Section – III

81. If f(g(x))= g(f(x)) = h(x), which of the following is true?
    a. If f(x)= x + 2 then g(x) can't be x – 10.
    b. If f(x) = g(x) then h(x) = $[f(x)]^2$.
    c. f(h(x)) = h(f(x)).
    d. None of these

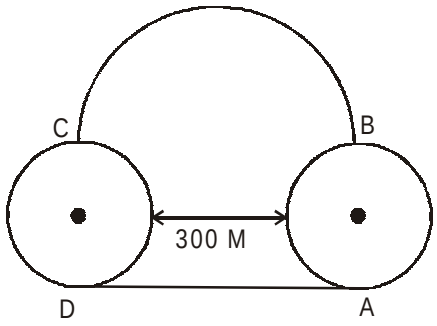
Directions for questions 82 and 83: Answer the questions based on the following information.

I. The employee IDs of Police officers in a country starts with the letter 'P' while that of civil servants starts with 'A'.
II. The second letter signifies the Rank, which can be any one of the 8 levels for Police officers and any one of the 12 levels for Civil Servants.
III. The positions 3 to 6 indicate the year of joining.
IV. The next 2 letters indicate the state.
V. Finally, the last 3 digits correspond to the serial number in the state, of posting in their batch (i.e. same year, cadre and service). Serial numbers are from 001 to 999.

82. If there are a total of 7300 police officers who joined in 1999, all at rank 2, what is the minimum number of states in which they have to be posted?
    a. 6 b. 7 c. 8 d. None of these

83. Theoretically, what is the maximum number of civil servants if there are only 31 states and every officer must retire after a maximum of 35 years of service?
    a. 12 × 35 × 31 × 999 b. 20 × 35 × 31 × 99
    c. 2 × 12 × 35 × 31 × 999 d. None of these

Directions for questions 84 and 85: Answer the questions based on the following information.
A race track consists of two circular paths each of radius 100 m and distance between their centres is 300 m connected by a semicircular bridge joining the points of tangency of the direct common tangent BC and the remaining part of the track is built along the common tangent DA.



Ram starts from A along the route A-B-C-D-A anticlock wise direction with a constant speed of 2π m/s. 100s after Ram started, Krishna also starts running from A in the opposite direction along the route A-D-C-B-A clock wise direction with a speed of π m/s.

84. How long do they take to meet first time after Krishna starts running?

a. $50\left(\frac{1}{3}+\frac{1}{\pi}\right)$sec b. $50\left(\frac{1}{3}+\frac{2}{\pi}\right)$sec c. $150\left(\frac{1}{3}+\frac{1}{\pi}\right)$sec d. $150\left(\frac{1}{3}+\frac{2}{3\pi}\right)$sec

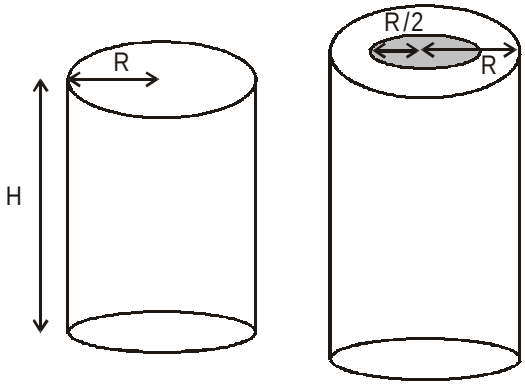
85. If the bridge can allow only one person at a time to stand at any point on it, what is the minimum time required for them to meet first time after Krishna starts running?

a. $50\left(\frac{1}{3}+\frac{1}{\pi}\right)$sec b. $50\left(\frac{1}{3}+\frac{2}{\pi}\right)$sec c. $150\left(\frac{1}{3}+\frac{1}{\pi}\right)$sec d. $150\left(\frac{1}{3}+\frac{2}{3\pi}\right)$sec

86. If all the first 96 multiples of 4 are arranged one after the other the penultimate digit in this sequence is

a. 2 b. 4 c. 8 d. 9

Directions for questions 87 and 88: Answer the questions based on the following information.
A metal cylinder (solid) of height 'H' and radius 'R' is moulded into a hollow cylinder of outer radius 'R' and inner radius 'R/2'.



