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2016

WB Class 11 Board Paper

MATHEMATICS

Time allowed: **3** *Hours* **15** *Minutes*

Maximum Marks: **80**

General Instructions:

(**i**) *This question paper comprises* ***four*** *groups –* ***A***, ***B***, ***C*** and ***D***.
(**ii**) *There are* **4** *questions in the question paper.* ***All*** *questions are* ***compulsory***.
(**iii**) *There is no overall choice in the question paper. However, an internal choice has been provided. You have to attempt only one of the choices in such questions.*
(**iv**) ***Group A*** *– Each questions of* ***one*** *mark each;* ***Group B*** *– Each questions of* ***two*** *marks each;* ***Group C*** *– Each questions of* ***four*** *marks each;* ***Group D*** *– Each questions of* ***five*** *marks each.*
(**v**) *Use of calculators is* ***not*** *permitted.*
(**vi**) *Figures in the margin indicate full marks for the questions.*

GROUP - A

All *questions are* ***compulsory.***

1. Choose the correct alternative: **1×10= 10**

(**i**) If $f(x) = \log_3 x$ and $\phi(x) = x^2$, then the value of $f\{\phi(3)\}$ will be

(**A**) 0
(**B**) 1
(**C**) 2
(**D**) 3

(**ii**) If $\tan\theta = -\frac{4}{3}$, then the value of $\sin\theta$ is

(**A**) $\frac{2}{5}$
(**B**) $\frac{4}{5}$ or $-\frac{4}{5}$
(**C**) $\frac{4}{5}$ but $\neq -\frac{4}{5}$
(**D**) $-\frac{4}{5}$ but $\neq \frac{4}{5}$

P.T.O.

(**iii**) If the ratio of the sum of first three terms to the sum of next three terms of a geometric series be 125:27, then the common ratio of the series be

(**A**) $\frac{5}{3}$
(**B**) $\frac{1}{4}$
(**C**) $\frac{3}{5}$
(**D**) $\frac{1}{2}$

(**iv**) If the point $(\lambda, 1+\lambda)$ is lying inside the circle $x^2+y^2=1$, then

(**A**) $\lambda = -\frac{1}{2}$
(**B**) $\lambda < 0$
(**C**) $-1 < \lambda < 0$
(**D**) $\lambda > 0$

(**v**) The distance between the points $A(5,1,2))$ and $B(6,4,-1)$ is

(**A**) $\sqrt{35}$ units
(**B**) $\sqrt{53}$ units
(**C**) $\sqrt{5}$ units
(**D**) $\sqrt{3}$ units

(**vi**) If the points $A(2,\beta,3)$, $B(\alpha,-5,1)$ and $C(-1,11,9)$ are collinear, then

(**A**) $\alpha = 3$
(**B**) $\beta = 3$
(**C**) $\alpha = -1$
(**D**) $\beta = -1$

(**vii**) The value of $\lim_{x\to 0} \frac{\sin 5x}{\tan 3x}$ is

(**A**) 2
(**B**) 5
(**C**) $\frac{5}{3}$
(**D**) $\frac{3}{5}$

(**viii**) If $y = \sqrt{\frac{1-\cos 2x}{1+\cos 2x}}$, then the value of $\frac{dy}{dx}$ will be

(**A**) $\tan^2 x$
(**B**) $\sec^2 x$
(**C**) $\sec x$
(**D**) $\tan x$

(**ix**) For two mutually exclusive events A and B, if $P(A) = \frac{1}{2}$ and $P(A \cup B) = \frac{2}{3}$, then the value of $P(B)$ will be

(**A**) $\frac{1}{4}$
(**B**) $\frac{1}{6}$
(**C**) $\frac{1}{3}$
(**D**) $\frac{1}{5}$

(**x**) If $i^2 = -1$, then the value of modulus of $(3i - 1)^2$ will be

(**A**) 9
(**B**) 10
(**C**) 8
(**D**) 6

GROUP - B

2. (**a**) Answer any ***two*** questions: **2 × 2 = 4**

(i) Find the domain for which the functions $f(x) = 3x^2 - 2x$ and $g(x) = 9x - 6$ are equal.

(ii) If $f(x) = e^{px+q}$, then show that
$$f(a) \cdot f(b) \cdot f(c) = f(a + b + c) \cdot e^{2q}.$$

(iii) If $13\theta = \pi$, then show that
$$\cos 3\theta + \cos 5\theta + 2\cos\theta \cdot \cos 9\theta = 0.$$

(iv) Prove that $\sec\alpha - \tan\alpha = \cot\left(\frac{\pi}{4} + \frac{\alpha}{2}\right)$.

(**b**) Answer any ***two*** questions: **2 × 2 = 4**

(i) Find the square root of the complex number $(7 - 24i)$.

(ii) Find the $(r + 1)$th term from the end in the expansion of $(1 - 3x)^n$.

P.T.O.

(iii) If $n \in \mathbb{N}$, then prove by mathematical induction that
$$1 + 3 + 5 + \cdots + (2n - 1) = n^2.$$

(iv) If the sum of first n, $2n$ and $3n$ terms of an arithmetic progression be S_1, S_2 and S_3 respectively, then prove that $S_3 = 3(S_2 - S_1)$.

(**c**) Answer any ***one*** question: **2 × 1 = 2**

(i) Find the locus of the mid-point of the portion of the line $x\cos\alpha + y\sin\alpha = 4$ intercepted between the axes of coordinates.

(ii) If the coordinates of a point lies on the ellipse $9x^2 + 16y^2 = 144$ be $\left(2, \frac{3\sqrt{3}}{2}\right)$, find the eccentric angle of that point.

