BHU MCA – 2019

1. Find the odd one in the series

(a) 12 : 37 (b) 8 : 33 (c) 15 : 46 (d) 7 : 22

2. Find the odd one in the series 8, 27, 64, 100, 125, 216, 343

(a) 27 (b) 64 (c) 100 (d) 343

3. Solve the differential equation $x\frac{dy}{dx} - y = \log x$

(a) $y = \frac{c}{x} - \log(x+1)$ (b) $y = cx - (\log x + 1)$

(c) $y = \log x + \frac{c}{x}$ (d) None of these

4. ₹ 395 is divided among A, B, C such that B get 25% more than A and 20% more than C, then share of A is

(a) 120 (b) 180 (c) 170 (d) 115

5. Find the eccentricity of hyperbola $x^2 - 2x + 8y - 2y^2 - 1 = 0$

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

6. $9^{1/3}, 9^{1/9}, 9^{1/27}, \dots$ upto the infinite then last value is

(a) 1 (b) 0 (c) 3 (d) None

7. $\log_{16} 512$ is equal to

(a) $\frac{9}{4}$ (b) $\frac{9}{2}$ (c) $\frac{3}{4}$ (d) $\frac{3}{2}$

8. If x, y, z are in GP $x^{1/a} = y^{1/b} = z^{1/c}$, then a, b, c are in

(a) HP (b) GP

(c) AP (d) Special Sequence

9. $\frac{1^3}{1} + \frac{1^3 + 2^3}{1+2} + \frac{1^3 + 2^3 + 3^3}{1+2+3} + \dots$ upto n terms

(a) $\frac{n}{12}(n^2 + 9n + 17)$ (b) $\frac{n}{24}(2n^2 + 9n + 13)$

(c) $\frac{n}{24}(2n^2 - 9n - 13)$ (d) None of these

10. If α, β are root of equation $x^2 - x + 1$, then $\alpha^2 + \beta^2$ is equal to

(a) 3 (b) −1 (c) −3 (d) 1

11. $\frac{a^{n+1} + b^{n+1}}{a^n + b^n}$ is geometric mean of a and b, then find n

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

12. $\int_0^{\pi/2} \sqrt{\tan x} + \sqrt{\cot x}$

(a) π (b) $\pi\sqrt{2}$ (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$

13. $\int_{\pi/5}^{3\pi/10} \frac{\sin x}{\sin x + \cos x}\,dx$

(a) $\frac{\pi}{10}$ (b) $\frac{\pi}{20}$ (c) $\frac{\pi}{5}$ (d) $\frac{\pi}{2}$

14. $\sin y = x\cos(a + y)$, then $\frac{dy}{dx}$ is equal to

(a) $\frac{\cos a}{\sin^2(a+y)}$ (b) $\frac{\sin a}{\sin^2(a+y)}$

(c) $\frac{\cos^2(a+y)}{\cos a}$ (d) $\frac{\cos a}{\cos^2(a+y)}$

15. $0.2^{\log_{\sqrt{5}}\left(\frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \dots\right)}$

(a) 4 (b) 2 (c) 1 (d) 8

16. $\left(\frac{2x^2}{3} - \frac{3}{2x^2}\right)^{10}$, then the middle term is

(a) −152 (b) −252 (c) 252 (d) 152

17. There are 5 black and 4 brown socks in a drawer a man pulls out 2 socks at random, then probability that, they are of same colour

(a) $\frac{2}{9}$ (b) $\frac{4}{10}$ (c) $\frac{5}{9}$ (d) $\frac{4}{9}$

Direction (Q. No. 18) *Read the following statements carefully and then find which of the conclusions logically follows from the given statements.*

18. Statements All politicians are honest, all honest are fair.

Conclusions

(i) Some honest are politician

(ii) No honest is politician

(iii) Some fair are politician

(a) Only conclusion (i) is true

(b) Conclusions (i) and (ii) are true

(c) Only conclusions (iii) is true

(d) Conclusions (i) and (iii) are true

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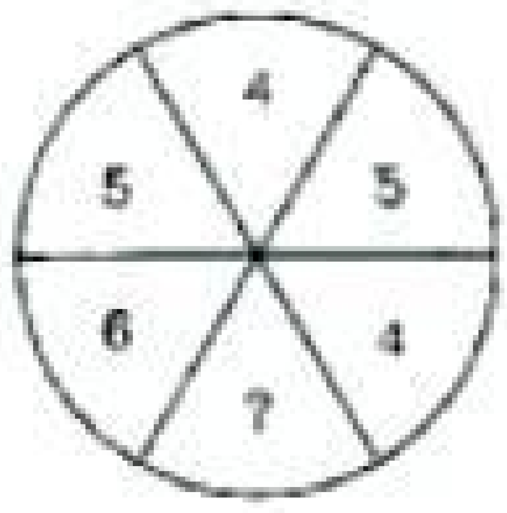
19. Inserting missing character



(a) 6 (b) 5 (c) 4 (d) 3

20. $\int \frac{1+\sin x}{1-\sin x}\,dx$

(a) $2\tan x - x + 2\sec x + C$ (b) $2\tan^2 x + x + \sec x$
(c) $2\tan x + x - 2\sec x + C$ (d) $2\sec^2 x + \tan x + C$

21. The axes of an ellipse are along the coordinate axes whose vertices are $(0, \pm 10)$ eccentricity $e = \frac{4}{5}$, then equation of ellipse is

(a) $\frac{x^2}{16}+\frac{y^2}{30}=1$ (b) $\frac{x^2}{36}+\frac{y^2}{164}=1$
(c) $\frac{x^2}{64}+\frac{y^2}{100}=1$ (d) $\frac{x^2}{36}+\frac{y^2}{100}=1$

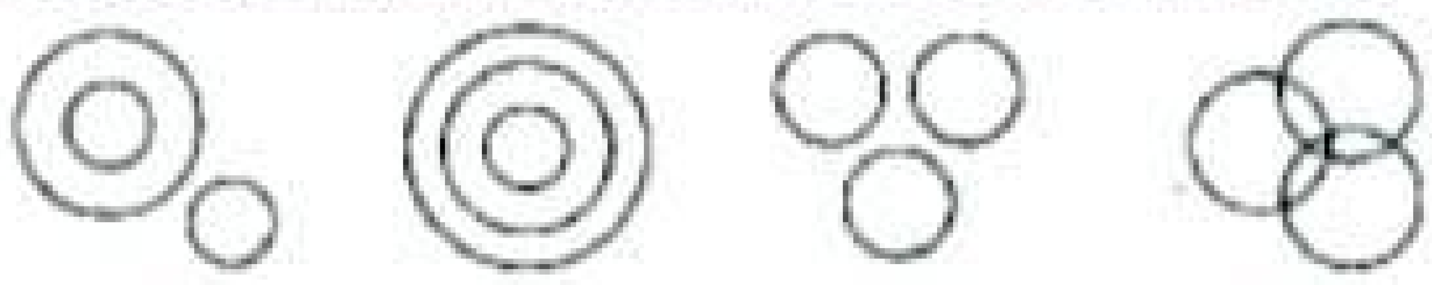
22. A box contains 5 different red ball and 6 different white ball. In how many ways can 6 balls be selected so that there are at least two balls of each colour

(a) 625 (b) 425 (c) 400 (d) 252

23. The determinant $\begin{vmatrix} x & x^2 & 1+x^3 \\ y & y^2 & 1+y^3 \\ z & z^2 & 1+z^3 \end{vmatrix} = 0$, then

(a) $xyz = -1$ (b) $xyz = -2$
(c) $xyz = 2$ (d) $xyz = 1$

24. Represent in venn diagram-Pigeon, Birds, Dog



(a) (b) (c) (d)

25. Represent in venu diagram-Food, Vegetable, Carrot

(a) (b) (c) (d)

26. Find wrong number in series.

3, 5, 7, 12, 17, 19

(a) 5 (b) 12 (c) 19 (d) 17

27. $\int \sec^4 x \tan x\,dx$

(a) $\sec^2 x \tan x + \sec x + C$ (b) $\sec x + \frac{\tan^2 x}{2} + C$
(c) $\frac{\tan^2 x}{2} + \frac{\tan^4 x}{4} + C$ (d) None of these

28. $y = \log\left[\left(\tan\left(\frac{\pi}{4}+\frac{x}{2}\right)\right)\right]$, then $\frac{dy}{dx}$

(a) $\sec^2\left(\frac{\pi}{4}+\frac{x}{2}\right)$ (b) $\sec x$
(c) $\frac{1}{2}\tan\left(\frac{\pi}{4}+\frac{x}{2}\right)$ (d) None of these

29. $\int_0^{\sqrt{2}} \sqrt{2-x^2}\,dx$

(a) $\frac{1}{2}$ (b) 1 (c) $\frac{3}{2}$ (d) $\frac{\pi}{2}$

30. $\frac{(1+i)^n}{(1-i)^{n-2}}$ is real, then find n

(a) 2 (b) 4 (c) 0 (d) 1

31. $\begin{bmatrix} 0 & 5 & -7 \\ -5 & 0 & 11 \\ 7 & -11 & 0 \end{bmatrix}$ is

(a) symmetric (b) skew-symmetric
(c) skew-hermitian (d) None of these

32. If the coefficient of x in the expansion of $\left(x^2 - \frac{\lambda}{x}\right)^5$ is 270. Then find the value of λ.

(a) 5 (b) 9 (c) 27 (d) 3

33. $\log_{2\sqrt{3}} x = 6$, then find x

(a) 1680 (b) 1728 (c) 1530 (d) 1800

34. The sum of n terms of an AP is $3n^2 + 5n$ and its mth term is 164 the value of m is

(a) $m = 26$ (b) $m = 27$
(c) $m = 28$ (d) $m = 29$

35. If the coefficient of $r, r+1, r+2$ th terms in expansion of $(1+x)^n$ are in ratio $1:7:42$, then the value of n is

(a) 30 (b) 55 (c) 52 (d) 50

36. In how many ways 9 papers can be arranged so that the goods and worst never together

(a) $9! - (8!2!)$ (b) 1440
(c) 2800 (d) None of these

37. If the average age of 50 student is 28 and age of 10 more student is added. So that average age increase by 0.2, then find the new average of students.

(a) 27.92 (b) 27.29
(c) 29.29 (d) None of these

38. A bag contains 5 white and 4 red balls another bag containing 6 white and 7 red ball. If on ball is drawn from one bag to second then one ball is drawn from 2nd bag then find the probability that drawn ball is white

(a) $\frac{59}{126}$ (b) $\frac{58}{63}$
(c) $\frac{29}{63}$ (d) $\frac{29}{126}$

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39. If the first, second and last term of an AP is a, b, c, then find the sum of AP

(a) $\frac{(c-a)(b+c-a)}{(b-a)}$ (b) $\frac{(c+a)(b+c-a)}{2(b-a)}$

(c) $\frac{(a+c)(b+c-2a)}{2(b-a)}$ (d) None of these

40. 10th term in the expansion of $\left(2x^2-\frac{1}{x}\right)^{12}$

(a) $\frac{252}{x^3}$ (b) $-\frac{1760}{x^3}$ (c) $\frac{1660}{x^3}$ (d) $-\frac{252}{x^3}$

41. Find the distance between $5x+3y-7=0$, $15x+9y+14=0$

(a) $\frac{35}{3\sqrt{34}}$ (b) $\frac{35}{\sqrt{34}}$

(c) $\frac{7}{2\sqrt{34}}$ (d) None of these

42. $\sin^{-1}\left(\frac{2x}{1+x^2}\right)=y, x\in[-1,1]$, then find $\frac{dy}{dx}$

(a) $\frac{1}{\sqrt{1+x^2}}$ (b) $\frac{2}{1+x^2}$

(c) $\frac{2}{\sqrt{1+x^2}}$ (d) None of these

43. Find the odd one.

(a) Shoes (b) Shirt (c) Cobbler (d) Ring

44. An Venchor bought 6 buttons for a rupee. How many for a rupee must he sell to gain 20%.

(a) 3 (b) 4 (c) 6 (d) 5

45. $[i^{87}+i^{89}+i^{70}+i^{72}]^9=?$

(a) 8 (b) 0 (c) –8 (d) –2

46. If $f(x)=\frac{x}{x+1}$ and $g(x)=\frac{1}{x+3}$, then domain of $f(g(x))$

(a) $R-\{-1,-2\}$ (b) $R-\{-1,0\}$

(c) $R-\{-3\}$ (d) $R-\{-3,-4\}$

47. If $x+iy=(1+i)(1+2i)(1+3i)$, then x^2+y^2 is equal to

(a) 0 (b) 100 (c) 50 (d) 25

48. If $y=\cos(\log x)+\sin(\log x)$ then value of $x^2y_2+xy_1+y=?$

(a) 2 (b) $\cos(\log x)$ (c) 0 (d) $-2\sin(\log x)$

49. A has more money than B and less than C, E has more money than A but less than C. D has more money than A, then who is richest one?.