87. The percentage increase in the height of hollow cylinder to a solid cylinder of height 'H' is:
a. 133.3% b. 100% c. 50% d. 33.3%

88. If the hollow cylinder is now cut into 5 unequal slices, parallel to the base so that the total surface area doubles (off all the parts put together), find h in term of R (where h and R are the height and outer radius of the hollow cylinder respectively).

a $\frac{3R}{2}$ b. $\frac{3R}{4}$ c. $\frac{7R}{8}$ d. $\frac{R}{2}$

89. A digits of a two digit number of the form 8K, where K is a natural number are interchanged and again get two digit number. The resulting number is divisible by 4 but not by 8. Then the product of the two digits is

a. 28 b. 32 c. 16 d. 36

90. There are 15 families in a town, each consisting of 4 members. On a certain festival, all the members of a family exchange flower bouquets with each other. In addition every family sends out exactly one bouquet to every other family. How many bouquets are required for this whole event, if no bouquet is reused?

a. 195 b. 390 c. 300 d. 285

91. In an equilateral triangle ΔABC, D divides BC in the ratio 2 : 1 while E divides AC in the ratio 1 : 2. Find BE : ED.

a. 4 : 3 b. $2:\sqrt{3}$ c. $\sqrt{7}:\sqrt{3}$ d. Cannot be determined

92. Two kites flying at the same altitude of 50 m are 100 m apart. If one of the strings makes an angle of 30 degrees while the other makes 60 degrees, find the distance between the fliers.

a. $100+\frac{200\sqrt{3}}{3}$ b. $\frac{50}{\sqrt{3}}+100+50\sqrt{3}$ c. $100(1+\sqrt{3})$ d. Cannot be determined

93. ABCDEF is a regular hexagon. If area of ΔABE is 100 sq.cm, the area of the original hexagon in sq.cm is:

a. $50\sqrt{3}$ sq. cm b. $100\sqrt{3}$ sq. cm c. 200 sq. cm d. 300 sq. cm

94. 'C' is a natural number and both $x^2+4x+C=0$ and $x^2+4x-C=0$ have rational roots. The number of possible values for C are:

a. 1 b. 2 c. 3 d. None of these

95. If $\log_2(x^2+3x)=\log_2(x+3)+2$, then $x=?$

a. 2 b. 4 c. –3 and 2 d. 4 and –3

96. 'S' is the set of all natural numbers up to 75. If 'a' is the sum of all numbers in S which leave a reminder 1 when divided by 4 and 'b' is the sum of all numbers in S which leave a reminder 3 when divided by 4, the difference between a and b is?

a. 72 b. 36 c. 38 d. 76

97. a, b, c and d are 4 natural numbers such that

I. HCF (a, d) = 1 and HCF (b, c) = 3

II. HCF $\left(\frac{a}{b},\frac{c}{d}\right)=\frac{2}{105}$ and LCM $\left(\frac{a}{b},\frac{c}{d}\right)=\frac{12}{5}$

III. HCF $\left(\frac{a}{c},\frac{b}{d}\right)=\frac{1}{210}$ and LCM $\left(\frac{a}{c},\frac{b}{d}\right)=60$

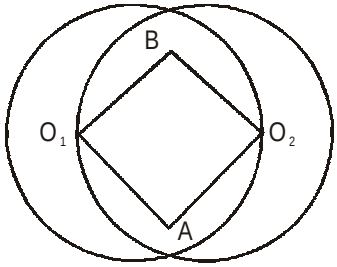
Then a + b+ c+ d is equal to

a. 45 b. 50 c. 60 d. 75

98. A man wants to divide his circular piece of land measuring 1100 sq.mts into two parts. The eldest son will get a square piece with centre coinciding with that of the circle. The younger son will take the remaining part around the square. However, he wants to compensate the younger son for this awkward shape by giving him 20% more land than the elder son. The length of the side of the square is:

a. $10\sqrt{5}$ m b. 22 m c. 25 m d. None of these

99.



