

Exercise – 1

Directions for questions 1 to 50: For the Multiple Choice Questions, select the correct alternative from the given choices. For the Non-Multiple Choice Questions, write your answer in the box provided.

Directions for questions 1 and 2: These questions are based on the following data.

Rohan entered the “Good World Supermarket” to buy pens, pencils and erasers for his younger brothers and sisters. He bought at least 11 pieces of each of the items and more pens than pencils and more pencils than erasers. He bought a total of 38 pieces.

- How many erasers did Rohan buy?
(A) 11 (B) 10
(C) 12 (D) Cannot say
- If the number of pencils cannot be divided equally among his four brothers, how many pens did he buy?
(A) 12 (B) 11
(C) 15 (D) 14

Directions for questions 3 and 4: These questions are based on the information given below.

Four boys Anil, Bimal, Charan and Deepak were playing a game of luck. Each one started with an integral number of rupees and had an integral number of rupees after each round. Four rounds were played in the game and in each round, there was a loser who gave a certain amount of money to the remaining three. In the first round Anil lost and gave to each of the others next to him two-thirds of what the others had at that time (i.e., he gave $\frac{2}{3}$ rd of what Bimal had to Bimal, $\frac{2}{3}$ rd of what Charan had to Charan, and $\frac{2}{3}$ rd of what Deepak had to Deepak). Similarly, in the second round Bimal lost and gave to each of the others $\frac{2}{3}$ rd of what he had. In the third round, Charan lost and gave to each of the others half of he had and in the fourth round Deepak lost and gave to each of the others half of what he had. After the four rounds, each of them had the same amount (₹ P).

- Find the minimum possible value that P can take.
(A) 180 (B) 240
(C) 225 (D) 450
- The total amount with a person at the end of each round will alternately increase and decrease or decrease and increase for which of the following?
(A) Anil (B) Bimal
(C) Charan (D) None of these

Directions for questions 5 and 6: These questions are based on the following data.

Seth Heeramal priced his diamond necklaces such that the cost of each necklace (in ₹) varied as the square of the number of diamonds in it. A necklace with 8 diamonds costs ₹1,60,000.

- What would be the price of a necklace with 10 diamonds?
(A) ₹1,75,000 (B) ₹2,25,000
(C) ₹2,50,000 (D) ₹4,00,000
- Mr. Sharma asked for 3 necklaces to be made out of the diamonds in a necklace by dividing the diamonds in the ratio 5 : 3 : 2. If the 3 smaller necklaces are priced using the same formula, what is the percentage loss

that Seth Heeramal would incur, if he has to oblige Mr. Sharma?

- (A) 22% (B) 38% (C) 62% (D) 78%

Directions for questions 7 and 8: These questions are based on the following data.

Smitha attempts all the questions in a management entrance test which has questions of three levels of difficulty – A, B and C. For the questions of various difficulty levels, the marks awarded for answering the questions correctly and those deducted for answering the questions incorrectly are as follows:

Difficulty level	Number of questions	Marks per correct answer	Penalty per incorrect answer
A	60	3	2
B	60	2	1
C	80	1	1/2

There is no penalty for unanswered questions.

- If Smitha gets a total of 60 marks across all the sections and she answered 40 questions of level C difficulty correctly, what is the maximum number of questions she could have answered incorrectly across all the sections?
(A) 74 (B) 116 (C) 108 (D) 102
- In the same test, Rohit attempted the least number of questions but got 120 marks. If he attempted at least one question of each level of difficulty, how many questions did he attempt?
(A) 40 (B) 41 (C) 45 (D) 48
- A change dispensing machine gives the amount in denominations ₹1, ₹2 and ₹5 coins. The total number of coins in it is 500. The total amount is ₹960. If the number of ₹5 coins and ₹1 coins are interchanged, the value increases by ₹480. The total number of ₹2 coins is
- When Sheela was asked how many apples she had, she replied, “If you add three-quarters of the number of the apples I have, to three-quarters of an apple, you will get the number of apples I have.” How many apples does she have?
(A) 3 (B) 4 (C) 6 (D) 9
- The class teacher of class V said that she would be distributing some chocolates to the first three rankers of the class. It would be done in a manner that the second ranker would get $\frac{5}{7}$ th of what the topper would get, and the third ranker would get $\frac{3}{5}$ th of what the second ranker would get. The topper got 60 chocolates more than the third ranker. How many chocolates were distributed to the three children?

12. In a four-digit number, the sum of the first two digits is equal to the sum of the last two digits. If the sum of the digits is 30 and the sum of the digits in units place and thousands place is twice its digit in hundreds place, then which of the following cannot be the units digit?
 (A) 6
 (B) 9
 (C) 7
 (D) More than one of the previous choices

13. In a fraction if the numerator is doubled and the denominator is increased by 4, it changes to $\frac{5}{6}$. If one is added to the denominator and the numerator is decreased by two, the fraction changes to $\frac{1}{3}$. What is the denominator of the fraction?

14. "Once some cats saw some rats. "If each cat caught one rat, there would be a cat without a rat. Should each rat now be shared by two cats there would be a rat not caught by the cats." Tell me, how many cats am I talking about?
 (A) 2 (B) 4 (C) 6 (D) 7

Directions for questions 15 and 16: These questions are based on the following data.

A, B, C and D are four salesmen. In the first month, they received a total commission of ₹4,200 from their company and divided it in the ratio 2 : 3 : 4 : 5. In the second month, the commission doubled, the amount was divided in the ratio 3 : 4 : 5 : 2. In the third month, the commission tripled when compared to the first month and they shared it in the ratio 4 : 5 : 3 : 2 and in the fourth month the commission became half of that of the previous month and they shared it in the ratio 4 : 3 : 5 : 2.

15. What was the average monthly earning of C over the period? (in ₹)

16. How much more should B have earned so that his average monthly earning would have been ₹3,500? (in ₹)

Directions for questions 17 to 19: These questions are based on the following data.

I was visiting my friend's house at Tuticorin for the first time. I knew that he had five children – two daughters and three sons. The daughters were Sonali and Monali and the sons were Surya, Sagar and Prithvi. When I stepped into the house was greeted by Sagar and Sonali. Sagar introduced himself and told me that he was twice as old as Sonali. The next to meet me was Monali who said that she and Sonali together were twice as old as Sagar. Then Surya walked in and introduced himself and said that he and Sagar were twice as old as their sisters together. In the afternoon Prithvi came to my room when I was relaxing and said "Sorry uncle, I was busy with my friends. As it is my 21st birthday today I could not meet you in the morning." When I greeted him and said that it was fine, he said, "You know uncle, that the three of us Sagar, Surya and I are five times as old as our sisters together," saying which he went away.

17. Who is the youngest of the siblings?
 (A) Surya (B) Monali (C) Sonali (D) Prithvi

18. How much older than Sonali is Monali?
 (A) 3 years (B) 3 years 6 months
 (C) 5 years 6 months (D) 7 years

19. After how long would Surya be twice as old as Sagar?
 (A) 2 years (B) 2 years 6 months
 (C) 3 years 6 months (D) 4 years

Directions for questions 20 and 21: These questions are based on the following data.

When I sat in my friend's toy store last Saturday, I noticed an interesting thing. Among the visitors, the ratio of the number of men to women was the same as that of women to children. The highest number of visitors to the store were children, who were attracted by the various kinds of toys in the store. At the end of the day, I found that 7 women visited the store.

20. How many children visited the store that day?
 (A) 44 (B) 49 (C) 52 (D) 57

21. If 15 children, 4 women and no men purchased toys that day, what is the ratio of those who purchased toys to those who did not?
 (A) 1 : 3 (B) 3 : 1 (C) 1 : 2 (D) 2 : 1

22. If $\frac{6a - 12b + 5c}{6a - 12b - 5c} = \frac{6a + 12b - 5c}{6a - 12b + 5c}$, which of the following is true?

- (A) $6ab - 12b^2 = 5ac + 5bc$
 (B) $6ab + 12b^2 = 5ac + 5bc$
 (C) $6ab + 5bc = 5ac + 12b^2$
 (D) $6ab + 5ac = 5bc + 12b^2$

23. If $\frac{a+b}{b+c} = \frac{c+d}{d+e} = \frac{e+f}{f+a}$, $c(a+d) \neq ad + c^2$ and

$d + e + f \neq 0$, find the value of $\frac{a+b+c}{d+e+f}$

- (A) 1 (B) 0
 (C) -1 (D) Cannot be determined

24. If $\frac{b+c}{c+d} = \frac{d+e}{e+f} = \frac{f+a}{a+b}$ and $a + b + c \neq$

$-(d + e + f)$, what is the value of $\frac{b}{d} + \frac{d}{f} + \frac{f}{b}$?

- (A) -3 (B) 0
 (C) 3 (D) Cannot be determined

25. The inhabitants of Warawa island (where the currency is Waras) are taxed in a funny manner. They have to pay a fixed sum irrespective of their income level. In addition to this they have to pay a sum which is proportional to the excess of their annual salary over Wr. 50,000. Mr. Wakhin pays a total tax of Wr. 6,200 per annum when his annual salary is Wr. 60,000 and his wife pays a total tax of Wr. 7,700 per annum when her annual salary is Wr. 75,000. What is the annual salary (in Waras) of Mr. Sangma who pays a total tax of Wr. 8,200 per annum?
 (A) Wr. 80,000 (B) Wr. 82,000
 (C) Wr. 90,000 (D) Wr. 81,000

Directions for question 26: This question is based on the following data.

On the 13th of a month I kept some money in a magical purse in which, on every alternate day, starting from the 14th, the money decreases by ₹10 when compared to the closing amount on the evening of the previous day. But on

every alternate day, starting from the 15th, the money doubles with respect to the closing amount on the evening of the previous day.

I had ₹500 on the 19th and the magical purse kept on decreasing and multiplying the money for me till the 25th of that month.

26. Had I started with ₹100, how much more money would I have than what I had on the 25th of the month?

(A) ₹400 (B) ₹760
(C) ₹1,280 (D) ₹1,640

27. The value of a magic number triples from the first day to the second day, decreases by half from the second day to the third day and increases by half of the increase in the number from the first day to the second day on the fourth day. If the cycle repeats and the value of the magic number after 10 days is 375, what was the value on the 1st day?

28. A shopkeeper sold wheat to four customers. To his first customer, he sold half a kg less than half of what he had. To his second customer, he sold half a kg of wheat less than half the remaining quantity of wheat he had and so on. The quantity of wheat left with him finally was 3 kg. The initial quantity of wheat he had must be

(A) between 20 kg and 25 kg
(B) between 25 kg and 30 kg
(C) between 30 kg and 35 kg
(D) between 35 kg and 40 kg

29. Prof. Mathur and Prof. Singh met in the All India Historians' conference last week. Prof. Mathur told Prof. Singh, "I found out that your teaching experience (in years) is twice that of mine." Prof. Singh replied in an affirmative manner. Prof. Mathur continued, "But last time when both of us came to the same conference, I remember that your teaching experience was thrice that of mine." "That was two years ago," Prof. Singh said. For how many years has Prof. Singh been teaching? (in years)

30. Many years ago when Mr. Waugh was asked as to who among Steve and Mark was elder, he said, "Two years from now Steve will be twice as old as he was two years ago and in three years from now Mark will be three times as old as he was three years ago." How old is Mark today, if Mr. Waugh was asked the question 27 years back and who is older?

(A) 31 years, Steve
(B) 33 years, both are of the same age
(C) 37 years, Mark
(D) 43 years, cannot say

31. A man going in his car finds that the distance he has covered is equal to the sum of the two quantities, one of which varies with time (t) and the second varies with t², (that has elapsed from the start). After 5 seconds, the man has covered a distance of 100 metres and after 6 seconds, the man has covered 138 metres. How far away from the starting point is the man after a time of 20 seconds?

(A) 400 m (B) 1300 m
(C) 1200 m (D) 1250 m

32. The owner of a jewellery showroom hired three watchmen to guard his diamonds, but a thief still got in and stole some diamonds. On the way out, the thief met each watchman, one at a time. To each, he gave six more than $\frac{1}{3}$ rd of the diamonds he had then. He escaped with 14 diamonds. How many diamonds did he steal from the store?

33. A test has 60 questions. A student scores 1 mark for a correct answer, $-\frac{1}{2}$ for a wrong answer and $-\frac{1}{4}$ for not attempting a question. If the net score of a student who attempted 48 questions is 33 marks, how many questions did he get wrong?

34. Three years ago, the ratio of A's age and B's age was 2 : 3. B's present age and C's age next year would be in the ratio 3 : 4. Two years hence, the ratio of A's and C's ages would be 3 : 5. Find the sum of the present ages of A, B, C (in years).

(A) 54 (B) 56 (C) 52 (D) 58

35. In a three-digit number the sum of the digits is 15. The tens digit is one less than the units digit. Which of the following numbers cannot be a digit in the hundreds place?

(A) 5 (B) 4 (C) 6 (D) 8

36. When Mr. Sundaram asked Ajit about his age, Ajit said, "My age was a quarter of your age five years ago, but will only be half my age fifteen years from now." How old is Mr. Sundaram?

(A) 40 years (B) 45 years
(C) 55 years (D) 62 years

Directions for questions 37 and 38: These questions are based on the following data.

Mr. Harish has three children whose names were Sachin, Rahul and Saurav. One day he bought 117 sweets for his children and planned to divide the sweets in such a manner that two times the number of sweets that Sachin would have got should be equal to three times that Rahul would have got and four times that Saurav would have got. Since Mr. Harish was very poor in counting, he divided the sweets in the ratio 2 : 3 : 4.

37. How many sweets more than the intended number did Saurav get as a result of the actual sharing?

38. If the distribution ratio was as intended and Saurav has to get as many sweets as Rahul actually got, what should the total number of sweets be?

Directions for questions 39 and 40: These questions are based on the following data.

The villagers of Panigarh were facing acute shortage of water this year. When the minister for water resources visited the village, he promised that a water tank would be constructed. As promised by the minister, a tank was built which can contain enough water for the entire village for 50 days.

The villagers were very happy as for the next 50 days there would not be any shortage of water. However, their joy was short lived as they discovered that there was a leak at the bottom of the tank which drained out 20000 litres of water every day. As a result of the leak, the water lasted only 40 days for the entire village.

39. What is the total requirement of water (in litres) of the village per day?
 (A) 40000 (B) 50000
 (C) 75000 (D) 80000
40. If the leak was plugged partially and only 5000 litres of water was getting drained out per day, on which day would the tank get emptied?
 (A) 45th (B) 46th
 (C) 47th (D) 48th
41. The road transport corporation has hired a consultant to determine the standard time that should be taken for a journey between two places. The consultant, after a detailed study, comes to the conclusion that the time of journey is proportional to the product of the square root of the number of passengers (n) and the distance to be covered(s). For two distinct trips, the time taken is in the ratio 2 : 1 and the distances covered are 80 km and 30 km respectively. How many passengers are there in the first bus, if the second bus has 64 passengers?
42. A small child buys a Cornetto cone ice-cream from the Golden Bakery. The ice-cream is packed to the top of the inverted cone and is not heaped above that. The amount of ice-cream that the child eats varies with the square of the radius of the base of the cone, when the height of the cone is constant and varies with the height of the cone, when the radius of the base of the cone is constant. When the radius is 3.5 cm and the height is 6 cm, the child eats 77 cc of ice-cream. What is the radius of the cone, when the child eats 154 cc of ice-cream and the height of the cone is only 3 cm?
 (A) 28 cm (B) 17.5 cm
 (C) 7 cm (D) 10.5 cm
43. This year the summer was the worst one that has been witnessed in the last decade. There were some showers only twice during the entire summer, that of course brought some relief to the residents of the city. The drop-in temperature in degrees Celsius from the previous day varies directly as the square root of the rainfall in mm. On April 22nd, 25 mm of rainfall was recorded. That day it was pleasant with the temperature recording was 32°C. It was quite a relief for the citizens who witnessed 42°C the day before. On May 16th, there was a rainfall of 36 mm. The temperature on May 15th was 44°C. What was the temperature on May 16th? (in °C)

Directions for questions 44 and 45: These questions are based on the following data.

In the "Get-none" supermarket a new software was installed in the computerised billing section using which,

the calculations for each of the items sold during the day could be done very easily. On the first day of the operation, while the calculations were being done at the end of the day, for a particular item it reversed the digits of both the number of pieces left unsold and the price per piece as a result of which, the closing stock of the item showed 63 pieces less and the value of the pieces still left was shown as ₹936. It is known that both the stock left and the price per piece are two-digit numbers.

44. How many items were actually left at the end of the day?
 (A) 29 (B) 81
 (C) 92 (D) Either (B) or (C)
45. By how much would the incorrectly calculated value of items sold be more/less than the correctly calculated value?
 (A) ₹887 more (B) ₹887 less
 (C) ₹1089 less (D) Cannot be determined
46. Mr. Richie Rich was a wealthy man who had inherited 2,602 silver coins as a part of his ancestral property. On his deathbed he divided these silver coins among his three sons Amar, Akbar and Anthony in a certain ratio. Amar gives 23 coins from his share to his wife, Akbar donates 37 coins to charity and Anthony sells 42 silver coins from his share. Now, the silver coins with them are in the ratio 11 : 9 : 5. How many coins did Amar receive from his father?
47. A, B and C have some money with them. If A gives ₹15 to B, then A and B would have the same amount. If C takes half of B's money, he will have five times as much money left with B. The ratio of the amounts with A and B is 5 : 2. What is the total amount with the three of them?
 (A) ₹55 (B) ₹110
 (C) ₹165 (D) ₹231
48. The sum of the ages of the four members of the Rathore family is 140 years. Five years ago, the ages of the four members Inder, Sunder, Mrs. Rathore and Mr. Rathore were in the ratio of 2 : 3 : 7 : 8. After how many years would Inder be as old as his mother is today?

Directions for questions 49 and 50: These questions are based on the following data.

Mr. Nanda and Mr. Parekh are two of my neighbours. Each son of Mr. Nanda had five times as many sisters as the number of brothers, while each son of Mr. Parekh had as many sisters as the number of brothers. Each daughter of Mr. Nanda had twice the number of sisters as the number of brothers, but each daughter of Mr. Parekh had twice the number of brothers as the number of sisters.

49. How many children does Mr. Parekh have?
 (A) 7 (B) 4 (C) 5 (D) 6
50. What is the ratio of the number of sons to that of the daughters in the two families together?
 (A) 4 : 3 (B) 3 : 4
 (C) 5 : 2 (D) 2 : 5

Exercise – 2

Directions for questions 1 to 40: For the Multiple Choice Questions, select the correct alternative from the given choices. For the Non-Multiple Choice Questions, write your answer in the box provided.

1. Rohan has a habit of buying and selling things. He purchased a single bedroom flat in a good residential locality and waited for the prices to rise. He sold it for a profit percentage which is equal to $\frac{1}{400}$ th of the price (in rupees) at which he purchased the flat. If he had received ₹43,824 in the transaction, at what price did he purchase the flat? (in ₹)
2. The pollution level at a point 50 m above the main chimney of a factory should be less than 0.02%. Due to a leak in a factory, the pollution level increased to 10%. If daily, 40% of the pollutants are cleaned up, then in how many days would the pollution come back to the acceptable level once again?
(Take $\log 2 = 0.3010$ and $\log 3 = 0.4771$)
3. Anand goes to the market and buys a certain article at a certain price and sells it at 10% profit. Had his brother Srinath gone to the market, being a much better businessman, he would have purchased the article for 10% less and sold it for ₹25 more than what Anand sold at thereby making a profit of 50% in the deal. What is Anand's cost price?
(A) ₹100 (B) ₹135
(C) ₹150 (D) Cannot be determined
4. Due to the slowdown in the software sector, the software stocks and debentures have lost the market fancy. The debentures of Soft Visual Limited are quoted at 20% discount and have 15% interest on face value. If Govind invests ₹1,87,400 in these debentures, what is the rate of return on his investment?
(A) 35% (B) 18% (C) 18.75% (D) 24.5%
5. 1000 people voted on a resolution and 10% of the votes were invalid. After some discussion, the 1,000 people voted again and this time there were 20% invalid votes. The number of votes against the resolution was increased by 50% while the motion was now rejected by a majority which is 300% more than that by which it was formerly passed. How many people voted against the resolution after the discussion?
6. Sam is a salesman working for a computer company. He earns a fixed salary of ₹1,200 per month and a commission of 8% on annual sales exceeding ₹1,00,000. What are his annual sales if on an average he earns ₹1,600 per month?
(A) ₹1,20,000 (B) ₹1,40,000
(C) ₹1,60,000 (D) ₹1,80,000
7. Aamlal, the local fruit vendor buys a certain number of oranges at ₹7 a dozen and an equal number at ₹6 a dozen. He sells all the oranges at ₹7.50 a dozen and makes a profit of ₹80. How many oranges does he buy?
 dozen
8. Mr. Bazaarimal has a shop. He marks up the price of his product by 40%. If he increases the discount from 5% to 10%, the profit will decrease by ₹14. How much profit would he earn if he gives a discount of 20% on the marked price? (in ₹)
9. The cost of painting the 4 walls of a room is ₹2000. The cost of painting the 4 walls of another room whose height is 25% more, whose length is 20% more and whose breadth is 50% more than the first room is ₹3300. What is the ratio of the length to the breadth of the first room?
(A) 2 : 1 (B) 5 : 3
(C) 3 : 2 (D) Cannot be determined
10. Sohanlal is a vegetable vendor at Monda market. He claims to sell vegetables at his cost price. But he cheats customers by using a false weight of 800 g instead of 1 kg. What is the percentage point difference between the percentage by which he under weighs and the percentage profit he makes?
11. A rectangular room has to be painted on its four walls and the ceiling. The cost of painting another rectangular room with breadth which is 10% less, length which is 10% more and height which is 10% less than the dimensions of the first room is ₹1,872. How much will it cost to paint the first room given that for this room, the length, breadth and height are in the ratio 2 : 1 : 3?
(A) ₹1,956 (B) ₹2,000
(C) ₹2,100 (D) Cannot be determined
12. Akai, a manufacturer of televisions, gives a commission of 10% on the list price of ₹25,000 to its dealers. If Akai now increases the commission to 25%, how much discount (in ₹) can the dealer give to his customer and still make a profit of 20%?
(A) ₹1,500 (B) ₹2,000 (C) ₹3,250 (D) ₹2,500
13. A manufacturer gets a profit of 20% by selling a 300 ml bottle of coke at ₹12. The greatest component of the cost for the manufacturer is the excise duty which is 50% of the cost price. If the government now decides to reduce the excise duty by 20%, by how much should the selling price (in ₹) be reduced to maintain the same profit percentage?
14. Sher Chand invests ₹19,000 in a 5% stock at 95. A few days later, he sells it and invests the proceeds in a 6% stock at 80 so that his annual income increases by ₹200. At what price did he sell his stock?
(A) ₹90 (B) ₹95 (C) ₹80 (D) ₹75
15. Due to the budget, presented by Sinha, the price of sugar increased by 40%. The Mehra family reduced its consumption so that its expenditure on sugar increased only by 12%. If its total consumption of sugar before the rise in price was 50 kg, what is the present consumption of sugar (in kg)?

16. Somu, a milkman, who wants to make a fast buck by using a false measure, measures only 900 ml instead of a litre. Somu's cost price and selling price of milk are ₹10 per litre and ₹12 per litre respectively. His profit and profit percentage, on buying and selling 18 litres are _____.

(A) ₹60, 20% (B) ₹60, $33\frac{1}{3}\%$
(C) ₹40, 25% (D) ₹40, $33\frac{1}{3}\%$

17. I went to buy a Maruti car at Nurav Motors. The dealer offered me three discount options on the list price of ₹2,10,585/-.

Option I : Two successive discounts of 15% each
Option II : Three successive discounts of 10% each
Option III: Successive discounts of 20%, 5% and 5%.
Which is the best option for me?