(a) E (b) A (c) D (d) C

50. The area bounded by the curve $\{x^2+y^2\le 1\le x+y\}$

(a) $\frac{\pi}{4}-\frac{1}{4}$ (b) $\frac{\pi}{4}-\frac{1}{2}$ (c) $\frac{\pi}{2}-1$ (d) $\frac{\pi}{2}+\frac{1}{4}$

51. If 1 Jan 2006 was Sunday then 1 Jan 2010?

(a) Friday (b) Sunday

(c) Saturday (d) Wednesday

52. First three of four number are in GP and last three are in AP with a common difference 6 and 1st and last term are same then find first term

(a) 2 (b) 4 (c) 6 (d) 8

53. If $y=x-\frac{x^2}{2}+\frac{x^3}{3}-\frac{x^4}{4}+\ldots$ then x is terms of y

(a) $x=e^y-1$ (b) $x=e^y+1$

(c) $x=y-\frac{y^2}{2!}+\frac{y^3}{3!}+\ldots$ (d) None of these

54. If $A=\{1,2,3\}$ relation $\{(1,2),(1,3),(2,3)\}$ on A is

(a) symmetric (b) reflexive and transitive

(c) transitive (d) equivalence

55. If $A=\{1,2,3\}$ then find the total number of equivalence relation including (1, 2).

(a) 1 (b) 4 (c) 1 (d) 3

56. $f(x)=\begin{cases}kx^2 & x\le 2\\ 3 & x>2\end{cases}$ is continuous at $x=2$, then k is equal to

(a) 2 (b) $\frac{3}{4}$ (c) $\frac{1}{4}$ (d) 1

57. $\frac{2+3i\sin\theta}{1-2i\sin\theta}$, $\theta\in(0,2\pi)$ find value of θ for which the value of expression is real

(a) $\theta=\frac{\pi}{2}$ (b) $\theta=\frac{\pi}{3}$ (c) $\theta=\pi$ (d) $\theta=\frac{\pi}{6}$

58. $\begin{vmatrix}x+1 & x+4 & x+a\\ x+2 & x+5 & x+b\\ x+3 & x+6 & x+c\end{vmatrix}$ a, b, c are in AP, then

(a) 1 (b) –1 (c) 0 (d) 2

59. If $a_1, a_2, a_3, \ldots a_n$ are in AP, then $\frac{1}{a_1a_2}+\frac{1}{a_2a_3}+\frac{1}{a_3a_4}+\ldots+\frac{1}{a_n+a_n}$

(a) $\frac{n-1}{a_1a_n}$ (b) $\frac{n+1}{a_1a_n}$

(c) $-\frac{n+1}{a_1a_n}$ (d) None of these

60. If $\Delta=\begin{vmatrix}\log_3 512 & \log_4 3\\ \log_3 8 & \log_4 9\end{vmatrix}$

(a) 1 (b) 2 log 3

(c) $\frac{15}{2}$ (d) 5

61. There are 120 student and 5% of them play all the three game Cricket, Carom and Chess and there are 30 such student who exactly play two of the three games and 40 students play only cricket. Then the number of students who play Carom alone or Chess alone are

(a) 47 (b) 45

(c) 46 (d) 44

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62. The average age of 40 students is 15 yr. If 10 new students are included then the average is increased by 0.2 yr. Then the average age of the 10 new students is

(a) 18 yr (b) 16 yr
(c) 16.4 yr (d) 15.2 yr

63. Find the equation of the normal of the curve $y = 2x^2 + 3\sin x$ at $x = 0$

(a) $x + 3y = 0$ (b) $5x + y = 0$
(c) $y + 2x = 0$ (d) $3x + y = 0$

64. Find the middle of the 8th from the left and 9th from the right end in the given series A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z

(a) N (b) M (c) J (d) P

65. $\left|x + \frac{1}{x}\right| > 2, x \neq 0$, then solution is

(a) $R - \{-1, 0, 1\}$ (b) $R - \{-1, 0, 2\}$
(c) $R - \{1, 0, 2\}$ (d) $R - \{-1, -1\}$

66. $2\begin{bmatrix} 1 & 2 \\ 0 & x \end{bmatrix} + \begin{bmatrix} y & 4 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 5 & 6 \\ 1 & 8 \end{bmatrix}$

(a) $x = 1, y = 3$ (b) $x = 3, y = 3$
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67. Which is not a leap year?

(a) 1200 (b) 800 (c) 700 (d) 2000

68. Find the odd one out 8, 27, 64, 100, 125, 216, 343

(a) 343 (b) 64 (c) 216 (d) 100

69. 8 men and 12 boys can do a piece of work in 10 days and 6 men and 8 boys in 14 days then third in how many days one men can do same work alone

(a) 100 (b) 70 (c) 140 (d) 280

70. $\frac{\log a}{b - c} = \frac{\log b}{c - a} = \frac{\log c}{a - b}$, then $a^{b+c} \times b^{c+a} \times c^{a+b} = ?$

(a) 1 (b) 0
(c) −1 (d) −5

71. In a examination there are 5 question with each having 4 answers then in how many ways a students given answers

(a) 1024 (b) 512 (c) 2880 (d) 5^4

72. Polar form of $\frac{1 + 3i}{1 - 2i} = ?$

(a) $\sqrt{2}\left(\cos\frac{3\pi}{4} + i\sin\frac{3\pi}{4}\right)$ (b) $\sqrt{2}\left(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right)$
(c) $\sqrt{2}\left(\cos\frac{\pi}{2} + i\sin\frac{\pi}{2}\right)$ (d) $\sqrt{2}\left(\sin\frac{5\pi}{4} + i\sin\frac{5\pi}{4}\right)$

73. Sum of two numbers is 15 and sum of their reciprocal is $\frac{3}{10}$, then find smaller of two numbers

(a) 15 (b) 10 (c) 5 (d) 4

74. Two events A and B having probabilities 0.25 and 0.50 respectively. The probabilities that both A and B occur simultaneously is 0.14. The probability that neither A nor B occurs

(a) 0.25 (b) 0.39 (c) 0.11 (d) 0.06

75. **Statement** (a) All books are pencil

(b) All pencil are pens

Conclusion (i) All books are pens

(ii) Some pencil are pens

(iii) Some pens are not book

(a) Ist is true (b) II is true
(c) I and II is true (d) Neither I nor II

76. If $\log_{10} 2 = a$ and $\log_{10} 3 = b$, then $\log_{10}\frac{160}{729}$ is

(a) $4a - 6b + 1$ (b) $4a + 6b + 1$
(c) $2a - 3b + 1$ (d) $2a + 3b + 1$

77. 5 Men and 4 women have to sit together in a row then find number of ways such that women occupy even place

(a) 1440 (b) ${}^{5}C_{4}4!5!$ (c) $4!5!2!$ (d) 2880

78. In certain code : 1 3 4 means : "good and tasty"

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79. If a man goes 12 km upstream and return back is 2 hr 45 min. If speed of boat is 11 km/h then find the speed of stream.

(a) 10 km/h (b) 4 km/h (c) 8 km/h (d) 5 km/h

80. Arrange the words as per the order in the telephone directory then find last word.

(a) Mahindra (b) Mahendra
(c) Mahinder (d) Mahender

81. The focus of $4y^2 - 12y + 12x - 39 = 0$ is

(a) $\left(-\frac{13}{4}, \frac{3}{2}\right)$ (b) $\left(-\frac{13}{2}, \frac{3}{4}\right)$ (c) $\left(-\frac{3}{2}, 0\right)$ (d) $\left(0, -\frac{13}{4}\right)$

82. A said to B "if you give me ₹ 10, I will have two times that will be left have you, then B said to A". If you give me ₹ 10 we will have equal the find money that A has originally

(a) 80 (b) 70
(c) 90 (d) None of these

83. If there is Friday on 1st Jan 2007, then what day of week will be on 1st Jan 2008?

(a) Monday (b) Tuesday (c) Saturday (d) Friday

84. If 5 men can make 5 item in 5 days, then in how many day 3 men will make 3 items?

(a) 6 (b) 3 (c) 5

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85. The amplitude of $\frac{1+\sqrt{3}i}{\sqrt{3}+i}$ is

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$

(c) $\frac{\pi}{3}$ (d) None of these

86. A circle is passing through origin and cut the intercept of length a and b with the co-ordinate axis equation of circle

(a) $x^2 - y^2 - ax + by = 0$ (b) $x^2 + y^2 - ax - by = 0$

(c) $x^2 + y^2 + ax + by = 0$

(d) $x^2 + y^2 + ax + by + a^2 + b^2 = 0$

87. The calendar of which year will be same as 2007?

(a) 2011 (b) 2012 (c) 2017 (d) 2018

88. If code in DELHI is written as HIPLM, then which word would be written as QEHVEW?

(a) MADRAS (b) MUMBAI

(c) KOLKATA (d) CHENNAI

89. A man bought some amount of sugar for ₹ 56 the price of sugar per kg is decreased ₹ 1 then the man can purchases 1 kg more sugar for the same amount of money then the original price of sugar per kg?

(a) ₹ 7/kg (b) ₹ 8/kg (c) ₹ 6/kg (d) ₹ 9/kg

90. Three numbers are chosen from third 20 natural numbers then find the probability of their product is even is

(a) $\frac{12}{19}$ (b) $\frac{17}{19}$ (c) $\frac{15}{19}$ (d) $\frac{13}{19}$

91. One year ago the age of the father is 8 times his son and the present age of father square of the age of the son. Then the age of the father is

(a) 49 yr (b) 64 yr (c) 48 yr (d) 47 yr

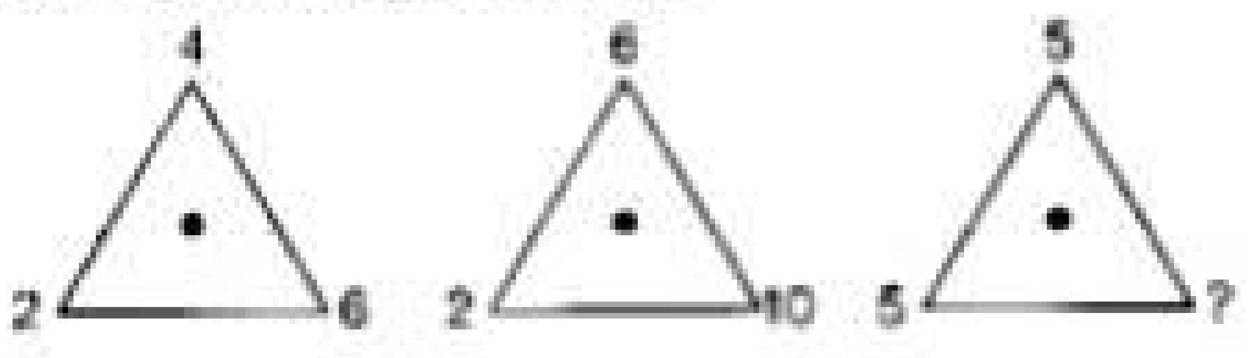
92. Complete the following series by choosing correct option. a__bb__aab__ca__bbc

(a) caba (b) acba (c) abba (d) bacb

93. The number of ways in which 5 men and 4 women can seat in a row such that women sits at even places

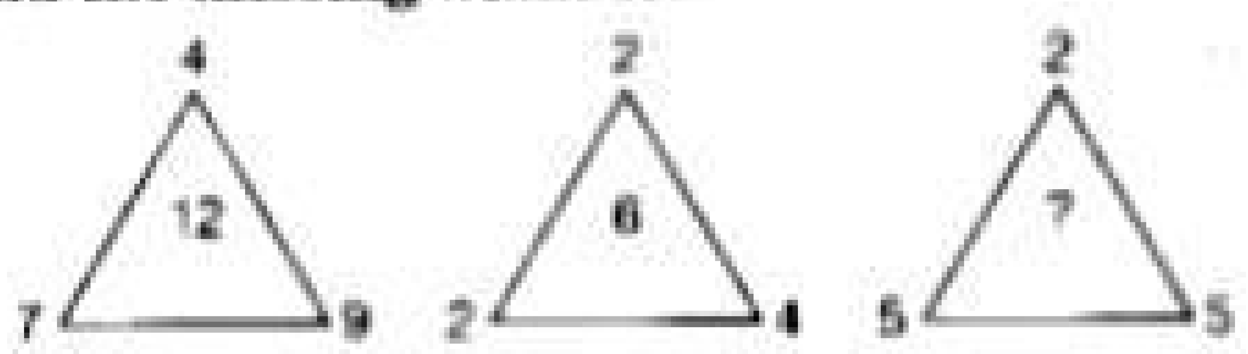
(a) 2! 5! 4! (b) 6! 4! (c) 7! 8! (d) 4! 5!

94. Find the missing number.



(a) 7 (b) 5 (c) 9 (d) 2

95. Find the missing number.



(a) 3 (b) 4 (c) 7 (d) 8

96. In how many times the hands of a clock in a straight line?

(a) 22 (b) 44 (c) 24 (d) 48

97. Find the nearest to 99547 divisible by 687

(a) 100166 (b) 99615 (c) 99479 (d) 98926

98. What is the least value of k such that roots of $x^2 - 5x + k = 0$ is imaginary

(a) 7 (b) 6 (c) 4 (d) 9

99. If $A = \begin{bmatrix} 4 & -3 \\ 3 & 2 \end{bmatrix}$, then find A^{-1}

(a) $\frac{1}{17}\begin{bmatrix} 2 & -3 \\ 3 & 4 \end{bmatrix}$ (b) $\frac{1}{17}\begin{bmatrix} 2 & 3 \\ -3 & 4 \end{bmatrix}$

(c) $\frac{1}{17}\begin{bmatrix} 3 & 4 \\ 2 & -3 \end{bmatrix}$ (d) $\frac{1}{17}\begin{bmatrix} 4 & 3 \\ 3 & 2 \end{bmatrix}$

100. Find the value of x : $\frac{5x-2}{3} - \frac{7x-3}{5} > \frac{x}{4}$, then x

(a) $(-4, \infty)$ (b) $[-4, 4]$

(c) $(-\infty, 4]$ (d) $(4, \infty)$

101. One morning, Udai and Vishal are facing each other the shadow of Vishal is to left the Udai then in which direction Udai faces

(a) South (b) North

(c) East (d) West

102. Pointing to a man in a photograph a woman said "His brother is the son of only son my grandfather. How the woman is related to the man in photograph?

