Model Question of HSC Examination 2020

Higher Mathematics 1st Paper (Creative) Subject Code : 2 6 5

Time — 2 hours 35 minutes Full marks — 50

[N.B. — Right marking indicate the full marks, taking at least two from each group answer the five questions]

Group A – Algebra & Geometry

1. ✪ $A = \begin{bmatrix} p+q+2r & p & q \\ r & q+r+2p & q \\ r & p & r+p+2q \end{bmatrix}$, $B = \begin{bmatrix} x & 3 \\ 6 & 3 \end{bmatrix}$ are two matrices.

a. If the matrix B is singular, then find the value of x. 2

b. Show that, $|A| = 2(p+q+r)^3$ 4

c. If $p = q = r = 1$, then find A^{-1} 4

2. ▶ $\vec{P} = 3\hat{i} - 6\hat{j} + 2\hat{k}$, $\vec{Q} = 2\hat{i} + 3\hat{j} - 4\hat{k}$ are two vectors.

a. If A(2, –1, 3) and B(3, 2, – 4), then find $\vec{AB}$. 2

b. Find the included angle between $\vec{P}$ and $\vec{Q}$. 4

c. Find the unit vector perpendicular to vectors $\vec{P}$ and $\vec{Q}$. 4

3. ▶ Stem-1 : $x^2 + y^2 + 2x + 3y + 1 = 0$

Stem-2 : $x^2 + y^2 + 4x + 3y + 2 = 0$ are equation of circles.

a. Find the equation of a circle with center $(-2, -3)$ and touches the x-axis. 2

b. Find the equation of tangent of stem-1 drawn from the origin. 4

c. Find the equation of common chord of stem-1 & stem-2. 4

4. ▶ 'AMERICA' is the super power in the world.

a. If ${}^nc_8 = {}^nc_3$, then find the value of ${}^np_8$. 2

b. Find the number of arrangements of the letters of the quoted word taken all at a time. 4

c. How many ways can the letters of quoted word be arranged by taking 3 letters at a time? 4

Group B – Trigonometry & Calculus

5. ✪ Stem-1 : A cyclist reached Dhaka from Gazipur and these two places originate an angle 18 in the center

of the earth. The radius of the earth is 6440 km.

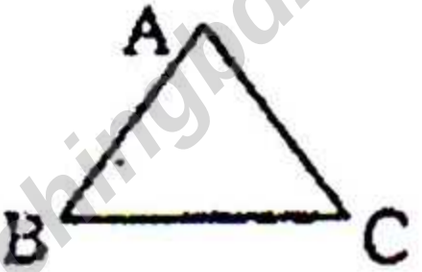
Stem-2 : $f(\theta) = \cos\theta$; when $-360° \le \theta \le 360°$.

a. Write down the formula to find period and find the period of $\cot\frac{3x}{2}$. 2

b. Find the distance between two places. 4

c. Draw a graph of $f(\theta)$ with procedure. 4

6. ▶



Where, $\angle A + \angle B + \angle C = \pi$

a. Prove that, $\tan(A + B) + \tan C = 0$. 2

b. Show that, $\sin^2 A + \sin^2 B - \sin^2 C = 2\sin A \sin B \sin C$. 4

c. If $\cot A + \cot B + \cot C = \sqrt{3}$ then prove that, the triangle is equilateral. 4

7. ▶ **Stem-1 :** $y = 4x^3 + 3x^2 - 6x + 3y + 1$ is the equation of a curve.

Stem-2 : $f(x) = (x^x)^x$

a. Find the value of $\lim_{x\to\alpha}\left(1+\frac{1}{x}\right)\left(\frac{5x^2-1}{x^2}\right)$ 2

b. Find the coordinates of the points on the stem-1, where tangents are parallel to x-axis. 4

c. Differentiate $f(x)$ with respect to x. 4

8. ✪ **Stem-1 :** $f(x) = e^x \sin 2x$

Stem-2 : $y^2 = 16x$ and $x^2 = 16y$ are two parabolas.

a. What is the integrating value of $\int \frac{\tan(\sin^{-1}x)}{\sqrt{1-x^2}}dx$? 2

b. Find the integration of $\int f(x)\,dx$ using stem-1. 4

c. Find the area bounded by the two parabolas using stem-2. 4

Higher Mathematics 1st Paper (MCQ)

Subject Code : | 2 | 6 | 5 |

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. If $A = \begin{bmatrix} 1 & 0 \\ 0 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 0 \\ 0 & 1 \end{bmatrix}$ then, the value of AB is —

ⓐ $\begin{bmatrix} 5 & 0 \\ 0 & 5 \end{bmatrix}$ ⓑ $\begin{bmatrix} 5 & 0 \\ 10 & 5 \end{bmatrix}$

ⓒ $\begin{bmatrix} 10 & 0 \\ 0 & 5 \end{bmatrix}$ ⓓ $\begin{bmatrix} 0 & 5 \\ 5 & 10 \end{bmatrix}$

2. For what value of p, the matrix $\begin{bmatrix} p & -5 \\ 4 & 5 \end{bmatrix}$ will be a singular matrix?

ⓐ 4
ⓑ 5
ⓒ −4
ⓓ −5

3. If $A = \begin{bmatrix} 5 & -4 \\ 0 & 3 \end{bmatrix}$ then,

i. the minor of $-4 = 6$
ii. cofactor of $3 = 6$
iii. $|A| = 39$

Which one is correct?