(A) Option I
(B) Option II
(C) Option III
(D) All options are equally good.

18. Three persons Vinod, Rajesh and Amitabh enter into a partnership with capitals ₹74,000, ₹1,11,000 and ₹1,48,000 respectively. From the annual profit of ₹62,000, Rajesh is first paid a monthly salary of ₹1,000 and then a commission of 10% of the remaining profit is paid to Vinod. The balance amount is divided among the three partners in the ratio of their capitals. Approximately what percentage of the total profit is Vinod's share?

(A) 20% (B) 22% (C) 24% (D) 26%

19. Three friends Makrand, Gaurav and Siddharth decided to enter into a partnership with amounts ₹24,000, ₹36,000 and ₹48,000 respectively. Gaurav is the working partner and receives $14\frac{2}{7}\%$ of the first-year profits for managing the business. The rest of the profits is shared by the partners in the ratio of their capitals. If the total earnings of Gaurav at the end of the first year is ₹90,000, what is the total profit? (in ₹)

20. Ratanlal sold his watch at a loss of 5%. If he had sold it for ₹56.25 more, he would have gained 10%. What will his gain or loss percentage be if he sells it for ₹450?

 %

Directions for questions 21 and 22: These questions are based on the following data.

There are five salesmen A, B, C, D and E. They receive a fixed amount, and a commission of 10% of the excess of sales above 4,000 pieces. If their total sale is less than 4,000 pieces, a percentage of the shortfall is cut from their salary. The fixed package received was ₹5,000 and the penalty was an amount equal to 20% of the sales value of the shortfall which would be deducted from their fixed package. Each piece is sold for ₹5. In the month of April, A, B, C, D and E could sell 6,000, 4,000, 2,000, 5,000 and 7,000 pieces respectively.

21. What is the average income of the five salesmen for the month of April?

(A) ₹4,800 (B) ₹5,200
(C) ₹6,000 (D) None of these

22. In order to avoid paying penalty, the five salesmen decided to swell up the volumes sold by any one of

the salesmen whose sales were less than 4,000 by the required number of pieces. It was decided that E would give those pieces to C. How much more/less would all the salesmen together receive now as compared to the earlier total?

(A) ₹500 more (B) ₹500 less
(C) ₹1,000 more (D) None of the above

Directions for questions 23 and 24: These questions are based on the following data.

In the month of May, the terms were changed. The fixed package was reduced to ₹2,000 for selling 2,000 pieces and then 5% commission for the next 1,000, 10% for the next 1,000 and so on, with the percentage commission getting increased by 5 percentage points for every additional 1,000 pieces sold. The sales of A, B, C, D and E were respectively 7,000, 5,000, 3,000, 4,000 and 5,000.

23. By what amount is the earning of A more/less in May, when compared to that earned, if on both the occasions the total number of items sold was 7,000?

(A) ₹1,250 more (B) ₹750 less
(C) ₹1,250 less (D) ₹250 less

24. By what amount did the average earning of all the five salesmen increase/decrease in the month of May as compared to that in April?

(A) Increased by ₹1,850. (B) Decreased by ₹1,650.
(C) Increased by ₹1,250. (D) Decreased by ₹1,250.

Directions for questions 25 and 26: These questions are based on the following data.

Two candidates Ram and Rajat are appearing for an examination. Each question correctly answered fetches 1 mark while for every wrong answer 1 mark is deducted. The examination has a fixed pass mark. Ram attempts a certain percentage of questions and gets 10% of his attempts wrong. Consequently, he secured a net score of 64% of the total which is 22 marks more than the pass mark. Rajat attempts a different percentage of questions and gets 20% of his attempts wrong. Consequently, he secures a net score of 54% of the total and passes by 12 marks.

25. What percentage of the total questions did Rajat attempt?

 %

26. What is the pass mark?

27. Recently I had gone to a locality called Shadigarh for conducting a survey on the married persons of the locality. I found that the entire community practised monogamy and each married person lived with his/her spouse. The population of the locality is 7,200 and $\frac{11}{18}$ th of those are males and the rest females. If 40% of the males are married, find the percentage of married females in the locality.

(A) $48\frac{1}{7}\%$ (B) $52\frac{4}{7}\%$ (C) $62\frac{6}{7}\%$ (D) $71\frac{1}{7}\%$

28. Three businessmen A, B and C started with capitals in the ratio 4 : 1 : 15. In the first year, at the end of every quarter A halves his capital, while B doubles his capital and C leaves his capital untouched. If at the end of the year, B's share of the profit is ₹22,000, what is the total profit? (in ₹)

29. The forgetful merchant Dershaw gives a discount of 20% on his marked price. Forgetting that, he took his marked price itself as the selling price and calculated his profit as 30% on the selling price. What is his actual profit percentage?
(A) $14\frac{2}{7}\%$ (B) 20% (C) 25% (D) $28\frac{4}{7}\%$
30. Ketan Parekh purchased 5% shares of Centasoft at ₹92 for a total sum of ₹46,000. He then sold ₹25,000 worth of the stock when the stock was quoted at ₹95, another 200 shares when the price of the stock had fallen down to ₹90 and the remaining shares he sold at no gain, no loss. If he retained the shares for one dividend date before selling any of them what is his overall profit or loss?
(A) ₹4,850 (B) ₹2,850
(C) ₹2,500 (D) Data inadequate
31. Praveen, Ramu and Shashi entered into a partnership with capitals of ₹62,000, ₹93,000 and ₹1,24,000 respectively. Praveen manages the business for a certain number of months while Ramu manages the business for the rest of the year. The persons who manage the business get a total commission equal to 10% of the profits. If the total income of Praveen at the end of the year is ₹2,900 and the total profit is ₹12,000, for how many months did Praveen manage the business?
32. An old woman buys a certain number of oranges for 12 a rupee and an equal number at 8 a rupee and sells at 10 a rupee. What is the loss or gain percent?
(A) 4% loss (B) 4% gain
(C) 6.25% loss (D) 6.25% gain
33. In the recently concluded Intermediate examination a total of 6,00,000 students appeared. 60% of them were males while the rest were females. If the pass percentage among males is 75% and the overall pass percentage is 70%, what is the pass percentage for females?
(A) 37.5% (B) 50% (C) 62.5% (D) 70%
34. The quantities V, x, y, z, a and b are related as follows: $V = 2xyz + 3ab$. If x, y, z, a, b change by +25%, +60%, -10%, +20% and +50%, what is the percentage increase in V?
(A) 60% (B) 80%
(C) 92% (D) Cannot be determined
35. Venkat is a fruit vendor who buys a gross of bananas at ₹10/- a dozen. During transport, two dozen bananas get spoilt. If Venkat also spends 10% of the cost of bananas on transport and wants an overall profit of 20%, at what price (in ₹) must he sell a dozen bananas?
36. Ramanand bought a bag at 30% discount on the list price. He then sold it at a price which is 160% of the list price thereby making a profit of ₹81. What is the list price (in ₹) of the bag?
37. The Indian cricket team bought a set of 11 cricket bats and 11 cricket balls a few months back. When it bought the same set for the second time, the price of each bat has gone up from ₹2,500 to ₹2,750 and that of each ball from ₹100 to ₹120. What is the percentage change in the total cost of the set?
(A) 20% (B) 18% (C) 15% (D) 10%
38. Garjana Constructions has $33\frac{1}{3}\%$ of its employees as women. 50% of these women are married and $33\frac{1}{3}\%$ of the married women have children. 75% of the men are married and $66\frac{2}{3}\%$ of the married men have children. If no two employees are married to each other what fraction of the employees do not have children?

18

Directions for questions 39 and 40: These questions are based on the following data.

Shiv Shankar manufactured and sold pens. The cost of production per pen was ₹8 and the selling price per pen was ₹10. The tax on the production cost was 12.5%. Shiv Shankar now decides to offer a discount of 5% on the marked price of ₹10, while the government decides to charge the tax at 12.5% on the marked price.

39. The percentage increase or decrease in the profit is
(A) 25% increase (B) 25% decrease
(C) 75% increase (D) 75% decrease
40. If Shiv Shankar stops offering discount and increases his volume of sales by 10%, what is the percentage increase or decrease in the government revenue compared to the tax from old volume of sales in the old tax regime? (negative sign indicates decrease)
(A) -37.5% (B) 37.5% (C) -25% (D) 25%

Exercise – 3

Directions for questions 1 to 40: For the Multiple Choice Questions, select the correct alternative from the given choices. For the Non-Multiple Choice Questions, write your answer in the box provided.

1. A father starts every day from home to pick up his son Raju from school at 3:30 p.m. One day, Raju leaves the school at 2:30 p.m. and starts walking home at a speed of 6 km/hr. He meets his father, who starts at his normal time, on the way and they reach home 24 minutes earlier than usual. Find the father's speed.
(A) 20 km/hr (B) 22 km/hr
(C) 24 km/hr (D) 15 km/hr
2. A, B and C run around a circular track of length 1,260 m at 3 m/s, 5 m/s and 7 m/s respectively, starting at the same time, from the same point and in the same direction. At how many distinct points on the track do all the three of them meet?
3. A boat takes 8 hours to travel a certain distance downstream and return to the starting point. If the speed of the boat in still water doubles, the boat would take 3 hours 12 minutes for the round trip. Find the ratio of the speeds of the boat in still water and the speed of the stream.
(A) 3 : 1 (B) 3 : 2 (C) 2 : 1 (D) 4 : 3

4. A boy travelled half the distance from his house to school at a speed of 10 km/hr. For exactly half of the remaining time he travelled at 15 km/hr and the rest of the time at 20 km/hr. Find his average speed.
(A) 13 km/hr (B) $12\frac{8}{11}$ km/hr
(C) 15 km/hr (D) $16\frac{1}{6}$ km/hr
5. In a kilometre race, A beats B by 1 minute. In the same race, B beats C by 30 seconds. If A beats C by 600 m, find the ratio of the speeds of A and B.
(A) 3 : 1 (B) 3 : 2 (C) 4 : 3 (D) 2 : 1
6. Harry starts from A towards B with a speed of 60 km/hr and after every 10 minutes he decreases his speed by 6 km/hr. If the distance between A and B is 42 km, then how much time does he take to travel from A to B? (in min)
7. A man jumps out of a plane, which is at a height of 2,300 m, with a closed parachute. When the parachute is closed, the man falls through a height of $5t^2$ m in t seconds and when the parachute is open, he falls through a height of $(2t^2 - 3t)$ m in t seconds. Find the height (in m) at which he should open the parachute, so that he takes 40 seconds to reach the ground.
8. In a mall, there is an escalator which moves at a speed of 1 step/sec. A man walks up the escalator and takes 36 seconds to reach the first floor. While coming back, he walks down the same escalator and takes 108 seconds to reach the ground floor. If the escalator is stationary, how long would he take to walk down to the ground floor?
(A) 54 seconds (B) 72 seconds
(C) 90 seconds (D) 96 seconds
9. On a circular track, P and Q take 12 minutes and 15 minutes respectively to complete a lap. P and Q start simultaneously from diametrically opposite points and run in the same direction. After how much time will they be diametrically opposite to each other for the second time?
(A) 1 hr 30 min (B) 2 hr
(C) 2 hr 30 min (D) 3 hr
10. Two cyclists start simultaneously from A and B and cycle towards B and A. They cross each other at 12:00 noon. The first person reaches B at 2:15 p.m., and the second person reaches A at 6:15 p.m. If the difference between their speeds is 8 km/hr, what is the distance between A and B? (in km)
11. A boat, P, which moves at a speed of 8 m/s in still water, starts from a jetty and travels downstream in a river. After 5 minutes, another boat Q that moves at a speed of 3 m/s in still water starts and follows P. After 15 more minutes, two passengers on P decide to board Q. They are left behind on a raft that floats along with the river to be picked up by Q. If P can cover 6 m/s. upstream, then find approximately the time for which the passengers stayed on the raft.
(A) 42 min (B) $48\frac{1}{2}$ min
(C) 41 min (D) 45 min
12. A and B start running simultaneously from the same point on a circular track. They meet after every 40 seconds if they run in opposite directions and after every 160 seconds if they run in the same direction. How much time (in sec) will they take to meet for the first time at the starting point?
13. The kingdom of Arthur II has a circular wall around it and four gates at the North, South, East and West points. The shire of Nottingham and the shire of Birmingham decide to race on the shortest route touching all the four gates. They start at the West gate and go towards the South gate. One of the shires rides five times as fast as the other. They meet for the 19th time after they start _____.
(A) at the North gate.
(B) at the South gate.
(C) exactly midway between the North and the West gates.
(D) exactly midway between the South and the East gates.
14. Amul and Cadbury run a 12 km cycling race on a circular track of circumference 750 m. Amul can beat Cadbury in a race of 2,000 m by 500 m. If Amul gives a headstart of 500 m to Cadbury, how many times will Amul overtake Cadbury in the race?
15. Aman who can row at 4 km/hr in still water, has to reach a point that is 130 km downstream of a river. Due to tides, the speed of the current changes every two hours. For two hours, it is 2 km/hr and for the next two hours it is 4 km/hr. This pattern repeats after every 4 hours. If Aman starts at the change of tide when the river begins to flow at 2 km/hr, in how much time does he reach his destination?
(A) $9\frac{1}{4}$ hr (B) $19\frac{1}{2}$ hr (C) $9\frac{2}{7}$ hr (D) $18\frac{3}{4}$ hr
16. Harinder travels at a certain speed, which is 25% less than his usual speed, and reaches the bus stand 10 minutes later than his usual time. If he travels at 25% over his usual speed, how much earlier (in min) than his usual time will he reach the bus stand?
17. The ants Anne and Amy went on a foraging trip. They started from their anthill and travelled in a straight line with equal speeds. At a certain point on the way Anne found a titbit and decided to take it back to the anthill but due to its weight Anne's speed reduced by 50%. Amy travelled further and returned with another titbit which had reduced its speed by 25%. If both Anne and Amy reached the anthill at the same time, Amy's trip was approximately how much farther than Anne's trip?
(A) 29% (B) 71% (C) 350% (D) 87%

Directions for questions 18 to 20: These questions are based on the following data.

On the planet Oz, there are 8 days in a week – Sunday to Saturday and another day called Oz day. There are 36 hours in a day and each hour has 90 minutes while each minute has 60 seconds. Just like on Earth, the hour hand covers the dial twice every day.

18. Find the approximate angle between the hands of a clock on Oz when the time is 16:50 a.m.
(A) 189° (B) 131° (C) 320° (D) 165°
19. At what time between 14 O'clock and 15 O'clock will the two hands of the clock on Oz be at an angle of 60° ?
(A) $14:59\frac{16}{17}$ (B) $14:37\frac{13}{17}$
(C) $14:58\frac{4}{17}$ (D) $14:55\frac{5}{17}$
20. Ziba, an inhabitant of the planet Oz, leaves home between 7:00 a.m. and 8:00 a.m. and returns between 1:00 p.m. and 2:00 p.m. to find that the minute and hour hands have interchanged their positions. For how long had Ziba gone out? (Assume that a.m. and p.m. are used in a similar manner as on Earth.)
(A) 6 hours 28 minutes (B) 12 hours 39 minutes
(C) 12 hours 28 minutes (D) 12 hours 22 minutes
21. Ganesh and Harish start simultaneously from the same point and run in the same direction, on a circular track of length 1600 m, at 50 m/min and 40 m/min respectively. Peter starts at the same time, from the same point and runs in the opposite direction at 30 m/min. Find the time taken (in hours) by all three to meet for the third time.
(A) 6 (B) 8 (C) 10 (D) 12
22. In a race of 9000 m, Ravi beats Rahul by 900 m, Rahul beats Ramu by 500 m and Ravi beats Ramu by $4\frac{1}{2}$ minutes. By how distance (in m) will Ravi beat Ramu in a race of 2,000 m?
23. Samanth and Saurav run a peculiar race. They both run on separate rectangular fields of dimensions 60 m x 80 m and 30 m x 40 m respectively. They agreed on a condition that they would run at least once between any two corners of their respective tracks before they finish. Saurav can run at a speed of 1.35 m/sec. What is the minimum speed at which Samanth must run to beat Saurav by 20 seconds?
(A) 3 m/sec (B) 2.84 m/sec
(C) 2.7 m/sec (D) 2.66 m/sec
24. The obtuse angle between the minute hand and hour hand of a clock is 165° . After M minutes, the obtuse angle between the hands of the clock is again 165° . What is the minimum value of M?
(A) $8\frac{2}{11}$ (B) $51\frac{9}{11}$ (C) $5\frac{5}{11}$ (D) $6\frac{6}{11}$
25. A and B start simultaneously from P and Q respectively towards Q and P. After reaching their destinations, they immediately turned back and travelled to their respective starting points. In this process, they met for the first time at a point 18 km from Q and for the second time at a point 15 km from P. If the speed of A is more than twice the speed of B, what is the distance (in km) between P and Q?
26. Anil left his house for school a few minutes late, but he travelled at $\frac{4}{3}$ times his usual speed and reached school as many minutes early. If, on the next day, he left home as many minutes early as he started late the previous day and travelled at $\frac{8}{11}$ times his usual speed, he would have reached the school _____.
(A) as many minutes late
(B) twice as many minutes late
(C) thrice as many minutes late
(D) Cannot be determined
27. A hare, a tortoise and a mongoose decide to run a closed-circuit race. The hare overtakes the mongoose 2 times per round, the 2nd time at the start and the mongoose overtakes the tortoise 4 times per round, the 4th time at the start. Find the ratio of the speeds of the hare and the tortoise.
(A) 5 : 1 (B) 8 : 1 (C) 15 : 1 (D) 10 : 1
28. Bhanti starts from P towards Q. Two hours later Amar also starts from P towards Q and overtakes Bhanti before reaching Q. After reaching Q, Amar turns back and heads towards P without stopping and meets Bhanti at a distance of 9 km from Q. If the speeds of Bhanti and Amar are in the ratio 2 : 3, what is the distance between P and Q?
(A) 105 km (B) 90 km
(C) 135 km (D) Cannot be determined
29. Car A starts from city X at 7:00 am at 50 km/hr towards Y. Car B starts from X at 8:00 am at 40 km/hr towards Y. Car C starts at 9:00 am from Y and travels towards X at 30 km/hr. If XY = 200 km, at what time is the distance between A and B equal to that of between A and C?
(A) 9:26:40 am (B) 9:28:36 am
(C) 9:30:30 am (D) 9:36:20 am
30. Amrish and Biswas start simultaneously from A and B respectively towards B and A. They cross each other at a point 17 m from A. B continues towards A, turns back and overtakes A at a point $19\frac{5}{6}$ m from B. Find the distance AB in meters.
31. P and Q start at 10:00 am from a point on a highway and walk in opposite directions. R starts at the same point at 11:00 am and goes in the same direction as P. He catches up with P at 11:30 am. R then reverses his direction and increases his speed by $61\frac{1}{9}\%$. He catches up with Q at 12:30 pm. Find the ratio of the speeds of P and Q.
(A) 4 : 5 (B) 5 : 6 (C) 3 : 4 (D) 7 : 9
32. A train takes 50 seconds to cross a boy travelling at 6 kmph in the opposite direction to it. Another train which is half as long and 25% faster takes 30 seconds to cross a stationary pole. Find the length of the second train. (in m)
33. Anubhav and Rakesh start running simultaneously around a circular track of 600 m length from the same point. If they run in the same direction, one of them overtakes the other every 60 seconds. If they meet at the starting point for the first time after 60 seconds, which of the following cannot be the speed of the faster person?
(A) 10 m/s (B) 20 m/s (C) 30 m/s (D) 40 m/s

34. A boat starts from a point P on a river on an upstream journey. After travelling 16 km, when the time was exactly 12:00 noon, it crosses a tree trunk floating downstream. After continuing upstream for 2 more hours, the boat turns around and travels downstream. If it reaches P at exactly 4:00 pm, when does the trunk reach P?
 (A) 5:00 pm (B) 4:30 pm
 (C) 3:00 pm (D) 4:00 pm
35. A train of length 600 m is leaving a platform at 15 kmph. Before it completely left the platform, another train of length 300 m coming in the opposite direction with a speed of 75 kmph starts crossing the first train. The second train entered the platform completely, and simultaneously crossed the first train. If the length of the platform is 1,125 metres, what is the time taken by the second train to cross the platform after it has crossed the first train? (in seconds)
36. A boat takes 3 hours more time for an upstream journey of 18 km than the downstream journey of the same distance. If the speed of the boat in still water is twice that of the stream, find the speed of the stream.
 (A) 3 km/hr (B) 4 km/hr
 (C) 4.5 km/hr (D) 6 km/hr
37. Ajay and Ajit start simultaneously from point A and run around a circular racetrack in the same direction after agreeing on certain conditions. Every time either one overtakes the other, the former would give the latter as many tokens as the latter has. But if either one overtakes the other at the starting point then the latter would give half of what he has to the former. Ajay runs

at a constant speed that is five times the speed of Ajit. Ajit had only one token initially and Ajay had 246 tokens at the end of the race which ends at A. How many tokens could Ajay have had in the beginning?

38. Two men P and Q start simultaneously from A and B respectively and walk towards B and A. They take two hours to meet. After meeting each other, P takes 3 hours less to reach B than Q takes to reach A. If the speed of Q is 2 km/hr, find the speed of P.
 (A) 3 km/hr (B) 3.5 km/hr
 (C) 4 km/hr (D) 5 km/hr
39. Two cars start simultaneously from the same point towards the same destination which is 420 km away. The first and the second cars travel at respective speeds of 60 kmph and 90 kmph. After travelling for some time, the speeds of the two cars get interchanged. Finally, the second car reaches the destination one hour earlier than the first. Find the time taken by the cars to interchange their speeds. (in hours)
40. Charan started on a motorcycle from P towards Q. At the same time, Dinesh started on foot from P. After some time, Dinesh called Charan, just when Charan reaches the midpoint of PQ. Dinesh continues towards Q while Charan turns back. He picks up Dinesh and together they travel towards Q. Due to this process, Charan took 1.6 times of the time he would normally take, while Dinesh saved 20 minutes. If PQ = 2.5 km, find Dinesh's speed. (in km/hr)

Exercise – 4

Directions for questions 1 to 50: For the Multiple Choice Questions, select the correct alternative from the given choices. For the Non-Multiple Choice Questions, write your answer in the box provided.

Directions for questions 1 and 2: These questions are based on the following data.

There are ten taps numbered 1 to 10 that can fill a cistern. The rates at which these taps fill the cistern are such that the rate of the n^{th} tap (where $n \geq 2$) is $\frac{2}{3}$ rd the cumulative rate of all the taps that are numbered less than it.

- If the total time taken to fill the cistern by all the 10 taps together is 1 minute, then how many minutes would the 6th tap take when working alone to fill it?
 (A) $12^{42/75}$ (B) $18^{22/45}$ (C) $20^{85/15}$ (D) $19^{47/162}$
- If the total time taken to fill the cistern by all the 10 taps together is 1 minute, then find the time taken by the first 7 taps together to fill it.
 (A) $4^{17/27}$ min (B) $5^{14/15}$ min
 (C) $3^{31/27}$ min (D) $3^{25/37}$ min

Directions for questions 3 and 4: These questions are based on the following data.

Anoop was writing the Reading Comprehension section in the DOG entrance examination. There were four passages of exactly the same word length and the four passages had 5, 8, 8 and 6 questions following them respectively. It is known that Anoop can answer exactly 12 questions in the time he takes to read any one of the four passages. His

rate of reading and answering questions remains the same throughout the section.

- Anoop took 13 minutes more to finish the first three passages than the time he took to finish the last passage. If Anoop answered all the questions in each passage, what approximate percent of the total time did he spend on the first passage?
 (A) 24.5% (B) 25.4% (C) 22.7% (D) 26.2%
- By what approximate percent should Anoop increase his reading speed if he has to cut down his total time spent on the section by 20%?
 (A) 36.36% (B) 54.54% (C) 50.50% (D) 45.45%

Directions for questions 5 and 6: These questions are based on the following data.