(a) Brother (b) Sister

(c) Aunt (d) Cousin

103. If equation $x^2 + 11x + a = 0$ and $x^2 + 14x + 2a = 0$ having common root then $a = ?$

(a) 4 (b) 8 (c) 12 (d) 24

104. If $g(x) = x^2 + x - 2$, $\frac{1}{2} f(g(x)) = 2x^2 - 5x + 2$, then $f(x) =$ is equal to

(a) $3 - x$ (b) $2x + 3$ (c) $x + 3$ (d) $2x - 3$

105. Arrange the words in alphabetical order which will be last word?

(a) Accumulate (b) Accutate

(c) Acelate (d) Accommodate

106. NCPGQKRLZYESVIYFMWBDO according to the series what will be the term in place of ? NDP, QWR, ZFE, ?

(a) SVI (b) VIY

(c) AFR (d) ECV

107. A watch gains uniformly is 2 min slow at noon on Monday and is 4 min 48 sec fast at 2 pm on the following Monday. When was it correct?

(a) 2 pm on Tuesday (b) 2 pm on Wednesday

(c) 3 pm on Thursday (d) 1 pm on Friday

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108. A vessel contain 600 liters of 12% solution of acid value of if x litre of 30% solution of Acid is mixed and the resultant mixture is greater than 15% and less than 18%

(a) $120 \le x \le 300$ (b) $250 \le x \le 300$
(c) $150 \le x \le 200$ (d) $160 \le x \le 300$

109. A man goes 5 km southward and then turn right and move 3 km after that turns to left and goes 5 km. Now in which direction he is from the starting point?

(a) South-West (b) South-East
(c) North-West (d) North-Eest

110. Preeti has a son Arun and Ram, is Preeti's brother. Ram has a sister Neeta who has one daughter Reena and son David, then Ram has how many nephews?

(a) 2 (b) 3 (c) 1 (d) 0

111. A man wants to cut three lengths from a single piece of board of length 91 cm. The second length is to 3 cm longer than the shortest and the third length is to be twice as long as the shortest. What are the possible lengths of the shortest board if the third piece is to be at least 5 cm longer than the second?

(a) greater than 8 and less than 21
(b) greater than 6 and less than 20
(c) $8 \le x \le 22$ (d) $7 < x < 21$

112. If A $ B means ⇒ A is brother of B

A @ B means ⇒ A is wife of B

A # B means ⇒ A is sister of B

A & B means ⇒ A is father of B then D is father-in-law of H is

(a) J & P # D @ H (b) J & D # P @ H
(c) D & P & J @ H (d) None of these

113. If AM of two numbers. a, b $(a > b)$ is twice of their GM then $a : b$ is equal to

(a) $(2-\sqrt{3}):(2+\sqrt{3})$ (b) $(2+\sqrt{3}):(2-\sqrt{3})$
(c) $\sqrt{3} : 2+\sqrt{3}$ (d) $2-\sqrt{3} : \sqrt{3}$

114. If $\Delta = \begin{bmatrix} x+y & x & x \\ 5x+4y & 4x & 2x \\ 10x+8y & 8x & 3x \end{bmatrix}$, then $\Delta = ?$

(a) $10x^2$ (b) $xy + x^3$
(c) $y^3 + 4y^2$ (d) x^3

Answers

1. (b)	**2.** (c)	**3.** (b)	**4.** (a)	**5.** (b)	**6.** (a)	**7.** (a)	**8.** (c)	**9.** (d)	**10.** (b)
11. (b)	**12.** (b)	**13.** (b)	**14.** (c)	**15.** (a)	**16.** (b)	**17.** (d)	**18.** (d)	**19.** (d)	**20.** (a)
21. (d)	**22.** (b)	**23.** (a)	**24.** (a)	**25.** (b)	**26.** (b)	**27.** (c)	**28.** (b)	**29.** (d)	**30.** (d)
31. (b)	**32.** (d)	**33.** (b)	**34.** (b)	**35.** (b)	**36.** (a)	**37.** (d)	**38.** (a)	**39.** (c)	**40.** (b)
41. (a)	**42.** (b)	**43.** (c)	**44.** (d)	**45.** (b)	**46.** (d)	**47.** (b)	**48.** (c)	**49.** (c)	**50.** (b)
51. (a)	**52.** (d)	**53.** (a)	**54.** (c)	**55.** (b)	**56.** (b)	**57.** (c)	**58.** (c)	**59.** (a)	**60.** (c)
61. (d)	**62.** (b)	**63.** (a)	**64.** (b)	**65.** (a)	**66.** (b)	**67.** (c)	**68.** (d)	**69.** (b)	**70.** (a)
71. (a)	**72.** (a)	**73.** (c)	**74.** (b)	**75.** (c)	**76.** (a)	**77.** (d)	**78.** (c)	**79.** (d)	**80.** (a)
81. (a)	**82.** (b)	**83.** (c)	**84.** (c)	**85.** (a)	**86.** (b)	**87.** (d)	**88.** (a)	**89.** (b)	**90.** (c)
91. (a)	**92.** (b)	**93.** (d)	**94.** (b)	**95.** (d)	**96.** (b)	**97.** (b)	**98.** (a)	**99.** (b)	**100.** (d)
101. (b)	**102.** (b)	**103.** (d)	**104.** (d)	**105.** (c)	**106.** (b)	**107.** (b)	**108.** (a)	**109.** (a)	**110.** (a)
111. (c)	**112.** (d)	**113.** (b)	**114.** (d)						

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Answer *with* Explanations

1. ***(b)*** a, c, d are form of $n : (3n+1)$ but b is not form of $n : (3n+1)$. Therefore (b) is correct option.

2. ***(c)*** The series in form $(2)^3, (3)^3, (4)^3 \dots (5)^3 (6)^3, (7)^3$

$\therefore$ 100 is odd in the series

3. ***(b)*** We have $x\dfrac{dy}{dx} - y = \log x$

$$\Rightarrow \quad \frac{dy}{dx} - \frac{y}{x} = \frac{\log x}{x}$$

This is a linear differential equation is

$$\therefore \quad I \cdot F = e^{\int \frac{-1}{x} dx} = e^{-\log x} = \frac{1}{x}$$

Solution of given differential equation

$$\frac{y}{x} = \int \frac{\log x}{x^2} dx$$

$$\frac{y}{x} = \log x \int \frac{1}{x^2} dx - \int \frac{1}{x} \cdot \int \frac{1}{x^2} dx \cdot dx + C$$

$$\frac{y}{x} = \frac{-\log x}{x} + \int \frac{1}{x^2} dx + C$$

$$\frac{y}{x} = -\frac{\log x}{x} - \frac{1}{x} + C$$

$$y = Cx - (\log x + 1)$$

4. ***(a)*** Given, $A + B + C = 395$

$$B = A + 25\% \text{ of } A$$

$$= A + \frac{25}{100}A = \frac{125}{100}A = \frac{5}{4}A$$

$$B = C + 20\% \text{ of } C = \frac{120}{100}C = \frac{6}{5}C$$

$$\frac{5}{4}A = \frac{6}{5}C$$

$$\Rightarrow \quad C = \frac{25}{24}A$$

$$\therefore \quad A + \frac{5}{4}A + \frac{25}{24}A = 395$$

$$\Rightarrow \quad \frac{79A}{24} = 395$$

$$\Rightarrow \quad A = \frac{395 \times 24}{79} = 120$$

$\therefore$ Share of $A = 120$

5. ***(b)*** Given, equation of hyperbola

$$x^2 - 2x + 8y - 2y^2 - 1 = 0$$

$$\Rightarrow \quad (x^2 - 2x + 1) - 2(y^2 - 4y + 4) = 1 + 1 - 8$$

$$\Rightarrow \quad (x-1)^2 - 2(y-2)^2 = -6$$

$$\Rightarrow \quad \frac{(y-2)^2}{3} - \frac{(x-1)^2}{6} = 1$$

Here, $\quad a^2 = 3, b^2 = 6$

$$\therefore \quad e = \sqrt{1 + \frac{b^2}{a^2}} = \sqrt{1 + \frac{6}{3}}$$

$$e = \sqrt{3}$$

6. ***(a)*** Given, $9^{1/3}, 9^{1/9}, 9^{1/27}, \dots$

$$= 9^{\frac{1}{3}}, 9^{\frac{1}{3^2}}, 9^{\frac{1}{3^3}}, 9^{\frac{1}{3^4}} \dots$$

$$a_1 = 9^{\frac{1}{3}}, a_2 = 9^{\frac{1}{3^2}}, a_3 = 9^{\frac{1}{3^3}}$$

$$a_n = 9^{\frac{1}{3^n}}$$

$$\lim_{n \to \infty} a_n = \lim_{n \to \infty} 9^{\left(\frac{1}{3}\right)^n} = 9^0 = 1$$

7. ***(a)*** We have $\log_{16} 512 = \log_{2^4} 2^9 = \dfrac{9}{4}\log_2 2 = \dfrac{9}{4}$

8. ***(c)*** Given, x, y, z are in GP

$$\therefore \quad y^2 = xz$$

and $\quad x^{1/a} = y^{1/b} = z^{1/c} = k$

$$x = k^a, y = k^b, z = k^c$$

Now, $\quad y^2 = xz$

$$\therefore \quad k^{2b} = k^a \cdot k^c$$

$$2b = a + c$$

$\therefore a, b, c$ are in AP

9. ***(d)*** Let

$$S_n = \frac{1^3}{1} + \frac{1^3 + 2^3}{1+2} + \frac{1^3 + 2^3 + 3^3}{1+2+3} + \dots$$

$$T_r = \frac{1^3 + 2^3 + 3^3 + \dots r^3}{1 + 2 + 3 + \dots r}$$

$$T_r = \frac{\left(\frac{r(r+1)}{2}\right)^2}{\frac{r(r+1)}{2}}$$

$$T_r = \frac{r(r+1)}{2} = \frac{1}{2}(r^2 + r)$$

$$S_n = \sum_{r=1}^{n} T_r = \frac{1}{2}\sum_{r=1}^{n}(r^2 + r)$$

$$S_n = \frac{1}{2}\left[\frac{n(n+1)(2n+1)}{6} + \frac{n(n+1)}{2}\right]$$

$$S_n = \frac{n(n+1)}{4}\left(\frac{2n+1}{3} + 1\right)$$

$$S_n = \frac{n(n+1)(n+2)}{6}$$

10. ***(b)*** Given, a, b are roots of equation $x^2 - x + 1 = 0$

$$\therefore \quad a + b = 1 \text{ and } ab = 1$$

Now, $\quad a^2 + b^2 = (a+b)^2 - 2ab$

$$= 1 - 2 = -1$$

11. ***(b)*** Geometric mean of a and b is $\sqrt{ab}$

Given, $\dfrac{a^{n+1} + b^{n+1}}{a^n + b^n}$ is GM of a and b

$$\therefore \quad \frac{a^{n+1} + b^{n+1}}{a^n + b^n} = \sqrt{ab}$$

$$\Rightarrow \quad a^{n+1} + b^{n+1} = a^{n+\frac{1}{2}}b^{\frac{1}{2}} + a^{\frac{1}{2}}b^{n+\frac{1}{2}}$$

$$\Rightarrow \quad a^{n+1} - a^{n+\frac{1}{2}}b^{\frac{1}{2}} = a^{\frac{1}{2}}b^{n+\frac{1}{2}} - b^{n+1}$$

$$\Rightarrow \quad a^{n+\frac{1}{2}}\left(a^{\frac{1}{2}} - b^{\frac{1}{2}}\right) = b^{n+\frac{1}{2}}\left(a^{\frac{1}{2}} - b^{\frac{1}{2}}\right)$$

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$$\Rightarrow \quad a^{n+\frac{1}{2}} = b^{n+\frac{1}{2}} \Rightarrow \left(\frac{a}{b}\right)^{n+\frac{1}{2}} = 1 = \left(\frac{a}{b}\right)^{0}$$

$$\therefore \quad n + \frac{1}{2} = 0 \Rightarrow n = -\frac{1}{2}$$

12. *(b)* Let

$$I = \int_0^{\frac{\pi}{2}} (\sqrt{\tan x} + \sqrt{\cot x})dx$$

$$\Rightarrow \quad I = \int_0^{\frac{\pi}{2}} \frac{\sin x + \cos x}{\sqrt{\sin x \cos x}}dx$$

$$\Rightarrow \quad I = \sqrt{2}\int_0^{\frac{\pi}{2}} \frac{\sin x + \cos x}{\sqrt{1-(\sin x - \cos x)^2}}dx$$

put $\quad \sin x - \cos x = t$

$\Rightarrow \quad (\cos x + \sin x)dx = dt$

$x = 0, t = -1, x = \frac{\pi}{2}, t = 1,$

$$\therefore \quad I = \sqrt{2}\int_{-1}^{1} \frac{dt}{\sqrt{1-t^2}}$$

$$\Rightarrow \quad I = 2\sqrt{2}\int_0^{1} \frac{dt}{\sqrt{1-t^2}}$$

$$I = 2\sqrt{2}[\sin^{-1} t]_0^1 = 2\sqrt{2} \times \frac{\pi}{2} = \pi\sqrt{2}$$

