Modulo Operator, Allegations & Mixtures, Speed Distance & Time, Races & Games

1 MARK QUESTIONS

1. – 41 mod 9 is
(A) 5 (B) 4
(C) 3 (D) 0
[March, 2025]

2. In what ratio must a grocer mix two varieties of tea worth ₹ 60 per kg and ₹ 65 per kg so that by selling the mixture at ₹ 68.20 per kg the gain is 10%?
(A) 3 : 2 (B) 2 : 3
(C) 2 : 5 (D) 3 : 5
[SQP, 2025- 26]

3. In a 100m race, A can give B a start of 10 m and can give C a start of 28 m. In the same race, B can give C a start of
(A) 10 m (B) 20 m
(C) 18 m (D) 8 m
[SQP, 2025- 26]

4. In a 1 km race, player P beats player Q by 18 metres or 9 seconds. What is P's time to complete the race ?
(A) 512 seconds (B) 502 seconds
(C) 491 seconds (D) 481 seconds
[March, 2024]

5. What time will it be after 1275 hours, if the present time is 9:00 p.m. ?
(A) 11 p.m. (B) 12 p.m.
(C) 3 p.m. (D) 3 a.m.
[March, 2024]

6. If it is currently 6: 00 pm in 12 hours clock then what will be the time after 375 hours?
(A) 6 am (B) 6 pm
(C) 9 am (D) 9 pm
[SQP, 2024- 25]

7. The last (unit) digit of $(22)^{12}$ is :
(a) 2 (b) 4
(c) 6 (d) 8
[March, 2023]

8. The least non-negative remainder, when 315 is divided by 7 is :
(a) 1 (b) 5
(c) 6 (d) 7
[March, 2023]

9. The ratio in which a grocer mixes two varieties of pulses costing 85 per kg and 100 per kg respectively so as to get a mixture worth 92 per kg, is :
(a) 7 : 8 (b) 8 : 7
(c) 5 : 7 (d) 7 : 5
[March, 2023]

10. The value of -70 mod 13 is
(a) 5 (b) −5
(c) 8 (d)−8
[SQP, 2023- 24]

11. A man can row 6 km/h in still water. It takes him twice as long to row up as to row down the river. Then the rate of the stream is
(a) 2 km/h (b) 4 km/h
(c) 6 km/h (d) 8 km/h
[SQP, 2023- 24]

12. The least non-negative remainder when 3^{50} is divided by 7 is
(a) 4 (b) 3
(c) 2 (d) 1
[SQP, 2023- 24]

13. What is the least value of 'x' that satisfies $x \equiv 27 (\text{mod } 4)$, when $27 < x \leq 36$?
a) 27 b) 30
c) 31 d) 35
[SQP, 2022- 23]

14. A person can row a boat along the stream of the river at 10 km/h and against the stream in 6 km/h. What is the speed of the stream flow?
a) 1 km/h b) 2 km/h
c) 4 km/h d) 5 km/h
[SQP, 2022- 23]

15. Two water supplying trucks – A and B supply water to remote areas. Truck A is carrying 100 litres of water to a village 1.5 km away and truck B is delivering 80 litres of water to another village, 1 km away. Due to bad road conditions, each truck loses 20 ml water while travelling each metre distance. Which truck is able to deliver more water and by how much more?
a) Truck A, 20 litres b) Truck B, 20 litres
c) Truck A, 10 litres d) Truck B, 10 litres
[SQP, 2022- 23]

16. In what ratio shall I add water to the liquid detergent costing ₹ 480 per litre to get resulting mixture worth ₹ 300 per litre?
a) 5:3 b) 3:8
c) 3:5 d) 5:8
[SQP, 2022- 23]

17. The value of 40(mod 11)
(a) -1 (b) 0
(c) 7 (d) 9

[SQP, 2021- 22]

18. A person can row in still water at the rate of 8 km/h. If it takes him thrice as long to row upstream as to row downstream then the speed of the stream is:
(a) 2 km/h (b) 3 km/h
(c) 4 km/h (d) 6 km/h

[SQP, 2021- 22]