A can complete a piece of work in 12 days working at his full efficiency. On the first day he works at his full efficiency, on the second day at half of his full efficiency, on the third day at one-fourth of his full efficiency.

- In how many days would the work get completed if A works in the same fashion working at full, half and quarter efficiencies respectively on the 1st, 2nd and 3rd days in every further period of 3 days?
 (A) 18 (B) 20 (C) $22\frac{3}{4}$ (D) $25\frac{2}{7}$

6. A worked for the first three days as described above, and from the fourth day he worked at full efficiency. B joined him on the fourth day and together they completed the job in 11 days from the beginning. If they earned ₹7,200, what is B's share? (in ₹)

Directions for questions 7 and 8: These questions are based on the following data.

A tank in the colony of Panikam is provided with three pipes A, B, C which can fill the tank in 20, 15, 12 hours respectively. The tank has a capacity of 60,000 litres and an outlet pipe D, which supplies water to the 100 houses in the colony.

7. If all the pipes are opened simultaneously, how much water enters the tank every hour? (in litres)

8. Each of the 100 houses in the colony receive water at the rate of 30 lt/min. The requirement of each house is 900 lt per day. If the tank is empty, what is the least time in which all the houses are supplied with their daily requirement? (in min)

Directions for questions 9 and 10: These questions are based on the following data.

Two masons were supposed to finish making a certain compound wall around a square playground in a certain number of days. They can do the job in the given time provided they work together. But the second mason did not come for work till the wall on the first side of the playground was built. The work at that point was lagging behind by 12 days. For the next side of the playground, the second mason worked alone and by the time this part of the wall was completed, the work was lagging behind by 39 days.

9. In how many days can the other two sides of the playground be made by both the masons working together?
(A) 32 (B) 28 (C) 36 (D) 24
10. The two masons finished making the other two walls working together. If they received an amount of ₹2,00,000 for the entire work, what would be the share of the second mason in this amount?
(A) ₹1,20,000 (B) ₹80,000
(C) ₹1,10,000 (D) ₹90,000

Directions for questions 11 to 13: These questions are based on the following data.

A, B and C have to make some electric switchboards. Working alone, A can make 1 switchboard in 12 hours. B is 20% faster than him, C is 50% more faster than A and D is twice as fast as A.

11. In how much time can C make 90 switchboards if he works alone?
(A) 720 hours (B) 600 hours
(C) 320 hours (D) 480 hours
12. For making one switchboard, A, B, C and D worked for 1 hour and A and B for the next 2 hours. In how

much more time can A alone complete the remaining work?

- (A) 0.8 hours (B) 1.2 hours
(C) 1.5 hours (D) 1.9 hours

13. A works on the first day, B on the second, C on the third and D on the fourth and then this same cycle is repeated till the completion of the work. If each person works for 12 hours a day, in how many days are 114 switchboards ready?
(A) 40 days (B) 60 days
(C) 80 days (D) 70 days

Directions for questions 14 and 15: These questions are based on the following data.

A person can dig a well at a rate of 10 m (in depth) per day. However, every day he finds that $\frac{1}{5}$ th of the total depth to which he dug at the end of the day gets filled up with mud again by the time the next day work begins.

14. When can he finish digging a well 30 m deep? (Assume that when he reaches a depth of 30 m, the walls of the well are cemented so that it doesn't fill up with mud again)
(A) In exactly 4 days (B) On the 5th day
(C) In exactly 5 days (D) On the 6th day
15. What was the depth of the well at the beginning of the fourth day?
(A) 14.4 m (B) 19.52 m
(C) 23.616 m (D) 24.72 m

16. In a factory, there are three shifts of work on a day, each comprising eight hours. During the three shifts, the average work efficiencies of workers are 80%, 70% and 50% respectively. A work is completed in 60 days by the group working in the first shift. If the work is done in all the shifts, then how many days less are required to complete the work?

17. In the above question there are 200 men and 300 women workers, in each shift. On a particular day women do not work in the first shift and 50% of the women do not work in the second shift. If the ratio of the rate of work of a man to that of a woman is 2 : 1, in which of the following shifts is the maximum amount of work done?
(A) First shift
(B) Second shift
(C) Third shift
(D) The second shift as well as the third shift.

18. Three persons P, Q and R can complete a work in 15, 20 and 30 days respectively. Only two of these three work on any given day. But, the same two persons do not work for any two consecutive days. What is the least number of days in which the work can be completed?
(A) $5\frac{5}{6}$ (B) $9\frac{1}{6}$ (C) $8\frac{6}{7}$ (D) $4\frac{8}{13}$

19. A and B each individually started to make identical clay models. A took 12 days more than B to complete his work. If both of them had worked together, they would have taken 16 days to make both the models. In how many days does A complete his model?

20. A, B and C together can complete a work in a certain number of days. After nine days, some work is remaining. This work can be completed by A, B and C in half-a-day, three-fourths of a day, and one day respectively. In how many days can A, B and C together complete the work?
- (A) $10\frac{1}{4}$ (B) $9\frac{3}{13}$
(C) $11\frac{1}{7}$ (D) Cannot be determined

Directions for questions 21 and 22: These questions are based on the following data.

A and B can independently dig a well in 10 and 5 days respectively. But, on a particularly difficult terrain, the work is such that due to fatigue every subsequent day the efficiency of a worker falls by 10%.

21. If A is given a task of digging one such well on the difficult terrain, when will he finish the work?
- (A) On the 12th day.
(B) On the 15th day.
(C) On the 11th day.
(D) He will never finish the work.
22. If B is given the task of digging one such well on the difficult terrain, when will he finish the work?
- (A) On the 9th day.
(B) On the 7th day.
(C) On the 8th day.
(D) He will never finish the work

Directions for questions 23 and 24: These questions are based on the following data.

Three men are hired to dig four identical moats. Initially the three men decide to work together on all the four moats. But after working together to dig the first moat they split up and dig the other three moats working individually. The second moat took $4\frac{1}{6}$ times the number of days that the first moat took to dig. The third moat took 10 days more than $\frac{5}{2}$ times the time taken to dig the first moat and the fourth moat took exactly $\frac{5}{2}$ times the time taken to dig the first moat.

23. Find the total time taken for the digging of all the four moats to be completed. (in days)

24. If the three men receive ₹10,000 for the four moats, what would the difference between the smallest and the largest shares be? (in ₹)

Directions for questions 25 and 26: These questions are based on the following data.

I gave my contractor some work to be completed in 10 days. He calculated that 50 workers working at x units /day and would be needed and started the work accordingly. When I went at the end of the 5th day, I found that only 40% of the work was completed as they worked with less than their normal rates of work. Since I wanted to get the work completed in the scheduled time, I asked the contractor to employ 20 more workers whose rates of work are x units / day each.

25. In how many days did the work get completed?
- (A) 8 (B) $8\frac{1}{5}$ (C) 10 (D) 12

26. If I paid ₹75,000 to the contractor from which he kept 20% for himself and distributed the remaining to the workers, what was the average daily earning of each of the last 20 workers?
- (A) ₹600 (B) ₹250 (C) ₹180 (D) ₹120

27. A certain tank has two pipes A and B, where each can either fill it or empty it at the same respective rates depending on the requirements. If pipe A only is used to fill the tank for the time that both pipes, used as filling pipe, together take to fill the tank, then $\frac{3}{5}$ th of the tank would be full. When the tank is empty, pipe A is used to fill the tank while B is used to empty it. What percent of the tank will be empty in half the time it takes to fill the tank by both pipes together when they are used for filling?

 %

28. Pipe A can fill a tank in 18 minutes while pipe B can fill it in 24 minutes. If, because of turbulent flow, the two pipes together take 14.4 minutes to fill the tank, by what percentage is the net flow rate, when both the pipes are open, less than the sum of the flow rates in the two pipes when they function alone?

- (A) 20% (B) $16\frac{2}{3}$ % (C) $28\frac{4}{7}$ % (D) 40%

Directions for questions 29 and 30: These are based on the following data.

A water tank is provided with four outlet pipes, having the same emptying rate, which are evenly spaced out vertically one above the other. The first pipe is located at the point that is at the bottom level of the tank. The fourth pipe is located at three-fourths of the height of the tank above its base. The first outlet pipe alone can empty the full tank in four hours. There is also an inlet pipe which can fill the empty tank in one hour. The inlet pipe is opened to fill the empty tank and after one hour it is closed and then all the outlet pipes are opened.

29. In how many minutes would the tank be empty?

30. When the tank is full, all the four pipes are opened simultaneously and then closed after one hour. If the filling pipe is opened now, in how many minutes will the tank be full?

Directions for questions 31 and 32: These questions are based on the following data.

Satish wrote 12 tests and the maximum marks of each test is 100. At the end of the year he sat down to check his performance for the entire year. He noticed that he could not trace the answer scripts of tests V, VII, XI and XII and could not recollect the marks that he had scored in those tests. However, he remembered that the average marks that he got in all those 12 tests was 85. The marks that he got in tests I, II, III, IV, VI, VIII, IX and X were 88, 84, 85, 77, 95, 76, 86 and 83 respectively. His friend Dinesh remembered that he got 2 marks more in test V than he got in test XI and he got 12 marks more in test XII than in test VII. The marks obtained in test XI was 18 more than those obtained in test VII.

31. How much did Satish score in test V?
- (A) 94 (B) 90 (C) 88 (D) 86

32. If test XII was reconducted and Satish increased his average by 1 mark, how many marks did Satish get in the retest?

(A) 100 (B) 98 (C) 96 (D) 92

33. Vicky, a famous batsman scored 6,000 runs in a certain number of innings. In the next five innings he was out of form and hence could make only a total of 90 runs, as a result of which his average fell by 2 runs. How many innings did he play in all?

34. Doodhimal, the local milkman was notorious for the quality of milk that he used to sell. Initially, he had 60 ltrs of pure milk in his can. He removed one-third of it and replaced that with water. He then removed one-third of the mixture and added water to it again. What is the least number of times this process should be repeated if Doodhimal wants the concentration of milk to be below 20%?

35. There are N liters of milk in container A and N liters of water in container B. X liters of milk is transferred from A to B. After thorough mixing, X liters of the contents of B are transferred back to A. The difference of the final concentrations of milk in A and water in A is 75 percentage points. Find the final concentration of milk in B.

(A) 12.5% (B) $14\frac{2}{7}\%$

(C) $16\frac{2}{3}\%$ (D) $11\frac{1}{9}\%$

36. Ranjan invested a total of ₹25,000 in two types of bonds – one offering 12% p.a. interest and the other 8% p.a. If at the end of the year he received a total amount of ₹2,750 as interest, how much did he invest at 12% p.a.?

(A) ₹12,500 (B) ₹15,000
(C) ₹18,750 (D) ₹20,250

37. Lekhakram, a renowned author, recently got his new novel released. To his utter dismay he found that for 1,007 pages there were on an average 2 mistakes on every page while in the first 612 pages there were only 434 mistakes. The mistakes seemed to increase for the latter pages. Find the average number of mistakes per page for the remaining pages.

38. Milawat Rai, the local grocer mixed three qualities of tea T_1 , T_2 and T_3 priced at ₹74 per kg, ₹68 per kg and ₹63 per kg respectively in the ratio 1 : 2 : 4. To 4 kg of this mixture he added some more quantity of T_1 . He now sold this new mixture for ₹84 per kg, thereby making a profit of 20%. How much of T_1 did he mix with the mixture?

(A) 4 kg (B) 6 kg (C) 8 kg (D) 9 kg

39. There are 125 middle level employees in Galgotia and Sons Pvt. Ltd. The average monthly salary of those employees is ₹5,500 and that of the senior level employees is ₹14,000. If the average monthly salary of all these employees is ₹8,687.5, find the total

number of employees in the company given that middle and senior level employees form 80% of their total employees.

40. I purchased a machine for ₹2,50,000. It depreciated in value by 20% in the first year, 17.5% in the second, 15% in the third and so on. What will be the cost of the machine after 8 years, given that all the figures are percentages of the initial cost of the machine? (in ₹)

41. There are 20 students in Mr. Talwar's class. Once he conducted a test for a maximum of 100 marks. He then arranged the marks of all the students in the ascending order. He found that Rohit, who normally topped the class, had slipped to the tenth position. He found that the average of the last 11 students was 64 and that of the top 10 was 67. If the average marks of all the students of his class was 65, how many marks did Rohit score?

(A) 64 (B) 67
(C) 74 (D) Cannot be determined

Directions for questions 42 and 43: These questions are based on the following data.

There are four numbers A, B, C and D. B is 5 more than A and D is 11 more than C. A is 23 less than D and the average of the four numbers is 22.

42. What is the value of A?

43. What is the value of C?

Directions for questions 44 and 45: These questions are based on the following data.

Four persons A, B, C and D each have a certain sum of money with them. The average amount with them is ₹300. If the amount with A and B increases by 100%, then the average for all the four increases by ₹75. If the amount with C increases by 100% and that with D by 40%, the average amount with C and D is ₹690.

44. How much money did C have?

(A) ₹100 (B) ₹150
(C) ₹200 (D) ₹400

45. If B gave A ₹50, both would have the same amount. Which of the following is the amount that A had?

(A) ₹50 (B) ₹100
(C) ₹200 (D) ₹250

46. A and B are two types of acid solutions containing water and acid in the ratios 5 : 4 and 3 : 2 respectively, both by weight. What quantity of solution A, by weight, has to be mixed with 25 kg of acid solution B and 32 kg of acid so that the resulting solution has $66\frac{2}{3}\%$

of acid content, by weight, in it?

(A) 27 kg (B) 36 kg
(C) 18 kg (D) None of these

47. Two large drums A and W have 1000 litres of alcohol and water respectively. Two litres of the contents in drum A are removed and mixed with the contents of drum W. This is the first operation. Two litres of the contents of drum W are then mixed with the contents of drum A. This is the second operation. The first and the second operations together constitute process P. Process P is carried out 3 times. After that, only the first operation is done. After this, 'a' is the alcohol in the first drum and 'w' is the water in the second drum. What is the relation between a and w?
- (A) $a \geq 1.1w$ (B) $a < w$
(C) $a = w$ (D) $w < a < 1.1w$
48. 8 litres of a solution of H_2SO_4 of more than 45% concentration is mixed with 7 litres of H_2SO_4 of 30% concentration. If C% is the concentration of the

resulting mixture, which of the following is true?

- (A) $C = 37$ (B) $C < 37$
(C) $37 < C \leq 38$ (D) $C > 38$

49. The average ages (all in years) of all the possible groups of 5 people taken out of six people, taken five at a time are 29, 39, 30, 37, 34, 41. What is the difference between the ages of the oldest and the youngest among the six? (in years)

50. A flask contains A and B in the ratio of 2 : 7. If 18 litres of the solution is replaced with 18 liters of A, then the ratio of A and B becomes 12 : 7. Find the amount of solution in the flask (in litres).

- (A) $\frac{171}{5}$ (B) $\frac{162}{5}$ (C) $\frac{153}{5}$ (D) $\frac{126}{5}$

Exercise – 5

Directions for questions 1 to 65: For the Multiple Choice Questions, select the correct alternative from the given choices. For the Non-Multiple Choice Questions, write your answer in the box provided.

Directions for questions 1 and 2: These questions are based on the following data.

The students of class VII of the Maslow High School were given the option of going to various places on a Sunday. One-seventh of the students went to a temple. A number equal to the square root of the remaining students went to a museum. One-fifth of the remaining students went to a fair. One-third of the remaining went to a science exhibition and the rest to a fiction movie which was running houseful in the nearby theatre. The total number of students who went to the temple and the total number of students who went to the museum is twice that of the students who went to the fair.

- How many students went to see the movie?
(A) 12 (B) 10 (C) 16 (D) 8
- The entry tickets for museum, fair, exhibition and the movie were ₹5, ₹4, ₹2 and ₹25 respectively. How much money did the students pay for all these on that Sunday?
(A) ₹275 (B) ₹320 (C) ₹388 (D) ₹470
- There is a happy family of the Mathurs; consisting of Mr. Mathur, his wife and their only son. Presently Mrs. Mathur's age (in years) is equal to the square of her son's age (in years). Mrs. Mathur studies the relationship between her age and her son's age and finds that four years later, she would be four times as old as her son. How old would Mrs. Mathur be when her son becomes as old as she is today?
(A) 32 years (B) 36 years (C) 66 years (D) 85 years
- One-fifth of a troop of monkeys were waiting on the roadside for passers-by while eight times the square root of the remaining were playing inside the forest. The remaining 20, which were old, were sitting on top of the trees watching the antics of younger members. How many monkeys were there in the troop?

- The local club authorities divided the members into three sub-groups: juniors, youngsters and seniors. The juniors met once every five days, the youngsters every three days and the seniors every two days. The club was started with all the members present on August 15, 1987. How many days till August 14, 1988

did none of the groups come to the club? (including both the starting and ending days)

6. In how many ways can 45^2 be written as a sum or difference of two non-zero perfect squares?
(A) 12 (B) 11 (C) 10 (D) 8

7. Consider the number $\left\{\frac{n(n+1)}{2}\right\}^2$, where n is a positive integer. Which of the following is false?

- (A) $\left\{\frac{n(n+1)}{2}\right\}^2$ is always divisible by the sum of the first 'n' natural numbers.
(B) $\left\{\frac{n(n+1)}{2}\right\}^2$ is always divisible by the sum of the cubes of the first n natural numbers.
(C) $\{n(n+1)\}^2$ is always even.
(D) $\left\{\frac{n(n+1)}{2}\right\}^2$ is never divisible by 237.

8. A milkman has three jars containing 57 litres, 129 litres and 177 litres of milk. When a measuring can of a certain capacity was used to measure out as many full cans as possible from each jar, the same quantity of milk is left in each jar. What is the volume of the largest such can? (in litres)

9. Aishwarya had a certain number of chocolates which she distributed equally among Bipasha and her three sisters and was left with 3 chocolates. Bipasha distributed her share of chocolates equally among Celina and her four sisters and was left with 2 chocolates. Celina distributed her share of chocolates equally among Diana and her five sisters and was left with 3 chocolates. What is the minimum number of chocolates that Aishwarya initially had if each of the persons who received (a) chocolate(s) received at least one chocolate?
(A) 191 (B) 161 (C) 131 (D) 71

10. A number when divided by D leaves a remainder of 7 and when divided by 3D leaves a remainder of 20. What is the remainder left when twice the number is divided by 3D?
 (A) 1 (B) 20
 (C) 13 (D) Cannot be determined
11. A number when divided by D leaves a remainder of 9 and when divided by 3D leaves a remainder of 35. What is the remainder left when twice the number is divided by 3D?
 (A) 13 (B) 31
 (C) 70 (D) Cannot be determined
12. The students of Class X of Morgan's High School took a test, which has a maximum of 50 marks. The teacher misplaced the test notebooks of two of the students – Robin and Garry, but remembered that Garry got an integral score between 10 and 15 and Robin got an integral score between 32 and 40. She also remembered that the product of the marks obtained by the two students is also equal to ten times the sum of the marks obtained by the two of them. How many marks did Garry score?
13. To celebrate their victory in the World Cup, the Sri Lankans distributed sweets among themselves. If the sweets were distributed equally among the 11 players, 2 sweets were left. If the sweets were distributed equally among the 11 players, 3 extras and 1 coach, even then 2 sweets were left. What is the minimum number of sweets in the box?
 (A) 167 (B) 334 (C) 332 (D) 165
14. Two friends Kranti and Sridhar were trying to find the HCF of fifty distinct numbers. If they were finding the HCF of two numbers at a time, what is the minimum number of times this operation should be repeated by them to find the HCF of all the 50 numbers?
 (A) 20 (B) 25 (C) 49 (D) 50
15. A number when divided by D leaves a remainder of 5 and when divided by 4D leaves a remainder of 41. What is the remainder left when eleven times the number is divided by 4D?
 (A) 29 (B) 23
 (C) 19 (D) Cannot be determined
16. Let $S = \{1, 2, 3, 4, 5, 6, \dots, 360, 361\}$. Starting with 1, every second number of S is selected to form set A, every third number of S is selected to form set B, every fourth number of S is selected to form set C and every fifth number of S is selected to form set D. The numbers which are not selected to form any of A, B, C or D are put together to form set Y. What is the sum of the numbers of set Y?
 (A) 17376 (B) 13032
 (C) 17280 (D) None of these
17. A man took a five-digit number ending in 9 and raised it to an even power greater than 50. He then multiplied it with 17 raised to a multiple of 4. What is the last digit of the resulting number?
18. John, the wine merchant, has two containers A and B of capacities 3248 litres and 4175 litres respectively, completely filled with wine. John has to measure the wine in both the containers such that after a certain number of exact measurements 7 litres of wine is left unmeasured in A and 8 litres of wine is left unmeasured in B. What is the volume of the measuring can if the process has to involve the least number of measurements?
 (A) 463 litres (B) 926 litres
 (C) 231 litres (D) 326 litres
19. Two friends Harry and Jayesh were discussing two numbers, one of which was twice the other. However, both had the same number of prime factors while the larger one had four factors more than the smaller one. What could the numbers be?
 (A) 40, 80 (B) 20, 40 (C) 30, 60 (D) 50, 100
20. The History teacher was referring to a year in the nineteenth century. Rohan found an easy way to remember the year. He found that when the number is viewed in a mirror held parallel to the page, the value increased to 4.5 times itself. Which year was the teacher referring to?
21. In the midtown area of city X, there is a main road of length 500 m. Starting from one end of this road, after every 100 m, small avenues of length 200 m each, run on either side and perpendicular to it. If trees are to be planted all along and on either sides of the avenues with a gap of 10 m between any two adjacent trees, what is the maximum number of trees that can be planted in all?
22. Two friends Preeti and Saipriya had two glasses and an unlimited supply of Pepsi. The sum of the capacities of the two glasses is 250 ml. Both of them start filling their respective glasses with Pepsi and then completely empty the contents into two separate jars of equal volume. They individually repeat this process until their respective jars exactly fill up after a certain whole number of such transfers. Preeti observed that the least size of the jar for which this was possible was 300 ml. What are the sizes of the two glasses?
 (A) 125 ml, 125 ml (B) 75 ml, 175 ml
 (C) 50 ml, 200 ml (D) 100 ml, 150 ml
23. A rectangular floor of dimensions 36 ft \times 24 ft has to be completely covered with identical square tiles. What is the minimum number of square tiles required? (Assume that all tiles have the same integral dimensions, (in fts).
24. The radii of the front wheel and the rear wheel of a toy bike are 14 cm and 21 cm respectively. A red mark is put by Ramesh on the point of contact of each of the wheels with the ground when the bike is stationary. If the bike starts moving and the wheels revolve independently without slipping, what is the minimum distance after which the two red marks touch the ground simultaneously?
 (A) 42 cm (B) 294 cm (C) 84 cm (D) 264 cm

25. Two brothers Ram and Shyam each had sticks of equal length. Ram divided his stick into parts of 7 cm each and had a small part of 2 cm left. Shyam divided his stick into parts of lengths 9 cm each and had a small part of 3 cm left. Rakesh, a friend of Ram and Shyam pointed out that the sticks were the shortest of all those for which this was possible. He took another stick of the same length and cut it into parts of length 8 cm each. What is the length of the stick that is left? (in cm)

26. A gardener has to plant trees in rows containing equal number of trees. If he plants in rows of 6, 8, 10 or 12 trees in each row, 5 trees are left unplanted, but if he plants in rows of 13 trees each, no trees are left unplanted. What is the minimum number of trees that the gardener plants?
- (A) 485 (B) 725 (C) 845 (D) 605

27. A man has a certain number of chocolates. If he distributes them among 10 children, he has 9 chocolates left; if he distributes them among 9 children he has 8 chocolates left; if he distributes them among 8 children he has 7 chocolates left; if he distributes them among 7 children he has 6 chocolates left; if he distributes them among 6 children, he has 5 chocolates left. What is the least number of chocolates that the man has?