13. *(b)* Let

$$I = \int_{\frac{\pi}{5}}^{\frac{3\pi}{10}} \frac{\sin x}{\sin x + \cos x}dx \qquad \text{...(i)}$$

$$I = \int_{\frac{\pi}{5}}^{\frac{3\pi}{10}} \frac{\sin\left(\frac{3\pi}{10} + \frac{\pi}{5} - x\right)}{\sin\left(\frac{3\pi}{10} + \frac{\pi}{5} - x\right) + \cos\left(\frac{3\pi}{10} + \frac{\pi}{5} - x\right)}dx$$

$$I = \int_{\frac{\pi}{5}}^{\frac{3\pi}{10}} \frac{\cos x}{\cos x + \sin x}dx \qquad \text{...(ii)}$$

Adding Eqs. (i) and (ii), we get

$$2I = \int_{\frac{\pi}{5}}^{\frac{3\pi}{10}} \frac{\sin x + \cos x}{\cos x + \sin x}dx$$

$$2I = \int_{\frac{\pi}{5}}^{\frac{3\pi}{10}} dx = [x]_{\pi/5}^{3\pi/10} = \frac{3\pi}{10} - \frac{\pi}{5} = \frac{\pi}{10}$$

$$I = \frac{\pi}{20}$$

14. *(c)* Given, $\sin y = x\cos(a + y)$

$$\Rightarrow \quad x = \frac{\sin y}{\cos(a + y)}$$

differentiate with respect to x, we get

$$1 = \left(\frac{\cos(a + y)(\cos y) + \sin y \sin(a + y)}{\cos^2(a + y)}\right)\frac{dy}{dx}$$

$$\Rightarrow \quad \frac{dy}{dx} = \frac{\cos^2(a + y)}{\cos(a + y - y)}$$

$$\Rightarrow \quad \frac{dy}{dx} = \frac{\cos^2(a + y)}{\cos a}$$

15. *(a)* We have, $0.2^{\log_{\sqrt{5}}\left(\frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \cdots\right)}$

$$= \frac{1}{5}^{\log_{\sqrt{5}}\left(\frac{\frac{1}{4}}{1-\frac{1}{2}}\right)} = (\sqrt{5})^{-2\log_{\sqrt{5}}\left(\frac{1}{2}\right)}$$

$$= (\sqrt{5})^{\log_{\sqrt{5}}\left(\frac{1}{2}\right)^{-2}} = \left(\frac{1}{2}\right)^{-2} = (2)^2 = 4$$

16. *(b)* Given, Binomial expansion

$$\left(\frac{2x^2}{3} - \frac{3}{2x^3}\right)^{10}$$

Middle terms $= {}^{10}C_5\left(\frac{2x^2}{3}\right)^5\left(\frac{-3}{2x^3}\right)^5 = -{}^{10}C_5 = -252$

17. *(d)* We have,

5 black and 4 brown socks

Total number of socks = 9

Two socks are drawn from 9 socks = ${}^9C_2$

Two socks are drawn are of same colours

$= {}^5C_2 + {}^4C_2$

Required probability $= \frac{{}^5C_2 + {}^4C_2}{{}^9C_2} = \frac{10 + 6}{36} = \frac{16}{36} = \frac{4}{9}$

18. *(d)* According to the statement,

Conclusion

(i) ✓ (ii) ✗ (iii) ✓

19. *(d)* In the given figure, there are two series

Series –1

$$4 \xrightarrow{+1} 5 \xrightarrow{+1} 6$$

Series –2

$$\boxed{3} \xrightarrow{+1} 4 \xrightarrow{+1} 5$$

20. *(a)* Let

$$I = \int \frac{1 + \sin x}{1 - \sin x}dx$$

$$\Rightarrow \quad I = \int \frac{(1 + \sin x)(1 + \sin x)}{(1 - \sin x)(1 + \sin x)}dx$$

$$\Rightarrow \quad I = \int \frac{1 + 2\sin x + \sin^2 x}{\cos^2 x}dx$$

$$\Rightarrow \quad I = \int (\sec^2 x + 2\sec x\tan x + \tan^2 x)dx$$

$$\Rightarrow \quad I = \int (\sec^2 x + 2\sec x\tan x + \sec^2 x - 1)dx$$

$$\Rightarrow \quad I = \int (2\sec^2 x + 2\sec x\tan x - 1)dx$$

$$\Rightarrow \quad I = 2\tan x + 2\sec x - x + C$$

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21. ***(d)*** Given,

vertex of an ellipse = $(0, \pm 10)$

eccentricity $(e) = \frac{4}{5}$

Here, $b = 10, e = \frac{4}{5}$

$$(be)^2 = b^2 - a^2$$

$$\Rightarrow \quad \left(10 \times \frac{4}{5}\right)^2 = (10)^2 - a^2$$

$$\Rightarrow \quad a^2 = 100 - 64 = 36$$

Equation of ellipse

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

$$\Rightarrow \quad \frac{x^2}{36} + \frac{y^2}{100} = 1$$

22. ***(b)*** We have 5 red balls and 6 white balls

Total number of selection of 6 balls such that at least two balls of each colour is

$$ {}^5C_2 \times {}^6C_4 + {}^5C_3 \times {}^6C_3 + {}^5C_4 \times {}^6C_2$$

$$= 10 \times 15 + 10 \times 20 + 5 \times 15$$

$$= 150 + 200 + 75 = 425$$

23. ***(a)*** Given,

$$\begin{vmatrix} x & x^2 & 1+x^3 \\ y & y^2 & 1+y^3 \\ z & z^2 & 1+z^3 \end{vmatrix} = 0$$

$$\Rightarrow \quad \begin{vmatrix} x & x^2 & 1 \\ y & y^2 & 1 \\ z & z^2 & 1 \end{vmatrix} + \begin{vmatrix} x & x^2 & x^3 \\ y & y^2 & y^3 \\ z & z^2 & z^3 \end{vmatrix} = 0$$

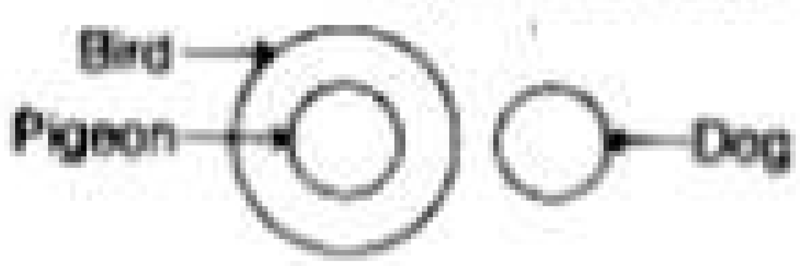
$$\Rightarrow \quad \begin{vmatrix} x & x^2 & 1 \\ y & y^2 & 1 \\ z & z^2 & 1 \end{vmatrix} + xyz\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix} = 0$$

$$\Rightarrow \quad (1 + xyz)\begin{vmatrix} x & x^2 & 1 \\ y & y^2 & 1 \\ z & z^2 & 1 \end{vmatrix} = 0$$

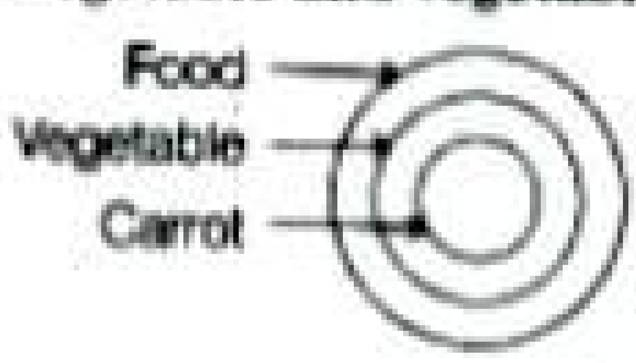
$$\Rightarrow \quad xyz + 1 = 0$$

$$\Rightarrow \quad xyz = -1$$

24. ***(a)*** Pigeon is a bird but dog is different.



25. ***(b)*** Carrot is a vegetable and vegetables are food.



26. ***(b)*** In the given series, except 12 all others are prime numbers.

27. ***(c)*** Let $I = \int \sec^4 x \tan x dx$

$$I = \int \sec^2 x \tan x \sec^2 x dx$$

$$I = \int (1 + \tan^2 x) \tan x \sec^2 x dx$$

put $\tan x = t \Rightarrow \sec^2 x dx = dt$

$$\therefore \quad I = \int (1 + t^2) t dt$$

$$I = \int (t + t^3) dt = \frac{t^2}{2} + \frac{t^4}{4} + C$$

$$I = \frac{\tan^2 x}{2} + \frac{\tan^4 x}{4} + C.$$

28. ***(b)*** Given,

$$y = \log\left[\tan\left(\frac{\pi}{4} + \frac{x}{2}\right)\right]$$

$$\Rightarrow \quad \frac{dy}{dx} = \frac{1}{\tan\left(\frac{\pi}{4} + \frac{x}{2}\right)} \times \sec^2\left(\frac{\pi}{4} + \frac{x}{2}\right) \times \frac{1}{2}$$

$$\Rightarrow \quad \frac{dy}{dx} = \frac{1}{2\sin\left(\frac{\pi}{4} + \frac{x}{2}\right)\cos\left(\frac{\pi}{4} + \frac{x}{2}\right)}$$

$$\Rightarrow \quad \frac{dy}{dx} = \frac{1}{\sin\left(\frac{\pi}{2} + x\right)}$$

$$\Rightarrow \quad \frac{dy}{dx} = \frac{1}{\cos x} = \sec x$$

29. ***(d)*** Let

$$I = \int_0^{\sqrt{2}} \sqrt{2 - x^2}\, dx$$

$$\Rightarrow \quad I = \left[\frac{x}{2}\sqrt{2 - x^2} + \sin^{-1}\frac{x}{\sqrt{2}}\right]_0^{\sqrt{2}}$$

$$\Rightarrow \quad I = (0 + \sin^{-1} 1) - (0 + 0) = \frac{\pi}{2}$$

30. ***(d)*** We have, $\frac{(1+i)^n}{(1-i)^{n-2}} = \left(\frac{1+i}{1-i}\right)^n (1-i)^2$

$$= \left[\frac{(1+i)(1+i)}{(1-i)(1+i)}\right]^n (-2i) = \left[\frac{2i}{2}\right]^n (-2i)$$

$$\Rightarrow \quad (-2)i^{n+1}$$

$(-2)i^{n+1}$ is real of $i^{n+1} = i^2$

$$\Rightarrow \quad n + 1 = 2 \Rightarrow n = 1$$

31. ***(b)*** We have,

$$A = \begin{bmatrix} 0 & 5 & -7 \\ -5 & 0 & 11 \\ 7 & -11 & 0 \end{bmatrix}$$

$$A^T = \begin{bmatrix} 0 & -5 & 7 \\ 5 & 0 & -11 \\ -7 & 11 & 0 \end{bmatrix} = -\begin{bmatrix} 0 & 5 & -7 \\ -5 & 0 & 11 \\ 7 & -11 & 0 \end{bmatrix}$$

$$A^T = -A$$

$\because A$ is skew-symmetric

32. ***(d)*** We have, $\left(x^2 - \frac{\lambda}{x}\right)^9$, $T_{r+1} = {}^9C_r (x^2)^{9-r} \left(\frac{\lambda}{x}\right)^r$

$$T_{r+1} = {}^9C_r x^{18 - 2r - r}(-\lambda)^r$$

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Coefficient of x in $\left(x^2-\frac{\lambda}{x}\right)^5$ is 270

if $10-2r-r=1$

$\Rightarrow r=3$

$\therefore {}^5C_3(\lambda)^3=270$

$\Rightarrow \lambda^3=\frac{270}{10}$

$\lambda^3=27 \Rightarrow \lambda=3$

33. ***(b)*** Given, $\log_{2\sqrt{3}} x=6$

$\Rightarrow x=(2\sqrt{3})^6$

$\Rightarrow x=2^6\times(\sqrt{3})^6$

$\Rightarrow x=64\times 27$

$\Rightarrow x=1728$

34. ***(b)*** Given,

Sum of n terms of an AP $=3n^2+5n$

i.e. $S_n=3n^2+5n$

$\Rightarrow S_m=3m^2+5m$

and $a_m=164$

$a_m=S_m-S_{m-1}$

$164=(3m^2+5m)-(3(m-1)^2+5(m-1))$

$\Rightarrow 164=3(m^2-(m-1)^2)+5(m-m+1)$

$\Rightarrow 164=3(m+m-1)(m-m+1)+5$

$\Rightarrow 164=6m-3+5$

$\Rightarrow m=27$

35. ***(b)*** We have,

Coefficient of $r, r+1, r+2$ th terms of expression $(1+x)^n$ is $1:7:42$

$\therefore {}^nC_{r-1}:{}^nC_r:{}^nC_{r+1}=1:7:42$

$\frac{{}^nC_{r-1}}{{}^nC_r}=\frac{1}{7}$ and $\frac{{}^nC_r}{{}^nC_{r+1}}=\frac{7}{42}$

