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. ★ $A = \begin{bmatrix} 1 & 3 & -2 \\ 2 & 5 & -4 \\ 3 & 7 & -5 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 2 & 1 \\ 6 & 4 & 3 \\ 9 & 8 & 4 \end{bmatrix}$, $C = \begin{bmatrix} 3 \\ 7 \\ 11 \end{bmatrix}$, $D = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$

a. The digits from 0 to 9 are written in a telephone dial. If the telephone numbers of Dhaka are of 5 digits, how many telephone connections can be given in Dhaka, if the telephone numbers are not starting with 0 (zero). 2

b. Find A^{-1}. 4

c. Find the value of x, y, z with the help of determinant when $BD = C$. 4

2. ▶ $f: R \to R$, defined by $f(x) = x^2 + 1$ and $g: R \to R$ defined by $g(x) = \sqrt{5 - x}$

a. In hw many ways can 5 persons be selected from 9 persons in which two particulars persons do not occur together? 2

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b. Find $f^{-1}([10, 26])$. 4

c. Find the range of the composite function (gof) (x). 4

3. ▶ (x_1, y_1), (x_2, y_2) are two points and $y = 1$..... (i), $3x - 4y = 5$..... (ii), $5x + 12y + 13 = 0$..... (iii) are three straight lines in a Cartesian plane.

a. Find the distance between $3x - 4y + 20 = 0$ and (ii). 2

b. Prove by vector method that the equation of the straight line passes through the stimulus points is $\frac{x - x_1}{x_1 - x_2} = \frac{y - y_1}{y_1 - y_2}$. 4

c. Find the incenter of the triangle formed by (i), (ii) and (iii) 4

4. ▶ $x + y + 1 = 0$..... (i), $x^2 + y^2 + 2x + 3y + 1 = 0$ ..... (ii) $x^2 + y^2 + 4x + 3y + 2 = 0$ ..... (iii).

a. Find the length of intercepts those are made by (ii) on the axes. 2

b. Find the equation of the circle whose center is on x-axis, length of radius is $\sqrt{2}$ unit and touches the straight line (i). 4

c. Find the equation of the circle whose diameter is the common chord of the circles (ii) and (iii). 4

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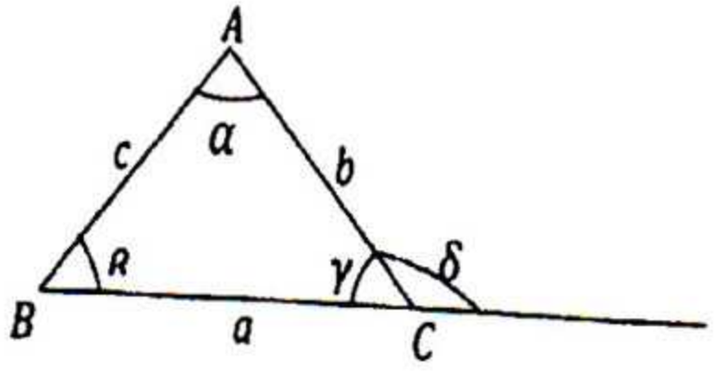
Group B – Trigonometry and Calculus

5. ▶



a. Prove that $2\sin^2(\beta+\gamma)+\cos 2\alpha = 1$. 2

b. Prove that $\cos^2\delta - \sin^2\alpha - \sin^2\beta = 2\cos\delta\cos\alpha\cos\beta - 1$. 4

c. Prove that $(2s-c)^2 + 4ab\cos^2\frac{\delta}{2} = c^2 + 4ab$, where

$s = \frac{1}{2}(a+b+c)$ 4

6. ▶ $F(x) = \sin x$, $G(x) = \tan x$.

a. Prove that $\lim\limits_{x\to 0}\frac{e^x-1}{x} = 1$. 2

b. If $F(x) + F(y) = a$ and $F\left(\frac{\pi}{2}-x\right) + F\left(\frac{\pi}{2}-y\right) = b$, prove

that $\tan\frac{x-y}{2} = \pm\sqrt{\frac{4-a^2-b^2}{a^2+b^2}}$ 4

c. Find the value of $\lim\limits_{x\to 0}\frac{G(x)-F(x)}{x^3}$ 4

7. ✪ $y = 17 - 15x + 9x^2 - x^3$ and $v = \ln(u + \sqrt{a^2+u^2})$.