28. Reliance Industries had a good year and made a profit of ₹2483 crore. What is the minimum amount that must be sent to reserves so that, if the remaining profit is distributed among the 10 crore controlling shareholders, or 15 crore preference shareholders or 20 crore common shareholders, an amount of ₹3 crore is left undistributed in each case?

(A) ₹5 crore (B) ₹7 crore
(C) ₹20 crore (D) ₹35 crore

29. In a firing range, four shooters are firing at their respective targets. The first shooter hits his target once every 5 seconds; second shooter hits his target once every 6 seconds, the third shooter hits his target once every 7 seconds and the fourth shooter hits his target once every 8 seconds. All of them hit their targets at 10:00 a.m. When will they next hit their targets together again?

(A) 10:14 a.m. (B) 10:28 a.m.
(C) 10:30 a.m. (D) 10:31 a.m.

30. Srinivas wrote his class X board examination this year. When the results came out he searched for his hall ticket to see his roll number but could not trace it. He only remembered the first three digits of the six-digit number as 267. His father however remembered that the number was divisible by 11. His mother gave the information that the number was also divisible by 13. All three of them tried to recollect the number when all of a sudden Srinivas said that he remembered that the number was a multiple of 7. What was the units digit of the number?

(A) 5 (B) 7
(C) 2 (D) Cannot be determined

31. In a school, all classes start at 9:00 a.m. The school has three sections: primary, middle and secondary.

Each class for the primary section lasts for half-an-hour, for the middle section for forty-five minutes, and for the secondary section for one hour. Lunch break has to be given for the entire school when the three sections have just finish their respective classes and hence become free. What is the earliest time for the lunch break?

(A) 11 : 00 a.m. (B) 11 : 30 a.m.
(C) 12 : 00 p.m. (D) 12 : 30 p.m.

32. What is the sum of all the even factors of 2160?

33. Students from Delhi Public School are taking their exams in Kendriya Vidyalaya. There are 60 students taking their Hindi exam, 72 students taking their French exam and 96 students taking their English exam. The authorities of the Kendriya Vidyalaya have to make arrangements such that each classroom has students taking the exam of only one subject. If all classrooms have equal number of students, what is the minimum number of classrooms required to accommodate all students of Delhi Public School?

34. Consider the following series of numbers 1, 4, 7, 10, 13, 16, Among the first 300 numbers of the series, how many numbers can be expressed as a difference of two perfect squares in at least one way?
- (A) 75 (B) 225 (C) 150 (D) 250

35. A square floor of dimensions 72 ft x 72 ft has to be completely covered with rectangular tiles each of whose length and breadth are in the ratio 3 : 2. The length (in cm) and the breadth (in cm) of each tile are integers. What is the difference between the maximum number of identical tiles and the minimum number of identical tiles?

36. A farmer has built a fence around an enclosure for his 57 cows. The enclosure is a square-shaped region of unknown dimensions. It has 37 fence poles on each side of the square. There is a pole at each corner. How many poles has the farmer used altogether?
- (A) 57 (B) 148 (C) 144 (D) 146

37. Mohit, Rohit and Lohit had 42 chocolates with them. The ratio of the sum of the number of chocolates with Mohit and Rohit to the sum of those with Rohit and Lohit to the sum of those with Lohit and Mohit is 6 : 7 : 8. Find the number of chocolates that Rohit had.

(A) 8 (B) 10
(C) 12 (D) Cannot be determined

38. A boy was carrying a basket of eggs having less than 50 eggs. He fell and some of the eggs broke as they fell from the basket. The boy had 10 eggs left with him. When asked by his mother how many eggs were broken, the boy could not recall. However, he recalled that when he counted the total number of eggs 3 at a time, 1 egg was left. When he counted 4 at a time, 1 egg was left when he counted 5 at a time, none were left. How many eggs were broken?

39. A storekeeper had a stone weighing 31 pounds which he uses to weigh goods in 31-pound lots. One day it fell and broke into 4 pieces. As he was about to throw them, he realized that the weights of the pieces were such that he could weigh any whole number of pounds from 1 to 31. What are the weights of the pieces?
 (A) 1, 4, 10, 16 (B) 1, 2, 3, 25
 (C) 2, 3, 4, 22 (D) 1, 3, 9, 18
40. Four friends Aakash, Vikash, Prakash and Subhash were trying to figure out the marks that they have got out of 20 in the recently held class test. If the marks of Aakash be divided by 2, that of Vikash be multiplied by 2, that of Prakash decreased by 2 and that of Subhash increased by 2, the results will be equal. They all noticed that their marks added up to 45. How many marks did Prakash get?
41. Jayesh is typing natural numbers on a computer. How many times must he press keys of the keyboard in order to type the first 300 natural numbers?
42. What is the remainder when 3^{1000} is divided by 73?
 (A) 1 (B) 8 (C) 16 (D) 27
43. A three-digit number, in which all the three digits are odd, is such that if the cubes of the digits are added, the sum would be equal to the number itself. If one of the digits is 7, find the number.
 (A) 171 (B) 371 (C) 575 (D) 775
44. I purchased a ticket for the football match between France and Italy in the World Cup. The number on the ticket was a five-digit perfect square such that the first and the last digits were the same, and the second and the fourth digits were the same. What could the ticket number be?
 (A) 52,625 (B) 12,321
 (C) 63,536 (D) 48,984
45. Nitin had forgotten his six-digit bank account number. He remembered only that it was of the form X515X0 and was divisible by 36. What was the value of X?
 (A) 4
 (B) 7
 (C) 8
 (D) There is no value of X possible.
46. On being asked about the age of his son, Richard replied that if his son's age was increased by 6 years, the result (when taken in years) was a number which had a positive integral square root which was equal to his son's age decreased by 6 years. What is his son's age? (in years)
47. I purchased a lottery ticket, but since I did not have ₹100 with me, I took a loan of ₹50 from my close friend Ranjit. The next week the results were printed in the newspaper. When I took the ticket out and tried to check the number, I found that the first five digits tallied with the first prize but since the last digit was torn, I could not find out if I was the winner. When I contacted Ranjit, he told me that the six-digit number was such that its first 6 multiples had the same 6 digits in different orders. Also, he demanded half the prize money from me in case I won. What was the last digit of the ticket number?
48. In a 56-digit number, N, all the digits in the odd places from the left are 5, and all the digits in the even places except the 12th place are 4. What should be the digit in the 12th place so that N is divisible by 11?
 (A) 0 (B) 6
 (C) 5 (D) No value is possible
49. Find the number of numbers less than 1500, which when divided by 7, 8, 9 leave remainders 3, 1, 2 respectively.
50. How many positive integers between 120 and 240 are co-prime to 720?
 (A) 28 (B) 32
 (C) 48 (D) 60
51. Find the last two digits of the series
 $7^0 + 7^1 + 7^2 + 7^3 + \dots + 7^{11} + 7^{12}$.
 (A) 21 (B) 35
 (C) 43 (D) None of these
52. A number N, when expressed in base 12 has 7 in its units place. What is the digit in the units place when the number N is converted into base 5?
 (A) 1 (B) 2
 (C) 4 (D) Cannot be determined
53. How many natural numbers exist such that in base 5, the number is a four-digit number and in base 6 the number is a three-digit number?
 (A) 90 (B) 91
 (C) 670 (D) 671
54. In base n, $32 \times 45 = 2133$. Express the number $(424)_{10}$ in base n.
55. Find the difference between $(72345)_8$ and $(46436)_8$.
 (A) $(14037)_8$ (B) $(23707)_8$
 (C) $(23605)_8$ (D) None of these
56. Which of the following numbers is a perfect cube in any base system greater or equal to 7?
 (A) 1331 (B) 14641
 (C) 729 (D) 64
57. The number of digits required to represent the decimal number 6796 in base 3 is
58. ABCDE and PQRST are two 5-digit numbers. If $ABC + 3DE = 269$ and $PQR + 3ST = 329$, which of the following is definitely a factor of $ABCDE + PQRST$? The digits A to E and P to T are not necessarily distinct.
 (A) 17 (B) 29 (C) 23 (D) 31

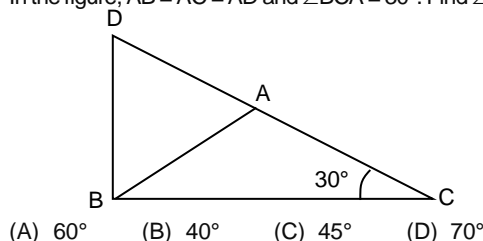
59. If $\text{Rem} \frac{13^{196}}{199} = 126$, find $\text{Rem} \left(\frac{13^{193}}{199} \right)$.
 (A) 34 (B) 44 (C) 155 (D) 165
60. What is the remainder of 5^{77} divided by 79?
 (A) 16 (B) 63 (C) 5 (D) 74
61. Find the remainder of 7^{100} divided by 2398.
62. Find the remainder of 3^{100} divided by 241.
 (A) 225 (B) 226 (C) 16 (D) 15

63. One of the two prime factors of 60499 ends in 99. Find the sum of the two prime factors.
 (A) 500 (B) 600 (C) 700 (D) 800
64. How many 6 digit-numbers of the form ababab, where a and b are single digits which are not necessarily distinct are multiples of 111?
 (A) 99 (B) 91 (C) 100 (D) 90
65. How many 6 digit-numbers of the form abcabc are multiples of 301?

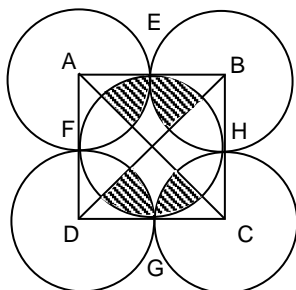
Exercise – 6

Directions for questions 1 to 60: For the Multiple Choice Questions, select the correct alternative from the given choices. For the Non-Multiple Choice Questions, write your answer in the box provided.

1. In the figure, $AB = AC = AD$ and $\angle BCA = 30^\circ$. Find $\angle BDA$.

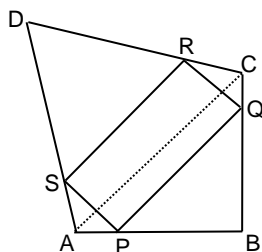


2.



In the above figure, ABCD is a square of side 6 cm. E, F, G and H are mid-points of AB, AD, CD and CB respectively. Any two adjacent circles having the centres as vertices of the square touch each other at the mid-point of the square. Find the area of the shaded region. (in cm^2)

- (A) $18\pi - 36$ (B) $9\pi - 18$
 (C) $9\pi + 18$ (D) $18(\pi - 1)$
3. ABCD is a quadrilateral. P, Q, R and S are points of trisection of the sides AB, BC, CD and DA respectively, which are closer to A and C. Find the sides of the figure (in cm.) formed by joining PQRS if the two diagonals AC and BD of the quadrilateral ABCD measure 15 cm and 21 cm respectively.

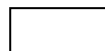
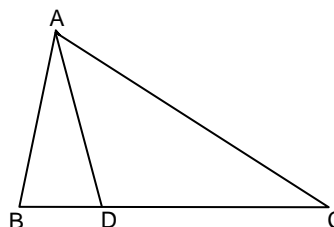


- (A) $PQ = 10$, $QR = 7$, $RS = 10$, $PS = 7$

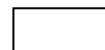
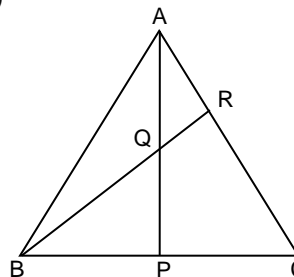
- (B) $PQ = 7$, $QR = 10$, $RS = 7$, $PS = 10$
 (C) $PQ = 10$, $QR = 10$, $RS = 7$, $PS = 7$
 (D) $PQ = 7$, $QR = 7$, $RS = 7$, $PS = 7$

4. In rectangle ABCD, P is a point on BC such that $BP : PC = 1 : 2$ and Q is a point on CD such that $CQ : QD = 1 : 3$. R is a point on AQ such that $AR : RQ = 1 : 4$. Find the ratio of the areas of triangle PQR and rectangle ABCD.
 (A) 3 : 10 (B) 1 : 5 (C) 2 : 5 (D) 7 : 20

5. In the figure, AD bisects $\angle BAC$. The area of $\triangle ABD = 30 \text{ sq.cm}$ and AC is 3 times AB. Find the area of $\triangle ABC$. (in cm^2)



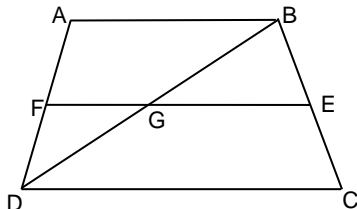
6. In $\triangle ABC$, $BC = 10 \text{ cm}$. If the area of the biggest rectangle that can be inscribed in a triangle is $10\sqrt{3} \text{ cm}^2$, find the length of the altitude AD. (in cm)
 (A) $4\sqrt{3}$ (B) $3\sqrt{3}$ (C) $2\sqrt{3}$ (D) $5\sqrt{3}$
7. In $\triangle ABC$ below, AP is a median. BQ bisects AP and meets AC in R. Find the length of AR if $AC = 45 \text{ cm}$. (in cm)



8. D is a point on the side BC of triangle ABC such that $\angle ADC = \angle BAC$. The length of the side CA is 6 cm. Find the maximum possible length of BD if it is known that both CB and CD take integral values greater than one.

(A) 7 cm (B) 16 cm (C) 18 cm (D) 14 cm

9. In a trapezium ABCD, AB is parallel to DC and $DC = 2AB$. EF, drawn parallel to AB, cuts AD in F and BC in E such that $\frac{BE}{EC} = \frac{3}{4}$. Diagonal DB intersects EF at G. Find the ratio FE: AB.



(A) 4 : 7 (B) 7 : 4 (C) 7 : 10 (D) 10 : 7

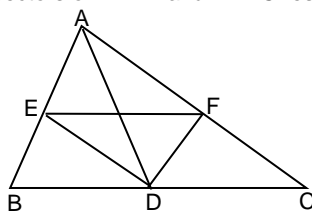
10. I had a rectangular plot whose length was 44 m more than the breadth. Mr. Tarapore offered me his plot whose length was 16 m more than that of my plot and the breadth was 16 m. I readily agreed to his offer since his plot was situated at a much better location than that of mine and moreover the areas of the two plots were the same. Find the length of Mr. Tarapore's plot. (in m)



11. In trapezium ABCD, AB and CD are parallel. $AB = 2$, $CD = 5$. P and Q are points on diagonals BD and AC respectively such that PQ is parallel to CD and $PQ = 3.25$. If $BD = 6$, find the length of PB.

(A) 3.5 (B) 4 (C) 4.5 (D) 5

12. In the figure (not drawn to scale), $\angle DEF = 35^\circ$. Find the other two angles of $\triangle DEF$ if DE and DF are the angle bisectors of $\angle ADB$ and $\angle ADC$ respectively.



(A) 25° and 120° (B) 65° and 80°
(C) 70° and 75° (D) 55° and 90°

13. In circle C_1 with radius 20 cm, O is the center and A, B, C, D are points on one radius such that $OA = AB = BC = CD = 5$ cm. Circles C_2 and C_3 each of radius 5 cm, are constructed with points C and A as centers. A fourth circle C_4 is constructed such that it touches C_2 and C_3 externally and C_1 internally. Find the radius of C_4 . (in cm)

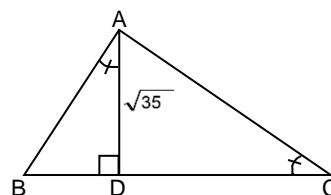


14. C_1 is a circle with center O and radius 15 cm. A, B, C, D, E are points on radius OE such that $OA = AB = BC = CD = DE = 3$ cm. Circles C_2 and C_3 are constructed with centers at B and D respectively and radius equal to 3 cm. Circle C_4 is constructed such that it touches

C_2 , C_3 externally and C_1 internally. Find the radius of C_4 .

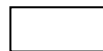
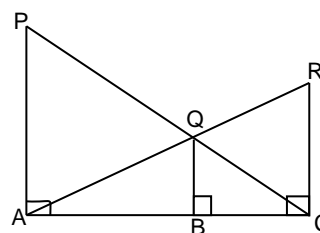
(A) 3.5 cm (B) 4 cm (C) 4.5 cm (D) 5 cm

15. In the figure, $\angle BAD + \angle DBA = 90^\circ$ and $\angle DCA = \angle BAD$. If $AD = \sqrt{35}$, find BD.

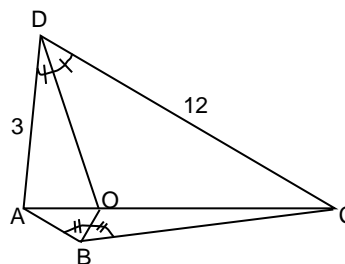


(A) 1 (B) 5
(C) 7 (D) Cannot be determined

16. In the figure, PA, QB and RC are perpendicular to AC. PA and RC are 3 cm and 1.5 cm long respectively. Find the length of QB. (in cm)

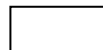


17. Quadrilateral ABCD is such that there is a point O on diagonal AC such that BO bisects $\angle ABC$ and DO bisects $\angle ADC$. If $AD = 3$ and $DC = 12$, which of the following is a possible value for BC?



(A) 1.7 (B) 3.2 (C) 12.8 (D) 20.4

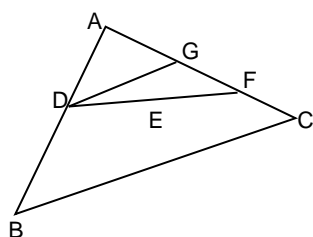
18. The volume of air that an exhaust fan can evacuate per unit time is proportional to the square of its speed in revolutions per minute. If it takes 20 minutes for such a fan, running at a certain speed, to evacuate all the air from a room of dimensions 2 m x 3 m x 4 m, find the number of solid boxes each of dimensions $1/2$ m x $1/2$ m x 1 m that should be placed in a room of dimensions 6 m x 8 m x 12.5 m, if the same fan has to evacuate the room within 10 minutes, when running at five times its initial speed.



19. Mr. Das is a well-settled businessman. He wanted to build an independent house. So, he purchased a rectangular plot with dimensions 48 m x 40 m. He planned in such a way that there should be a path of uniform width inside and all around the plot of area 336 sq.m. What should be the width of the path?

(A) 2 m (B) 4 m (C) 6 m (D) 7 m

20.



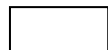
In $\triangle ABC$, D is a point on AB such that $AD : DB = 4 : 5$. F is a point on AC such that the median DG in $\triangle ADF$ is parallel to BC. Find the ratio of CF and FA.

- (A) 2 : 9 (B) 1 : 4 (C) 2 : 7 (D) 1 : 8

21. In rhombus ABCD, $\angle A = 120^\circ$ and each side is equal to 2 cm. With A, B, C, D as centers, arcs of radius 1 cm are drawn cutting AB, BC, CD, DA at P, Q, R, S respectively. The figure PQRS is cut out along the arcs. What is its area?

- (A) $\frac{\pi - \sqrt{3}}{2}$ (B) $\sqrt{3} - \frac{\pi}{2}$
(C) $\pi - \sqrt{3}$ (D) $2\sqrt{3} - \pi$

22. In a circle with center O, chords AB and CD intersect at a point P such that $\angle APC = 60^\circ$ and O lies in the interior of $\angle APC$. If $\angle COB = \angle 110^\circ$, find the measure of $\angle AOD$. (in degrees)



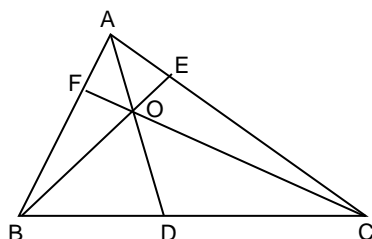
Directions for question 23: This question is based on the following data.

Anoop managed to draw three circles of equal radii on the diagonal of a square such that the extreme circles touch two sides of the square and the middle circle. He then proceeds to draw a few more circles of the same radii until he could not fit any more without any overlapping circle.

23. If Anoop managed to fit five equal circles on one of the diagonals of a square, such that the extreme circles touch the sides of the square, then find the ratio of the radius of the circles to the side of the square.

- (A) $1 : (5 + 4\sqrt{2})$ (B) $(5 - 4\sqrt{2}) : 1$
(C) $1 : (2 + 4\sqrt{2})$ (D) $1 : (2 + 5\sqrt{2})$

24.

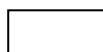


If the figure, $BD/DC = 2/3$ and $AO/OD = 1/2$. Find

$$\frac{AF^2 \cdot AE + BF^2 \cdot EC}{AF^2 \cdot EC + BF^2 \cdot AE}$$

- (A) $\frac{145}{509}$ (B) $\frac{509}{145}$
(C) 1 (D) Cannot be determined

25. In a right-angled triangle with sides a, b, c where $a < b < c$, $2a + 7c = 9b$. If $a = 12$, find c.

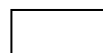
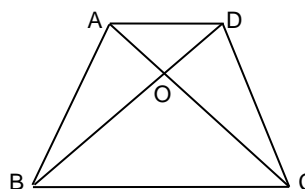


26. Manoj drew a pattern, consisting of a series of squares with every square after the first being formed by joining the midpoints of the earlier square. Manoj decided to calculate three areas. The first area was the sum of the areas of all these squares. The second was the sum of the differences between the areas of any two consecutive squares and the third was the sum of the areas of alternate squares starting from the second square from the outside. If the squares are assumed to be drawn to infinity then the ratio of the three sums would be _____.

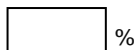
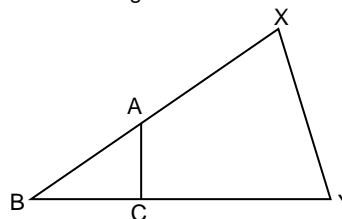
- (A) 8 : 6 : 3 (B) 6 : 3 : 2 (C) 4 : 3 : 1 (D) 5 : 3 : 2

27. A, B, C, D are 4 collinear points which are not necessarily distinct. C lies on one extreme. If $CB + AD = CA + BD$, which of the following is true?
(A) If $A = B$, then both lie between C and D.
(B) If $A = D$, then A lies between C and B.
(C) If $B = D$, then B lies between C and A.
(D) If $A \neq B$, then either A or B lie on the other extreme.

28. In the figure, AD and BC are parallel. $AO = (1/3)OC$. If $OD = 1.2$ cm, find BD (in cm)



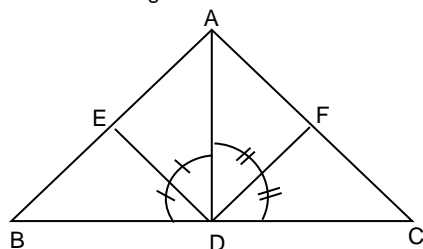
29. The famous trapeze artist Udaan Singh plans to make conical tents for the performers of his circus group. He wants 22 persons to stay in each tent. The tents have to be such that each person gets 8 sq.m of floor space and 40 cu.m of volume for himself/herself. What should be the height of the tents?
(A) 15 m (B) 20 m
(C) 24 m (D) Cannot be determined
30. In the figure, $CY = 3BC$ and $AX = 2BA$. By what percent is the area of $\triangle XBY$ greater than that of $\triangle ABC$?



31. Fifi, the housefly has to fly from one corner of a hall on the floor to the diagonally opposite corner on the ceiling as quickly as possible. The hall is 3 meters in height, 4 meters in breadth and 12 meters in length. Fifi has not more than 20 seconds for getting to the other corner. Find the minimum possible speed with which it should fly to make it in time.

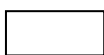


32. In triangle ABC, AD is the median. The bisectors of $\angle ADB$ and $\angle ADC$ meet the sides AB and AC at E and F respectively. If EB is 8 times AE and AF = 4 cm, then find the length of AC.

