

Jashore Board-2017

Higher Mathematics 1st Paper (Creative) Subject Code :

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Time — 2 hours 35 minutes

Full marks — 50

*[N.B. The figures in the right margin indicate full marks.
Answer five questions taking at least two from each group.]*

Group A – Algebra and Geometry

1. ► $x + y + z = 1 \dots \dots \dots$ (i)

$lx + my + nz = k \dots \dots \dots$ (ii)

$l^2x + m^2y + n^2z = k^2 \dots \dots \dots$ (iii)

a. If $2 \begin{bmatrix} 1 & -2 \\ 2 & -1 \end{bmatrix} + F = I_2$, Find the matrix F, where I_2 is an identity matrix. 2

b. Expressing the given equations in the form of $AX = B$, show that $\det(A) = (l - m)(m - n)(n - l)$. 4

c. A is a matrix, which is formed by taking co-efficient of x, y, z. Find out an inverse matrix of A, where $l = 1$, $m = 2$, $n = -1$. 4

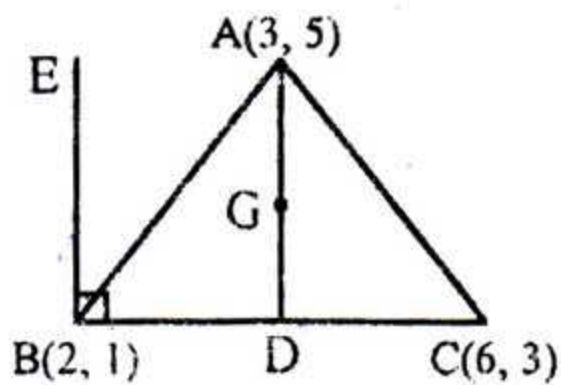
2. ► A team of 10 students came from SYLHET to BANDARBAN for study tour. The team is to travel in two vehicles, one of which will not hold more than 7 and the other not more than 4 students.

a. If $f(x) = 2x - 5$ and $g(x) = x^2 + 6$, find $(g \circ f)(2)$. 2

b. Show that the number of permutations of the letters of the first place is 21 times than that of the letters of the second Place 4

c. In how many ways can they travel? 4

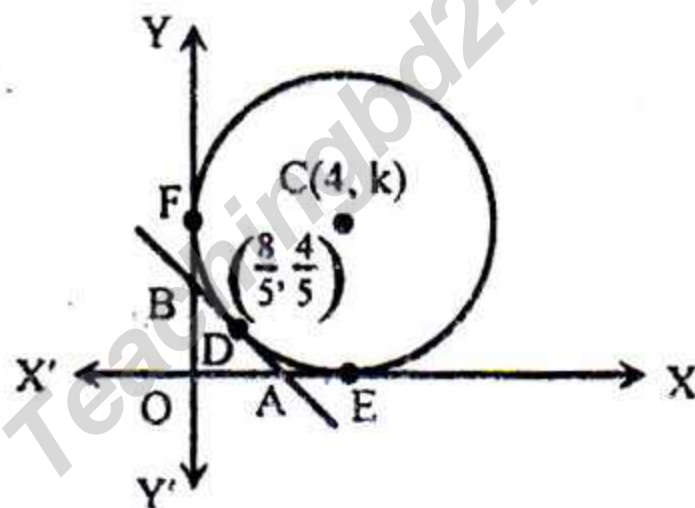
3. ★



In the figure G is a centroid of the triangle ABC, D is the middle point of BC. $BE \perp BC$.

- Find the area of triangle ABC. 2
- Show that the point G divides the median AD internally in the ratio $2 : 1$. 4
- Find the equation of bisectors of the angle $\angle EBC$. 4

4. ►



- If $\vec{P} = \hat{i} - 2\hat{j} - 3\hat{k}$, $\vec{Q} = 3\hat{i} - \hat{j} + 2\hat{k}$, show that, $\vec{P} + \vec{Q}$ and $\vec{P} - \vec{Q}$ vector are perpendicular. 2
- Find the equation of the circle which passes through the points C, E and F. 4
- Find the another equation of the tangent which is parallel to the tangent AB of the circle. 4

Group B – Trigonometry and Calculus

5. ★ **Stem-1:** In $\triangle XYZ$, $\cos X = \sin Y - \cos Z$.

Stem-2: $\sqrt{1+n} \cdot \tan \frac{\alpha}{2} = \sqrt{1-n} \cdot \tan \frac{\beta}{2}$.