19. If $x \equiv -4 \ (mod\ 3)$, then a solution for x is:
(a) -2 (b) 12
(c)19 (d) 35

[SQP, 2021- 22]

20. Two athletes Vijay and Samuel finish 100 meters race in 12 secs and 16 secs respectively. By how many meters does Vijay defeat Samuel?
(a) 10.2 meters (b) 15 meters
(c) 25 meters (d) 33.3 meters

[SQP, 2021- 22]

21. If the present time is 8.40 PM, then the time after 876.5 hours will be:
(a) 8:40 AM (b) 9:10 AM
(c) 6:10 PM (d) 10:40 PM

[SQP, 2021- 22]

22. A retailer buys 250 kg of rice, a part of which he sells at 10% profit and the remaining at 5% loss. If the net profit made by the retailer in the whole transaction is 7%, then the quantity of rice sold at 10% profit is
(a) 200 kg (b) 150 kg
(c) 100 kg (d) 50 kg

[SQP, 2021- 22]

23. Two pipes A and B can fill a cistern in 8 hours and 12 hours respectively. The pipes when opened simultaneously takes 12 minutes more to fill the cistern due to leakage. Once the cistern is full, it will get emptied due to leakage in
(a) 5 hrs. (b) 20 hrs.
(c) 60 hrs. (d) 120 hrs

[SQP, 2021- 22]

24. The smallest positive integer (mod 11) to which 282 is congruent, is :
(A) 3 (B) 7
(C) 9 (D) 17

[July, 2025]

25. A man can row 6 km/h in still water. It takes him twice as long to row up as to row down the river. Then, the speed of the stream is:
(A) 2 km/h (B) 4 km/h
(C) 6 km/h (D) 8 km/h

[July, 2025]

26. In what ratio must water be mixed with milk to gain $16\frac{2}{3}\%$ on selling the mixture at cost price ?
(A) 1 : 6 (B) 6 : 1
(C) 3 : 2 (D) 2 : 3

[July, 2024]

27. In a 100 m race, A can beat B by 25 m and B can beat C by 4 m. By how much can A beat C in the same race ?
(A) 32 m (B) 28 m
(C) 24 m (D) 20 m

[July, 2024]

28. If 100 x (mod 7), then the least positive value of x is :
(a) 6 (b) 4
(c) 3 (d) 2

[July, 2023]

29. In a kilometre race, A beats B by 50 metres or 10 seconds. The time taken by A to complete the race is :
(a) 90 seconds (b) 120 seconds
(c) 190 seconds (d) 200 seconds

[July, 2023]

30. If a man rows 32 km downstream and 14 km upstream in 6 hours each, then the speed of the stream is :
(a) 2 km/h (b) 1 5 km/h
(c) 2 5 km/h (d) 2 25 km/h

[July, 2023]

2 MARKS QUESTIONS

31. Two pipes P and Q together can fill a tank in 10 minutes. If pipe P takes 15 minutes less than Q to fill the tank alone, then find the time taken by pipe Q to fill the tank alone.

[2M, July, 2025]

32. The cost of Type I sugar is ₹ 25 per kg and Type II sugar is ₹ 35 per kg. If both Type I sugar and Type II sugar are mixed in the ratio 3:2, find the price per kg of the mixture.

[2M, March, 2025]

33. Evaluate (137 + 995) (mod 12).

[2M, July, 2024]

34. Find the unit's digit of 12^{12}.

[2M, July, 2024]

35. A runs $\frac{3}{2}$ times as fast as B. If A gives B a start of 40 m, how far must the winning post from the starting point be, so that A and B reach at the same time?

[2M, March, 2025]

36. In a one-kilometre race, A beats B by 30 seconds and B beats C by 15 seconds. If A beats C by 180 metres, then find the time taken by A to run 1 kilometre.

[2M, March, 2023]

37. Two pipes A and B can fill a tank in 24 minutes and 32 minutes respectively. If both the pipes are opened simultaneously, after how much time should B be closed so that the tank is full in 18 minutes ?

[2M, March, 2023]

38. Find the last digit of $(2^{100} + 100!)$

[2M, SQP, 2025- 26]

39. A pump can fill a tank with water in 2 hours. Because of leakage, it took $\frac{7}{3}$ hrs to fill the tank. How much time will it take for the leakage to drain all the water in the full tank?