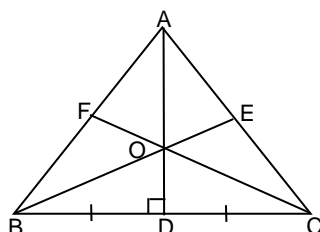


- (A) 32 cm (B) 36 cm
(C) 38 cm (D) Cannot be determined

33. In a trapezium, the smaller of the two parallel sides is 4 cm. One diagonal of a trapezium divides the other in the ratio 1 : 2. Find the other parallel side of the trapezium. (in cm)



34. D is the midpoint of the side BC of a triangle ABC. O is a point on AD such that AO is 4 times OD. BO and CO produced meet AC and AB in E and F respectively. Find the length of the side AB if FB = 3 cm.

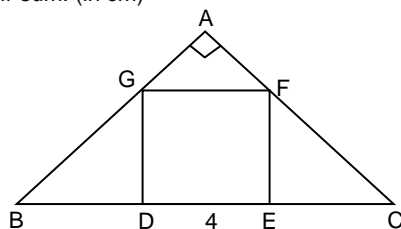


- (A) 3 cm (B) 6 cm (C) 9 cm (D) 12 cm

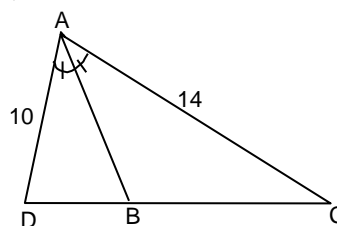
35. Anup brought three cylindrical ice-cream packs whose radii are in the ratio of 2 : 3 : 4. He has to carry them home. The rate at which the temperature of each pack increases varies directly as the lateral surface area and varies inversely as the volume of the container. He has an insulating flask which can be used to enclose exactly one of the three packs. If he wants, to keep in the flask that pack whose temperature increases at the fastest rate, which pack must he keep in the flask?

- (A) First pack (B) Second pack
(C) Third pack (D) Either first or second

36. In the figure, triangle ABC is right-angled at A. DEFG is a square of side 4 cm. The lengths of BD and EC (both in cm) are distinct integers greater than 1. Find their sum. (in cm)

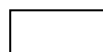
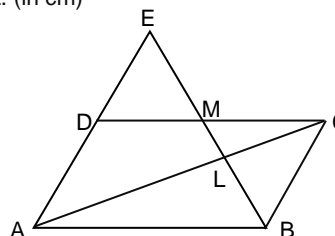


37. In $\triangle ADC$, the bisector of $\angle DAC$ intersects DC at B. AD = 10, AC = 14 and BC = BD + 1. Find BC.

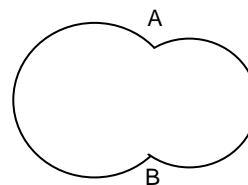


- (A) 3.5 m (B) 6 m
(C) 8 m (D) Cannot be determined

38. In the figure, ABCD is a parallelogram and M is the midpoint of the side CD. If BL = 3 cm, find the length of EL. (in cm)



39. Mr. Bagicha Singh has a beautiful garden in the shape as shown below. There are two circles intersecting each other at A and B. If the radii are 50 m and 40 m and if AB is 60 m, find the longest distance between any two points on his garden.

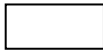


- (A) $20\sqrt{5} + 13$ m (B) $13(10 + \sqrt{50})$ m
(C) $10(13 + \sqrt{7})$ m (D) $13(10 + \sqrt{7})$ m

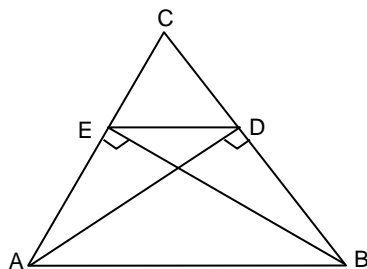
40. In $\triangle ABC$, line segment XY intersects AB in X and AC in Y such that XY is parallel to BC. The area of triangle AXY is half of the triangle ABC. Find the ratio of BX : AB.

- (A) $\frac{\sqrt{2}}{\sqrt{2}-1}$ (B) $\frac{\sqrt{2}-1}{\sqrt{2}}$
(C) $\frac{1-\sqrt{2}}{\sqrt{2}}$ (D) None of these

41. Crowe the crow was very thirsty, and it found a bucket with a little water in it. The bucket was in the shape of a frustum of a cone. The base had a circumference of 88 cm and the top had a circumference of 44 cm and the height of the bucket was 20 cm. The water level was only half the height of the bucket. Crowe needed the water level to reach 80 percent of the height. Find how many spherically shaped pebbles of diameter 2 cm should Crowe drop into the water so that the level rises to the required height.

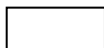


42. In $\triangle ABC$, AD and BE are perpendiculars to sides BC and AC respectively. $AD : BE = 13 : 14$, $CD = 5$ cm and ED is $(5/13)$ AB. Find the length of BD in cm.

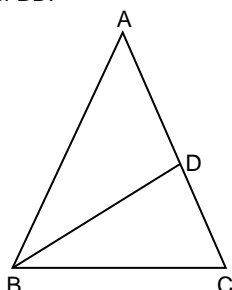


- (A) $\frac{99}{13}$ (B) 9 (C) $\frac{168}{13}$ (D) 12

43. A certain tank full of water is in the shape of an inverted cone and develops a leak at its vertex. The water level fell by 30% in the first 3942 seconds. How much more time is needed for the level to fall to 40% of the initial level? (in min)

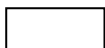


44. In triangle ABC, $AB = AC$ and $BC = 4.5$ cm. D is a point on the side AC such that $BC^2 = (AC)(CD)$. Find the length of BD.

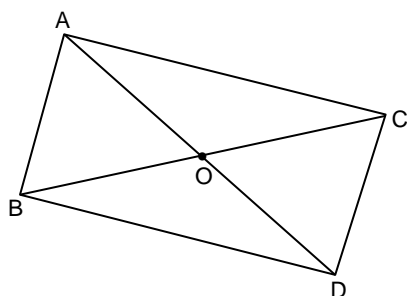


- (A) 2.25 cm (B) 4.5 cm
(C) 6.75 cm (D) Cannot be determined

45. There are four cities P, Q, R and S. P is 100 km from Q and 75 km from R. S lies on the straight-line road joining Q and R. If the triangles formed by P, Q, R and P, Q, S are right angled, how far is S from P? (in km)



46.



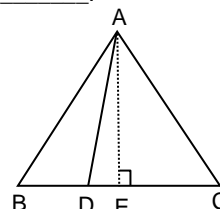
In the above figure, ABC and DBC are two right-angled triangles. The length of AO is one and half times the length of DO. Find the ratio of areas of $\triangle ABC$ and $\triangle DBC$

- (A) 9 : 4 (B) 1 : 1
(C) 3 : 2 (D) Data insufficient

47. Apoorva has to pack cartons with cakes of soap. She has 24,000 cakes of soap. The cakes were individually of the dimensions $5 \text{ cm} \times 3 \text{ cm} \times 4 \text{ cm}$ while the carton was 51 cm broad, 52 cm high and 35 cm long. She is left with 2240 cakes after using exactly 16 cartons. At this rate, how many cartons more than the minimum possible number of cartons does she use?



48. In the figure, ABC is an isosceles triangle with $AB = AC = 7$ cm. $AD = 5$ cm. If BD and CD (in cms) are distinct integers, the sum of the lengths of BD and CD could be _____.

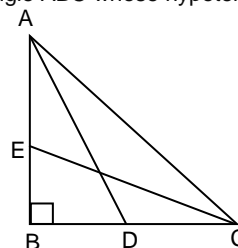


- (A) 15 cm (B) 11 cm (C) 14 cm (D) 9 cm

49. Mr. Tairakmal is an internationally renowned swimmer. He purchased a plot in the shape of a right triangle in which the longest side was 100 m and one of the other sides was 80 m. What is the maximum area of a circular swimming pool that he can construct on his plot?

- (A) 400π sq.m. (B) 600π sq.m.
(C) 625π sq.m. (D) 675π sq.cm

50. Find the sum of squares of the medians AD and CE drawn from the two acute angled vertices of a right-angled triangle ABC whose hypotenuse is 20 cm.



- (A) 500 cm^2 (B) 400 cm^2
(C) 200 cm^2 (D) Cannot be determined

51. In a circle, the lengths of chords PQ and QR are 15 cm and 20 cm respectively and $\angle Q = 90^\circ$. What is the greatest possible distance of any point A on the circle from the chord QR?

- (A) 19 cm (B) 20 cm (C) 22.5 cm (D) 21.5 cm

52. In a trapezium, the non-parallel sides are equal, and the parallel sides measure 7 and 25. Each diagonal is perpendicular to one of the non-parallel sides. What is the area of the trapezium?



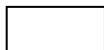
53. A rope of length 20 m is bent to form square ABCD. By fixing AB at its place and by bending the remaining part of the rope, a right-angled triangle ABE is formed. Then the difference of the area of the triangle and that of the square (in m^2) is _____.

- (A) $\frac{20}{3}$ (B) $\frac{25}{3}$ (C) 5 (D) 6

54. ABCD is a trapezium with $AB \parallel CD$. The diagonals intersect at O. The area of the triangle OAB is A and the area of triangle OCD is B. The area of the trapezium is _____.

(A) $a\sqrt{b} + b\sqrt{a}$ (B) $(\sqrt{b} - \sqrt{a})^2$
(C) $(\sqrt{a} + \sqrt{b})^2$ (D) $a + b + \sqrt{ab}$

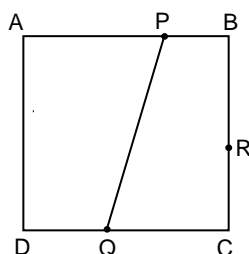
55. A circle is inscribed in an isosceles trapezium. The length of the segment joining the midpoints of the non-parallel sides is 13 cm and this segment divides the trapezium into two parts whose areas are in the ratio of 7 : 19. What is the diameter of the circle? (in cm)



56. A closed box is in the form of a frustum. The dimensions of the base are 12 cm \times 10 cm and those of the top face are 6 cm \times 4 cm. Moreover, the centre of the top face is directly above the centre of the base and each edge of the top face is parallel to the corresponding side of the bottom face. The height is $\sqrt{7}$ cm. An ant is at the bottom left corner in the front. It has to reach the top right corner at the back. What is the minimum distance it has to travel on the surface of the box? (in cm)

(A) $\sqrt{241}$ (B) $\sqrt{137}$ (C) $\sqrt{145}$ (D) $\sqrt{97} + 4$

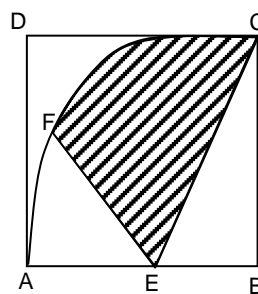
57.



A square piece of paper ABCD is folded such that the vertex A falls on R on side BC and the crease formed is PQ, as shown in the figure. If $AP : PB = 13 : 5$, then $\tan \angle RDC =$ _____.

(A) $\frac{5}{12}$ (B) $\frac{5}{13}$ (C) $\frac{1}{3}$ (D) $\frac{1}{2}$

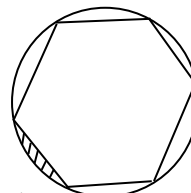
58.



ABCD is a square of side 18 cm. F is a point inside the square, such that BCF forms an equilateral triangle. CFA is a quarter circle with centre B. E is the point on AB such that the area of the region EFC is half that of the area of the quarter circle. Find the length of AE (in cm).

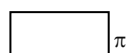
(A) 3π (B) $18 - 3\pi$
(C) 9 (D) $18 - 6\sqrt{3}$

59. In the figure below, a circle circumscribes a regular hexagon of side a. The area of the shaded region is _____.



(A) $\left(\frac{\pi}{6} - \frac{\sqrt{3}}{4}\right)a^2$ (B) $\left(\frac{\pi}{12} - \frac{\sqrt{3}}{8}\right)a^2$
(C) $\left(\frac{\pi}{3} - \frac{\sqrt{3}}{2}\right)a^2$ (D) $\left(\frac{\pi}{3} - \frac{\sqrt{3}}{4}\right)a^2$

60. From a solid cylinder of base diameter 48 cm and height 7 cm, a cone with base diameter 48 cm and height 7 cm is cut. If the total area of the part that is left is T and that of the solid cylinder is S, what is the value of $T - S$ (in cm^2)?



Exercise – 7

Directions for questions 1 to 60: For the Multiple Choice Questions, select the correct alternative from the given choices. For the Non-Multiple Choice Questions, write your answer in the box provided.

- The circumcentre of the triangle formed by A $(\sqrt{3}, 0)$, B(0, 3) and C $(-\sqrt{3}, 0)$ is _____.
(A) (0, 1) (B) (0, 3) (C) $(-1, 0)$ (D) (1, 1)
- If A (1, 5), B (2, 4) and C (5, 1) are the three vertices of a parallelogram ABCD, then the fourth vertex D is _____.
(A) $(-2, -4)$ (B) $(-2, 4)$
(C) $(4, -2)$ (D) (4, 2)
- If the axes are translated to the point (7, -3) then the new co-ordinates of the point (1, 1) will be _____.
(A) (6, 4) (B) $(-6, -4)$ (C) $(-6, 4)$ (D) (6, -4)
- If A (5, 7), B (2, 3) and C $(-2, 0)$ are the three consecutive vertices of a rhombus ABCD, then find the area of the rhombus ABCD. (in sq. units)
- If (4, 4) and $(-4, -4)$ are two vertices of an equilateral triangle, then the third vertex can possibly be _____.
(A) (3, 1)
(B) $(4\sqrt{3}, 4\sqrt{3})$
(C) $(3\sqrt{3}, 3\sqrt{3})$
(D) $(-4\sqrt{3}, 4\sqrt{3})$
- Find the area of an isosceles right-angled triangle, if (0, 0) and (3, 3) are the coordinates of the right-angled vertex and midpoint of the hypotenuse respectively.
 sq units
- The vertices of a triangle are (0, 0), (0, 2) and (2, 0). The distance between the orthocentre and the circumcentre is _____.
(A) $5\sqrt{2}$ (B) $2\sqrt{2}$ (C) $\sqrt{2}$ (D) 2

8. If the lines $x + 2ay + a = 0$; $x + 3by + b = 0$ and $x + 4cy + c = 0$ are concurrent, then a , b and c are in _____.
 (A) arithmetic Progression.
 (B) geometric Progression.
 (C) harmonic Progression.
 (D) None of these
9. The equation of the straight-line passing through $(3, 4)$ and the intersecting point of the two lines $5x - y = 9$ and $x + 6y = 8$ is _____.
 (A) $x + y - 7 = 0$ (B) $3x + y - 13 = 0$
 (C) $3x - y - 5 = 0$ (D) $x - y + 1 = 0$
10. The area of the triangle (in sq. units) formed by the y -axis, the straight-line L passing through $(3, 4)$ and $(6, 0)$, and a line perpendicular to L and passing through $(2, 0)$, is closest to the integer
11. The equations of perpendicular bisectors of the sides AB and AC of $\triangle ABC$ are $x - y + 5 = 0$ and $x + 2y = 0$ respectively. If $A = (1, -2)$, then the equation of the line BC is _____.
 (A) $14x + 23y - 40 = 0$ (B) $3x - 4y + 7 = 0$
 (C) $2x + 3y + 11 = 0$ (D) $7x + 8y - 12 = 0$
12. Find the distance of the point $(3, 5)$ from the line $2x - y + 2 = 0$, measured along a line parallel to $x - y + 6 = 0$.
 (A) $\frac{3}{5}\sqrt{5}$ units (B) $\frac{3}{2}\sqrt{2}$ units
 (C) $3\sqrt{2}$ units (D) $4\sqrt{2}$ units
13. A straight line through the point $A(1, 2)$ and making an angle of 135° with the negative direction of x -axis, meets the line $3x + 4y = 12$ at P . The distance AP is _____.
 (A) $\frac{2}{7}$ (B) $\frac{2}{\sqrt{7}}$ (C) $\sqrt{\frac{2}{7}}$ (D) $\frac{\sqrt{2}}{7}$
14. The vertex of an equilateral triangle is $(2, 3)$ and the opposite side is $x + y = 2$. The equations of the other sides are _____.
 (A) $(2 - \sqrt{3})x - y - 2\sqrt{3} - 1 = 0$,
 $(2 + \sqrt{3})x - y - 2\sqrt{3} + 1 = 0$
 (B) $(2 + \sqrt{3})x - y + 2\sqrt{3} - 1 = 0$,
 $(2 + \sqrt{3})x + y - 2\sqrt{3} + 1 = 0$
 (C) $(2 + \sqrt{3})x - y - 2\sqrt{3} - 1 = 0$,
 $(2 - \sqrt{3})x - y + 2\sqrt{3} - 1 = 0$
 (D) $(2 + \sqrt{3})x + y + 2\sqrt{3} + 1 = 0$,
 $(2 - \sqrt{3})x + y + 2\sqrt{3} - 1 = 0$
15. The points on the line $x + y = 4$ that lie at a unit distance from the line $4x + 3y - 10 = 0$ are _____.
 (A) $(3, 1)$, $(1, 3)$ (B) $(-7, 11)$, $(11, -7)$
 (C) $(3, 1)$, $(-7, 11)$ (D) $(1, 3)$, $(11, -7)$
16. (a) If A , B , C and D are angles of a cyclic quadrilateral then the value of $\cos A + \cos B + \cos C + \cos D$ is
 (b) The value of $\cos 28^\circ + \cos 65^\circ + \cos 115^\circ + \cos 208^\circ + \cos 240^\circ + \cos 300^\circ$ is
17. If $\cot \theta = \frac{b}{a}$ where $a, b > 0$ and $\theta \notin Q_1$, the value of $\frac{a \sin \theta - b \cos \theta}{a \sin \theta + b \cos \theta}$ is _____.
 (A) $\frac{b-a}{b+a}$ (B) $\frac{b^2 - a^2}{b^2 + a^2}$ (C) $\frac{b+a}{b-a}$ (D) $\frac{a^2 - b^2}{a^2 + b^2}$
18. The value of $\left(\frac{\cot A}{\operatorname{cosec} A + 1} + \frac{\cot A}{\operatorname{cosec} A - 1} \right) \frac{1}{\sec A}$ is
19. If $x = a(\cot \theta) + b(\operatorname{cosec} \theta)$ and $y = a(\cot \theta) - b(\operatorname{cosec} \theta)$, the equation obtained by eliminating θ is _____.
 (A) $\frac{(x-y)^2}{4a^2} + \frac{(x+y)^2}{4b^2} = 1$
 (B) $\frac{(x-y)^2}{4b^2} + \frac{(x+y)^2}{4a^2} = 1$
 (C) $\frac{(x-y)^2}{4a^2} - \frac{(x+y)^2}{4b^2} = 1$
 (D) $\frac{(x-y)^2}{4b^2} - \frac{(x+y)^2}{4a^2} = 1$
20. If $\sin \theta + \cos \theta = \sqrt{2}$, find $\tan^n \theta + \cot^n \theta$.
21. If A as well as B are angles measuring between 0 and $\frac{\pi}{2}$, $A + B = 45^\circ$, then the value of $(1 - \cot A)(1 + \cot B)$ is _____.
 (A) 1 (B) 2
 (C) $-2 \tan A$ (D) $-2 \cot A$
22. Given $4 \sin A \cdot \sin(60^\circ + A) \cdot \sin(60^\circ - A) = \sin 3A$. The value of $\sin 12^\circ \sin 48^\circ \sin 54^\circ$ is equal to _____.
 (A) $\frac{1}{16}$ (B) $\frac{1}{8}$ (C) $\frac{1}{4}$ (D) $\frac{1}{2}$
23. If $\sin 18^\circ = \frac{\sqrt{5}-1}{4}$, $\cos 36^\circ = \frac{\sqrt{5}+1}{4}$, then the value of $\tan 9^\circ - \tan 27^\circ - \tan 63^\circ + \tan 81^\circ$ is
24. The range of $\cos^2 \theta + \sin^4 \theta$ is _____.
 (A) $\left[\frac{3}{4}, 1 \right]$ (B) $\left[\frac{1}{4}, \frac{3}{4} \right]$ (C) $\left[-\frac{1}{2}, \frac{1}{2} \right]$ (D) $\left[-\frac{1}{2}, 1 \right]$
25. The minimum value of $1 + 8 \sin^2 x \cos^2 x$ is
26. $\sin^2(\theta - 45^\circ) + \sin^2(\theta + 15^\circ) - \sin^2(\theta - 15^\circ) =$ _____.
 (A) $\frac{1}{4}$ (B) $\frac{1}{2}$ (C) 1 (D) 0
27. The minimum value of $4 \tan^2 x + 9 \cot^2 x$ is
28. In a triangle ABC , if angles A, B, C are in A.P and $b : c = \sqrt{6} : \sqrt{3} - 1$, then angle A is _____.
 (A) 75° (B) 30° (C) 15° (D) 105°

29. An aeroplane flying horizontally 1 km above the ground with a uniform speed is observed at an elevation of 53° from a point on the ground. The plane is moving away from the observer. After 12 seconds the angle of elevation of the plane is observed to be 45° from the same point. Find the speed of the aeroplane. (Given, $\sin 37^\circ = 0.6$)

(A) 48 km/sec (B) $\frac{1}{48}$ km/sec
(C) 24 km/sec (D) $\frac{1}{24}$ km/sec

30. The angles of elevation of the tops of two towers, standing on level ground, from a point on the ground mid-way between the towers are 60° and 45° respectively. The height of the first tower is $112\sqrt{3}$ m. The height of the second tower is (in m)

31. If A and B are two sets such that $n(A) = 3$ and $n(B) = 5$, then the number of mappings from A to B are _____.

(A) 5^3 (B) 3^5 (C) 2^8 (D) 3×5

32. The number of one-one mappings from set A to set B where $A = \{1, 2, 3, 4\}$ and $B = \{2, 3, 4, 5, 6\}$ is _____.

(A) 5 (B) 4^5 (C) 120 (D) 0

33. If $n(A) = 4$ and $n(B) = 3$, then the number of onto functions from set A to set B is _____.

34. The number of bijections defined from set A to A where $A = \{1, 2, 3, 4\}$ is _____.

35. If $f(p)$ is a polynomial satisfying $f(p) \cdot f\left(\frac{1}{p}\right) = f(p) + f\left(\frac{1}{p}\right)$ and $f(5) = -124$, then $f(9) =$ _____.

36. If $f(x)$ and $f(y)$ satisfy the relation $f(x+y) = f(x) + f(y)$ where $x, y \in \mathbb{R}$ and $f(1) = 2$, then $\sum_{i=1}^{10} f(i) =$ _____.

37. If $f(x) + f(2-x) = 4$, then the value of $f\left(\frac{1}{100}\right) + f\left(\frac{2}{100}\right) + f\left(\frac{3}{100}\right) + \dots + f\left(\frac{199}{100}\right) =$

38. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = x - 1$ for $x < -2$
 $= x$ for $-2 \leq x \leq 2$
 $= 1 - 2x$ for $x > 2$
then the value of $f(-2.5) + f(-1.5) + f(-3.5) =$

39. If $f(x) = 2^x + 2^{-x}$ and $g(x) = 2^x - 2^{-x}$, then the value of $f(x) \cdot g(y) + f(y) \cdot g(x) =$ _____.

(A) $g(x+y)$ (B) $f(x+y)$
(C) $2g(x+y)$ (D) $2f(x+y)$

40. The domain of the function $f(x) = \sqrt{2x-1} + \frac{1}{3x-4}$ is _____.

(A) $\left[\frac{1}{2}, \infty\right)$ (B) $\left[\frac{1}{2}, \infty\right) - \left\{\frac{4}{3}\right\}$
(C) $\mathbb{R} - \left\{\frac{4}{3}\right\}$ (D) \mathbb{R}

41. The domain of the function $f(x) = \sqrt{\frac{5-|x|}{7-|x|}}$ is _____.

(A) $[-5, 5]$ (B) $[-5, 5] \cup (-\infty, -7) \cup (7, \infty)$
(C) $(-\infty, -7)$ (D) $(7, \infty)$

42. The range of the function defined by $f(x) = \frac{x}{\sqrt{x^2+1}}$ is _____.

(A) $(-1, 1)$ (B) $(0, 1)$
(C) $[0, \infty)$ (D) \mathbb{R}

43. Let $f(x) = \max(4x+3, 5-6x)$. The minimum possible value of $f(x)$ is _____.

(A) $\frac{19}{5}$ (B) $\frac{5}{19}$ (C) $\frac{5}{21}$ (D) $\frac{1}{5}$

Directions for questions 44 to 46: These questions are based on the following data.