- a. Prove that, $\tan 75^\circ = 2 + \sqrt{3}$. 2
- b. According to stem-1, show that the triangle is right angled. 4
- c. According to stem-2, show that, $\cos \beta = \frac{\cos \alpha - n}{1 - n \cos \alpha}$. 4

6. ► $\angle E + \angle F = 65^\circ$, $\angle F - \angle E = 25^\circ$.

- a. If $\tan \beta = \frac{1}{3}$, find the value of $\sin 2\beta$. 2
- b. Show that, $2 \sin\left(\pi + \frac{F}{4}\right) = -\sqrt{2 - \sqrt{2 + \sqrt{2}}}$. 4
- c. Show that, $\tan \angle E \cdot \tan 2\angle E \cdot \tan 3\angle E \cdot \tan 4\angle E = 3$. 4

7. ► $f(x) = x^{\tan^{-1}x}$, $g(x) = \log_x a$, $h(x) = \sqrt{a + b \cos x}$.

- a. Evaluate $\lim_{y \rightarrow 0} \frac{1 - \cos y}{y}$. 2
- b. Differentiate $f(x)$ and $g(x)$ with respect to x . 4
- c. If $y = h(x)$, then show that, $2y \cdot \frac{d^2y}{dx^2} + 2 \cdot \left(\frac{dy}{dx}\right)^2 + y^2 = a$. 4

8. ★ $F(x) = \frac{x^2 + x + 1}{x}$, $H(x) = \frac{xe^x}{(x+1)^2}$.

- a. Find the slope of the tangent of the curve $y = (x - 2)(x + 1)$ at the point $x = 2$. 2
- b. Show that the minimum value of $F(x)$ is greater than maximum value. 4
- c. Find the value of $\int_0^1 H(x) dx$. 4

Time — 25 minutes

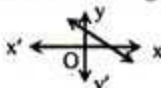
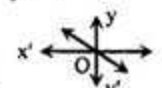
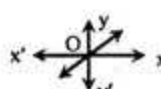

Full marks — 25

[N.B. Choose the best answer among the options. Fill the circle in the answer sheet with ball point pen. Each question has value 1.]

1. Which one of the following is NOT correct in the ΔABC ?

- a. $a = b \cos B + c \cos C$ b. $a = b \cos C + c \cos B$
 c. $b = c \cos A + a \cos C$ d. $b^2 = c^2 + a^2 - 2ca \cos B$

2. Which one is the graph of $x + y = 0$

- a.  b. 
 c.  d. 

3. Which one is the range of $f(x) = \sin x$?

- a. $[-1, 1)$ b. $(-1, 1]$ c. $[-1, 1]$ d. $(-1, 1)$

4. If the function $f(x)$ is continuous at $x = a$ —

- i. $f(a)$ is defined
 ii. $\lim_{x \rightarrow a} f(x)$ exists iii. $\lim_{x \rightarrow a} f(x) = f(a)$

Which one is correct?

- a. i and ii b. i and iii c. ii and iii d. i, ii and iii

5. Which one is equal to $\frac{1 - \tan^2(45^\circ + x)}{1 + \tan^2(45^\circ + x)}$?

- a. $\cos 2x$ b. $-\cos 2x$ c. $-\sin 2x$ d. $\sin 2x$

6. If $A = 60^\circ$, $B = 45^\circ$ then which one is the value of $\cos(B - A)$?

- a. $\frac{2\sqrt{2}}{\sqrt{3}-1}$ b. $\frac{2\sqrt{2}}{\sqrt{3}+1}$ c. $\frac{\sqrt{3}+1}{2\sqrt{2}}$ d. $\frac{\sqrt{3}-1}{2\sqrt{2}}$

7. Which one is the centre of the circle $3x^2 + 3y^2 + x - 2y + \frac{1}{2} = 0$?

- a. $(\frac{1}{3}, -\frac{2}{3})$ b. $(\frac{1}{6}, \frac{1}{3})$ c. $(-\frac{1}{6}, \frac{1}{3})$ d. $(\frac{1}{6}, -\frac{1}{3})$

8. Which one is the value of $\operatorname{cosec}(-2580^\circ)$?

- a. $-\frac{\sqrt{3}}{2}$ b. $-\frac{2}{\sqrt{3}}$ c. $\frac{2}{\sqrt{3}}$ d. $\frac{\sqrt{3}}{2}$