ⓐ i & ii
ⓑ ii & iii
ⓒ iii & i
ⓓ i, ii & iii

4. The angle between the vectors 3i and 6i is—

ⓐ 0°
ⓑ 300
ⓒ 90°
ⓓ 180°

5. Whta is the value of $(j \times i).k = ?$ when i, j & k are unit vectors.

ⓐ −1 ⓑ 0
ⓒ 1 ⓓ i

6. Perpendicular distance from the origin to the line $8x + 6y + 25 = 0$ is —

ⓐ 0 ⓑ $\frac{5}{\sqrt{2}}$
ⓒ 5/2 ⓓ 2/5

7. The radius of the circle $x^2 + y^2 - 6x + 9 = 0$ is—

ⓐ 3
ⓑ 2
ⓒ 1
ⓓ 0

8. Which is the center of circle $(x - 2)^2 + (y + 3)^2 = 25$?

ⓐ (0, 0)
ⓑ (2, −3)
ⓒ (−2, 3)
ⓓ (3, 5)

Answer the questions 9 & 10 based on the stem :

$x^2 + y^2 - 8x - 6y + k = 0$ is a circle.

9. For what value of k, the given equation touches the y-axis?

ⓐ 4 ⓑ 5
ⓒ 9 ⓓ 15

10. After putting the value of k the radius of circle is —

ⓐ 4
ⓑ 9
ⓒ 16
ⓓ 18

11. if $^nP_1 = 240$ and $^nP_1 = 120$ then, what is the value of r?

ⓐ 1 ⓑ 2
ⓒ 3 ⓓ 5

12. If $\sec\theta = 3$, then which one is the value of $\tan\theta$?

ⓐ $\pm 2\sqrt{2}$ ⓑ $2\sqrt{2}$
ⓒ $\pm\sqrt{10}$ ⓓ $\sqrt{10}$

Answer the question 13 & 14 from the stem.

An arc of a circle with radius 10 cm. subtends an angle of 30° at the center of the circle.

13. ✪ What is the length of arc?

ⓐ 2 cm ⓑ 2.62 cm
ⓒ 5 cm ⓓ 5.24 cn

14. ★ **Which one is the area of sector?**

ⓐ 52.36 sq.cm
ⓑ 26.18 sq.cm
ⓒ 13.08 sq.cm
ⓓ 6.54 sq.cm

15. **If $\pi < \theta < \frac{3\pi}{2}$, $\tan\theta = \frac{1}{2}$, then**

i. The position of revolving line of making angle in 3rd quadrant.

ii. $\sin\theta = -\frac{1}{\sqrt{5}}$

iii. $\sec\theta = -\frac{3}{\sqrt{5}}$

Which one is correct?

ⓐ i & ii
ⓑ ii & iii
ⓒ iii & i
ⓓ i, ii & iii

16. **Which one is the value of $\sin^2\frac{\pi}{8} + \sin^2\frac{5\pi}{8}$?**

ⓐ -1 ⓑ $-1/2$
ⓒ 0 ⓓ 1

17. **If $f(x) = 2x - 3$ and $g(x) = x^2 - 2$, then $gof(-5) = ?$**

ⓐ 43
ⓑ 167
ⓒ -43
ⓓ -167

18. **If $f(x) = \frac{x-3}{2x-1}$, $x \neq \frac{1}{2}$, then the value of $f^{-1}(-2)$ is—**

ⓐ -1
ⓑ $-1/5$
ⓒ $1/5$
ⓓ 1

19. **The value of $\lim_{x\to 0}(e^x - 1)/x$ is—**

ⓐ -1
ⓑ 0
ⓒ 1
ⓓ 2

20. **Limiting value of $\lim_{x\to\infty}\frac{3^x - 3^{-x}}{3^x + 3^{-x}}$ is —**

ⓐ 0
ⓑ 1
ⓒ 2
ⓓ 3

21. ★ **If $y = x^3 - 12x$, what is the value of x? when $\frac{dy}{dx} = 0$.**

ⓐ 0
ⓑ ± 2
ⓒ 2
ⓓ 4

22. **Differentiation of a^x with respect to x is —**

ⓐ a^x/na
ⓑ a^x/nx
ⓒ $\frac{1}{a^x/n\,a}$
ⓓ $\frac{a^x}{/n\,x}$

23. **Derivative of $\ln(1+e^x)$ with respect to x is —**

ⓐ $\frac{13}{1+e^x}$ ⓑ $\frac{e^x}{(1+e^x)^2}$
ⓒ $\frac{e^x}{1+e^{2x}}$ ⓓ $\frac{e^x}{1+e^x}$

24. **Which one is the value of integration $\int\frac{dx}{6}$?**

ⓐ $6 + c$
ⓑ x
ⓒ $\frac{1}{6} + c$
ⓓ $x/6 + c$

25. ★ **The value of $\int_0^{\frac{\pi}{2}} \sin^2 x\,dx$ is—**

ⓐ $\frac{\pi}{4}$ ⓑ $\frac{\pi}{3}$
ⓒ $\frac{\pi}{2}$ ⓓ π

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