For real numbers x and y , consider the following definitions. $f(x+y) = f(x) \cdot f(y)$; $g(x) + g(y) = g(x \times y)$
 $f^n(x) = f(x) \times f(x) \times \dots \times f(x)$ n times; Given, $f(x) \neq 0$, for $x \neq 0$, answer the following questions.

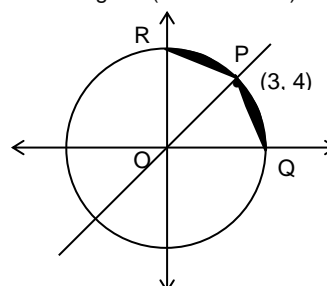
44. If $f(1) = 4$, then find $f^6(4)$.
(A) 2^{34} (B) 2^{24} (C) 2^{48} (D) 2^{44}

45. If $g(2) = 3$ and $f(3) = 2$, find $f(g(8))$.

46. Which of the following relations is incorrect?

(A) $f^n(x) = f(nx)$
(B) $g(1) = 0$
(C) If $g(2) = 3$ and $f(3) = 4$, then $f(g(4)) = 16$
(D) $f(0) = 0$

47. In the figure (not drawn to scale) below, find the area of the shaded region. (take $\pi = 3.14$)

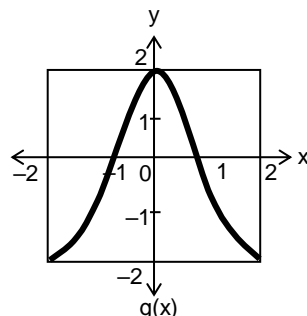
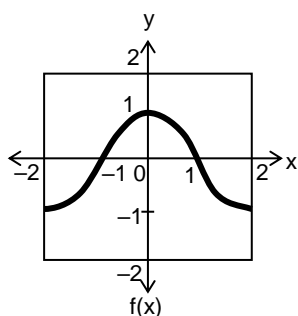


(A) $\frac{39}{8}$ sq.units (B) $\frac{25}{8}$ sq.units
(C) $\frac{17}{8}$ sq.units (D) $\frac{13}{8}$ sq.units

Directions for questions 48 to 52: These questions are based on the following data given below:

In each question a pair of graphs, $y = f(x)$ and $y = g(x)$ is provided. From the given options, find the relation that best describes the relation between $f(x)$ and $g(x)$.

48.



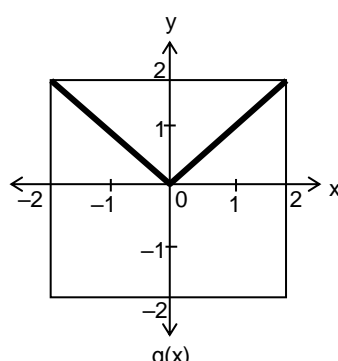
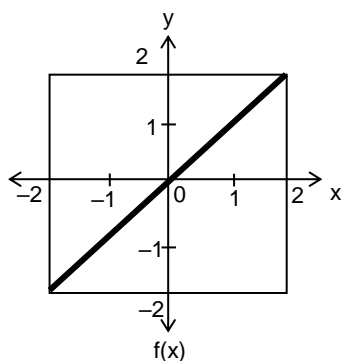
(A) $f(2x) = g(x)$

(B) $f(x) = g(2x)$

(C) $2f(x) = g(x)$

(D) $f(x) = 2g(x)$

49.



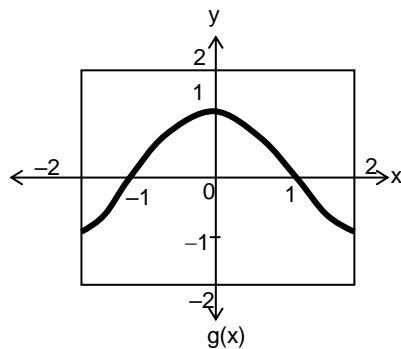
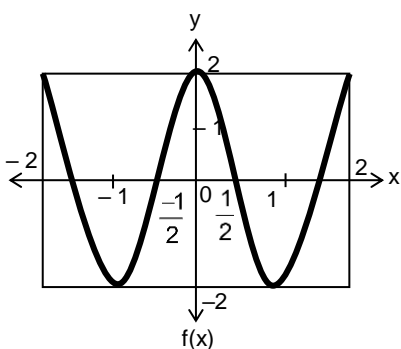
(A) $f(x) = |g(-x)|$

(B) $g(x) = |f(x)|$

(C) $f(x) = -(g(-x))$

(D) $g(x) = |f(-x)|$

50.



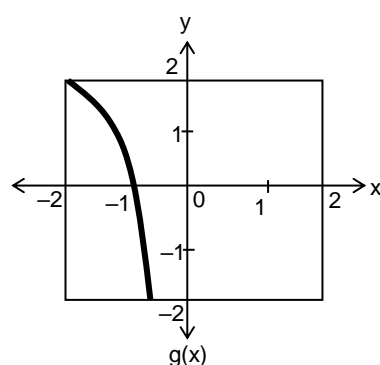
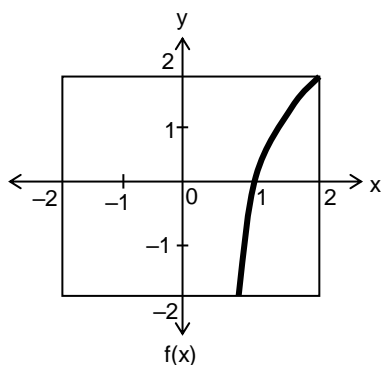
(A) $f(x) = 2g(x)$

(B) $f(2x) = 2g(x)$

(C) $f(x) = g(2x)$

(D) $f(x) = 2g(2x)$

51.



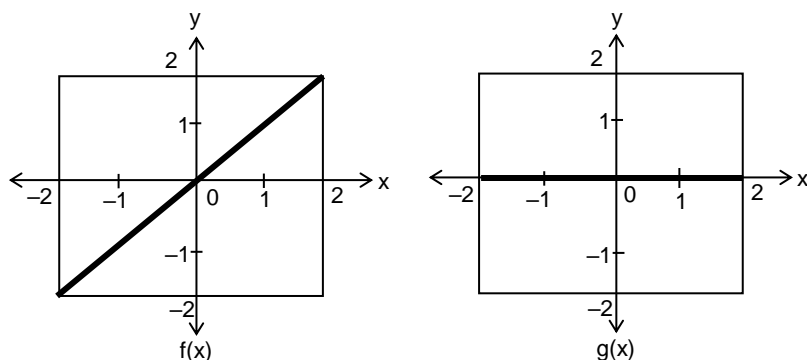
(A) $f(x) = g(-x)$

(B) $f(x) = -g(x)$

(C) $f(x) = -g(-x)$

(D) $f(x) = -|g(x)|$

52.



- (A) $f(x) = g(x) + g(-x)$ (B) $g(x) = f(x) + f(-x)$ (C) $g(x) = f(x) - f(-x)$ (D) $g(x) = f(x) + |f(-x)|$

53. If $f(x) = x^2 + 3x + 6$, $g(x) = \frac{|x|}{x}$, $h(x) = 1 - 2x^5$ and

$i(x) = x^2 - 4$, then find the value of $f(g(h(i(1.5))))$.

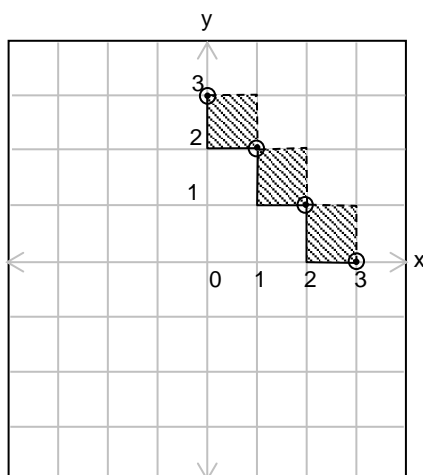
- (A) 4 (B) 10
(C) 16.5 (D) None of these

Directions for questions 54 to 60: Select the correct alternative from given choices

Note A: In questions 54 to 60, $\lfloor x \rfloor$ or the floor function, denotes the greatest integer less than or equal to x and $\lceil x \rceil$ or the ceil function denotes the least integer greater than or equal to x . In the graphs, the dark line along the edge of the shaded region indicates that the points on that edge are included along with the region, the broken line indicates their exclusion from the region. Where the broken line meets the dark line, the dark dot indicates inclusion and the hollow dot indicates exclusion.

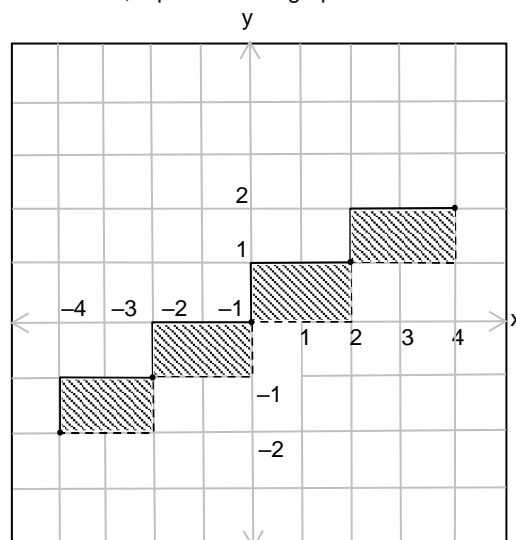
Note B (for questions 59 and 60): The corners along the line $x + y = 0$ are included, though they have not been marked with dark dots. [It may be presumed that as there are two dark lines meeting at these corners (in addition to the two dotted lines), these points are included in the graph].

54. Which of the following relations between x and y , for $0 \leq x \leq 3$, represents the graph shown in the figure?



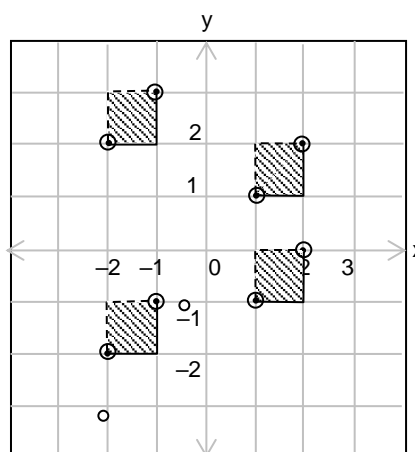
- (A) $\lfloor x \rfloor + \lfloor y \rfloor = 2$ (B) $\lceil x \rceil + \lceil y \rceil = 4$
(C) $\lfloor x \rfloor + \lceil y \rceil = 3$ (D) $\lceil x \rceil + \lfloor y \rfloor = 3$

55. Which of the following relations between x and y , for $-4 \leq x \leq 4$, represents the graph shown?



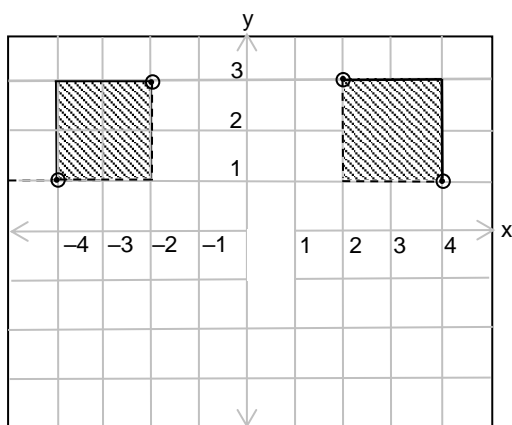
- (A) $\lceil x/2 \rceil - \lceil y \rceil = 0$ (B) $\lceil x/2 \rceil - \lfloor y \rfloor = 1$
(C) $\lfloor x/2 \rfloor - \lfloor y \rfloor = 0$ (D) $\lfloor x/2 \rfloor - \lceil y \rceil = -1$

56. Which of the following relations between x and y , for $1 \leq |x| \leq 2$, represents the given graph?



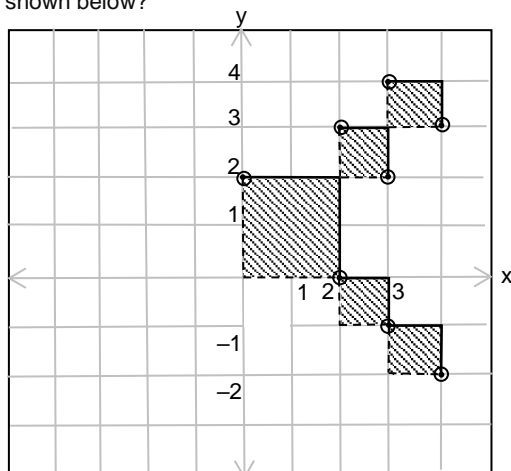
- (A) $|\lfloor x \rfloor| + |\lceil y \rceil| = 3$ (B) $|\lceil x \rceil| + |\lfloor y \rfloor| = 3$
(C) $\lceil \lfloor x \rfloor \rceil + \lfloor \lceil y \rceil \rfloor = 3$ (D) $\lfloor \lceil x \rceil \rfloor + \lceil \lfloor y \rfloor \rceil = 3$

57. Which of the following relations between x and y , for $2 < |x| \leq 4$, represents the given graph?



- (A) $\left\lfloor \frac{x}{2} \right\rfloor + \left\lceil \frac{y-1}{2} \right\rceil = 3$ (B) $\left\lceil \frac{x}{2} \right\rceil + \left\lfloor \frac{y-1}{2} \right\rfloor = 3$
 (C) $\left\lceil \frac{x}{2} \right\rceil + \left\lceil \frac{y-1}{2} \right\rceil = 3$ (D) $\left\lfloor \frac{x}{2} \right\rfloor + \left\lfloor \frac{y-1}{2} \right\rfloor = 3$

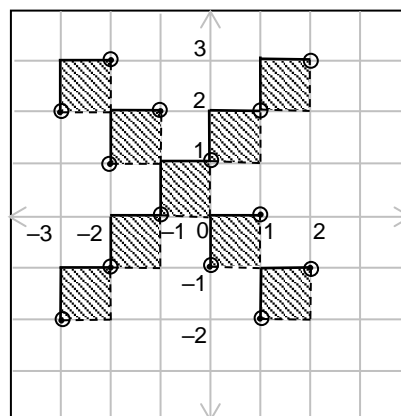
58. If $\lceil x \rceil = a$ and $\lceil y \rceil = b$, which of the following relations between x and y , for $0 \leq x \leq 4$, represents the graph shown below?



- (A) $a(a+2) = b(b+2)$ (B) $a(a+3) = b(b+3)$

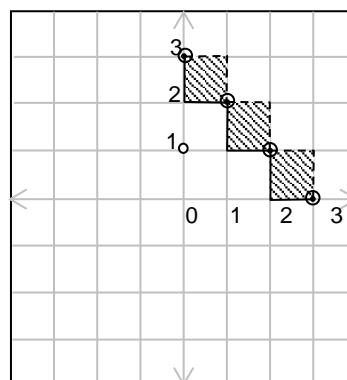
- (C) $a(a-2) = b(b-2)$ (D) $a(a-3) = b(b-3)$

59. Which of the following relations between x and y , for $-3 \leq x \leq 2$, represents the graph shown below?
 $p = \lfloor x \rfloor$, $q = \lceil y \rceil$



- (A) $p^2 - 2p = q^2 + 2q$ (B) $p^2 + 2p = q^2 - 2q$
 (C) $p^2 + 2p = q^2 + 2q$ (D) $p^2 - 2p = q^2 - 2q$

60. Which of the following relations between x and y , for $0 \leq x \leq 3$, does NOT represent the graph shown below?



- (A) $\lceil -x-1 \rceil + \lceil -y-2 \rceil = -6$
 (B) $\lfloor x+1 \rfloor + \lfloor y \rfloor = 3$
 (C) $\lfloor x-1 \rfloor + \lfloor y+2 \rfloor = 3$
 (D) $\lceil -x-2 \rceil + \lceil -y-1 \rceil = -5$

Exercise – 8

Directions for questions 1 to 50: For the Multiple Choice Questions, select the correct alternative from the given choices. For the Non-Multiple Choice Questions, write your answer in the box provided.

Directions for questions 1 and 2: These questions are based on the following data definitions.

$$f(a, b) = \sqrt{a^2 + b^2}; \quad g[(a, b), (c, d)] = \frac{ac + bd}{c^2 + d^2};$$

$$h[(a, b), (c, d)] = \frac{bc - ad}{c^2 + d^2}; \quad i[(a, b), (c, d)] = ac - bd;$$

$$j[(a, b), (c, d)] = ad + bc.$$

1. Find $f\{g[(3, 4), (12, 16)], h[(3, 4), (12, 16)]\}$.

- (A) $\frac{1}{2}$ (B) $\frac{1}{2\sqrt{2}}$ (C) $\frac{1}{4}$ (D) $\frac{1}{8}$

2. Find $f\{i[(3, 4), (12, 16)], j[(3, 4), (12, 16)]\}$

- (A) 54 (B) 100
 (C) 125 (D) None of these

Directions for questions 3 and 4: These questions are based on the following data.

A function $f(x)$ is defined as follows:

$$f(x) = \frac{|x-2| - |x+2|}{2}$$

Functions $g(x)$, $h(x)$ and $i(x)$ are defined as follows:

$$g(x) = -f(x), \quad h(x) = f(-x) \text{ and } i(x) = -f(-x).$$

3. If $F(x) = \max[f(x), g(x)]$, then $F(x) = \underline{\hspace{2cm}}$.
 (A) $f(x)$ (B) $|f(x)|$
 (C) $g(x)$ (D) $\frac{f(x)+g(x)}{2}$
4. For how many integral values of x is $f(x) = g(x)$?
 (A) 1 (B) 2 (C) 3 (D) 4
5. If $a * b = \frac{\text{LCM}(a,b)}{\text{HCF}(a,b)}$, and $(x*y)*(y*z) = 1$, which of the following is necessarily true?
 (A) $x = y = z$ (B) $x = z$
 (C) $x = z$ or $y^2 = xz$ (D) None of these
6. If $(a, b) * (c, d) = (ad - bc, ab - cd)$ and $(x, y) = [(1, 3) * (2, 4)] * [(5, 6) * (7, 8)]$ then $(x + y, x - y) * (x - y, x + y)$ equals _____.
 (A) $(42^2, 0)$ (B) $(-84^2, 0)$
 (C) $(0, -84^2)$ (D) $(-42^2, 0)$
7. $a \odot b = \frac{1}{(a+1)(b+1)} - \frac{1}{ab}$
 $(1 \odot 2) + (2 \odot 3) + (3 \odot 4) + \dots + (9 \odot 10) = \underline{\hspace{2cm}}$.
 (A) $\frac{-54}{55}$ (B) $\frac{-27}{55}$ (C) $\frac{-54}{101}$ (D) $\frac{27}{55}$
8. a, b, c, d are four positive real numbers. Consider the following definitions.
 (1) $f(a, b, c, d) = \min[\max(a, b, c), \max(a, b, d), \max(a, c, d), \max(b, c, d)]$
 (2) $g(a, b, c, d) = \max[\max(a, b, c), \max(a, b, d), \max(a, c, d), \max(b, c, d)]$
 (3) $h(a, b, c, d) = \max[\max(a, b, c), \min(a, b, d), \min(a, c, d), \max(b, c, d)]$
 (4) $i(a, b, c, d) = \min[\max(a, b, c), \max(a, b, d), \max(a, c, d), \min(b, c, d)]$
 Which of the following is undefined?
 (A) $\frac{f(a,b,c,d)+g(a,b,c,d)}{h(a,b,c,d)-i(a,b,c,d)}$
 (B) $\frac{g(a,b,c,d)-h(a,b,c,d)}{i(a,b,c,d)-f(a,b,c,d)}$
 (C) $\frac{i(a,b,c,d)+f(a,b,c,d)}{h(a,b,c,d)-g(a,b,c,d)}$
 (D) $\frac{g(a,b,c,d)-i(a,b,c,d)}{f(a,b,c,d)-h(a,b,c,d)}$
9. Given that $3x + 13y = 85$, how many integral solutions exist for $-50 \leq x \leq 50$?
10. The cost of 3 pencils, 6 sharpeners and 9 pens is ₹129 and the cost of 7 pencils, 11 sharpeners and 15 pens is ₹232. Find the total cost of 1 pencil, 1 sharpener and 1 eraser.
 (A) ₹20 (B) ₹25 (C) ₹29 (D) ₹24
11. John bought a certain number of oranges, apples and bananas. Altogether he bought 12 fruits and spent ₹55. If the cost of each orange, apple and banana is ₹2, ₹5 and ₹6 respectively, what is the maximum number of fruits of the same kind that John could have possibly bought?

12. Roma bought some candies for ₹4.95. If Roma had only 25 paise and 10 paise coins, in how many ways can she pay for candies?
 (A) 8 (B) 12 (C) 10 (D) 13

Directions for questions 13 and 14: These questions are based on the following data.

Mary bought some books on Mathematics, Physics and Chemistry priced at ₹7, ₹4 and ₹19 per book, respectively. The amount spent was ₹168 and a total of 21 books were bought.

13. In how many combinations could Mary have bought the books?

14. If Mary had not bought more than 10 books of any subject, find the difference between the number of Physics and Mathematics books bought.

15. After scoring a double century in test cricket, Virendra Sehwag now hopes to score a double century in a one-day match. If he aspires to score these 200 runs (exactly) with only fours and sixes, in how many different combinations of fours and sixes can he achieve this feat?

