

2018

MATHEMATICS

Full Marks : 100

Time : 3 hours

General Instructions :

- (i) Write all the answers in the Answer Script.
- (ii) The question paper consists of three Sections — A, B and C.
- (iii) Section — A consists of 15 questions, carrying 2 marks each.
- (iv) Section — B consists of 10 questions, carrying 4 marks each, out of which 2 questions have internal choices.
- (v) Section — C consists of 5 questions, carrying 6 marks each, out of which 2 questions have internal choices.

SECTION — A

(Answer all the 15 Questions)

1. If $A = \{2, 5, 7\}$, find $P(A)$ and $n[P(A)]$ 2
2. Prove that $\log(1 + 2 + 3) = \log 1 + \log 2 + \log 3$ 2
3. If ${}^nC_7 = {}^nC_5$, find n . 2

4. Insert two numbers between 3 and 81 so that the resulting sequence is GP. 2

5. Prove that $\sin 75^\circ = \frac{(\sqrt{6} + \sqrt{2})}{4}$. 2

6. If the three points $A(a, 0)$, $B(0, b)$ and $P(x, y)$ are collinear, using slopes, prove that $\frac{x}{a} + \frac{y}{b} = 1$. 2

7. Find the equation of a circle with centre (2, 4) and radius 5. 2

8. Find the domain of the real – valued function

$$f(x) = \frac{x^2 + 2x + 3}{x^2 - 5x + 6} \quad 2$$

9. Evaluate $\lim_{x \rightarrow \frac{\pi}{4}} \frac{(\sec^2 x - 2)}{(\tan x - 1)}$. 2

10. Prove that $2 \sin 22 \frac{1^\circ}{2} \cos 22 \frac{1^\circ}{2} = \frac{1}{\sqrt{2}}$. 2

11. In a single throw of two dice, find the probability of obtaining “a total of 10”. 2

(3)

12. Express $\left(\frac{1+i}{1-i}\right)$ in the form $a + ib$. 2
13. If ${}^n P_r = 720$ and ${}^n C_r = 120$, find value of r . 2
14. Write the negation of the following statements:
(i) Shillong is the capital of Kerela. 2
(ii) 3 is greater than 5
15. Find the middle term in the expansion of $(3+x)^6$ 2

SECTION — B

(Answer all the Questions)

16. In an examination, 56% of the candidates failed in English and 48% failed in Science. If 18% failed in both English and Science, find the percentage of those who passed in both the subjects. 4
17. Using the principle of mathematical induction, prove that $1 + 2 + 3 + \dots + n = \frac{1}{2}n(n+1)$ 4

(4)

18. Prove that $\cos 6x = 32\cos^6 x - 48\cos^4 x + 18\cos^2 x - 1$ 4
19. Find the general solution of $\sqrt{3} \cos x + \sin x = 1$ 4
- Or
- Prove that $\cos x \cos 2x \cos 4x \cos 8x = \frac{\sin 16x}{16 \sin x}$
20. Find the equation of the line passing through the point $(-2, -4)$ and perpendicular to the line $4x - 5y + 7 = 0$. 4
21. The probability that a person will get an electrification contract is $\left(\frac{2}{5}\right)$ and the probability that he will not get a plumbing contract is $\left(\frac{4}{7}\right)$. If the probability of getting at least one contract is $\left(\frac{2}{3}\right)$, what is the probability that he will get both? 4
22. Prove that ${}^n C_r + {}^n C_{r-1} = {}^{n+1} C_r$ 4

Or

- (i) How many permutations can be made of the letters of the word "SERIES"?
- (ii) How many of these start with S and end with S?

(5)

23. Solve the following systems of inequations graphically:
 $3x + 2y \leq 18, x + 2y \leq 10, x \geq 0, y \geq 0.$ 4
24. Find from first principle the derivative of $\sin(2x + 3)$ 4
25. Represent the complex number $(-1 + i\sqrt{3})$ in the polar form. 4

SECTION — C

(Answer all the Questions)

26. Prove that
 $\cos 10^\circ \cos 30^\circ \cos 50^\circ \cos 70^\circ = \frac{3}{16}$ 6
27. If S be the sum, P the product and R the sum of the reciprocals of n terms in a GP, Prove that 6

$$P^2 = \left(\frac{S}{R}\right)^n.$$

Or

Find the sum of the series $7 + 77 + 777 + \dots$ to n terms 6

(6)

28. (i) Using Binomial theorem, find the value of $(999)^4$ 3
- (ii) Find the coefficient of x^6 in the expansion of
 $\left(3x^2 - \frac{1}{3x}\right)^9$ 3
29. Find the (i) lengths of major and minor axes, (ii) coordinates of the vertices, (iii) eccentricity, (iv) coordinates of the foci and (v) length of the latus rectum of the ellipse 6

$$9x^2 + 16y^2 = 144.$$

30. Find the mean deviation about the median for the data: 6

Class	0-10	10-20	20-30	30-40	40-50	50-60
Frequency	6	8	11	18	5	2

Or

Find the mean, variance and standard deviation of first n natural numbers.

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