(**d**) Answer any ***one*** question: **2 × 1 = 2**

(i) If $y = \frac{e^x}{1+x^2}$, determine $\frac{dy}{dx}$.

(ii) Evaluate $\lim\limits_{x\to\frac{\pi}{4}} \frac{1-\tan x}{x-\frac{\pi}{4}}$.

(**e**) Answer any ***one*** question: **2 × 1 = 2**

(i) Find the probability of obtaining total 7 points with the rolling of two dice simultaneously.

(ii) Two variables x and y are related by $y = 10 - 3x$. If the standard deviation of x be 4, find the standard deviation of y.

GROUP - C

3. (**a**) Answer any ***two*** questions: **4 × 2 = 8**

(i) For any three sets A, B and C
$$A \cup (B \cap C) = (A \cup B) \cap (A \cup C).$$

(ii) Find the value of $16\cos\frac{\pi}{15}\cos\frac{2\pi}{15}\cos\frac{4\pi}{15}\cos\frac{8\pi}{15}$.

(iii) Show that
$$\sin^3\alpha + \sin^3(120° + \alpha) + \sin^3(240° + \alpha) = -\frac{3}{4}\sin 3\alpha.$$

(**b**) Answer any ***two*** questions: **4 × 2 = 8**

(i) Prove by mathematical induction (where $n \in \mathbb{N}$):

$$\frac{1}{3\cdot6}+\frac{1}{6\cdot9}+\frac{1}{9\cdot12}+\cdots+\frac{1}{3n(3n+3)}=\frac{n}{9(n+1)}.$$

(ii) If the pth and qth terms of an A.P are a and b respectively, then show that the sum of first $(p+q)$ terms of that A.P is $\frac{1}{2}(p+q)\left(a+b+\frac{a-b}{p-q}\right)$.

(iii) Find the probability of drawing 4 cards from a pack of 52 cards such that at least two cards will be aces.

(iv) Find the sum to n terms of the following series:

$$\left(x+\frac{1}{x}\right)^2+\left(x^2+\frac{1}{x^2}\right)^2+\left(x^3+\frac{1}{x^3}\right)^2+\left(x^4+\frac{1}{x^4}\right)^2+\cdots.$$

(**c**) Answer any ***two*** questions: **4 × 2 = 8**

(i) Two sides of a square have the equations $5x+12y=10$ and $5x+12y+29=0$ and the third side passes through the point $(3,5)$. Find the equations of the other two sides of the square.

(ii) Find the equation of the circle passes through the points $(4,3)$ and $(-2,5)$ and whose centre lies on the line $2x-3y=4$.

(iii) Show that the area of the triangle formed by the straight lines $y=m_1x+c_1$, $y=m_2x+c_2$ and $x=0$ is $\frac{1}{2}\cdot\frac{(c_1-c_2)^2}{|m_1-m_2|}$ sq. units.

(iv) Find the value of $\cos B$ for the triangle formed by joining the points $A(6,11,2), B(1,-1,2)$ and $C(1,2,6)$.

(**d**) Answer any ***one*** question: **4 × 1 = 4**

(i) Evaluate $\lim\limits_{x\to0}\frac{\cot 2x-\operatorname{cosec}2x}{x}$.

(ii) Find from the first principle, the derivative of $f(x)=e^{x^2}$ at $x=1$.

(**e**) Answer any ***one*** question: **4 × 1 = 4**

(i) Check the validity of the following statement by using the method of contradiction:

"The sum of a real number and a complex number is a complex number."

(ii) Check the validity of the following compound propositions:
(x) "72 is a multiple of both 4 and 9."
(y) "120 is a multiple of both 15 and 9."

4 × 1 = 4

(**f**) Answer any ***one*** question:

(i) Find the probability that a leap year, selected at random will contain 53 Sundays.

(ii) Find the coefficient of variation of the following data:

Marks	0-10	10-20	20-30	30-40	40-50
No. of students	4	10	16	12	8

GROUP - D

4. (**a**) Answer any ***one*** question: **5 × 1 = 5**

(i) Find the general solutions of x and y satisfying the equations $5\sin x\cos y = 1$ and $4\tan x = \tan y$.

(ii) Find the domain of definition and range of the function f defined by $f(x) = \frac{x}{1+x^2}$.

(iii) If $f(x) = ax^2 + bx + c$ and $f(2) = 1, f(3) = 6, f(-1) = 10$, then find the value of $f'(1)$.

(**b**) Answer any ***two*** questions: **5 × 2=10**

(i) If $z = x + iy$ and $|z-1| + |z+1| = 4$, then show that $3x^2 + 4y^2 = 12$, where $i = \sqrt{-1}$.

(ii) In how many ways can 6 boys and 4 girls be seated in a round table so that two girls never be seated together?

(iii) If $a_1, a_2, \ldots, a_n$ are in A.P, then prove that

$$\frac{1}{a_1a_2} + \frac{1}{a_2a_3} + \frac{1}{a_3a_4} + \cdots + \frac{1}{a_{n-1}a_n} = \frac{n-1}{a_1a_n}.$$

(iv) Solve $\frac{|x|-2}{|x|-3} \geq 0$, where $x \in \mathbb{R}$ and $x \neq \pm 3$.

5 × 1=5

(**c**) Answer any ***one*** question:

(i) If the extremities of a focal chord of the parabola $y^2 = 4ax$ be $(at_1^2, 2at_1)$ and $(at_2^2, 2at_2)$, prove that $t_1 t_2 = -1$.

(ii) If S, S' are the foci and P be any point on the hyperbola $x^2 - y^2 = a^2$, prove that $SP \cdot S'P = CP^2$ where C is the centre of the hyperbola.

 # West Bengal Board 2016 mathematics Paper
 # Annual Examination