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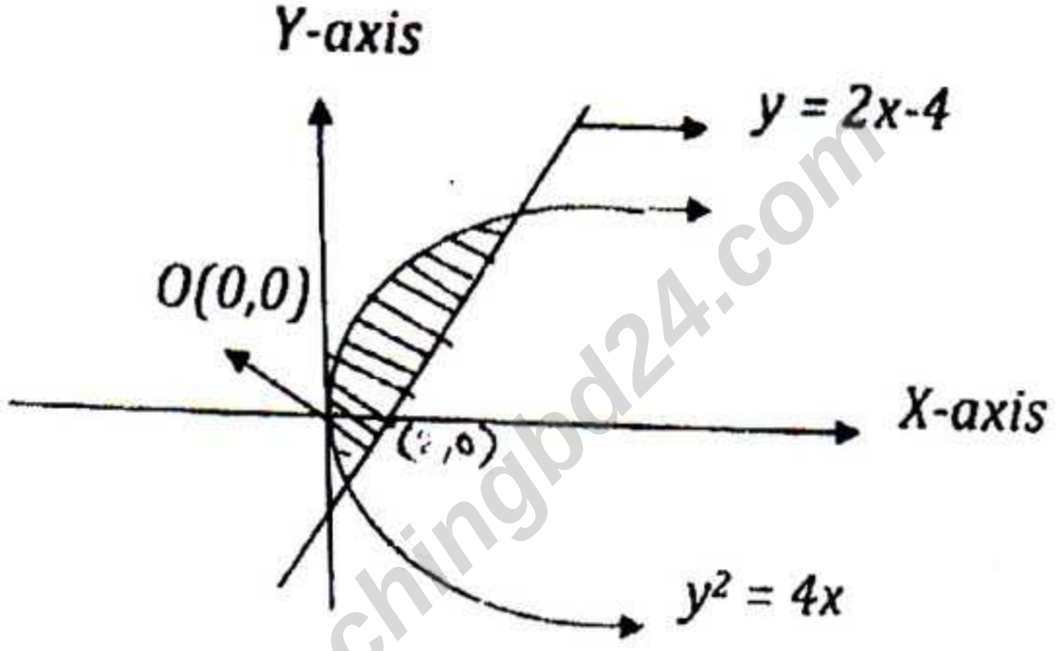
a. Find the derivative w. r. to z: $\tan^{-1}\frac{4\sqrt{z}}{1-4z}$. 2

b. Show that $(a^2 + u^2)\, v_2 + uv_1 = 0$. 4

c. Find the interval whether y is increasing or decreasing. 4

8. ✪ Sceneario-I :



Sceneario-II: $s = \frac{1}{e^{2t} - 3e^{t}}$.

a. Evaluate: $\int_0^{\frac{\pi}{2}} \cos^2 x\, dx$. 2

b. Find $\int sdt$. 4

c. Find the area of the shaded region. 4

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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 $A = \begin{bmatrix} i & m & n \\ s & q & r \\ l & m & s \end{bmatrix}$, for what value of 's' $|A| = 0$

ⓐ 0
ⓑ 1
ⓒ n
ⓓ p

2. ★ What is the inverse matrix of $\begin{bmatrix} i & i \\ 2i & i \end{bmatrix}$ where 'i' represent an imaginary number.

ⓐ $\begin{bmatrix} i & -i \\ 2i & -i \end{bmatrix}$ ⓑ $\begin{bmatrix} -i & i \\ 2i & -i \end{bmatrix}$
ⓒ $\begin{bmatrix} i & i \\ 2i & i \end{bmatrix}$ ⓓ $\begin{bmatrix} i & -i \\ -2i & i \end{bmatrix}$

3. Which one is the conjugate matrix of $\begin{bmatrix} 2 & 3-2i \\ 1+2i & i-2 \end{bmatrix}$?

ⓐ $\begin{bmatrix} 2 & 3+2i \\ 1-2i & -i-2 \end{bmatrix}$
ⓑ $\begin{bmatrix} 2 & -3+2i \\ -1-2i & -i+2 \end{bmatrix}$
ⓒ $\begin{bmatrix} -2 & -3+2i \\ -2-2i & -i+2 \end{bmatrix}$
ⓓ $\begin{bmatrix} 2i & 3i+2 \\ i-2 & -1-2i \end{bmatrix}$

4. What is the polar co-ordinates of the point (–2, –2)?

ⓐ $\left(2\sqrt{2}, \frac{\pi}{4}\right)$
ⓑ $\left(2\sqrt{2}, \frac{3\pi}{4}\right)$
ⓒ $\left(2\sqrt{2}, \frac{5\pi}{4}\right)$
ⓓ $\left(2\sqrt{2}, \frac{7\pi}{4}\right)$

5. ★ Distance between the parallel lines $4x - 3y + 13 = 0$ and $4x - 3y - 2 = 0$ is —

ⓐ 3 ⓑ 5
ⓒ 11 ⓓ 15

6. Two straight lines $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are —

i. Identical if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

ii. parallel if $\frac{a_1}{a_2} = \frac{b_1}{b_2}$

iii. perpendicular if $a_1a_2 + b_1b_2 = 0$

Which one of the following is correct?

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

$\vec{a}$ and $\vec{b}$ are two coplanar vectors and $\vec{a}$ and $\vec{b}$ are two unit vectors along $\vec{a}$ and $\vec{b}$ respectively.

