

No of Questions: 120

Time: 2 ½ hours

- Suppose that A denotes the collection of all complex numbers whose square is a negative real number. Which one of the following statements is correct?
 - $A \subseteq R$
 - $A \supseteq R$
 - $A = \{x + iy \mid x^2 \in R \mid x, y \in R\}$
 - $A = \{iy \mid y \in R\}$
- Which one of the following is correct?
 - $A \cup (B - C) = A \cap (B \cap C')$
 - $A - (B \cup C) = (A \cap B') \cap C'$
 - $A - (B \cap C) = (A \cap B') \cap C'$
 - $A \cap (B - C) = (A \cap B) \cap C$
- If $3(x+1) + 3(x+1) = 30$, then what is the value of $3(x+2) + 3x$?
 - 30
 - 60
 - 81
 - 90
- If A, B and C are three sets and U is the universal set such that $n(U) = 700, n(A) = 200, n(B) = 300$ and $n(A \cap B) = 100$, then what is the value of $(A' \cap B')$?
 - 100
 - 200
 - 300
 - 400
- The binary number $0.111111\dots$ (Where the digit 1 is recurring) is equivalent in decimal system to which one of the following?
 - $1/10$
 - $11/10$
 - 1
 - $10/11$
- What is the binary equivalent of decimal number $(0.8125)_{10}$?
 - $(0.1101)_2$
 - $(0.1001)_2$
 - $(0.1111)_2$
 - $(0.1011)_2$
- What is the value of $\frac{(\log_{27} 9)(\log_{16} 64)}{\log_4 \sqrt{2}}$?
 - 1
 - 2
 - 4
 - 8
- The order of a set A is 3 and that of a set B is 2. What is the number of relations from A to B ?
 - 4
 - 6
 - 32
 - 64
- Let $U = \{1, 2, 3, \dots, 20\}$. Let A, B, C be the subsets of U . Let A be the set of all numbers, which are perfect squares, B be the set of all numbers which are multiples of 5 and C be the set of all numbers, which are divisible by 2 and 3. Consider the following statements:
 - A, B, C are mutually exclusive.
 - A, B, C are mutually exhaustive.
 - The number of elements in the complement set of $A \cup B$ is 12.
 Which of the statements given above are the correct?
 - I and II only
 - I and III only
 - II and III only
 - I, II and III
- If $A = \{a, b, c\}$, then what is the number of proper subsets of A ?
 - 5
 - 6
 - 7
 - 8
- If a non-empty set A contains n elements, then its power set contains how many elements?
 - n^2
 - 2^n
 - $2n$
 - $2n+1$
- For what values of a does the equation $\cos 2x + a \sin x = 2a - 7$ possess a real solution?
 - $a < 2$
 - $a \geq 8$
 - $a > 8$
 - a is any integer < -2
- If the roots of the equations $x^2 - (a-1)x + (a+b) = 0$ and $ax^2 - 2x + b = 0$ are identical, then what are the values of a and b ?
 - $a = 2, b = 4$
 - $a = 2, b = -4$
 - $a = 1, b = \frac{1}{2}$
 - $a = -1, b = -1/2$
- If $x = 2^{1/3} - 2^{-1/3}$, then what is the value of $2x^3 + 6x$?
 - 1
 - 2
 - 3
 - 4
- If $2^x + 3^y = 17$ and $2^{x+2} - 3^{y+1} = 5$, then what is the value of x ?
 - 3
 - 2
 - 1
 - 0
- If $\frac{1}{2 - \sqrt{-2}}$ is one of the roots of $ax^2 + bx + c = 0$, where a, b, c are real, then what are the values of a, b, c respectively?
 - 6, -4, 1
 - 4, 6, -1
 - 3, -2, 1
 - 6, 4, 1
- What is the sum of the roots of the equation $(2 - \sqrt{3})x^2 - (7 - 4\sqrt{3})x + (2 + \sqrt{3}) = 0$?
 - $2 - \sqrt{3}$
 - $2 + \sqrt{3}$