16. How many ordered pairs of positive integers (x, y) satisfy the equation $\frac{1}{x} + \frac{1}{y} = \frac{1}{18}$?
 (A) 7 (B) 15 (C) 8 (D) 10

17. How many ordered pairs of integers (x, y) , where $x > 0$, satisfy the equation $\frac{1}{x} + \frac{1}{y} = \frac{1}{29}$?
 (A) 6 (B) 4 (C) 8 (D) 12

18. How many ordered pairs of integers (x, y) satisfy the equation $\frac{13}{x} - \frac{5}{y} = \frac{1}{8}$?

19. If $x^2 - y^2 = 60$, how many integral values can (x, y) take?
 (A) 16 (B) 4 (C) 2 (D) 8

20. If $x^2 - y^2 = 385$, how many integral values can (x, y) take?

21. $\frac{1}{5 \cdot 10} + \frac{1}{10 \cdot 15} + \frac{1}{15 \cdot 20} + \dots \infty = \underline{\hspace{2cm}}$.
 (A) $1/10$ (B) $1/80$ (C) $1/5$ (D) $1/25$

22. The sum of the infinite series $1 + (1+b)r + (1+b+b^2)r^2 + \dots \infty$, where r and b are proper fractions, is _____.
 (A) $\frac{1}{1-rb}$ (B) $\frac{1}{(1-r)(1-b)}$
 (C) $\frac{1}{(1-r)(1-br)}$ (D) None of these

23. $1 + \frac{4}{5} + \frac{7}{5^2} + \frac{10}{5^3} + \dots \infty = \underline{\hspace{2cm}}$.
 (A) $\frac{35}{16}$ (B) $\frac{37}{17}$ (C) $\frac{16}{35}$ (D) $\frac{17}{37}$
24. $\frac{1^3}{2} + \frac{1^3+2^3}{2+4} + \frac{1^3+2^3+3^3}{2+4+6} + \dots$ upto n terms =
 (A) $\frac{n(n+1)^2(n+2)}{12}$ (B) $\frac{n(n+1)(n+3)}{12}$
 (C) $\frac{n(n+1)(n+2)}{12}$ (D) $\frac{n^2(n+1)}{4n+2}$
25. If $7^{1+x} + 7^{1-x}, \frac{p}{2}$ and $10^x + 10^{-x}$ are the three consecutive terms of an arithmetic progression, then find the range of p .
 (A) $[14, \infty)$ (B) $[16, \infty)$ (C) $[10, \infty)$ (D) $[12, \infty)$
26. If $a_1, a_2, a_3, \dots, a_{39}$ are in arithmetic progression and $a_1 + a_{10} + a_{15} + a_{25} + a_{30} + a_{39} = 270$, then find the value of $a_1 + a_{19} + a_{21} + a_{39}$.
27. Find the sum of the series $0.7 + 0.77 + 0.777 + \dots$ upto n terms.
 (A) $\frac{7}{9} \left(9n + \frac{1}{10^n} - 1 \right)$ (B) $\frac{7}{81} \left(9n + \frac{1}{10^n} - 1 \right)$
 (C) $\frac{7}{81} \left(9n - \frac{1}{10^n} + 1 \right)$ (D) $\frac{7}{9} \left(9n - \frac{1}{10^n} + 1 \right)$
28. Find the sum of the series $1 + 5x + 9x^2 + 13x^3 + \dots$
 (A) $\frac{1-3x}{(1+x)^2}$ (B) $\frac{1+3x}{(1-x)^2}$
 (C) $\frac{1+3x}{(1+x)^2}$ (D) $\frac{1-3x}{(1-x)^2}$
29. Find the sum of the first n terms of
 $\frac{3}{4} + \frac{5}{36} + \frac{7}{144} + \frac{9}{400} + \dots$
 (A) $\frac{n^2 + n}{n^2 + 2n + 1}$ (B) $\frac{n^2}{n^2 + 2n + 1}$
 (C) $\frac{2n}{n^2 + 2n + 1}$ (D) None of these
30. A real-estate dealer tried to make a deal with the owner of a plot. The plot owner did not agree with the terms and conditions of the dealer. Mr. Madhya Varthi tried to settle their deal and he was successful. The dealer was given two options. He could pay the entire amount of ₹1,80,000 at once or he could pay the interest 10% on the outstanding amount in addition to an amount of ₹10,000 every year, starting from the end of the first year. The businessman agreed for the annual instalments. By the end of the instalments what extra amount would the businessman pay to the owner of the plot? (in ₹)
31. Garibilal borrowed some money from Amirilal to admit his son in a reputed engineering college. He agreed to pay the interest-free loan of ₹60,000 in monthly instalments which increased by a constant amount. After the 20th instalment he found that he had paid $\frac{3}{4}$ th of the loan. If the entire loan was cleared this way in exactly 25 instalments, find the value of the first instalment
 (A) ₹1,200 (B) ₹1,320 (C) ₹1,440 (D) ₹1,680
32. There is a rubber ball, the material of which is elastic in nature. The floor of a room is paved with granite stones. After striking the floor, the rubber ball rebounds to $\frac{3}{4}$ th of the height from which it has fallen. A boy drops the ball from a height of 25 m and the ball rebounds several times and finally comes to rest. Out of curiosity, the boy asks his uncle to tell him the total distance covered by the ball from the point where it is dropped. What should be the uncle's correct reply? (in m)
33. A clerk in a bank was to count ₹2500 in ten rupees notes. He could count ₹220 in the first minute. As his fingers began to pain he counted ₹10 less in every subsequent minute. In this way he counted the sum with him. How much time did he take to complete the counting of all the notes?
 (A) 20 minutes (B) 25 minutes
 (C) Either (A) or (B) (D) 45 minutes
34. A man took a loan of ₹25,000 with the promise that he would pay back ₹500 at the end of the first month and from the second month onwards, he would pay ₹50 more than what he paid in the previous month. The instalment that would be less than or equal to the preceding instalment would thus be the final instalment. What was the final instalment? (in ₹)
35. My son was participating in the "biscuit race" conducted on the Annual Sports day of his school. There were 10 biscuits hung, each at a distance of 25 m. The first biscuit was hung at a distance of 100 m from the starting point. The participants were supposed to reach the first biscuit, eat it and come back to the starting point and without wasting any time turn back for the second biscuit and this process of eating and coming back to the starting point continued for all the 10 biscuits. How many metres in all did my son run?
 (A) 1500 m (B) 2125 m
 (C) 3400 m (D) 4250 m
36. I went to my sister's house and returned from there in the evening, while returning home I was feeling very weak. Though I covered 10 km during the first hour of my return journey, for every subsequent hour, my speed reduced to a half of what it was in the previous hour. If I had travelled this way, in how many hours would I have been 25 kilometres away from my sister's house?
 (A) 10 hours (B) 16 hours
 (C) 20 hours (D) None of these
37. Mr. Singh has five children – Dolly, Polly, Molly, Solly and Lolly – named in the decreasing order of their ages. The age difference between any two consecutive children is the same (an integral number of years). If Dolly is 14 years old, what are the possible ages of Molly?
 I. 13 years II. 12 years III. 11 years
 (A) Only II (B) Only III
 (C) Only II and III (D) Only I and II

38. A boy throws a ball down from a helicopter flying at an altitude of 3000 m. If the distances through which the ball falls in successive seconds is 6 m, 16 m, 26 m and so on, what is the distance through which the ball falls in the 20th second? (in m)

39. In a one-day series, Kumble, Harbhajan and Zaheer took a total of 21 wickets among the three of them. Kumble took more wickets than Harbhajan who took more wickets than Zaheer. Incidentally the number of wickets taken by them form an A.P. Had Zaheer taken 1 more wicket, Harbhajan 2 more and Kumble 15 more wickets, the number of wickets taken by them would have been in G.P. Find the number of wickets taken by Kumble.

40. For a loan of ₹32,400 that I gave to my friend Rajesh, he promised me to pay the amount in monthly instalments starting with a certain amount and increasing the instalments every month by ₹100. In this way he could clear off the loan in 24 months. What was the instalment for the first month? (in ₹)

41. Some friends have some money which was in an increasing G.P. The total money with the first and the last friend was ₹66 and the product of the amount that the second friend had and that the last but one friend had (in rupees) was 128. If the total money with all the friends was ₹126, find how many friends were there?
- (A) 6 (B) 5
(C) 3 (D) Cannot be determined

42. There are some numbers in a series of brackets as given below.
{1}, {2, 3, 4}, {5, 6, 7, 8, 9} and so on. Find the sum of all the numbers in the 25th bracket.

43. My son who studies in V standard gets pocket money of ₹500 every month. One day he listened to a lecture on the importance of thrift and decided to save more and more money every month. He could save ₹120 in the first month. In the second month he saved five

rupees more than what he saved in the first month. In the third month also he saved five rupees more than what he saved in the second month. If he had continued saving in this way, how much would he be saving in two years? (in ₹)

44. In a certain series, the n th term $T_n = 5T_{n-1} - 16n$ and $T_1 = 19$. Find T_{30} .
(A) $2(5^{30}) - 125$ (B) $2(5^{30}) + 125$
(C) $2(5^{29}) - 120$ (D) $2(5^{29}) + 120$

45. Find the sum of the coefficients of x^{150} and x^{151} in the expansion of $(1+x)^{350} \cdot x^0 + (1+x)^{349} x + (1+x)^{348} x^2 + (1+x)^{347} x^3 + \dots + (1+x)^0 x^{350}$.
(A) $^{351}C_{151}$ (B) $^{351}C_{150}$
(C) $^{352}C_{151}$ (D) $^{352}C_{150}$

46. $S = \frac{1}{126} + \frac{1}{127} + \frac{1}{128} + \frac{1}{129} + \dots + \frac{1}{250}$

Which of the following statements are true?

- I. $S = 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \frac{1}{5} - \frac{1}{6} + \dots - \frac{1}{250}$
II. $S = \frac{1}{188} \left[\frac{1}{(126)(250)} + \frac{1}{(127)(249)} + \frac{1}{(128)(248)} + \dots + \frac{1}{(250)(126)} \right]$
III. $S = \frac{1}{(126)(250)} + \frac{1}{(127)(249)} + \frac{1}{(128)(248)} + \dots + \frac{1}{(250)(126)}$

- (A) only I (B) I and II
(C) I and III (D) only III

47. Evaluate

$$\frac{1}{(2)(4)} + \frac{1}{(4)(6)} + \frac{1}{(6)(8)} + \frac{1}{(8)(10)} + \dots + \frac{1}{(28)(30)}$$

(A) 14/15 (B) 1/5 (C) 7/30 (D) 7/60

48. Find the sum to 20 terms of the series

$$3(4)^2 + 5(5)^2 + 7(6)^2 + 9(7)^2 + \dots$$

(A) 103703 (B) 130730
(C) 170330 (D) 130370

49. $75(5) + 74(6) + 73(7) + \dots + 5(75) =$
(A) 88730 (B) 85320 (C) 87380 (D) 83780

50. If $T_n = \left(1 + \frac{4}{n^2 - 4}\right) T_{n-1}$, $n \geq 3$, $T_2 = \frac{3}{4}$ then $T_{20} =$

- (A) $\frac{285}{77}$ (B) $\frac{513}{140}$ (C) $\frac{693}{184}$ (D) $\frac{77}{155}$

Exercise – 9

Directions for questions 1 to 50: For the Multiple Choice Questions, select the correct alternative from the given choices. For the Non-Multiple Choice Questions, write your answer in the box provided.

1. If α and β are the roots of the quadratic equation $x^2 + px + q = 0$, find the equation whose roots are $\alpha\beta^2$ and $\alpha^2\beta$.

- (A) $x^2 - pqx + p^3 = 0$ (B) $x^2 + pqx + p^3 = 0$
(C) $x^2 - pqx - q^3 = 0$ (D) $x^2 + pqx + q^3 = 0$

2. If x is real then the range of $\frac{x^2 + 2x - 11}{2(x - 3)}$ is _____.

- (A) $(-\infty, 6)$ (B) $(-\infty, 2) \cup (6, \infty)$
(C) $(2, 6)$ (D) $(-\infty, 2] \cup [6, \infty)$

3. If the roots of the equation $3ax^2 + 2bx + c = 0$ are in

the ratio 2 : 3, then _____.

- (A) $8ac = 25b^2$ (B) $8ac = 9b^2$
(C) $8b^2 = 9ac$ (D) $8b^2 = 25ac$

4. The roots of the equation $(k + m - \ell)x^2 - 2mx + (\ell + m - k) = 0$ are _____.

- (A) $\ell, \frac{2k}{k-m+1}$ (B) $1, \frac{\ell+m-k}{k+m-\ell}$
(C) $\ell, \frac{k+m-1}{\ell+m-k}$ (D) $1, \frac{2m}{k+\ell-m}$

5. If three times of one of the roots of the equation $px^2 + 3qx + 2r = 0$ is twice its other root, find the value

of $\frac{q^2}{pr}$.

- (A) $\frac{25}{9}$ (B) $\frac{25}{18}$ (C) $\frac{25}{12}$ (D) $\frac{25}{27}$

6. Each root of $x^2 - (4m + 1)x + 4m + 2.25 = 0$ is positive. It follows that _____.

- (A) $m > \frac{-1}{4}$ (B) $m > \frac{-9}{4}$
(C) $\frac{-1}{2} \leq m \leq 1$ (D) $m \geq 1$

7. If p and q are the roots of the equation $x^2 - ax - 1 = 0$ and r, s are the roots of $x^2 - bx - 1 = 0$, the value of $(r + p)(s + p)(r - q)(s - q)$ is _____.

- (A) $2(a^2 - b^2)$ (B) $a^2 + b^2$
(C) $2(b^2 - a^2)$ (D) $b^2 - a^2$

8. If $3x^4 + 10x^3 - 42x^2 + 10x + 3 = 0$, $x + \frac{1}{x}$ equals _____.

- (A) $\frac{8}{3}$ or -6 (B) $\frac{-8}{3}$ or 6
(C) $\frac{8}{3}$ (D) -6

9. The expression $\frac{2\sqrt{2}by - (y^2 + b^2)}{2\sqrt{2}y - b}$ where $b > 0$ and y is real lies in the interval _____.

- (A) $\left(-\infty, \frac{b}{2}\right] \cup [b, \infty)$ (B) $(-\infty, -b] \cup \left[\frac{b}{2}, \infty\right)$
(C) $\left[\frac{-b}{2}, b\right]$ (D) $\left[-b, \frac{b}{2}\right]$

10. Find the value of k for which one of the roots of $x^2 - 3x + 2k = 0$ is half that of one of the roots of $x^2 - 7x + 12k = 0$.

11. If $px^2 + qx + r = 0$ and $qx^2 + rx + p = 0$, $p \neq 0$, $q \neq 0$ have a common root, then _____.

- (A) $p^3 + q^3 - r^3 = 3pqr$ (B) $p^3 - q^3 + r^3 = 3pqr$
(C) $p^3 + q^3 + r^3 = -pqr$ (D) $p^3 + q^3 + r^3 = 3pqr$

Directions for questions 12 and 13: These questions are based on the following data.

This year, among the movies released across the state, one-fifth were mythological. Ten times the square root of the remaining were action films. The number of art films were one-fourth the number of action films. The remaining 150 films were based on science fiction.

12. If one out of every twenty action films did good business, how many action films did good business?

13. Five art films got awards at various international film festivals. What percentage of the art films received awards?

 %

Directions for questions 14 and 15: These questions are based on the following data.

My friends and I planned a tour to Shimla. We had 14 adults and some children in our party. The tour was planned for 10 days. The expenditure of each adult per day was twice that of each child. The total budget was estimated to be ₹48,000. Two days before we left, Mr. Raman's father and mother came to his house and some guests (all adults) arrived at Mr. Singh's house. We insisted that these people also accompany us on the tour. As a result we reduced the tour by 2 days, to keep the per head expenses unchanged. In doing so we found that we had an additional ₹1,920 left with us, which we decided to distribute among all the members, excluding the guests such that the children got half of what the adults got. The number of guests that arrived at Mr. Singh's house is the square root of the number of children diminished by 8 and the number of children in the group was less than that of the adults.

14. What was the daily expenditure per adult?

- (A) ₹120 (B) ₹160 (C) ₹200 (D) ₹240

15. How many guests came to Mr. Singh's residence?

- (A) 1 (B) 2
(C) 3 (D) Cannot be determined

16. When the sports teacher took the students of class X to the ground and enquired about their preferences, one-fourth said that they would like to play football, while four times the square root of the total number of students preferred cricket and the remaining 16 students expressed their willingness to play indoor games. How many students are there in class X?

17. Some balls are arranged in some number of rows such that they form an equilateral triangle. The first row consists of one ball, the second two, the third three and so on. If 116 more balls are taken, they can be arranged in the form of a square with each side containing 4 balls less than those in each side of the triangle. How many balls were there initially?

18. My son and some of his friends were organising a picnic. They estimated the expenditure to be ₹500. They mobilised some more students. The number of children who actually went to the picnic increased by five, the expenditure per head came down by five rupees. How many children went to the picnic?

19. If the roots of the equation $x^4 + px^3 + qx^2 + rx + 105 = 0$ are all distinct negative integers, find the value of r .

20. Let $f(x) = ax^2 + bx + c$, $a < 0$. If $f(x) = 0$ has real and equal roots and p_1, p_2 , and p_3 are real numbers such that $p_1 < p_2 < p_3 < \frac{-b}{2a}$. Which of the following is true?

- (A) $f(p_1) < f(p_2)$ and $f(p_2) > f(p_3)$
(B) $f(p_1) < f(p_2) < f(p_3)$
(C) $f(p_1) > f(p_2) > f(p_3)$
(D) $f(p_1) > f(p_2)$ and $f(p_2) < f(p_3)$

21. Let $f(x) = ax^2 + bx + c$, $a < 0$. If α, β are the distinct real roots of the equation $f(x) = 0$ and p_1, p_2 and p_3 are real numbers such that $p_1 < \alpha < p_2 < \beta < p_3$, which of the following holds true?
 (A) $f(p_1) < f(p_2) < f(p_3)$
 (B) $f(p_1) > f(p_2)$ and $f(p_2) < f(p_3)$
 (C) $f(p_1) > f(p_2) > f(p_3)$
 (D) $f(p_1) < f(p_2)$ and $f(p_2) > f(p_3)$
22. If p is the greatest negative integer for which $p^2 \geq 20p + 3500$, which of the following is true?
 (A) $-50 < p \leq -29$ (B) $-29 < p \leq -1$
 (C) $-73 < p \leq -50$ (D) $-102 \leq p \leq -73$
23. In the cubic equation $x^3 + p_1x^2 + p_2x + p_3 = 0$, p_1, p_2 and p_3 are in GP and a, b and c are the roots of the equation. If $a + b + c = -1$, then $(ab + bc + ca)^2 =$ _____.
 (A) $2abc$ (B) $3abc$ (C) $\frac{1}{2}abc$ (D) $-abc$
24. If the roots of the equation $x^3 - kx^2 + 336x - 512 = 0$ are in geometric progression, find the value of 'k'.
25. If α, β and γ are the roots of the equation $x^3 - 8x^2 + 9x + 3 = 0$, $\Sigma \frac{1}{\alpha\beta}$ equals _____.
 (A) $\frac{8}{3}$ (B) $\frac{1}{3}$ (C) $-\frac{8}{3}$ (D) $-\frac{1}{3}$
26. If the roots of the equation $x^3 + px^2 + qx + r = 0$ are in arithmetic progression, _____.
 (A) $2q = r + p$ (B) $q^2 = pr$
 (C) $p^3 + 9(pr - pq) = 0$ (D) $2p^3 = 9(pq - 3r)$
27. If p, q, r are the roots of the equation $x^3 - 6x^2 + 8x - 7 = 0$, the value of Σp^2 is
28. Which of the following is false?
 (A) $(255)^{49} < (250)^{50}$ (B) $(31)^{29} < (30)^{30}$
 (C) $(240)^{38} > (234)^{39}$ (D) $(60)^{61} > (61)^{60}$
29. If $x \in \mathbb{Z}^+$ and $(x+1)^x < x^{x+1}$, which of the following best describes x ?
 (A) No such x exists (B) $x \geq 1$
 (C) $x \geq 3$ (D) $x \geq 4$
30. If $x^2 + y^2 + z^2 = 4$, and $k = xy + yz + zx$, then _____.
 (A) $k \geq -2$ (B) $k \leq -4$
 (C) $k \leq -2$ (D) $k \geq 1$
31. If $x = 10/(a+b)$ and $y = 10/(a+b)$ and if $a, b > 0$ then $x + y$ is
 (A) always less than 10.
 (B) always greater than or equal to 20.
 (C) always between 10 and 20.
 (D) always greater than or equal to 30.
32. If a, b, c are three distinct positive real numbers then $\frac{a^2(b+c) + b^2(c+a) + c^2(a+b)}{abc}$ is always
 (A) greater than 9. (B) greater than 7.
 (C) greater than 6. (D) greater than 8.
33. Find the set of all 'x' for which $\frac{2x}{2x^2 + 5x + 2} > \frac{1}{x+1}$.
 (A) $(-2, -1/2)$
 (B) $(-2, -2/3)$
 (C) $(-2, -1) \cup (-2/3, -1/2)$
 (D) None of these
34. If $x^{\log_6 x} > 6$, x belongs to _____.
 (A) $(0, 1/6) \cup (6, \infty)$ (B) $(0, 6) \cup (6, \infty)$
 (C) $(-\infty, 1/6) \cup (6, \infty)$ (D) $[0, 1/6] \cup [6, \infty)$
35. How many negative integers satisfy $|x+4| + |x-7| < 13$?
36. If $x \in \mathbb{R}$, the greatest value that $\frac{x^4}{1+x^8}$ can take is
 (A) $2/5$ (B) $1/3$ (C) $1/2$ (D) $3/4$
37. What is the maximum value of the expression $25 - |x^2 - 2x + 4|$?
38. If a, b, c and d are positive real numbers and $a + b + c + d \geq k(abcd)^{1/4}$, $k =$
39. If $p^4 q^4 + q^4 r^4 + r^4 p^4 \geq k$, $k =$ _____.
 (A) $4(p^2 + q^2 + r^2)$ (B) $2p^2 q^2 r^2$
 (C) $pqr(p^2 + q^2 + r^2)$ (D) $p^2 q^2 r^2(p^2 + q^2 + r^2)$
40. If $3x + 4y = 15$, the maximum value of $x^2 y^3$ is _____.
 (A) $\frac{9^3}{16}$ (B) $\frac{9^3}{4}$ (C) $\frac{9^3}{64}$ (D) $\frac{9^3}{32}$
41. If the product of 100 positive numbers is unity, their sum is always _____.
 (A) equal to 100
 (B) divisible by 100
 (C) never greater than 100
 (D) never less than 100
42. If $x < -2$ and $3^{|x+2|} - 3^x = |3^x - 1| + 2$ then the value of x is
43. If a, b, c, d are positive real numbers and $(a+b+c+d)(abc+bcd+cda+dab) > k(abcd)$, the least value of $k+3$ is
44. If p, q and r are positive real numbers and $p^2 + q^2 + r^2 = 7$, $pq + qr + rp$ is at most equal to
45. The minimum value of the expression $\frac{(a+b+c)^3}{(a+b-c)(a+c-b)(b+c-a)}$, where a, b and c are the sides of a triangle is

46. If $p + q + r + s = 10$, where p, q, r and s are positive real numbers and $x = (p + q)(r + s)$, which of the following is true?

(A) $0 \leq x \leq 5$ (B) $5 \leq x \leq 25$
(C) $0 < x \leq 25$ (D) $3 \leq x \leq 25$

47. If $p > 0$, $q > 0$ and $pq = 1$, find the minimum value of $(p + 2)(q + 2)$.

48. If $p_1, p_2, p_3, \dots, p_n$ are positive real numbers, and $(p_1 + p_1^2 + p_1^3)(p_2 + p_2^2 + p_2^3) \dots (p_n + p_n^2 + p_n^3) \geq k$ $(p_1 p_2 \dots p_n)^2$, the least value of k is _____.

(A) 3 (B) 3^n (C) $\frac{1}{3}$ (D) $\frac{1}{3^n}$

49. If $|p| < 1$, $|q| < 1$, which of the following is/are possible?

(A) $|1 + pq| = |p + q|$
(B) $|1 + pq| > |p + q|$
(C) $|1 - pq| > |p + q|$
(D) More than one of the above

50. Solve for x : $\frac{x^2 - 5x + 6}{x^2 + 3x + 2} \leq 0$.

(A) $[-2, -1] \cup [2, 3]$
(B) $[-2, -1] \cup (2, 3)$
(C) $(-2, -1) \cup (1, 3)$
(D) $(-2, -1) \cup [2, 3]$

Exercise – 10

Directions for questions 1 to 40: For the Multiple Choice Questions, select the correct alternative from the given choices. For the Non-Multiple Choice Questions, write your answer in the box provided.

1. If p, q and r are distinct numbers satisfying $\frac{1}{2^p} = 3^{\frac{1}{q}} = 576^{\frac{1}{r}}$, the value of $\frac{r}{3p + q}$ is

2. If $A^{\frac{1}{B}} = B^{\frac{1}{C}} = C^{\frac{1}{A}}$, each of these equals to _____.

(A) $(ABC)^{\frac{1}{AB+BC+CA}}$ (B) $(ABC)^{\frac{AB+BC+CA}{ABC}}$
(C) $(ABC)^{\frac{ABC}{A+B+C}}$ (D) $(ABC)^{\frac{1}{A+B+C}}$

3. Solve for x : $\sqrt[3]{12^3 \sqrt[3]{12^3 \sqrt[3]{12^3 \dots \infty}}} = 144^x$

(A) $\frac{1}{2}$ (B) $\frac{1}{4}$ (C) $\frac{1}{6}$ (D) $\frac{1}{3}$

4. If $a = e^{\frac{1}{e}}$, find the value of $a \cdot a \cdot a \dots$, where the exponential expression extends without end.