Answer (7-8) on the basis of the information.

7. What is the projection of $\vec{a}$ on the vector $\vec{b}$?

ⓐ $(\hat{a}.\hat{b})\vec{b}$ ⓑ $(\hat{a}.\hat{b})a$
ⓒ $(\vec{a}.\hat{b})$ ⓓ $(\hat{a}.\vec{b})$

8. What is the component of $\vec{b}$ along the vector $\vec{a}$?

ⓐ $(\hat{a}.\vec{b})\hat{b}$ ⓑ $(\hat{a}.\vec{b})\hat{a}$
ⓒ $(\vec{a}.\hat{b})\hat{b}$ ⓓ $(\vec{a}.\hat{b})\hat{a}$

9. How many different words can be formed using all the letters of the word 'ELEPHANT' at a time?

ⓐ 720 ⓑ 2160
ⓒ 4320 ⓓ 20160

10. ★ How many diagonals have a polygon of 12 sides?

ⓐ 54 ⓑ 66
ⓒ 120 ⓓ 132

11. A person has 8 friends and 5 are relative among them. In how many ways can he invite 4 friends where 3 relatives will be included?

ⓐ 30 ⓑ 60
ⓒ 70 ⓓ 180

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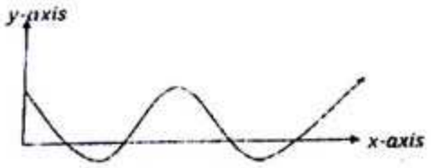
12.

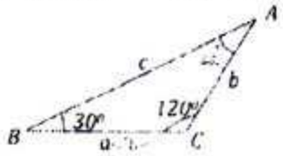


Which one of the following trigonometric function may represent the above graph?

ⓐ 2 sinx ⓑ tanx + 1
ⓒ tanx – 1 ⓓ 1 + 2 cos x

13. $\sqrt{\frac{1-\sin\alpha}{1+\sin\alpha}} = ?$

ⓐ sec α, tan α ⓑ sec α– tan α
ⓒ sec α+ tan α ⓓ cosec α.cot α



14. $\frac{a}{c} = ?$

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

15. What is the circum-radius of ΔABC when a = 2 unit?

ⓐ 1 ⓑ 2
ⓒ $\frac{2}{\sqrt{3}}$ ⓓ 4

16. Equation of the chord of the circle $x^2 + y^2 = 81$ which is bisected at (–2, 3) is —

ⓐ 2x + 3y + 13 = 0
ⓑ 2x – 3y + 13 = 0
ⓒ 2x – 3y + 68 = 0
ⓓ 2x – 3y + 94 = 0

17. The characteristics of the general equation of a circle in x and y are —

i. This is a second degree equation in x
ii. The co-efficients of both x^2 and y^2 are 1
iii. If $g^2 + f^2 > c$, the equation represent a real circle.

Which one is correct?

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

18. The length of the tangent from (1, –1) to $x^2 + y^2 - \frac{1}{2}x + \frac{3}{2}y + 4 = 0$ is —

ⓐ 4 ⓑ $2\sqrt{2}$
ⓒ $\sqrt{5}$ ⓓ 2

19. Which one of the following is a bijective function?

ⓐ $f: \Re \to \Re, f(x) = x^2$
ⓑ $f: [0, 2] \to \Re, f(x) = x^3$
ⓒ $f: [-2, 2] \to [0, 4], f(x) = x^2$
ⓓ $f: [0, 2] \to [0, 4], f(x) = x^2$

20. If $\lim_{x\to 0} f(x) = 1$, the value of f(x) is —

i. $\frac{\sin x}{x}$ ii. $\frac{\tan x}{x}$
iii. $\frac{x}{\cos x}$

Which one the correct?

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

21. What is the point at which (i) meets with 'y – axis'.

ⓐ (0, –3) ⓑ (3, 0)
ⓒ (0, 3) ⓓ (–1, 0)

22. What is the slope of the tangent of the curve line (i) at (3, 0).

ⓐ –4 ⓑ –3
ⓒ 3 ⓓ 8

23. If pv = 5, what is the vlaue of $\int_1^3 p\, dv$?

ⓐ *l*n 3 ⓑ 5 ln 2
ⓒ 5 ln 3 ⓓ 10 ln 3

24. If F (t) = ∫ ln t dt, t > 0 then F (t) = ?

ⓐ $\frac{1}{t}$ ⓑ ln t
ⓒ t ln t ⓓ t ln t – t

25. ★ If f (x) is a continuous function at x = a and f′ (x) = 0 then —

i. f(x) is maximum when f″ (x) . 0
ii. f(x) is minimum when f″ (x) < 0
iii. f(x) has neither a maximum nor a minimum value when f ′ (x) is expressible as the sum of two square

Which one of the correct?

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

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	ⓐ		

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