- c) $7 - 4\sqrt{3}$ d) 4
18. If one of the roots of the equation $a(b-c)x^2 + b(c-a)x + c(a-b) = 0$ is 1, what is the second root?
- a) $-\frac{b(c-a)}{a(b-c)}$ b) $\frac{b(c-a)}{a(b-c)}$
- c) $\frac{c(a-b)}{a(b-c)}$ d) $-\frac{c(a-b)}{a(b-c)}$
19. If the roots of a quadratic equation $ax^2 + bx + c = 0$ are α and β , then the quadratic equation having roots α^2 and β^2 is
- a) $x^2 - (b^2 - 2ac)x + c = 0$
- b) $a^2x^2 - (b^2 - 2ac)x + c = 0$
- c) $ax^2 - (b^2 - 2ac)x + c^2 = 0$
- d) $a^2x^2 - (b^2 - 2ac)x + c^2 = 0$
20. If a, b, c are in geometric progression and a, 2b, 3c are in arithmetic progression, then what is the common ratio r such that $0 < r < 1$?
- a) $1/3$ b) $1/2$
- c) $1/4$ d) $1/8$
21. If the nth term of an arithmetic progression is $2n - 1$, then what is the sum upto n terms?
- a) n^2 b) $n^2 - 1$
- c) $n^2 + 1$ d) $1/2 n(n + 1)$
22. Which term of the sequence $20, 19\frac{1}{4}, 18\frac{1}{2}, 17\frac{3}{4}, \dots$ is the first negative term?
- a) 27th
- b) 28th
- c) 29th
- d) No such term exists
23. If $\frac{1}{b-a} + \frac{1}{b-c} = \frac{1}{a} + \frac{1}{c}$, then a, b, c are in
- a) AP b) GP
- c) HP d) None of these
24. What does the series $1 + 3^{-\frac{1}{2}} + 3 + \frac{1}{3\sqrt{3}} + \dots$ represents?
- a) AP
- b) GP
- c) HP
- d) None of the above series
25. Let $z = i^3(1+i)$ be a complex number. What is its argument?
- a) π b) $\pi/4$
- c) $-\pi/4$ d) $5\pi/4$
26. If $\alpha = \frac{1+i\sqrt{3}}{2}$, then what is the value of $1 + \alpha^8 + \alpha^{16} + \alpha^{24} + \alpha^{32}$?
- a) 0 b) 1
- c) ω d) $-\omega^2$
27. If ω is the cube root of unity, then what is the conjugate of $2\omega^2 + 3i$?
- a) $2\omega - 3i$ b) $2\omega + 2i$
- c) $2\omega + 3i$ d) $3\omega - 2i$
28. What is the value of $(1+i)^5 + (1-i)^5$ where $i = \sqrt{-1}$?
- a) -8 b) 8
- c) $8i$ d) $-8i$
29. What is the coefficient of x^3 in $(3 - 2x)/(1 + 3x)^3$?
- a) -272 b) -540
- c) -870 d) -918
30. What is the sum of the coefficients of all the terms in the expansion of $(45x - 49)^4$?
- a) -256 b) -100
- c) 100 d) 256
31. If the letters of the word BAZAR are arranged in dictionary order, then what is the 50th word?
- a) ZAABR b) ZBAAR
- c) ZBRAA d) ZAARB
32. What is the number of words formed from the letters of the word 'JOKE' so that the vowels and consonants alternate?
- a) 4 b) 8
- c) 12 d) None of these
33. A, B, C, D and E are coplanar points and three of them lie in a straight line. What is the maximum number of triangles that can be drawn with these points as their vertices?
- a) 5 b) 9
- c) 10 d) 12
34. The points (2, -2), (8, 4), (4, 6) and (-1, 1) in order are the vertices of which one of the following quadrilaterals?
- a) Square
- b) Rhombus
- c) Rectangle (but not square)
- d) Trapezium
35. Consider the following statements:
- The equation to a straight line parallel to the axis of x is $y = d$, where d is a constant.
 - The equation to the axis of x is $x = 0$.
- Which of the statement (s) given above is/are correct?
- a) 1 only b) 2 only
- c) Both 1 and 2 d) Neither 1 nor 2
36. The line $mx + ny = 1$ passes through the points