$\frac{n!r!(n-r)!}{(n-r+1)!(r-1)!n!}=\frac{1}{7}$ and $\frac{n!(r+1)!(n-r-1)!}{r!(n-r)!n!}=\frac{7}{42}$

$\frac{r}{n+1-r}=\frac{1}{7}$ and $\frac{r+1}{n-r}=\frac{1}{6}$

$7r=n+1-r$ and $6r+6=n-r$

$r=\frac{n+1}{8}$ and $r=\frac{n-6}{7}$

$\Rightarrow \frac{n+1}{8}=\frac{n-6}{7}$

$\Rightarrow 7n+7=8n-48$

$\Rightarrow n=55$

36. ***(a)*** We have,

9 papers in which one is good and one is worst

Total arrangement of 9 papers $=9!$

Total arrangement of good and worst together is $8!\times 2!$

Total arrangement of worst and good never together $=9!-8!\times 2!$

37. ***(d)*** Given,

Average age of 50 students is 28

$$\sum_{i=1}^{50} x_i=50\times 28=1400$$

Average age of 60 students is 28.2

$$\sum_{i=1}^{60} x_i=60\times 28.2=1692$$

Total age of 10 students $=1692-1400=292$

Average age of 10 students $=\frac{292}{10}=29.2$

38. ***(a)*** Bag I = 5 white and 4 red balls

Bag II = 6 white and 7 red balls

Consider the events

A = White ball is drawn from Ist Bag

B = Red ball is drawn from Ist Bag

C = White ball is drawn from IInd Bag

$P(A)=\frac{5}{9}, P\left(\frac{C}{A}\right)=\frac{7}{14}$

$P(B)=\frac{4}{9}, P\left(\frac{C}{B}\right)=\frac{6}{14}$

$P(C)=P(A)\times P\left(\frac{C}{A}\right)+P(B)\times P\left(\frac{C}{B}\right)=\frac{5}{9}\times\frac{7}{14}+\frac{4}{9}\times\frac{6}{14}$

$P(C)=\frac{35+24}{126}=\frac{59}{126}$

39. ***(c)*** Given, a, b, c are first, second and last term of AP

Let $a_1=a$

$a_2=b$

$a_n=c$

$\therefore b=a+d$ (where d is common difference)

$c=a+(n-1)d$

$\Rightarrow b+c=a+d+a+nd-d$

$\Rightarrow b+c=2a+nd$

$\Rightarrow b+c=2a+n(b-a) \Rightarrow n=\frac{b+c-2a}{b-a}$

$\therefore S_n=\frac{n}{2}(a_1+a_n)$

$\Rightarrow S_n=\left(\frac{b+c-2a}{2(b-a)}\right)(a+c)$

$\Rightarrow S_n=\frac{(c+a)(b+c-2a)}{2(b-a)}$

40. ***(b)*** 10th terms of in the expansion $\left(2x^2-\frac{1}{x}\right)^{12}$ is

$${}^{12}C_9(2x^2)^3\left(-\frac{1}{x}\right)^9=\frac{12\times 11\times 10}{1\times 2\times 3}\times 2^3\times\frac{x^6}{x^9}(-1)^9=-\frac{1760}{x^3}$$

41. ***(a)*** We have $5x+3y-7=0$

and $15x+9y+14=0$

$\Rightarrow 5x+3y=7$ ...(i)

and $5x+3y=-\frac{14}{3}$ ...(ii)

(i) and (ii) are parallel lines

$\therefore$ Distance between parallel lines $=\left|\frac{7+\frac{14}{3}}{\sqrt{5^2+3^2}}\right|=\frac{35}{3\sqrt{34}}$

42. ***(b)*** Given, $y=\sin^{-1}\left(\frac{2x}{1+x^2}\right)$

$\Rightarrow y=2\tan^{-1}x$

$\Rightarrow \frac{dy}{dx}=\frac{2}{1+x^2}$

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43. ***(c)*** Except cobbler, all others are different items that are worn by a human.

44. ***(d)*** Let x button sell in one rupee he gains 20%

$$\therefore \quad x + 20\% \text{ of } x = 6$$

$$\Rightarrow \quad \frac{120}{100}x = 6 \Rightarrow x = \frac{600}{120} = 5$$

He sells 5 button in one rupees to get 20% gain

45. ***(b)*** Given,

$$(i^{87} + i^{89} + i^{70} + i^{72})^3$$

$$(i^{84} \cdot i^3 + i^{88} \cdot i + i^{68} \cdot i^2 + i^{72})^3$$

$$(i^3 + i + i^2 + 1)^3$$

$$(-i + i - 1 + 1)^3 = 0$$

46. ***(d)*** Given,

$$f(x) = \frac{x}{x+1} \text{ and } g(x) = \frac{1}{x+3}, x \neq -3$$

$$f(g(x)) = \frac{g(x)}{g(x)+1} = \frac{\frac{1}{x+3}}{\frac{1}{x+3}+1} = \frac{1}{x+4}$$

Domain of $f(g(x)) = R - \{-3, -4\}$

47. ***(b)*** Given, $x + iy = (1+i)(1+2i)(1+3i)$

$$\therefore \quad x - iy = (1-i)(1-2i)(1-3i)$$

$$(x+iy)(x-iy) = (1+i)(1+2i)(1+3i)$$

$$(1-i)(1-2i)(1-3i)$$

$$x^2 + y^2 = (1+1)(1+4)(1+9)$$

$$\Rightarrow \quad x^2 + y^2 = 2 \times 5 \times 10 = 100$$

48. ***(c)*** We have

$$y = \cos(\log x) + \sin(\log x)$$

$$y_1 = \frac{-\sin(\log x)}{x} + \frac{\cos(\log x)}{x}$$

$$\Rightarrow \quad xy_1 = -\sin(\log x) + \cos(\log x)$$

differentiate with respect to x, we get

$$xy_2 + y_1 = \frac{-\cos(\log x)}{x} - \frac{\sin(\log x)}{x}$$

$$\Rightarrow \quad x^2y_2 + xy_1 = -(\cos(\log x) + \sin(\log x))$$

$$\Rightarrow \quad x^2y_2 + xy_1 = -y$$

$$\Rightarrow \quad x^2y_2 + xy_1 + y = 0$$

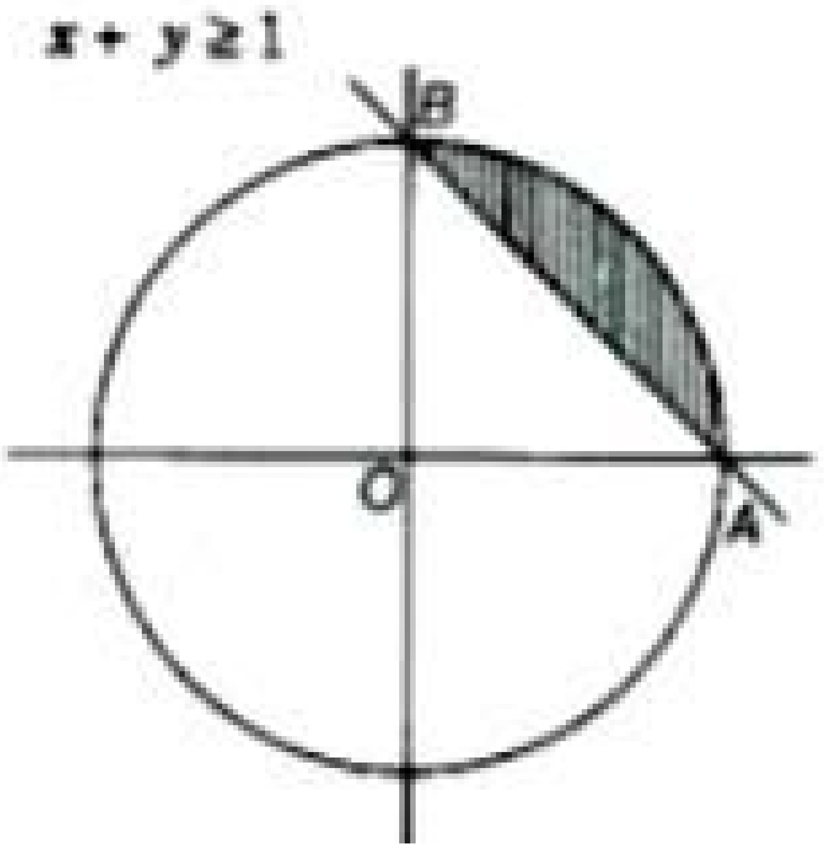
49. ***(c)*** According to the question,

D > C > E > A > B

Hence, D is the richest.

50. ***(b)*** Given, $x^2 + y^2 \leq 1$

and $x + y \geq 1$



Area of shaded region

Area of quadrant − Area of ΔOAB

$$= \frac{\pi}{4}(1)^2 - \frac{1}{2} \times 1 \times 1 = \frac{\pi}{4} - \frac{1}{2}$$

51. ***(a)*** Given, 1 Jan 2006 = Sunday

∴ 1 Jan 2007 = Monday

∴ 1 Jan 2008 = Tuesday

∴ 1 Jan 2009 = Thursday (∵ 2008 is a leap year)

∴ 1 Jan 2010 = Friday

52. ***(d)*** Let four numbers are a, b, c and d

Given,

$$b^2 = ac \quad \text{...(i)}$$

$$c = b + 6 \quad \text{...(ii)}$$

$$d = b + 12 \quad \text{...(iii)}$$

$$a = d \quad \text{...(iv)}$$

From Eqs. (ii) and (iii)

$$d - c = 6$$

$$\Rightarrow \quad c = d - 6$$

$$\Rightarrow \quad c = a - 6$$

$$\therefore \quad (d-12)^2 = a(a-6)$$

$$\Rightarrow \quad (a-12)^2 = a(a-6)$$

$$\Rightarrow \quad a^2 - 24a + 144 = a^2 - 6a$$

$$\Rightarrow \quad 18a = 144$$

$$\Rightarrow \quad a = \frac{144}{18} = 8$$

53. ***(a)*** Given, $y = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4}$

$$y = \log_e(1+x)$$

$$\Rightarrow \quad 1 + x = e^y \Rightarrow x = e^y - 1$$

54. ***(c)*** Given, $A = \{1, 2, 3\}$

$$R = \{(1, 2), (1, 3), (2, 3)\}$$

$(1, 1) \notin R$ ∴ R is not reflexive

$(1, 2) \in R$ but $(2, 1) \notin R$ ∴ R is not symmetric

$(1, 2) \in R$, $(2, 3) \in R$, $(1, 3) \in R$ ∴ R transitive

∴ R is transitive

55. ***(b)*** $A = \{1, 2, 3\}$

Total number of equivalence including (1, 2) is 4

(1) $R = \{(1, 2)\ (2, 1)\ (1, 1)\ (2, 2)\ (3, 3)\}$

(2) $R = \{(1, 2)\ (2, 1), (2, 3)\ (3, 2)\ (1, 1)\ (2, 2)\ (3, 3)\}$

(3) $R = \{(1, 2)\ (2, 1)\ (1, 3)\ (3, 1)\ (1, 1)\ (2, 2)\ (3, 3)\}$

(4) $R = \{(1, 2)\ (2, 1), (1, 3)\ (3, 1)\ (2, 3)\ (3, 2)\ (1, 1), (2, 2)\ (3, 3)\}$

56. ***(b)*** We have $f(x) = \begin{cases} kx^2 & x \leq 2 \\ 3 & x > 2 \end{cases}$

$f(x)$ is continuos at $x = 2$

$$\therefore \quad \lim_{x \to 2} f(x) = f(2)$$

$$\lim_{x \to 2} kx^2 = 3$$

$$\Rightarrow \quad 4k = 3$$

$$\Rightarrow \quad k = \frac{3}{4}$$

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57. *(c)* Given, $\dfrac{2+3i\sin\theta}{1-2i\sin\theta}=\dfrac{(2+3i\sin\theta)(1+2i\sin\theta)}{(1-2i\sin\theta)(1+2i\sin\theta)}$

$$=\frac{(2-6\sin^2\theta)+i(4\sin\theta+3\sin\theta)}{1+4\sin^2\theta}$$

is real if $\dfrac{7\sin\theta}{1+4\sin^2\theta}=0,\ \sin\theta=0,\ \theta=\pi$

58. *(c)* We have $A=\begin{vmatrix} x+1 & x+4 & x+a \\ x+2 & x+5 & x+b \\ x+3 & x+6 & x+c \end{vmatrix}$

$$R_1 \to R_1 + R_3$$

$$A=\begin{vmatrix} 2x+4 & 2x+10 & 2x+a+c \\ x+2 & x+5 & x+b \\ x+3 & x+6 & x+c \end{vmatrix}$$

$$A=2\begin{vmatrix} x+2 & x+5 & x+b \\ x+2 & x+5 & x+b \\ x+3 & x+6 & x+c \end{vmatrix} \quad [a, b, c \text{ are in AP}, a+c=2b]$$