(A) \sqrt{e} (B) e (C) e^2 (D) 3

5. The smallest of $5^{1/6}, 3^{1/4}, 4^{1/3}, 2^{1/2}$ is _____.

(A) $5^{1/6}$ (B) $3^{1/4}$ (C) $4^{1/3}$ (D) $2^{1/2}$

6. Solve for y : $3^{2y} - 2 \cdot 3^{y+2} - 243 = 0$.

7. Find the ascending order of $2^{300}, 3^{200}$ and 6^{100} .

(A) $6^{100}, 3^{200}, 2^{300}$ (B) $6^{100}, 2^{300}, 3^{200}$
(C) $2^{300}, 3^{200}, 6^{100}$ (D) $3^{200}, 2^{300}, 6^{100}$

8. The value of $\frac{x^{2a}}{x^{2a} + x^{a+b} + x^{a+c}} + \frac{x^{2b}}{x^{2b} + x^{a+b} + x^{b+c}} + \frac{x^{2c}}{x^{2c} + x^{a+c} + x^{b+c}}$ is

9. $\left(\frac{2^{b^2}}{2^{ac}}\right)^a \left(\frac{2^{c^2}}{2^{ab}}\right)^b \left(\frac{2^{a^2}}{2^{bc}}\right)^c =$

10. Find the relationship between a, b and c if $5^a = 3^b = 225^c$, where $a \neq b, b \neq c$ and $c \neq a$.

(A) $\frac{1}{c} = \frac{1}{a} + \frac{1}{b}$ (B) $\frac{1}{2c} = \frac{ab}{a+b}$
(C) $c = \frac{ab}{2(a+b)}$ (D) $\frac{c}{2} = \frac{1}{a} + \frac{1}{b}$

11. Solve for x : $5^{2x} - 16.5^x - 225 = 0$.

12. If $4^x = (0.008)^y = 10^z$, what is the relation between x, y and z given that they are non-zero real numbers?

(A) $\frac{1}{2x} + \frac{1}{3y} + \frac{1}{z} = 0$ (B) $\frac{1}{2x} = \frac{1}{y} + \frac{1}{z}$
(C) $\frac{1}{x} = \frac{1}{3y} + \frac{1}{z}$ (D) $\frac{1}{2x} = \frac{1}{3y} + \frac{1}{z}$

13. Simplify $[(625)^{4x}]^k [(125)^{8x}]^y [(3125)(25^2)]^z$

(A) 5^{4x+3y} (B) $5^{(4x+3y)^2}$
(C) $5^{(4x)^2} 5^{(3y)^2}$ (D) $5^{(3x+4y)^2}$

14. If $\log_b a + \log_b(1 + a) = 0$, find the value of $a^2 - 1$.

(A) a (B) ab (C) $-a$ (D) $-ab$

15. Simplify: $x^{\log y - \log z} \times y^{\log z - \log x} \times z^{\log x - \log y}$

(A) 0 (B) 1 (C) xyz (D) $x + y + z$

16. If $a = b^2 = c^4 = d^6 = e^8$, find the value of $\log_a abcde$.

(A) 21 (B) $\frac{49}{24}$ (C) 384 (D) $\frac{53}{24}$

17. Using the information, $\log_2 10 \approx 0.30103$, $\log_3 10 \approx 0.47712$, find the leading (leftmost) digit of 2^{142} .

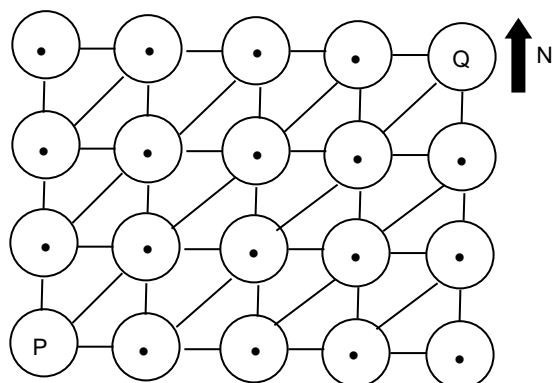
18. How many digits are there in the number 1125^{225} , where $\log 2 = 0.3010$ and $\log 3 = 0.4771$?

19. If $\log_8(\log_6 x) < 0$, then _____.
 (A) $1 < x < 6$ (B) $x \in (-\infty, 6)$
 (C) $x \in (6, \infty)$ (D) None of these
20. If $\log_{0.9}(\log_5 x) < 0$ then _____.
 (A) $1 < x < 5$ (B) $x \in (5, \infty)$
 (C) $x \in (-\infty, 5)$ (D) None of these
21. If $\frac{\log a}{4} = \frac{\log b}{3} = \frac{\log c}{5}$, then $a^2 =$ _____.
 (A) bc^2 (B) b^2c (C) $\sqrt{b}c$ (D) bc
22. How many zeroes are there between the decimal point and the first significant digit in $(2/3)^{1000}$, where $\log 2 = 0.3010$ and $\log 3 = 0.4771$?
 (A) 175 (B) 174
 (C) 176 (D) None of these
23. $\frac{1}{\log_2 n} + \frac{1}{\log_3 n} + \dots + \frac{1}{\log_{100} n} =$ _____.
 (A) 1 (B) $\log_{100} n$
 (C) $\log_n 100!$ (D) None of these
24. The solution set of the inequation $\log_{15}(x^2 - 25) \leq \log_{15}(4x + 35)$ is _____.
 (A) $[-5, 10]$ (B) $[-6, 10]$
 (C) $[-6, 5]$ (D) $[-6, -5] \cup (5, 10]$
25. Find the solution set of the inequation $\log_{1/2}(x^2 - 6x + 3) \geq 2$.
 (A) $\left[\frac{1}{2}, 3 - \sqrt{6}\right] \cup \left(3 + \sqrt{6}, \frac{11}{2}\right]$
 (B) $\left[\frac{1}{2}, 3 - \sqrt{6}\right] \cup \left[3 + \sqrt{6}, \frac{11}{2}\right]$
 (C) $\left[\frac{1}{2}, 3 - \sqrt{6}\right] \cup \left(3 + \sqrt{6}, \frac{11}{2}\right)$
 (D) $\left(-\infty, \frac{1}{2}\right] \cup \left[\frac{1}{2}, \infty\right)$
26. If $p = \log_e \frac{(fg)^2}{e^3}$, $q = \log_f \frac{(eg)^2}{f^3}$ and $r = \log_g \frac{(ef)^2}{g^3}$, where e, f and g are pairwise co-primes and p, q and r are rational numbers, then $\frac{p}{p+2} + \frac{q}{q+2} + \frac{r}{r+2} =$ _____.
 (A) 2 (B) 1 (C) $5/3$ (D) $7/3$
27. The value of $\log(\sqrt{6} - \sqrt{3} - 2 + \sqrt{2}) + \log(\sqrt{6} + \sqrt{3} + 2 + \sqrt{2})$ is _____.
 (A) $\log 2$ (B) $2 \log 3$
 (C) $\frac{1}{2} \log 6$ (D) None of these
28. If $\log_{|p-4|}|p-3| + \log_{|p-3|}|p-4| \leq 2$ and $\log_{|p-4|}|p-3| > 0$, the value of p is _____.
 (A) $\frac{1}{7}$ (B) $\frac{5}{3}$ (C) $\frac{7}{2}$ (D) $\frac{3}{4}$
29. Let x, y, z and w be positive real numbers. The maximum value of $x^{\log y(\log z - \log w)} + y^{\log z(\log w - \log x)} + z^{\log w(\log x - \log y)} + w^{\log x(\log y - \log z)}$ is _____.
 (A) 1 (B) 2 (C) 3 (D) 4
30. If $x = \frac{2}{3 + \sqrt{7}}$, then the value of $x^2 - 6x + 2$ is _____.
 (A) $\frac{1}{2}$ (B) $\frac{3}{2}$ (C) $\frac{5}{2}$ (D) $\frac{7}{2}$
31. $\sqrt{\sqrt{192} - \sqrt{180}} =$ _____.
 (A) $\sqrt{5\sqrt{3} - \sqrt{3\sqrt{3}}}$ (B) $3^{1/2}(\sqrt{5} - \sqrt{3})$
 (C) $3^{1/4}(\sqrt{5} + \sqrt{3})$ (D) $3^{1/4}(\sqrt{5} - \sqrt{2})$
32. If $x = \frac{\sqrt{3} - 1}{\sqrt{3} + 1}$ then $x^4 + \frac{1}{x^4} =$ _____.
 (A) -194 (B) $112\sqrt{3}$
 (C) 194 (D) $-112\sqrt{3}$
33. $\sqrt{\frac{3\sqrt{2} + 2\sqrt{3}}{3\sqrt{2} - 2\sqrt{3}}} =$ _____.
 (A) $(3\sqrt{2} + 2\sqrt{3})/6$ (B) $(3\sqrt{2} - 2\sqrt{3})/\sqrt{6}$
 (C) $\sqrt{3} + \sqrt{2}$ (D) $\sqrt{3} - \sqrt{2}$
34. $\sqrt[4]{49 - 20\sqrt{6}} =$ _____.
 (A) $\sqrt{2} - 1$ (B) $\sqrt{2} + \sqrt{3}$
 (C) $\sqrt{5} - \sqrt{3}$ (D) $\sqrt{3} - \sqrt{2}$
35. If $(9\sqrt{3} + 11\sqrt{2})^{1/3} = \sqrt{a} + \sqrt{b}$ and a and b are integers, where $a > b$, then _____.
 (A) $a = \sqrt{3}$ (B) $a = 2$ (C) $b = \sqrt{3}$ (D) $b = 2$
36. If $(8 + 3\sqrt{7})^{x^2 - 3} + (8 - 3\sqrt{7})^{x^2 - 3} = 16$, then the values of x are _____.
 (A) 2, -2 (B) $\sqrt{2}, -\sqrt{2}$
 (C) 2, $\sqrt{2}$ (D) 2, -2, $\sqrt{2}, -\sqrt{2}$
37. $\frac{\sqrt{5} + \sqrt{3}}{\sqrt{5} - \sqrt{3}} + \frac{\sqrt{5} - \sqrt{3}}{\sqrt{5} + \sqrt{3}} =$ _____.
 (A) 2 (B) 3 (C) 4 (D) 5
38. If $P = \sqrt{2} + \sqrt{24}$, $Q = \sqrt{3} + 4$, $R = \sqrt{6} + \sqrt{8}$ and $S = \sqrt{12} + 2$. Which is the least among P, Q, R and S ?
 (A) P (B) Q (C) R (D) S
39. If $E = \sqrt{3} + \sqrt{23}$, $F = \sqrt{6} + \sqrt{19}$, $G = \sqrt{5} + \sqrt{21}$ and $H = 2 + \sqrt{28.5}$, then the ascending order of E, F, G and H is _____.
 (A) E, F, G, H (B) E, H, F, G
 (C) H, G, F, E (D) H, F, G, E
40. $(5\sqrt{2} + 7)^{\frac{1}{3}} + (5\sqrt{2} - 7)^{\frac{1}{3}}$ is _____.
 (A) an integer.
 (B) a rational number but not an integer.
 (C) an irrational number.
 (D) None of these

Exercise – 11

Directions for questions 1 to 50: For the Multiple Choice Questions, select the correct alternative from the given choices. For the Non-Multiple Choice Questions, write your answer in the box provided.

Directions for questions 1 and 2: The figure given below depicts a network of routes connecting the circular cells of an ants nest.



1. If an ant can travel only in the North or in the East direction, in how many possible routes can an ant travel from cell P to cell Q?
(A) 35 (B) 21 (C) 105 (D) 45
2. If an ant can travel only in the North, the East or the North-East direction, in how many possible routes can the ant travel from cell P to cell Q?
(A) 143 (B) 129 (C) 126 (D) 152
3. Jim, Joe and Julian decide to divide 20 chocolates among themselves as follows. Jim initially picks a card from a set of 21 cards, numbered 0 through 20, and receives as many chocolates as the number, he then replaces the card. Now Joe picks up a card and replaces it as often as necessary, till he gets a card numbered greater or equal to that picked by Jim. Joe receives as many chocolates as the difference between the numbers obtained by him and Jim, and Julian receives the remaining chocolates. In how many different ways can the chocolates be divided?
4. Miss Susie a famous psychologist, constructs a Venn diagram to study the voting pattern among a sample population of 5000 voters. The survey requires the voter to identify election issues from among a list of five issues. A voter may identify none, one, or more than one of the issues listed as an election issue. How many distinct regions should the Venn diagram contain?
5. There are 15 points in space, of which 5 points lie on the same plane and of the other 10, no four points are in the same plane. Find the number of distinct planes which are determined by the 15 points.
(A) 432 (B) 200 (C) 120 (D) 446
6. From the first 20 natural numbers, a combination of 3 distinct numbers is selected and then arranged in

ascending order. How many such combinations can be picked so that the average of the extreme numbers gives the middle element?

- (A) 102 (B) 90 (C) 94 (D) 86

7. Points A, B, C, D and E lie on a line l_1 and points P, Q, R, and S lie on another line l_2 . If each of the five points on l_1 is connected to each of the points on l_2 , by means of straight lines terminated by the points, excluding the given points, the maximum number of points at which the lines can intersect is
8. Ten pencils are to be distributed among Alice, Bryan and Crane, such that Alice receives more pencils than Bryan, who in turn receives more pencils than Crane. Find the number of ways the distribution can be carried out if each of them has to receive at least one pencil.
(A) 4 (B) 8
(C) 12 (D) None of these
9. All possible six-digit numbers are formed using the digits 1, 2, 3, 4, 5 and 6 without repetition. How many of the numbers thus formed are divisible by every factor of the digit present in its units place?
10. Fifty chocolates are to be completely distributed among 15 children such that each receives an odd number of chocolates. Find the number of ways the distribution can be carried out.
(A) $\frac{50!}{35! \cdot 15!}$ (B) $\frac{35!}{15!}$
(C) $\frac{50!}{2! \cdot 35! \cdot 15!}$ (D) None of these
11. In how many different ways can the letters of the word 'SURJECTION' be arranged such that the vowels occupy only odd positions and the letters of the word thus formed when considered from left to right are in alphabetical order?
(A) 0 (B) 1
(C) $6! \cdot {}^5C_4$ (D) $6! \cdot {}^5P_4$
12. What is the maximum number of points in which 10 straight lines can intersect 5 circles?
13. Five beads, which include 2 red, 2 black and a white bead are used to make a necklace. If the necklace cannot have two red beads adjacent to each other, then taking all possible symmetries into account, how many different types of necklaces can be made?
14. If all the letters of the word 'COCOCOLA' are permuted in all possible ways and are arranged in a dictionary order, then the 561th word is _____.
(A) LOOOACCC (B) ACCCOOOL
(C) LACCCOOO (D) CCCOOOAL

15. How many multiples of 4 greater than 40,000 but less than 70,000 can be formed using the digits 0, 1, 3, 4, 6, 7, 8, when repetition of digits is allowed?
-
16. In how many ways can the letters of the word ROBUST be reordered so that no letter is in the right place?
- (A) 265 (B) 720 (C) 719 (D) 120
17. From a collection of umbrellas hung in a row, one or more can be selected in 511 ways. In how many ways can 4 umbrellas be selected such that the selection contains no two consecutive umbrellas?
- (A) 45 (B) 28 (C) 36 (D) 15
18. In how many ways can 5 different coins be placed into 3 different boxes, such that each box has at least one coin placed in it?
-
19. In how many ways can 5 different coins be placed in 3 different boxes, without any restriction?
- (A) 60 (B) 243 (C) 125 (D) 10
20. In how many ways can 10 identical coins be placed in 3 different boxes, such that each box has at least 2 coins placed in it?
-
21. In how many ways can 20 identical coins be placed in 3 different boxes such that no box contains less than 3 or more than 8 coins?
- (A) 35 (B) 21 (C) 20 (D) 15
22. How many triangles can be formed using the eight vertices and the centre of the regular octagon ABCDEFGH, such that at least one of A and E is a vertex of the triangle?
- (A) 64 (B) 52 (C) 34 (D) 48
23. In how many ways can 6 different objects be distributed among 5 persons, such that 4 persons get one object each and the fifth person gets two objects?
-
24. In how many ways, can 5 boys and 18 girls be seated in a row such that each arrangement begins and ends with a boy and in between two successive boys an odd number of girls sit?
- (A) $(14400)(18!)$ (B) $(12600)(18!)$
(C) $(22500)(18!)$ (D) $(13600)(18!)$
25. Find the number of positive integral solutions of $x_1 \cdot x_2 \cdot x_3 \cdot x_4 = 600$.
-
26. A purse contains 30 coins, of which twenty are one-rupee and the remaining are 50-paise coins. Twelve coins are picked simultaneously at random and are placed in a box. If a coin is now picked from the box, find the probability of it being a one-rupee coin.
- (A) $4/7$ (B) $1/2$ (C) $2/3$ (D) $5/6$
27. A, B and C are three students who attend the same tutorial classes. The probability that on a particular day exactly one out of A and B attends the class is $7/10$; exactly one out of B and C attends is $4/10$; exactly one out of A and C attends is $7/10$. If the probability that all the three attend the class is $9/100$, find the probability that at least one attends the class.
- (A) $46/100$ (B) $63/100$
(C) $74/100$ (D) $99/100$
28. A box contains 3 oranges and 2 apples. In each draw a fruit is drawn at random. If it is an orange it is not replaced and an additional orange is removed (if present) and in case it is an apple, the fruit is replaced, and an additional apple is added. Find the probability of getting an apple in third such draw.
- (A) $107/140$ (B) $15/31$
(C) $14/29$ (D) $105/139$
29. A box contains 10 balls numbered 1 through 10. Anju, Anshu and Ankitha pick a ball each, one after the other, each time replacing the ball. What is the probability that Anju picks a ball numbered less than that picked by Anshu, who in turn picks a lesser numbered ball than Ankitha?
- (A) $3/25$ (B) $1/6$ (C) $4/25$ (D) $81/400$
30. Bose picks up a card and replaces it, from a standard pack of cards till he gets a queen or a heart. What is the probability that the final card picked is a queen?
- (A) $1/5$ (B) $4/17$ (C) $1/4$ (D) $3/5$
31. Ten students stand in a row. Assuming that all possible arrangements of these ten students are equally likely, what is the probability there are exactly 3 students between two particular students Ram and Shyam?
- (A) $1/10$ (B) $2/5$ (C) $2/15$ (D) $1/15$
32. A biased die has a probability of $1/4$ of showing a 5, while the probability of any of 1, 2, 3, 4 or 6 turning up is the same. If three such dice are rolled, what is the probability of getting a sum of at least 14 without getting a 6 on any die?
- (A) $5/124$ (B) $9/160$
(C) $1/30$ (D) $7/160$
33. Six boys and two girls stand in a ring. Assuming that all arrangements are equally likely, what is the probability that the two girls are separated by at least 2 boys in both directions?
- (A) $1/3$ (B) $3/7$ (C) $3/8$ (D) $1/4$
34. A and B draw a card from a pack of 52 cards successively in the order given. Each time they replace the card. If the person who draws a queen first receives ₹400, what is the expectation of B? (in ₹)
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35. A, B, C, D and E play the following game. Each person picks one card from cards numbered 1 through 10. The person who picks the greatest numbered card loses and is out of the game. Now the remaining four return their cards to the pack and draw again, and again the person with the greatest numbered card loses. This process is repeated till only one person is left in the game who is declared as the winner. What is the probability that A is the winner?
- (A) $3/14$ (B) $4/17$ (C) $1/5$ (D) $5/24$

36. Three persons A, B and C are to address a gathering along with 7 other persons. If the order in which the speakers address the gathering is selected at random, what is the probability that A delivers the speech before B, who in turn delivers his speech before C?
(A) $5/6$ (B) $1/6$ (C) $1/8$ (D) $2/5$
37. If a six-digit number is selected at random, what is the probability the digits in the odd places (counting from the left) of the number thus selected are even and the digits in even places are odd?
(A) $1/425$ (B) $1/276$
(C) $1/72$ (D) None of the above
38. A coin is tossed four times. Find the probability of getting head and tail alternately.
(A) $1/16$ (B) $1/8$ (C) $1/4$ (D) $3/8$
39. A set of four fair dice are rolled. What is the probability that at least one of them shows a 6?
(A) $1 - (5/6)^4$ (B) $1 - (2/3)^4$
(C) $(4/5)^4$ (D) $(5/6)^4$
40. Twelve marbles are selected at random from a large collection of white, red, green and yellow marbles. The number of marbles of each colour is unlimited. Find the probability that the selection contains at least one marble of each colour.
(A) $\frac{5}{16}$ (B) $\frac{10}{33}$ (C) $\frac{33}{91}$ (D) $\frac{27}{55}$
41. Twelve marbles are selected at random from a large collection of white, red, green and yellow marbles. The number of marbles of each colour is unlimited. Find the probability that the selection contains at least one marble of each colour and a distinct number of each colour.
(A) $\frac{48}{455}$ (B) $\frac{72}{455}$
(C) $\frac{36}{455}$ (D) None of these
42. There are 3 bags, A, B, and C. A has 3 black and 5 white balls, B has 4 black and 4 white balls while C has 2 black and 6 white balls. A bag is selected at random and from that bag a ball is selected at random. If it turns out to be white, what is the probability that the bag selected was C?
(A) $\frac{1}{3}$ (B) $\frac{2}{9}$ (C) $\frac{5}{8}$ (D) $\frac{2}{5}$
43. One number is selected at random from the following list of three-digit numbers: 235, 257, 337, 355, 435, 457, 537 and 555. For the selected number, A is the event that the first digit is 2, B is the event that the second digit is 3 while C is the event that the third digit is 5. Which of the following are true?
I. A, B are independent
II. A, C are independent
III. B, C are independent
(A) I only (B) I, III only
(C) I, II, III (D) II, III only
44. A string MN of length 3 units is pulled along the perimeter of an equilateral triangle ABC, such that it passes over the point A. Each side of triangle ABC is 2 units long. Line MN (not string MN) divides $\triangle ABC$ into two regions. What is the probability that the area of the region in which A lies is less than half the area of the triangle?
(A) $1/4$ (B) $1/3$ (C) $1/2$ (D) $2/3$
45. Player throws a dice. If 1 or 2 turns up, he is given ₹10. If 3 or 4 turns up, he is given ₹20 and if 5 or 6 turns up, he gets a chance to throw the dice once again. What is his expected gain in the long run? (in ₹)
46. If $y = |x - 1| + |x - 2| + |x - 3| + \dots + |x - 100|$, then the number of values of x that give the minimum value of y is
(A) 1 (B) 2 (C) 0 (D) infinite
47. If the sum of deviations of a set of 10 observations about 25 is -2, then find the sum of the observations.
48. Find the mean of the series containing n elements, such that the j^{th} element $x_j = (j + 1)j$; $1 \leq j \leq n$.
(A) $\frac{(2n+1)(n+1)}{6}$ (B) $\frac{(2n+5)(n+1)}{6}$
(C) $\frac{(2n+4)(n+1)}{6}$ (D) $\frac{(n+4)(2n+1)}{6}$
49. If the variance of the sequence $5x_i + 7$ where $i = 1$ to 11 is 225, then standard deviation of the sequence $7x_i + 53\sqrt{35}$ is _____.
(A) 21 (B) 441 (C) $3\sqrt{35}$ (D) 315
50. If the mean of 15 observations is 9 and standard deviation is 2, the sum of the squares of the observations is