- (1, 2) and (2, 1). What is the value of m ?
- a) 1 b) 3
c) $\frac{1}{2}$ d) $\frac{1}{3}$
37. What is the distance between the lines $3x + 4y = 9$ and $6x + 8y = 18$?
- a) 0 b) 3 units
c) 9 units d) 18 units
38. A straight line passes through the points (5, 0) and (0, 3). The length of the perpendicular from the point (4, 4) on the line is
- a) $\frac{\sqrt{17}}{2}$ b) $\frac{\sqrt{17}}{2}$
c) $\frac{15}{\sqrt{34}}$ d) $\frac{17}{2}$
39. What is the equation of a circle, whose centre lies on the x-axis at a distance h from the origin and the circle passes through the origin?
- a) $x^2 + y^2 - 2hx = 0$
b) $x^2 + y^2 - 2hx + h^2 = 0$
c) $x^2 + y^2 + 2hxy = 0$
d) $x^2 + y^2 - h^2 = 0$
40. Which one of the following points lies inside a circle of radius 6 and centre at (3, 5)?
- a) (-2, -1) b) (0, 1)
c) (-1, -2) d) (2, -1)
41. What does an equation of the first degree containing one arbitrary parameter passing through a fixed point represent?
- a) Circle b) Straight line
c) Parabola d) Ellipse
42. What is the eccentricity of the conic $4x^2 + 9y^2 = 144$?
- a) $\sqrt{5}/3$ b) $\sqrt{5}/4$
c) $3\sqrt{5}$ d) $2/3$
43. Let A and B be obtuse angles such that $\sin A = 4/5$ and $\cos B = 12/13$. What is the value of $\sin(A + B)$?
- a) $-63/65$ b) $-33/65$
c) $33/65$ d) $63/65$
44. What is the value of $\frac{(\cos 10^\circ + \sin 20^\circ)}{(\cos 20^\circ - \sin 10^\circ)}$?
- a) $1/\sqrt{3}$ b) $-1/\sqrt{3}$
c) $\sqrt{3}$ d) $-\sqrt{3}$
45. For what value of x does the equation $4 \sin x + 3 \sin 2x - 2 \sin 3x + \sin 4x = 2\sqrt{3}$ hold?
- a) $\pi/6$ b) $\pi/4$
c) $\pi/3$ d) $\pi/2$
46. One radian is approximately equal to which one of the following?
- a) 90° b) 180°
c) 57° d) 47°
47. Consider the following statements
I. If $\theta = 1200^\circ$, then $(\sec \theta + \tan \theta) - 1$ is positive.
II. If $\theta = 1200^\circ$, then $(\operatorname{cosec} \theta - \cot \theta)$ is negative.
Which of the statements given above is/are correct?
- a) I only
b) II only
c) Both I and II
d) Neither I nor II
48. If α and β are positive angles such that $\alpha + \beta = \pi/4$, then what is $(1 + \tan \alpha)(1 + \tan \beta)$ equal to?
- a) 0 b) 1
c) 2 d) 3
49. If $\sin A + \sin B + \sin C = 3$ then what is $\cos A + \cos B + \cos C$ equal to?
- a) -1 b) 0
c) 1 d) 3
50. What is the maximum value of $\sin 3\theta \cos 2\theta + \cos 3\theta \sin 2\theta$?
- a) 1 b) 2
c) 4 d) 10
51. The angle subtended at the centre of a circle of radius 3 cm by an arc of length 1 cm is:
- a) $30^\circ/\pi$ b) $60^\circ/\pi$
c) 60° d) None of the above
52. What is the value of $\sin^{-1}\left(\sin \frac{2\pi}{3}\right)$?
- a) $-\pi/3$ b) $2\pi/3$
c) $-2\pi/3$ d) $\pi/3$
53. If $\sin^{-1} x - \cos^{-1} x = \frac{\pi}{6}$, then what is the value of x ?
- a) $x = -\frac{1}{2}$ b) $x = 1$
c) $x = 1/2$ d) $x = \frac{\sqrt{3}}{2}$
54. What is the principle value of $\operatorname{cosec}^{-1}(-\sqrt{2})$?
- a) $\pi/4$ b) $\pi/2$
c) $-\pi/4$ d) 0
55. In any triangle ABC, the sides are 6 cm, 10 cm and 14 cm. Then the triangle is obtuse angled with the obtuse angle equal to
- a) 150° b) 135°
c) 120° d) 105°
56. The lower 24 m portion of a 50 m tall tower is painted green and the remaining portion red. What is the distance of a point on the ground from the base of the tower where the two different portions of the tower subtend equal angles?
- a) 60 m b) 72 m
c) 90 m d) 120 m