$R_1 = R_2$

$\because\ A = 0$

59. *(a)* Given $a_1, a_2, a_3 \ldots a_n$ are in AP

$\therefore\quad d = a_2 - a_1 = a_3 - a_2 = a_4 - a_3 \ldots = a_n - a_{n-1}$

Now, $\quad = \dfrac{1}{a_1a_2}+\dfrac{1}{a_2a_3}+\ldots\dfrac{1}{a_{n-1}a_n}$

$$=\frac{1}{d}\left(\frac{d}{a_1a_2}+\frac{d}{a_2a_3}+\ldots\frac{d}{a_{n-1}a_n}\right)$$

$$=\frac{1}{d}\left(\frac{a_2-a_1}{a_1a_2}+\frac{a_3-a_2}{a_2a_3}+\ldots\frac{a_n-a_{n-1}}{a_{n-1}a_n}\right)$$

$$=\frac{1}{d}\left[\frac{1}{a_1}-\frac{1}{a_2}+\frac{1}{a_2}-\frac{1}{a_3}+\ldots\frac{1}{a_{n-1}}-\frac{1}{a_n}\right]$$

$$\frac{1}{d}\left(\frac{1}{a_1}-\frac{1}{a_n}\right)=\frac{1}{d}\left(\frac{a_n-a_1}{a_1a_n}\right)$$

$$=\frac{1}{d}\left(\frac{(n-1)d}{a_1a_n}\right) \quad [\because a_n = a_1+(n-1)d]$$

$$=\frac{n-1}{a_1a_n}$$

60. *(c)* Given, $\Delta=\begin{vmatrix} \log_3 512 & \log_4 3 \\ \log_3 8 & \log_4 9 \end{vmatrix}$

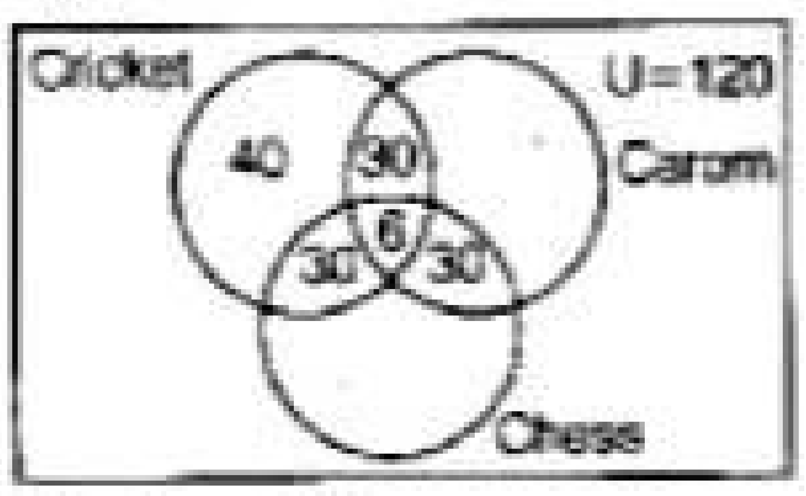
$$\Delta = \log_3 512 \times \log_4 9 - \log_4 3 \times \log_3 8$$

$$\Delta = \log_3 2^9 \times \log_{2^2} 3^2 - \log_{2^2} 3 \times \log_3 2^3$$

$$\Delta = 9\log_3 2 \times \log_2 3 - \frac{1}{2}\log_2 3 \times 3\log_3 2$$

$$\Delta = 9 - \frac{3}{2} = \frac{15}{2}$$

61. *(d)* By Venn diagram method.



Given, total students = 120

Number of students who play all the three games

$$=\frac{120\times5}{100}=6$$

Therefore, number of students who can play chess alone or carrom alone = 120 − (30 + 40 + 6) = 120 − 76 = 44

62. *(b)* Given, Average age of 40 students is 15 yr

$$\therefore \quad \sum_{i=1}^{40} x_i = 40 \times 15 = 600$$

Average age of 50 students is 15.2 yr

$$\therefore \quad \sum_{i=1}^{50} x_i = 50 \times 15.2 = 760$$

Average age of 10 new students $=\dfrac{760-600}{10}=16$ yr

63. *(a)* We have $y = 2x^2 + 3\sin x$

put $\quad x = 0, y = 0 \Rightarrow \dfrac{dy}{dx} = 4x + 3\cos x$

$$\left(\frac{dy}{dx}\right)_{x=0} = 0 + 3 = 3$$

Equation of normal of curve of $x = 0, y = 0$ is

$$y - 0 = -\frac{dx}{dy}(x-0)$$

$$y = -\frac{1}{3}(x) \Rightarrow x + 3y = 0$$

64. *(b)* Given,

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

8th from left   middle   6th from right

$\therefore$ Required element = M

65. *(a)* Given, $\quad \left|x+\dfrac{1}{x}\right| > 2, x \neq 0$

$$x+\frac{1}{x}>2 \text{ or } x+\frac{1}{x}<-2$$

$$\Rightarrow \quad x^2-2x+1>0 \text{ or } x^2+2x+1<0$$

$$\Rightarrow \quad (x-1)^2>0 \text{ or } (x+1)^2<0$$

$$\Rightarrow \quad x>1 \text{ or } x<-1$$

Solution $R - \{-1, 0, 1\}$

66. *(b)* Given,

$$2\begin{bmatrix} 1 & 2 \\ 0 & x \end{bmatrix}+\begin{bmatrix} y & 4 \\ 1 & 2 \end{bmatrix}=\begin{bmatrix} 5 & 8 \\ 1 & 8 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 4 \\ 0 & 2x \end{bmatrix}+\begin{bmatrix} y & 4 \\ 1 & 2 \end{bmatrix}=\begin{bmatrix} 5 & 8 \\ 1 & 8 \end{bmatrix}$$

$$\begin{bmatrix} 2+y & 8 \\ 1 & 2x+2 \end{bmatrix}=\begin{bmatrix} 5 & 8 \\ 1 & 8 \end{bmatrix}$$

$$\therefore \quad 2+y=5 \Rightarrow y=3$$

$$2x+2=8 \Rightarrow x=3$$

67. *(c)* In case of a century the leap year must be divided by 400. So, 700 is not a leap year.

68. *(d)*

$$\begin{array}{ccccccc} 8 & 27 & 64 & \boxed{100} & 125 & 216 & 343 \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ 2^3 & 3^3 & 4^3 & \boxed{10^2} & 5^3 & 6^3 & 7^3 \end{array}$$

Hence, 100 is odd one out.

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69. ***(b)*** Let the men do the work in x days and boys in y days

$\therefore \quad \frac{8}{x} + \frac{12}{y} = \frac{1}{10}$ ...(i)

and $\quad \frac{6}{x} + \frac{8}{y} = \frac{1}{14}$ ...(ii)

Solving Eqs. (i) and (ii), we get

$$x = 70$$

$\therefore$ One man can do same work alone in 70 days

70. ***(a)*** Given, $\frac{\log a}{b-c} = \frac{\log b}{c-a} = \frac{\log c}{a-b} = k$

$\therefore \quad \log a = k(b-c), \log b = k(c-a), \log c = k(a-b)$

Let $a^{b+c} \cdot b^{c+a} \cdot c^{a+b} = x$

$(b+c)\log a + (c+a)\log b + (a+b)\log c = \log x$

$k(b+c)(b-c) + k(c+a)(c-a) + k(a+b)(a-b) = \log x$

$k(b^2 - c^2 + c^2 - a^2 + a^2 - b^2) = \log x$

$\Rightarrow \quad \log x = 0$

$\Rightarrow \quad x = 1$

Hence, $\quad a^{b+c} \cdot b^{c+a} \cdot c^{a+b} = 1$

71. ***(a)*** We have,

5 question with each having 4 answers

Total numbers of ways students gives answer $= 4^5$

$= 1024$

72. ***(a)*** Given, $\quad Z = \frac{1+3i}{1-2i}$

$$Z = \frac{(1+3i)(1+2i)}{(1-2i)(1+2i)}$$

$$Z = \frac{1-6+3i+2i}{1+4}$$

$$Z = \frac{-5+5i}{5} = -1+i$$

$$|Z| = \sqrt{1+1} = \sqrt{2}$$

$$\arg(Z) = \tan^{-1}\left(\frac{1}{-1}\right) = \frac{3\pi}{4}$$

$\therefore$ Polar form $= \sqrt{2}\left(\cos\frac{3\pi}{4} + i\sin\frac{3\pi}{4}\right)$

73. ***(c)*** Let two numbers are x and y

Given, $\quad x + y = 15$ ...(i)

$$\frac{1}{x} + \frac{1}{y} = \frac{3}{10}$$

$\Rightarrow \quad x + y = \frac{3xy}{10}$

$\Rightarrow \quad 15 = \frac{3xy}{10}$

$\Rightarrow \quad xy = 50$ ...(ii)

Solving Eqs. (i) and (ii) we get

two numbers are 5 and 10

Smaller number is 5

74. ***(b)*** Given, $P(A) = 0.25, P(B) = 0.50$

$P(A \cap B) = 0.14$

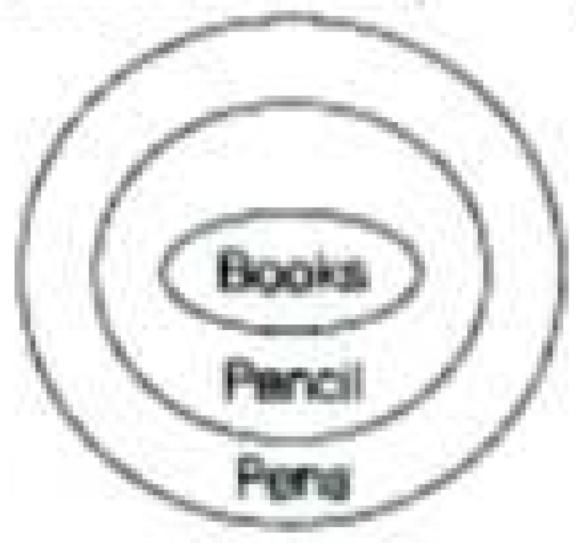
$P(A \cup B)' = 1 - P(A \cup B)$

$P(A \cup B)' = 1 - (P(A) + P(B) - P(A \cap B))$

$= 1 - 0.25 - 0.50 + 0.14$

$= 0.39$

75. ***(c)*** According to the statement,



Conclusion

(i) ✓ $\quad$ (ii) ✓ $\quad$ (iii) ✗

76. ***(a)*** Given, $\log_{10} 2 = a$ and $\log_{10} 3 = b$

Now, $\log_{10}\frac{160}{729}$

$= \log_{10}160 - \log_{10}729$

$= \log_{10}16 + \log_{10}10 - \log_{10}729$

$= \log_{10}(2)^4 + 1 - \log_{10}(3)^6$

$= 4\log_{10}2 + 1 - 6\log_{10}3$

$= 4a + 1 - 6b = 4a - 6b + 1$

77. ***(d)*** Total number of ways 5 men and 4 women have to sit together such that women occupy even places is $5! \times 4!$

$= 120 \times 24 = 2880$

78. ***(c)***

1 3 4 $\longrightarrow$ good and tasty

4 $\boxed{7}$ 8 $\longrightarrow$ see good $\boxed{\text{picture}}$

$\boxed{7}$ 2 9 $\longrightarrow$ $\boxed{\text{picture}}$ are paint

$\therefore$ see = 8

79. ***(d)*** Let the speed of stream $= x$ km/h

speed of boat = 11 km/h

speed of boat in upstream $= (11 - x)$ km/h

speed of boat in down stream $= (11 + x)$ km/h

Time in upstream $= \frac{12}{11-x}$

Time in down stream $= \frac{12}{11+x}$

$\therefore \quad \frac{12}{11-x} + \frac{12}{11+x} = 2 + \frac{45}{60}$

$\Rightarrow \quad 12\left(\frac{1}{11-x} + \frac{1}{11+x}\right) = \frac{11}{4}$

$\Rightarrow \quad \frac{12 \times 22}{121 - x^2} = \frac{11}{4}$

$\Rightarrow \quad 96 = 121 - x^2 \Rightarrow x^2 = 121 - 96$

$\Rightarrow \quad x^2 = 25 \Rightarrow x = 5$

$\therefore$ Speed of stream = 5 km/h

80. ***(a)*** Arrangement of words according to a telephone directory is–

Mahender $\rightarrow$ Maherdra $\rightarrow$ Mahinder $\rightarrow$ Mahindra

Last word is – Mahindra

81. ***(a)*** Given, $\quad 4y^2 - 12y + 12x + 39 = 0$

$\Rightarrow \quad (2y)^2 - 2 \times 2 \times 3 \times y + (3)^2 - (3)^2 + 12x + 39 = 0$

$\Rightarrow \quad (2y - 3)^2 - 9 + 12x + 39 = 0$

$\Rightarrow \quad 4\left(y - \frac{3}{2}\right)^4 + 12x + 30 = 0$

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$$\Rightarrow \quad \left(y-\frac{3}{2}\right)^2 = -\frac{1}{4}(12x+30)$$

$$\Rightarrow \quad \left(y-\frac{3}{2}\right)^2 = -3\left(x+\frac{5}{2}\right)$$

Ideal equation, $y^2 = 4ax$. Here $(a, 0)$

On comparing, $x+\frac{5}{2} = -\frac{3}{4}$; $x = -\frac{3}{4}-\frac{5}{2}$

$$x = \frac{-6-20}{8} = \frac{-26}{8} = -\frac{13}{4}$$

and $\quad y-\frac{3}{2} = 0$

$$y = \frac{3}{2}$$

Hence, required focus $= (x, y) = \left(\frac{-13}{4}, \frac{3}{2}\right)$

82. ***(b)*** Let the A have money $= ₹\, x$

and the B have money $= ₹\, y$

According to the problem, $x + 10 = 2(y - 10)$ ...(i)

$x - 10 = y + 10$ ...(ii)

Solving Eqs. (i) and (ii), we get

$$x = 70, \; y = 50$$

$\therefore$ A have money $= ₹\, 70$

83. ***(c)*** Given, 1st Jan 2007 = Friday.

