of circle

$$x^2+y^2+8x+10y-8=0 \quad \text{— (1)} \qquad +1$$

We know that equation of circle

$$(x-h)^2+(y-k)^2=r^2$$

from (1)

$$x^2+y^2+8x+10y-8=0$$

$$(x^2+8x)+(y^2+10y)=8 \qquad +1$$

$$x^2+2\times4x+y^2+2\times5\times y=8$$

$$[x^2+2\times4\times x+(4)^2-(4)^2]+[y^2+2\times5\times y+(5)^2-(5)^2]=8$$

$$(x+4)^2+(y+5)^2=8+16+25$$

$$(x+4)^2+(y+5)^2=49$$

$$(x-(-4))^2+(y-(-5)^2)^2=7^2 \quad \text{— (2)} \qquad +1$$

Comparing equ (2) with equation
where $h=-4$, $k=-5$, & $r=7$

Thus, centre of circle $=(h,k)=(-4,-5)$ $\qquad +1$
and Radius $r=7$

3(d) Given det

Equ. of circle with centre (h, k) is

$$(x-h)^2 + (y-k)^2 = r^2 \quad \text{— (A)}$$

Since the circle passes through $(2, -2)$
Point $(2, -2)$ will satisfy the equation of circle

putting $x = 2$, $y = -2$ in A

$$(2-h)^2 + (-2-k)^2 = r^2$$
$$4 + h^2 - 4h + 4 + (-2)^2 + (-k)^2 + 2(-2)(-k) = r^2$$
$$4 + h^2 - 4h + 4 + k^2 + 4k = r^2$$
$$h^2 + k^2 - 4h + 4k + 8 = r^2 \quad \text{— (1)}$$ +1

Similarly,
Since circle passes through $(3, 4)$
point $(3, 4)$ will satisfy the equation of circle

put $x = 3$, $y = 4$ in (A)

$$(3-h)^2 + (4-k)^2 = r^2$$
$$3^2 + h^2 - 2(3)h + (4)^2 + (k)^2 - 2 \times 4 \times k = r^2$$
$$9 + h^2 - 6h + 16 + k^2 - 8k = r^2$$
$$h^2 + k^2 - 6h - 8k + 25 = r^2 \quad \text{— (2)}$$ +1

Subtracting (2) from (1)

$$(h^2 + k^2 - 6h - 8k + 25) - (h^2 + k^2 - 4h + 4k + 8) = r^2 - r^2$$
$$h^2 + k^2 - 4h + 4k + 8 - h^2 - k^2 - 6h + 8k - 25 = 0$$
$$h^2 - h^2 + k^2 - k^2 - 4h + 6h + 4k + 8k + 8 - 25 = 0$$
$$2h + 12k - 17 = 0 \quad \text{— (3)}$$

since centre (h,k) lie on the line $x+y=2$
i.e. point (h,k) will satisfy the equation of circle

$h+k=2 \quad \text{--- (4)}$

from equ (3) & (4)

$2h+12k=17$
$h+k=2$

from (4)

$h+k=2$
$k=2-h$

put in equ (3)

$2h+12(2-h)=17$
$2h+24-12h=17$
$-10h=17-24$
$-10h=-7$
$h=7/10$
$h=0.7$

+1

putting value of $h=0.7$ in $k=2-h$

$k=2-0.7$
$k=1.3$

putting value of $(h,k)=(0.7,1.3)$ in (A)

$(x-h)^2+(y-k)^2=r^2$
$(2-0.7)^2+(-2-1.3)^2=r^2$
$(1.3)^2+(-3.3)^2=r^2$
$1.69+58=r^2 \implies r^2=12.58$

putting value of h,k & r^2 in A.

+1

$(x-0.7)^2+(y-1.3)^2=12.58$

Ans

Q1

i

Sol Let

$$y = \tan(2x+3)$$

Differentiate with respect to x. +1

$$\frac{dy}{dx} = \frac{d}{dx}\tan(2x+3)$$ +1

$$= 2\sec^2(2x+3)$$ Ans // +2

ii Sol Given

$$f(x) = 2x^2 - 1$$

at $x = 3$

then

$$f(3) = 2(3)^2 - 1$$
$$= 18 - 1$$
$$= 17$$ +2

and $\lim_{x \to 3} f(x) = \lim_{x \to 3} (2x^2 - 1) = 2(3)^2 - 1 = 17$

Clearly $\lim_{x \to 3} f(x) = f(3)$

+2

Thus, f is continuous at $x = 3$

d) We know that

$$\frac{dy}{dx} = \lim_{\delta x \to 0} \frac{f(x+\delta x) - f(x)}{\delta x}$$

Here $f(x) = \sin x$

$\Rightarrow f(x+\delta x) = \sin(x+\delta x)$ +1

$\Rightarrow f(x-\delta x) - f(x) = \sin(x+\delta x) - \sin x$

We know that

$\sin C - \sin D = 2\cos\left(\frac{C+D}{2}\right)\sin\left(\frac{C-D}{2}\right)$ +1