57. The angle of elevation of the tip of a flag staff from a point 10 m due South of its base is 60° . What is the height of the flag staff correct to the nearest meter?
- a) 15 m b) 16 m
c) 17 m d) 18 m
58. If $f: \mathbb{R} \rightarrow \mathbb{R}^+$ such that $f(x) = (1/3)^x$, then what is the value of $f^{-1}(x)$?
- a) $(1/3)^x$ b) 3^x
c) $\log_{1/3} x$ d) $\log_x(1/3)$
59. Given, $f(x) = x + \frac{1}{x}$, then what is $f^2(x)$ equal to?
- a) $\frac{x^2+1}{x} + \frac{x}{x^2+1}$
b) $(x+1/x)^2$
c) $x^4 + (1/x^4)$
d) $x^2 + (1/x^2)$
60. Consider the following statements:
- $\lim_{x \rightarrow 0} \frac{x^2}{x}$
 - $\left(\frac{x^2}{x}\right)$ is not continuous at $x = 0$
 - $\lim_{x \rightarrow 0} \frac{|x|}{x}$ does not exist.
- Which of the statements given above are correct?
- a) 1, 2 and 3
b) 1 and 2 only
c) 2 and 3 only
d) 1 and 3 only
61. What is the value of $\lim_{x \rightarrow \infty} \left(\frac{x+6}{x+1}\right)^{x+4}$?
- a) e b) e^2
c) e^4 d) e^5
62. At how many points is the function $f(x) = [x]$ discontinuous?
- a) 1 b) 2
c) 3 d) Infinite
63. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a function whose inverse is $x + 5/3$. What is $f(x)$ equal to?
- a) $f(x) = 3x + 5$
b) $f(x) = 3x - 5$
c) $f(x) = 5x - 3$
d) $f(x)$ does not exist
64. The probability that a student passes in mathematics is $4/9$ and that he passes in physics is $2/5$. Assuming that passing in mathematics and physics are independent of each other, what is the probability that he passes in mathematics but fails in physics?
- a) $4/15$ b) $8/45$
c) $26/45$ d) $19/45$
65. What is the probability that in a family of 4 children there will be at least one boy?
- a) $15/16$ b) $3/8$
c) $1/16$ d) $7/8$
66. If A and B are two mutually exclusive and exhaustive events with $P(B) = 3P(A)$, then what is the value of $P(\bar{B})$?
- a) $3/4$ b) $1/4$
c) $1/3$ d) $2/3$
67. In tossing three coins at a time, what is the probability of getting at most one head?
- a) $3/8$ b) $7/8$
c) $1/2$ d) $1/8$
68. A husband and wife appear in an interview for two vacancies in the same post. The probability of husband's selection is $1/5$ and that of wife's selection is $1/3$. What is the probability that only one of them will be selected?
- a) $1/5$ b) $2/5$
c) $3/5$ d) $4/5$
69. Two dice each numbered from 1 to 6 are thrown together. Let A and B be two events given by A: even number on the first die. B: number on the second die is greater than 4. Q. What is $P(A \cup B)$ equal to?
- a) $1/2$ b) $1/4$
c) $2/3$ d) $1/6$
70. What is the angle between the two lines whose direction numbers are $(\sqrt{3} - 1, -\sqrt{3} - 1, 4)$ and $(-\sqrt{3} - 1, \sqrt{3} - 1, 4)$?
- a) $\pi/6$ b) $\pi/4$
c) $\pi/3$ d) $\pi/2$
71. A line makes angles θ, ϕ and ψ with x, y, z axes respectively. Consider the following.
- $\sin^2 \theta + \sin^2 \phi = \cos^2 \psi$
 - $\cos^2 \theta + \cos^2 \phi = \sin^2 \psi$
 - $\sin^2 \theta + \cos^2 \phi = \cos^2 \psi$
- Which of the above is/are correct?
- a) 1 only b) 2 only
c) 3 only d) 2 and 3
72. Which one of the following planes is normal to the plane $3x + y + z = 5$?
- a) $x + 2y + z = 6$
b) $x - 2y + z = 6$
c) $x + 2y - z = 6$
d) $x - 2y - z = 6$
73. Under what condition do the planes $bx - ay = n$, $cy - bz = l$, $az - cx = m$ intersect in a