The radius of both the circles is $10\sqrt{2}$ m . The area of square O_1AO_2B is? (O_1 and O_2 are centres of circles)

a. 25 sq.m b. 50 sq.m c. 100 sq.m d. $100\sqrt{2}$ sq.m

100. The sum to 2n terms of the series, $\log_3 1 - \log_3 3 + \log_3 9 - \log_3 27\ldots$ is:

a. $\frac{(2n-1)}{(n-1)}$ b. $\frac{(n-1)}{(1-2n)}$ c. 1 – n d. –n

101. We have large supply of 10 kg, 50 kg, 100 kg and 1000 kg packs of rice. We need to supply 1,380 kgs of rice which costs us Re.1/kg. However each pack costs Rs. 8 for transport, irrespective of the weight. We must deliver full packs only. Any excess that we supply is a loss. What is the minimum cost that we incur?

a. Rs. 1444 b. Rs. 1414 c. Rs. 1448 d. None of these

102 . There are 3 identical yellow balls and 4 identical blue balls. They are arranged in a straight line. What is the probability that neither of the yellow balls are at the extreme ends of the arrangements?

a. $\frac{1}{2}$ b. $\frac{1}{4}$ c. $\frac{2}{7}$ d. $\frac{6}{7}$

103. The remainders obtained in which of the following are dependent on n, n is a natural number?

a. $\frac{4^n}{6}$ b. $\frac{5^n}{6}$ c. $\frac{49^n}{6}$ d. $\frac{3^n}{6}$

104. If (x_1, y_1) and (x_2, y_2) are two distinct integral solutions of the equation 3x + 4y = 81, the least possible distance between the points (x_1, y_1) and (x_2, y_2) is:

a. 12 b. 5 c. 13 d. 25

105. If $N = 3^a \times 3^b$, a and b are any two integers whose range from 1 to 6. What is the probability that N is a multiple of 729?

a. $\frac{5}{18}$ b. $\frac{5}{11}$ c. $\frac{13}{18}$ d. None of these

106. If N(x) = –x, [x] denotes the greatest integer less than or equal to x and |x| is the absolute value of x (where x is any real number greater than 1), which of the following is greatest?

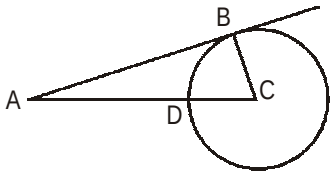
a. $[1+|N(x)|]\cdot[1-|N(x)|]$ b. $[1-|x|^2]$

c. $|1-x|[1+x]$ d. $|1-x^2|$

107. The smallest 4 digit number which is divisible by 3 and 37 but leaves a reminder 1 when divided by 11 is

a. 1332 b. 3774 c. 3663 d. None of these

108. Find the radius of the circle given AB = 5 cm and AD = 1 cm, where AB is the tangent to the circle and the line AC cuts the circle at D and C is the centre of the circle.



a. 12 cm b. 3 cm c. 4 cm d. None of these

109. The value of $1+\frac{1}{2}+\frac{1}{2\times7}+\frac{1}{4\times7}+\frac{1}{4\times49}+\frac{1}{8\times49}+\cdots\infty$ is

a. $\frac{14}{13}$ b. $\frac{28}{13}$ c. $\frac{21}{13}$ d. $\frac{49}{26}$

110. Let S= {1, 2, 3, 4, 5, 6}. If a, b are selected from S such that b < a. Find the number of pairs such that $\frac{a!}{b!}$ is divisible by 3.

a. 11 b. 12 c. 13 d. 14

111. There are 20 coins out of which 12 are showing heads and 8 show tails. Now a coin is picked randomly and is flipped over. This process is done 25 times. Now there are X heads and Y tails. Which of the following is/are true ?

I. X + Y = 20

II. XY is odd.

III. XY is even.

a. Only I b. Both I and II c. Both I and III d. None of these

Directions for questions 112 and 113: Answer the questions based on the following information.

A survey of sports channel viewers indicates the following statistics

I. All the respondents viewed atleast one of the four channels that were being polled for.
II. 80 % of them viewed ESPN.
III. 90 % of them viewed Star Sports.
IV. 40 % of them did not view Ten sports.
V. 25 % of them did not view DD sports.