9. Which one is the value of $\frac{d}{dx}(a^{10})$?

- a. $a^{10} \ln a$ b. $10 a^9$ c. a^{10} d. 0

10. Which one is the magnitude of $\frac{1}{2}\hat{i} + \frac{1}{3}\hat{j} + \hat{k}$?

- a. $\frac{7}{6}$ b. $\frac{49}{36}$ c. $\frac{11}{6}$ d. $\sqrt{\frac{11}{6}}$

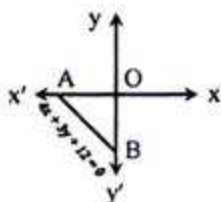
11. If $f(x)$ is not constant, then which one is equal to $\int \frac{f'(x)}{f(x)} dx$?

- a. $f'(x) + C$ b. $f(x) + C$
 c. $\ln|x| + C$ d. $\ln|f(x)| + C$

Answer the questions 12 and 13 based on the following stem:

12. Which one is the perpendicular distance from the origin to AB?

- a. $\frac{25}{12}$ b. $\frac{12}{25}$
 c. $\frac{12}{5}$ d. $\frac{5}{12}$



13. Which one is the co-ordinates of middle point of AB?

- a. $(-\frac{3}{2}, -2)$ b. $(-3, -2)$ c. $(\frac{3}{2}, -2)$ d. $(-\frac{2}{3}, -2)$

14. $\begin{bmatrix} 4 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 4 \end{bmatrix}$ is a —

- i. square matrix ii. diagonal Matrix iii. scalar matrix
 Which one is correct?

- a. i and ii b. i and iii c. ii and iii d. i, ii and iii

Answer the questions no. 15 and 16 based on the following stem:

$f(x) = \ln 2x$

15. Which one is the slope of tangent of the curve $f(x)$ at the point $x = 2$?

- a. $\frac{1}{4}$ b. $\frac{1}{2}$ c. 2 d. 4

16. Which one is the domain of $\int f(x) dx$?

- a. $\frac{1}{2x} + C$ b. $\frac{1}{x} + C$
 c. $x \ln 2x + x + C$ d. $x \ln 2x - x + C$

17. Which one is the domain of $f(x) = \frac{x-4}{2x+1}$?

- a. $\mathbb{R} - \{4\}$ b. $\mathbb{R} - \{-\frac{1}{2}\}$
 c. $\mathbb{R} - \{-4\}$ d. $\mathbb{R} - \{\frac{1}{2}\}$

18. Which one is the slope of the line $3x + 4y + 1 = 0$?

- a. $-\frac{4}{3}$ b. $-\frac{3}{4}$ c. $\frac{3}{4}$ d. $\frac{4}{3}$

19. Which unit is the intercept of y-axis by the circle $x^2 + y^2 + 2x + 4y - 1 = 0$?

- a. $2\sqrt{2}$ b. $\sqrt{5}$ c. $2\sqrt{5}$ d. $\sqrt{2}$

20. Which one is the value of nC_1 ?

- a. $n-1$ b. n c. $n+1$ d. 1

21. Which one is the unit vector along $\hat{i} - \hat{j} + \hat{k}$?

- a. $\frac{\hat{i} + \hat{j} + \hat{k}}{\sqrt{3}}$ b. $\frac{\hat{i} - \hat{j} + \hat{k}}{3}$ c. $\hat{i} - \hat{j} + \hat{k}$ d. $\frac{\hat{i} - \hat{j} + \hat{k}}{\sqrt{3}}$

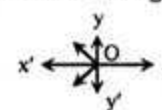
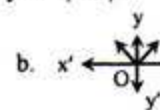
22. If $A + B + C = \frac{\pi}{2}$, then which one is equal to $\sec(B + C)$?

- a. $\sec A$ b. $-\sec A$ c. $-\operatorname{cosec} A$ d. $\operatorname{cosec} A$

23. How many permutations can be made with the word "algebra" so that the vowels occur together?

- a. 2520 b. 720 c. 360 d. 120

24. Which one is the graph of $y = -|2x|$?

- a.  b. 

- c.  d. 

25. Which one is the value of $\begin{vmatrix} 0 & 1 \\ 2 & -1 \end{vmatrix}$?

- a. -3 b. -2 c. 2 d. 3

Ans.	1	a	2	b	3	c	4	d	5	c	6	c	7	c	8	b	9	d	10	a	11	d	12	c	13	a
	14	d	15	b	16	d	17	b	18	b	19	c	20	b	21	d	22	d	23	c	24	d	25	b		