line?

- a) $a + b + c = 0$
- b) $a = b = c$
- c) $al + bm + cn = 0$
- d) $l + m + n = 0$

74. What is the angle between two planes $2x - y + z = 0$ and $x + y + 2z = 6$?

- a) $\pi/2$ b) $\pi/3$
- c) $\pi/4$ d) $\pi/6$

75. What is the equation to the straight line passing through (a, b, c) and parallel to z-axis?

- a) $\frac{x-a}{1} = \frac{y-b}{0} = \frac{z-c}{0}$
- b) $\frac{x-a}{0} = \frac{y-b}{0} = \frac{z-c}{1}$
- c) $\frac{x-a}{0} = \frac{y-b}{1} = \frac{z-c}{0}$
- d) $\frac{x-a}{0} = \frac{y-b}{1} = \frac{z-c}{1}$

76. The sum of the direction cosines of z-axis is

- a) 0 b) $1/3$
- c) 1 d) 3

77. The marks scored by two students A and B in six subjects are given below:

A. 71 56 45 89 54 44

B. 55 74 83 54 38 52

Which one of the following statements is correct?

- a) The average scores of A and B are same but A is consistent
- b) The average scores of A and B are not same but A is consistent
- c) The average scores of A and B are same but B is consistent
- d) The average scores of A and B are not same but B is consistent

78. The following question consists of two statements, one labeled as the 'Assertion a)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answer. While constructing the cumulative frequency column of a frequency distribution, it is noticed that these cumulative frequencies are in arithmetic progression.

Assertion a): All the class frequencies are equal.

Reason (R): When all the class frequencies are equal, the cumulative frequencies are in arithmetic progression.

- a) Both A and R are individually true, and R is the correct explanation of A.
- b) Both A and R are individually true but R is

not the correct explanation of A.

- c) A is true but R is false.
- d) A is false but R is true

79. The average sales and standard deviation of sales for four months for a company are as follows:

	Month 1	Month 2	Month 3	Month 4
Average	30	57	82	28
Standard	2	3	4	2
Deviation of sales				

During which month are the sales most consistent?