112. What is the maximum percentage of viewers who could have watched all the four channels?

a. 25% b. 60% c. 45% d. 5%

113. What is the minimum percentage of the viewers who could have watched all the four channels?

a. 0 b. 5% c. 25% d. 10%

114. If $m = \frac{x^4 + x^{-4} + 1}{x^2 + x^{-2} + 1}$ and x < 0. The minimum value of m is?

a. Minima doesn't exist b. 1
c. 2 d. 8

115. There are 4 towns at the milestones of A at 10 miles, B at 20 miles, C at 35 miles and D at 45 miles. Sunil wants to set up a shop to service these 4 towns . If the demand from each of these towns is found to be identical and there are no other shops servicing them which of the following is the only way to minimize the cost of transportation?

a. Set up the shop anywhere between towns A and B
b. Set up the shop anywhere from B to C
c. Set up the shop at B
d. Set up the shop at C

116. Four people whose speeds are 1 m/s, 2 m/s, 4 m/s and 8 m/s start from the north, East, West and Southern most points of a circle simultaneously in the clockwise direction. If the fastest person takes T minutes to complete one single round, find when all of them would meet at a single point ?

a. After T minutes b. After 8T minutes

c. They would never meet at the same point d. None of these

117. The sufficient condition for the expression $|x - 2|(x - 3)^2(x - 1) > 0$ to be valid is:

a. x > 1 b. x > 2 c. x > 3 d. None of these

118. A can do 125% more work than B in the same time interval. If B levels a circular plot of radius 50 ft, the radius of circular plot which A can level in the same time is:

a. 75 ft b. 112.5 ft c. 62.5 ft d. None of these

119. A junction of two highways is patrolled by two cars, one on each road. Each car covers a distance of 5 km on either side of the junction on its road. If the speeds of the 2 cars are 50 km/hr and 75 km/hr and they start at the junction at 6 a.m. from same point, when will they meet next?

a. 6 : 16 a.m. b. 6 : 24 a.m. c. 6 : 30 a.m. d. 6 : 48 a.m.

120. A large brick cube is fabricated by using 8 smaller cubes and bonding them with cement paste of uniform thickness. The cement layer is applied for joining all the surfaces which need to be in contact. If cement forms 20% of the volume of the bigger cube, the ratio of thickness of cement layer to the side of the smaller cubes is?

a. $\left(\frac{6}{5}\right)^{\frac{1}{3}} - 1$ b. $\left(\frac{6}{5}\right)^{\frac{2}{3}} - 1$ c. $\left(\frac{5}{4}\right)^{\frac{1}{3}} - 1$ d. $\left(\frac{5}{4}\right)^{\frac{2}{3}} - 1$

121. If p is an integer greater than 2, at most how many of $p^2 - 1$, $p^2 + 1$, $p^2 - 2$, $p^2 + 2$ can be prime?

a. 1 b. 2 c. 3 d. 4

122. If $\frac{a}{27}, \frac{a}{36}, \frac{a}{96}, \frac{a}{81}$ are all integers, then the largest of the following options which is necessarily less than 'a' is?

a. 1000 b. 2000 c. 3000 d. 4000

123. I begin every day by donating Rs. 1000 and doubling the remaining money by trading in stocks. What is the smallest sum of money that I need to start with, to avoid being bankrupt?
a. Rs. 1200 b. Rs. 1500 c. Rs. 2000 d. None of these

Directions for question 124: A relation R is described as follows

R	a	b	c	d	e	f
1	a	b	c	d	e	f
2	b	c	d	e	f	a
3	c	d	e	f	a	b

R is of the form
R(number, letter) = letter in common cell [For example R(2, c) = d]
R^N (n, a) = R(n, R^{N-1} (n, a)), where N is a natural number and n = 1, 2 or 3.

124. If $R^N(x,y)$ is the same for any value of N, then x is equal to
a. 1 b. 2 c. 3 d. Either 2 or 3

125. IN a ΔABC , AD bisects the $\angle BAC$ and AE bisects the $\angle BAD$. If BE : ED : DC is 1 : 2 : 4, then AD : AC is equal to
a. 3 : 4 b. 3 : 2 c. 3 : 8 d. 1 : 8