$\Rightarrow f(x+\delta x) - f(x) = 2\cos\left(\frac{x+\delta x+x}{2}\right)\sin\left(\frac{\delta x}{2}\right)$

$\frac{dy}{dx} = \lim_{\delta x \to 0} \cos(x + \delta x/2) \frac{\sin(\delta x/2)}{(\delta x/2)}$ +1

$\frac{d(\sin x)}{dx} = \cos x$ as $\lim_{x \to 0} \frac{\sin x}{x} = 1$ Ans// +1

Q5 ;

Sol let

$$I = \int_2^3 x^5 \, dx$$

$$\Rightarrow I = \left[\frac{x^6}{6}\right]_2^3$$ +1

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

$$= \frac{729 - 64}{6}$$ +1

$$= \frac{665}{6}$$

$$= 110.8$$ Ans +1

ii

Sol let

$$I = \int \tan^2(2x-3) \cdot dx$$

we know that

$$\tan^2\theta + 1 = \sec^2\theta$$ +1

so

$$I = \int (\sec^2(2x-3) - 1) \, dx$$

$$I = \int \sec^2(2x-3) \, dx - \int dx$$ +1

$$I = \int \sec^2(2x-3) \, dx - x$$

put

$2x - 3 = t$

$2\,dx = dt$

$dx = dt/2$

$I = \frac{1}{2}\int \sec^2 t \, dt - x$ +1

$I = \frac{1}{2} \tan t - x + c$

$I = \frac{1}{2} \tan(2x-3) - x + c$ Ans// +1

iii)

Sol Let

$I = \int \sin 2x \cos 3x \, dx$

By formula.

$2\sin A \cos B = \sin(A+B) + \sin(A-B)$ +1

$I = \frac{1}{2}\int \left(\sin(2x+3x) + \sin(2x-3x)\right) dx$ +1

$= \frac{1}{2}\int \left(\sin 5x - \sin x\right) dx$

~~Put~~ $\cancel{5x = t \Rightarrow dx = dt/5}$

$$\Rightarrow \quad \cancel{I = \frac{1}{2}\int \sin t \, \frac{dt}{5}}$$

$$I = \frac{1}{2}\left[-\frac{\cos 5x}{5} + \cos x\right] + C$$

$$I = -\frac{1}{10}\cos 5x + \frac{1}{2}\cos x + C$$ +2

Ans//

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i)
Sol Given

$$A = \begin{bmatrix} 2 & 3 & 4 \\ 4 & 6 & 8 \\ 1 & 1 & 1 \end{bmatrix}$$

$$\det \begin{vmatrix} 2 & 3 & 4 \\ 4 & 6 & 8 \\ 1 & 1 & 1 \end{vmatrix} = 2(6-8) - 3(4-8) + 4(4-6)$$ +2

$$= -4 + 12 - 8$$

$$= 0$$

+2

Therefore inverse of the matrix does not exists.

ii)
Sol Given

$$A = \begin{bmatrix} 2 & -5 \\ 6 & -2 \end{bmatrix} \text{ and } B = \begin{bmatrix} 3 & 2 \\ -1 & 0 \end{bmatrix}$$

Then.

$$5A - 2B = 5\begin{bmatrix} 2 & -5 \\ 6 & -2 \end{bmatrix} - 2\begin{bmatrix} 3 & 2 \\ -1 & 0 \end{bmatrix}$$ +1

$$= \begin{bmatrix} 10 & -25 \\ 30 & -10 \end{bmatrix} - \begin{bmatrix} 6 & 4 \\ -2 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 10-6 & -25-4 \\ 30-(-2) & -10-0 \end{bmatrix}$$ +1

$$= \begin{bmatrix} 4 & -29 \\ 32 & -10 \end{bmatrix}$$ +2

Ans

iii)
Sol Given

$$A = \begin{bmatrix} 2 & -3 & 0 \\ 2 & -5 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

$$A \cdot A = \begin{bmatrix} 2 & -3 & 0 \\ 2 & -5 & 0 \\ 0 & 0 & 3 \end{bmatrix} \cdot \begin{bmatrix} 2 & -3 & 0 \\ 2 & -5 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$ +1

$$A^2 = \begin{bmatrix} 4-6+0 & -6+15+0 & 0 \\ 4-10+0 & -6+25+0 & 0 \\ 0 & 0 & 9 \end{bmatrix}$$ +2

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$$= \begin{bmatrix} -2 & 9 & 0 \\ -6 & 19 & 0 \\ 0 & 0 & 9 \end{bmatrix}$$ Ans

+1