- a) Month 1 b) Month 2
- c) Month 3 d) Month 4

80. What is the mean deviation of the data 2, 9, 9, 3, 6, 9, 4?

- a) 2.23 b) 2.57
- c) 3.23 d) 3.57

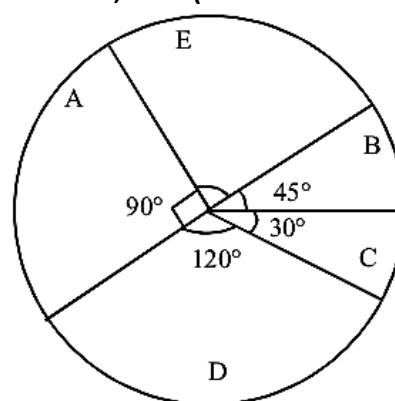
81. The average daily income of workers of a factory including that of the owner is Rs.110. However, if the income of the owner is excluded, the average daily income of the remaining 9 workers is Rs. 76. What is the daily income of the owner?

- a) Rs. 300 b) Rs. 316
- c) Rs. 322 d) Rs. 416

82. Directions – note: study the pie chart given below and answer the question that follow:

The following pie chart give the distribution of fund in a five year plan under the major heads of development expenditures:

Agriculture a), Industry b), Education c), Employment d) and Miscellaneous (E) The total allocation is 36,000 (in cores of rupees)



Q. Which head is allocated maximum funds?

- a) Agriculture b) Industry
- c) Employment d) Miscellaneous

83. Frequency curve may be:

- a) symmetrical b) positive skew

- c) negative skew d) all the above
84. If $x = \cos t$, $y = \sin t$, then what is $\frac{d^2y}{dx^2}$ equal to?
- a) y^{-3} b) y^3
c) $-y^{-3}$ d) $-y^3$
85. If $f(x) = \log_e [\log_e x]$, then what is $f'(e)$ equal to?
- a) $e-1$ b) e
c) 1 d) 0
86. If $f(x) = e^x$ and $g(x) = \log x$ then what is the value of $(g \circ f)'(x)$?
- a) 0 b) 1
c) e d) None of these
87. If $y = \cos t$ and $x = \sin t$, then what is $\frac{dy}{dx}$ equal to?
- a) xy b) x/y
c) $-y/x$ d) $-x/y$
88. Which one of the following statements is not correct?
- a) The derivative of $f(x)$ at $x = a$ is the slope of the graph of $f(x)$ at the point $[a, f(a)]$
b) $f(x)$ has a positive derivative at $x = a$ means $f(x)$ increases as x increases from 'a'
c) The sum of two differentiable functions is differentiable
d) If a function is continuous at a point, it is also differentiable at the same point.
89. What is the maximum value of x, y subject to the condition $x + y = 8$?
- a) 8 b) 16
c) 24 d) 32
90. The velocity of telegraphic communication is given by $v = x^2 \log(1/x)$, where x is the displacement. For maximum velocity, x equals to?
- a) $e^{1/2}$ b) $e^{-1/2}$
c) $(2e)^{-1}$ d) $2e^{-1/2}$
91. At an extreme point of a function $f(x)$, the tangent to the curve is
- a) parallel to the x-axis
b) perpendicular to the x-axis
c) inclined at an angle 45° to the x-axis
d) inclined at an angle 60° to the x-axis
92. If $f(x) = \ln(x - \sqrt{1+x^2})$, then what is $\int f''(x) dx$ equal to?
- a) $\frac{1}{(x - \sqrt{1+x^2})} + c$
- b) $-\frac{1}{\sqrt{1+x^2}} + c$
c) $-\sqrt{1+x^2} + c$
d) $\ln(x - \sqrt{1+x^2}) + c$
93. What is $\int e^{\ln x} \sin x dx$ equal to?
- a) $\sin x (\sin x - \cos x) + c$
b) $(\sin x - x \cos x) + c$
c) $(x \sin x + \cos x) + c$
d) $(\sin x + x \cos x) - c$
94. What is $\int \left(\frac{1}{\cos^2 x} - \frac{1}{\sin^2 x} \right) dx$ equal to?
- a) $2 \operatorname{cosec} 2x + c$
b) $-2 \cot 2x + c$
c) $2 \sec 2x + c$
d) $-2 \tan 2x + c$
95. What is the area of the region bounded by the line $3x - 5y = 15$, $x = 1$, $x = 3$ and x-axis in sq unit?
- a) $36/5$ b) $18/5$
c) $9/5$ d) $3/5$
96. What is the area bounded by the curve $y = x^2$ and the line $y = 16$?
- a) $32/3$ b) $64/3$
c) $256/3$ d) $128/3$
97. What is $\int_0^1 \frac{\tan^{-1} x}{1+x^2} dx$ equal to?
- a) $\frac{\pi^2}{8}$ b) $\frac{\pi^2}{32}$
c) $\frac{\pi}{4}$ d) $\frac{\pi}{8}$
98. What are the order and degree respectively of the differential equation $y = x \frac{dy}{dx} + \frac{dx}{dy}$?
- a) $1, 1$ b) $1, 2$
c) $2, 1$ d) $2, 2$
99. What are the order and degree respectively of the differential equation $\left\{ \left(\frac{d^4 y}{dx^4} \right)^3 \right\}^{2/3} - 7x \left(\frac{d^3 y}{dx^3} \right)^3 = 8$?
- a) $3, 2$ b) $4, 3$
c) $4, 2$ d) $3, 3$
100. What is the degree of the differential equation $\left(1 + \frac{dy}{dx} \right)^4 = \left(\frac{d^2 y}{dx^2} \right)^2$?
- a) 1 b) 2
c) 4 d) 8
101. What is the degree of the differential equation