1st Jan. 2008 → Friday +1 = Saturday.

84. ***(c)*** Here $\quad M_1 = 5, D_1 = 5$ and $W_1 = 5$

$$M_2 = 3, D_2 = ? \text{ and } W_2 = 3$$

Since $\quad \frac{M_1D_1}{W_1} = \frac{M_2D_2}{W_2} \Rightarrow \frac{5\times 5}{5} = \frac{3\times D_2}{3} \Rightarrow D_2 = 5$

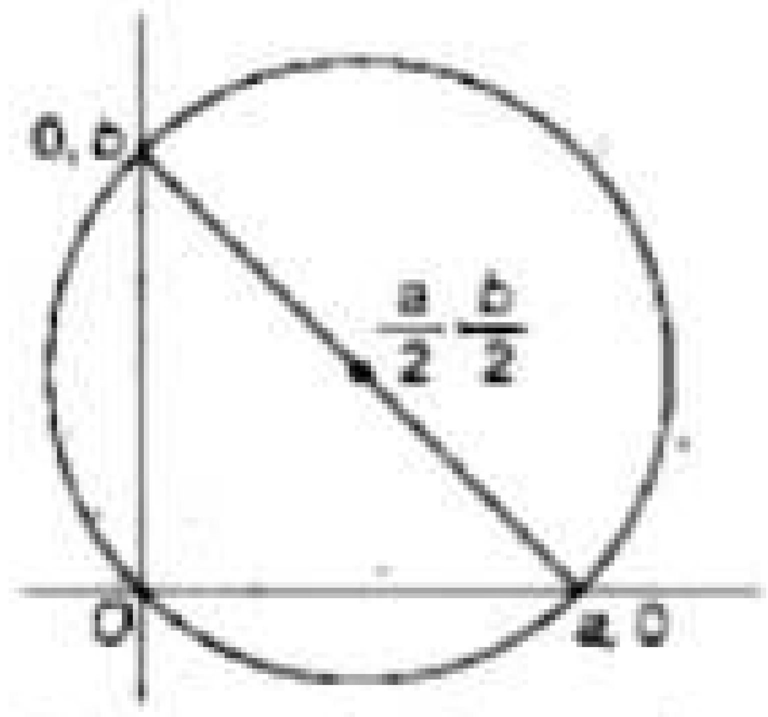
85. ***(a)*** Let $Z = \frac{1+\sqrt{3}i}{\sqrt{3}+i}$

$$Z = \frac{(1+\sqrt{3}i)(\sqrt{3}-i)}{(\sqrt{3}+i)(\sqrt{3}-i)};\; Z = \frac{\sqrt{3}+\sqrt{3}-i+3i}{3+1}$$

$$Z = \frac{2\sqrt{3}+2i}{4};\; Z = \frac{\sqrt{3}+i}{2}$$

$$\arg(Z) = \tan^{-1}\left(\frac{1/2}{\sqrt{3}/2}\right) = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right) = \frac{\pi}{6}$$

86. ***(b)*** Equation of circle passes through $(0, 0)$, $(a, 0)$ and $(0, b)$ is



$$\left(x-\frac{a}{2}\right)^2 + \left(y-\frac{b}{2}\right)^2 = \left(\frac{a^2}{4}+\frac{b^2}{4}\right)$$

$$\Rightarrow \quad x^2 - ax + \frac{a^2}{4} + y^2 - by + \frac{b^2}{4} = \frac{a^2}{4} + \frac{b^2}{4}$$

$$\Rightarrow \quad x^2 + y^2 - ax - by = 0$$

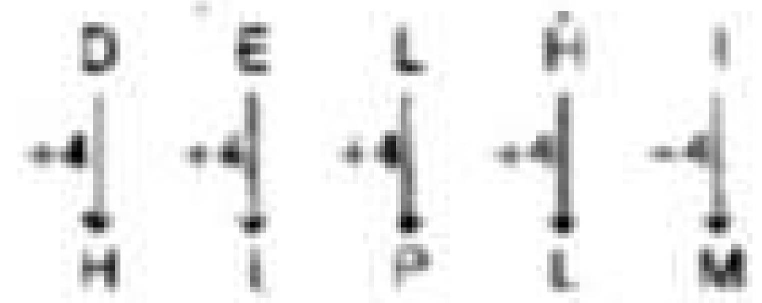
87. ***(d)*** To find the total number of 0 odd days, calculation of odd days from 2007.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Odd day	1	2	1	1	1	2	1	1	1	2	1

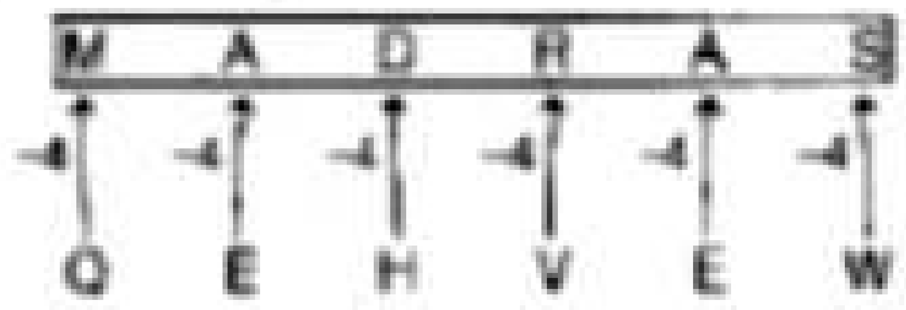
Total = 14 odd days = 0 odd day

Hence, the calendar of 2018 will be same as 2007.

88. ***(a)*** As,



Similarly,



89. ***(b)*** Let the cost of sugar per kg $= ₹\, x$

A man bought in ₹ 56 $= \left(\frac{56}{x}\right)$ kg

Cost of sugar decreased ₹ 1 per kg

$\therefore$ Cost of sugar per kg $= ₹\,(x-1)$

According to the problem, $\left(\frac{56}{x}+1\right) = \frac{56}{x-1}$

$$\frac{56}{x-1} - \frac{56}{x} = 1$$

$$56(x - x + 1) = x^2 - x$$

$$\Rightarrow \quad x^2 - x - 56 = 0$$

$$\Rightarrow \quad (x-8)(x+7) = 0$$

$$\Rightarrow \quad x = 8, x \neq -7$$

$\therefore$ Cost of sugar = ₹ 8/kg

90. ***(c)*** Given, 20 natural number

Three number are selected such that product of number is even

Required probability = 1 − Probability of product is not even $= 1 - \frac{^{10}C_3}{^{20}C_3}$

[$\because$ all number are odd their product is not even]

$$= 1 - \frac{10\times 9\times 8}{20\times 19\times 18} = 1 - \frac{4}{19} = \frac{15}{19}$$

91. ***(a)*** Let the present age of father $= x$ years

and the present age of sons $= y$ years

According to the problems,

$$x - 1 = 8(y-1) \quad \text{...(i)}$$

$$x = y^2 \quad \text{...(ii)}$$

Put the value of x in Eq. (i), we get

$$y^2 - 1 = 8(y-1)$$

$$(y+1)(y-1) = 8(y-1)$$

$$y + 1 = 8$$

$$y = 7$$

$$x = (7)^2 = 49$$

$\therefore$ Present age of father = 49 yr

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92. ***(b)*** aabbc/aabbc/aabbc

$\Rightarrow$ acba

93. ***(d)*** Number of ways in which 5 men and 4 women can seat in a row such that women sits at even place is $5! \times 4!$.

94. ***(b)*** In first figure, $\frac{2+6}{2} = \frac{8}{2} = 4$

In second figure, $\frac{2+10}{2} = \frac{12}{2} = 6$

Similarly, in third figure, $\frac{5+?}{2} = 5$

$$5 + ? = 10$$

$\therefore$ $? = 5$

95. ***(d)*** In first figure, $\left(\frac{7+9+4}{2}\right) + 2 = 10 + 2 = 12$

In second figure, $\left(\frac{2+4+2}{2}\right) + 2 = 4 + 2 = 6$

Similarly in third figure, $\left(\frac{5+5+2}{2}\right) + 2 = 6 + 2 = 8$

96. ***(b)*** In 12h the hands of a clock are in a straight line 22 times. So, in 24 h the hands of a clock are in a straight line $22 \times 2 = 44$ times.

97. ***(b)*** $687 \times 145 = 99615$

$687 \times 144 = 98428$

99615 is near by 94547

98. ***(a)*** We have $x^2 - 5x + k = 0$

Roots of equation are imaginary

$\therefore$ $b^2 - 4ac < 0$

$\Rightarrow$ $25 - 4k < 0$

$\Rightarrow$ $k > \frac{25}{4}$

$k > 6.25$

least value of k is 7

99. ***(b)*** We have $A = \begin{bmatrix} 4 & -3 \\ 3 & 2 \end{bmatrix}$

$$|A| = 8 + 9 = 17 \neq 0$$

$\therefore$ A^{-1} exists $\text{Adj } A = \begin{bmatrix} 2 & -3 \\ 3 & 4 \end{bmatrix}^T$

$$\text{Adj } A = \begin{bmatrix} 2 & 3 \\ -3 & 4 \end{bmatrix}$$

$$A^{-1} = \frac{1}{|A|} \text{Adj } A = \frac{1}{17}\begin{bmatrix} 2 & 3 \\ -3 & 4 \end{bmatrix}$$