$$\frac{d^3y}{dx^3} + 2\left(\frac{d^2y}{dx^2}\right) - \frac{dy}{dx} + y = 0?$$

- a) 6 b) 3
c) 2 d) 1

102. For what values of k , does the system of linear equations $x + y + z = 2$, $2x + y - z = 3$, $3x + 2y + kz = 4$ have a unique solution?

- a) $k = 0$ b) $-1 < k < 1$
c) $-2 < k < 2$ d) $k \neq 0$

103. If $A = \begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}$ is a 2×2 matrix and

$f(x) = x^2 - x + 2$ is a polynomial, then what is

$f(A)$?

- a) $\begin{bmatrix} 1 & 7 \\ 1 & 7 \end{bmatrix}$ b) $\begin{bmatrix} 2 & 6 \\ 0 & 8 \end{bmatrix}$
c) $\begin{bmatrix} 2 & 6 \\ 0 & 6 \end{bmatrix}$ d) $\begin{bmatrix} 2 & 6 \\ 0 & 7 \end{bmatrix}$

104. If ω is the cube root of unity, then what is one root

of the equation $\begin{vmatrix} x^2 & -2x & -2\omega^2 \\ 2 & \omega & -\omega \\ 0 & \omega & 1 \end{vmatrix} = 0$?

- a) 1 b) -2
c) 2 d) ω

105. If a, b, c are in GP, then what is the value of

$$\begin{vmatrix} a & b & a+b \\ b & c & b+c \\ a+b & b+c & 0 \end{vmatrix}?$$

- a) 0 b) 1
c) -1 d) None of these

106. If a, b, c are non-zero real numbers and

$$\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = 0.$$
 Then what is the value of

$$\frac{1}{a} + \frac{1}{b} + \frac{1}{c}?$$

- a) 2 b) 1
c) -1 d) 0

107. If $A = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$, $B = \begin{bmatrix} i & 0 \\ 0 & -i \end{bmatrix}$, $C = \begin{bmatrix} 0 & -i \\ -i & 0 \end{bmatrix}$, then

which one of the following is not correct?

- a) $A^2 = B^2$ b) $B^2 = C^2$
c) $AB = C$ d) $AB = BA$

108. $A = \begin{bmatrix} 3 & 1 \\ 0 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 1 \\ 0 & 2 \end{bmatrix}$, then which of the

following is/are correct?

- I. AB is defined

II. BA is defined

III. $AB = BA$

- a) Only I b) Only II
c) Both I and II d) I, II and III

109. If $\begin{vmatrix} 8 & -5 & 1 \\ 5 & x & 1 \\ 6 & 3 & 1 \end{vmatrix} = 2$ then what is the value of x ?

- a) 4 b) 5
c) 6 d) 8

110. The determinant of a orthogonal matrix is:

- a) ± 1 b) 2
c) 0 d) ± 2

111. Let α be the angle which the vector $\vec{V} = 2\hat{i} - \hat{j} + 2\hat{k}$ makes with the z -axis, then, what is the value of $\sin \alpha$?

- a) $2/3$ b) $1/3$
c) $\frac{\sqrt{5}}{3}$ d) $\frac{\sqrt{5}}{9}$

112. If $a\hat{i} + \hat{j} + \hat{k}$, $\hat{i} + b\hat{j} + \hat{k}$ and $\hat{i} + \hat{j} + c\hat{k}$ are coplanar vector, then what is the value of $a+b+c-abc$?

- a) 0 b) 1
c) 2 d) -2

113. If \vec{a} and \vec{b} are unit vectors, then what is the value of $|\vec{a} \times \vec{b}|^2 + (\vec{a} \cdot \vec{b})^2$?

- a) 0 b) 2
c) 1 d) $\frac{1}{2}$

114. If $\vec{a} = \hat{i} - 2\hat{j} + 5\hat{k}$, $\vec{b} = 2\hat{i} + \hat{j} - 3\hat{k}$, then what is $(\vec{b} - \vec{a}) \cdot (3\vec{a} + \vec{b})$ equal to?

- a) 106 b) -106
c) 53 d) -53

115. PQRS is a parallelogram, where $\vec{PQ} = 3\hat{i} + 2\hat{j} - m\hat{k}$, $\vec{PS} = \hat{i} + 3\hat{j} + \hat{k}$ and the parallelogram is $\sqrt{90}$. what is the value of m ?

- a) 1 b) -1
c) 2 d) -2

116. If \vec{a} and \vec{b} are two vectors such that $\vec{a} \cdot \vec{b} = 0$ and $\vec{a} \times \vec{b} = 0$, then which one of the following is correct?

- a) \vec{a} is parallel to \vec{b}
b) \vec{a} is perpendicular to \vec{b}
c) Either \vec{a} or \vec{b} is a null vector
d) None of the above

117. The vector $\vec{a} \times (\vec{b} \times \vec{a})$ is coplanar with:

- a) \vec{a} only
b) \vec{b} only
c) Both \vec{a} and \vec{b}

d) Neither \bar{a} nor \bar{b}

118. Let A and B be two non-empty subsets of a set X. If $(A-B) \cup (B-A) = A \cup B$, then which one of the following is correct?

- a) $A \subset B$ b) $A \subset (X-B)$
 c) $A = B$ d) $B \subset A$

119. If $3^{(x-1)} + 3^{(x+1)} = 30$, then what is the value of $3^{(x+2)} + 3^x$?

- a) 30 b) 60
 c) 81 d) 90

120. The following question consist of two statement, one labelled as the "Assertion (A)" and the other as "Reason (R)", you are to examine these two

statements carefully and select the answer.

Assertion (A): If events, A, B, C, D are mutually exhaustive, then $(A \cup B \cup C)^c = D$.

Reason (R): $(A \cup B \cup C)^c = D$ implies if any element is excluded from the sets A, B and C, then it is included in D.

- a) Both A and R are individually true, and R is the correct explanation of A.
 b) Both A and R are individually true but R is not the correct explanation of A.
 c) A is true but R is false.
 d) A is false but R is true.