100. ***(d)*** We have

$$\frac{5x-2}{3} - \frac{7x-3}{5} > \frac{x}{4}$$

$$\frac{25x - 10 - 21x + 9}{15} > \frac{x}{4}$$

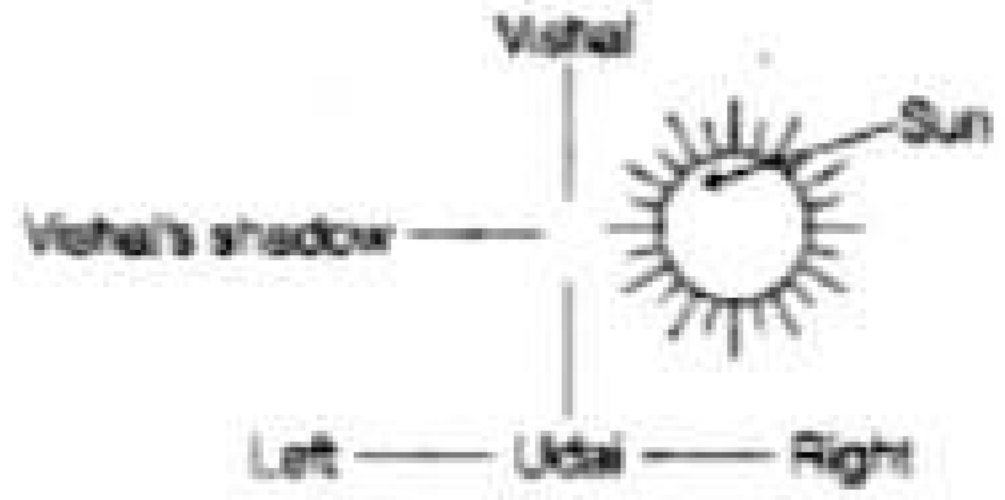
$$\frac{4x-1}{15} > \frac{x}{4}$$

$$16x - 4 > 15x$$

$\Rightarrow$ $x > 4$

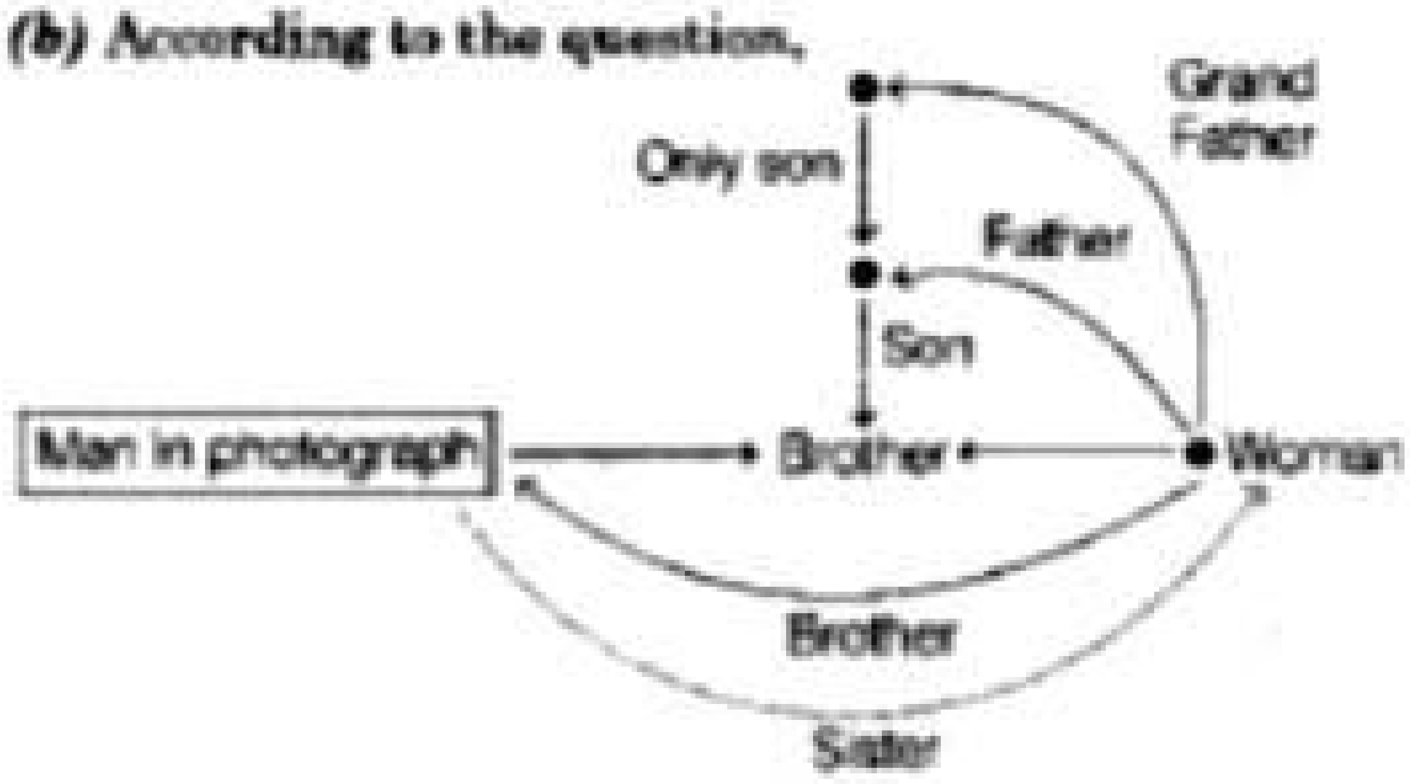
$\therefore$ $x \in (4, \infty)$

101. ***(b)***



Clearly, Udai faces North direction.

102. ***(b)*** According to the question,



Clearly, the woman is the sister of the man in photograph.

103. ***(d)*** Let α be the common root of equation

$x^2 + 11x + a = 0$ and $x^2 + 14x + 2a = 0$

$\therefore$ $\alpha^2 + 11\alpha + a = 0$ ...(i)

$\alpha^2 + 14\alpha + 2a = 0$ ...(ii)

Solving Eqs. (i) and (ii) we get

$$\alpha = -\frac{a}{3}$$

Putting the value of α in Eq. (i), we get

$$\left(-\frac{a}{3}\right)^2 + 11\left(\frac{-a}{3}\right) + a = 0$$

$$\frac{a}{9} - \frac{11}{3} + 1 = 0 \Rightarrow \frac{a}{9} = \frac{8}{3} \Rightarrow a = 24$$

104. ***(d)*** Given, $\frac{1}{2}f(g(x)) = 2x^2 - 5x + 2$

$$f(g(x)) = 4x^2 - 10x + 4$$

Here, $g(x) = x^2 + x - 2$

$\because$ $g(f) = f^2 + f - 2$

On comparing,

$$f^2 + f - 2 = 4x^2 - 10x + 4$$

$$f^2 + f - (4x^2 - 10x - 6) = 0$$

Here, we get a quadratic equation in form of 'f'.

Now, find the roots by 'Sridharacharya's formula'.

$$f(x) = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-1 \pm \sqrt{1 + 4(4x^2 - 10x - 6)}}{2}$$

$$= \frac{-1 \pm \sqrt{16x^2 - 40x + 25}}{2} = \frac{-1 \pm \sqrt{(4x-5)^2}}{2}$$

$$= \frac{-1 \pm (4x-5)}{2} = \frac{-1 + 4x - 5}{2} \text{ or } \frac{-1 - 4x + 5}{2}$$

$$= \frac{4x-6}{2} \text{ or } \frac{4-4x}{2} = 2x - 3 \text{ or } 2 - 2x$$

105. ***(c)*** Alphabetical order of words is as follows

Accommodate $\rightarrow$ Acculate $\rightarrow$ Accumulate $\rightarrow$ Acelate

$\therefore$ last word = Acelate

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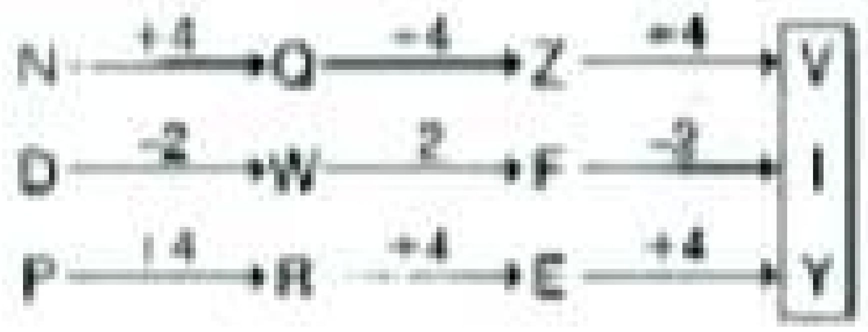
106. *(b)* NCPGQKRLZYESVIYFMWBDO

According to above series



107. *(b)* Time from monday noon (12 pm) to 2 pm the following Monday = 7 days 2 h = 170 h

Now, the watch gains $\left(2+4\frac{4}{5}\right)$ min from Monday (12 pm) to 2 pm, the following Monday.

In other words, the watch gains $\frac{34}{5}$ min in 170 h.

Therefore, it will gain 2 min in $\left(\frac{170 \times 5}{34} \times 2\right) = 50$ h

$= 2$ days 2 h

Therefore, the watch is correct after 2 days 2 h from Monday noon or at 2 pm Wednesday.

108. *(a)* A vessel contains 12% of solution in 600 liters

$\therefore \quad \text{acid} = \frac{12}{100} \times 600 = 72$

Another vessel contains 30% of solution in x liters

$\therefore \quad \text{acid} = \frac{30}{100}x = \frac{3}{10}x$

Total acid $= 72 + \frac{3}{10}x$

According to the problem,

$$15\% \text{ of } (x+600) < 72 + \frac{3}{10}x < 18\% (x+600)$$

$$\frac{15}{100}(x+600) < \frac{720+30x}{100} < \frac{18}{100}(x+600)$$

$$15x + 9000 < 7200 + 30x < 18x + 10800$$

$\Rightarrow \quad 15x + 9000 < 7200 + 30x$

$\Rightarrow \quad 9000 - 7200 < 15x \Rightarrow x > \frac{1800}{15} = 120$

$\Rightarrow \quad x > 120$

and $\quad 7200 + 30x < 18x + 10800$

$12x < 10800 - 7200$

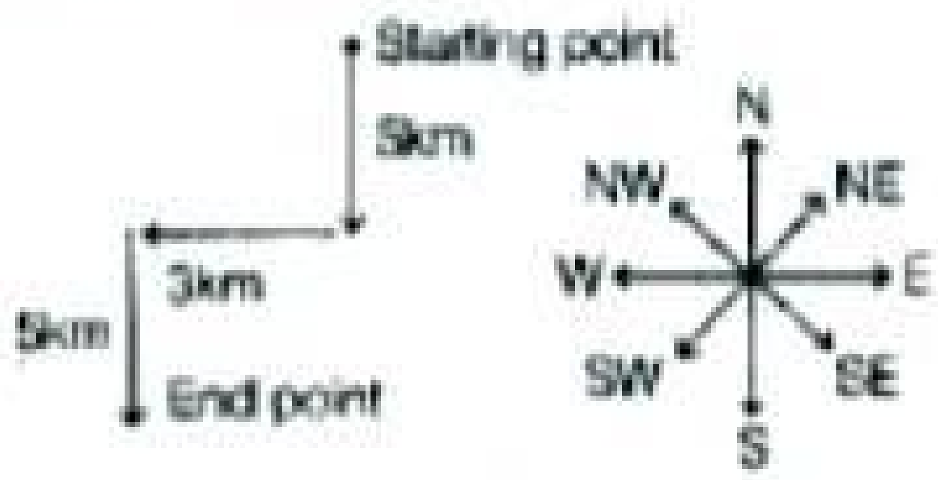
$12x < 3600$

$x < \frac{3600}{12} = 300$

$\therefore \quad x < 300$

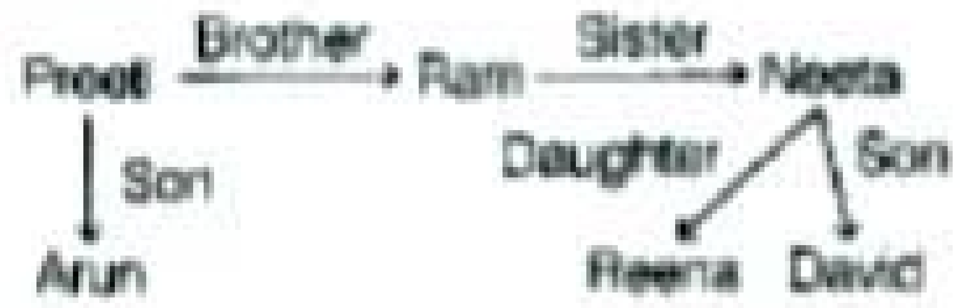
Hence, $120 < x < 300$

109. *(a)* According to the question,



Clarly, the man is in South-West direction from the starting point.

110. *(a)* According to the question,



From the above figure, Ram has two nephews-Arun & David.

111. *(c)* Let x is the length of the shortest board then $x+3$ and $2x$ are the lengths of second and third piece, respectively

Thus, $\quad x + x + 3 + 2x \le 91$ and $2x \ge x + 3 + 5$

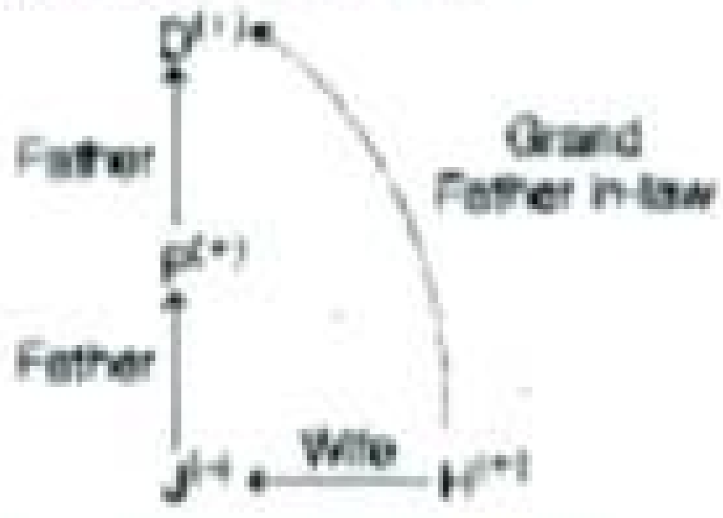
$\Rightarrow \quad 4x + 3 \le 91 \Rightarrow x \le 88$ and $x \ge 8$

$\therefore \quad 8 \le x \le 22$

112. *(d)* From option (a) J & P # D @ H

From option (b), J & D # P @ H

From option (c), D & P & J @ H



Hence, none of the option is correct.

113. *(b)* AM of two numbers a and b are $\frac{a+b}{2}$

and GM of two numbers a and b are $\sqrt{ab}$

Given, AM = 2GM

$\therefore \quad \frac{a+b}{2} = 2\sqrt{ab} \Rightarrow (a+b)^2 = 16ab$

$(a+b)^2 - (a-b)^2 = 4ab$

$\therefore \quad a - b = 2\sqrt{3}\sqrt{ab}$ ...(i)

$a + b = 4\sqrt{ab}$ ...(ii)

From Eqs. (i) and (ii), we get

$a : b = (2+\sqrt{3}) : (2-\sqrt{3})$

114. *(d)* We have $\Delta = \begin{vmatrix} x+y & x & x \\ 5x+4y & 4x & 2x \\ 10x+8y & 8x & 3x \end{vmatrix}$

$$\Delta = \begin{vmatrix} x & x & x \\ 5x & 4x & 2x \\ 10x & 8x & 3x \end{vmatrix} + \begin{vmatrix} y & x & x \\ 4y & 4x & 2x \\ 8y & 8x & 3x \end{vmatrix} \Rightarrow \Delta = x^3 \begin{vmatrix} 1 & 1 & 1 \\ 5 & 4 & 2 \\ 10 & 8 & 3 \end{vmatrix} + 0$$

$\Delta = x^3[(12-16) - 1(15-20) + 1(40-40)]$

$\Delta = x^3$

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