[2M, SQP, 2024- 25]

40. In a 200 m race, A can give a start of 18 m to B and a start of 31 m to C. In a race of 350 m, how much start can B give to C?

[2M, SQP, 2024- 25]

41. A boat goes 3.5 km upstream and then returns. Total time taken is 1 hour and 12 minutes. If the speed of the current is 1 km/h, then find the speed of the boat in still water.

[2M, March, 2025]

42. In what ratio water must be added in milk costing ₹ 60 per litre, so that the resulting mixture would be of worth ₹ 50 per litre?

[2M, SQP, 2024- 25]

43. A boatman takes half as much time in rowing his boat for a certain distance downstream than upstream. What is the ratio between his speed of rowing the boat in still water and speed of current?

[2M, SQP, 2022- 23]

44. In a 200-metre race, Anuj can beat Param by 5 metre or 3 seconds. How much time did Anuj take to complete the race?

[2M, SQP, 2022- 23]

45. A man rows 15km upstream and 25km downstream each in 5 hours. Find the speed of the stream.

[2M, SQP, 2023- 24]

46. 'A' can run 40 meters while 'B' runs 50 meters in the same time. In a 1000 m race, find by how much distance 'B' beats 'A'.

[2M, SQP, 2023- 24]

47. A boat takes thrice as long to go upstream to a point as to return downstream to the starting point. If the speed of the stream is $5km/h$, find the speed of the boat in still water.

[2M, SQP, 2024- 25]

48. Pipe A can fill a tank in 1 hour and Pipe B can fill it in 1½ hours. If both the pipes are opened in the empty tank, how much time will they take to fill the tank?

[2M, March, 2025]

3 MARKS QUESTIONS

49. A man goes 12 km downstream and comes back to the starting point by swimming non-stop in 3 hours. If the speed of the stream is 3 km/h, find the speed with which the man can swim in still water.

[3M, July, 2024]

50. A person can row a boat at 5 km/h in still water. It takes him thrice as long to row upstream as to row downstream. Find the rate at which the stream is flowing.

[3M, July, 2023]

51. A container has 50 litres of juice in it. 5 litres of juice is taken out and is replaced by 5 litres of water. This process is repeated four more times. What is the amount of juice left in the container after final replacement ? [Take $(0.9)^5 = 0\ 59049$]

[3M, July, 2023]

52. In a 1000-metre race, A, B and C get Gold, Silver, and Bronze medals respectively. If A beats B by 100 metres and B beats C by 100 metres, then by how many metres does A beat C ?

[3M, July, 2023]

53. Find the unt's digit in 7^{295}.

[3M, March, 2025]

54. A container has 50 litres of juice in it. 5 litres of juice is taken out and is replaced by 5 litres of water. This process is repeated 4 more times. Determine the quantity of juice in the container after final replacement. [Use $(0.9)^5 = 0\ 59049$]

[3M, March, 2024]

55. A bottle is full of dettol. One-third of its dettol is taken away and an equal amount of water is poured into the bottle to fill it again. This operation is repeated three times. Find the final ratio of Dettol to water in the bottle.

[3M, March, 2023]

56. A pipe A can fill a tank in 3 hours. There are two outlet pipes B and C from the tank which can empty it in 7 and 10 hours respectively. It all the three pipes are opened simultaneously; how long will it take to fill the tank ?

[3M, March, 2023]

57. A boat running upstream takes 8 hours 48 minutes to cover a certain distance, while it takes 4 hours to cover the same distance running downstream. What is the ratio between the speed of the boat and speed of the water current?

[3M, SQP, 2025- 26]

58. Pipes A, B and C can fill a tank in 30, 60 and 120 minutes respectively. Pipes B and C are kept open for 10 minutes, and then Pipe B is shut while Pipe A is opened. Pipe C is closed 10 minutes before the tank overflows. How long does it take to fill the tank?

[3M, SQP, 2025- 26]

59. Find the remainder when 5^{61} is divided by 7.

[3M, SQP, 2024- 25]

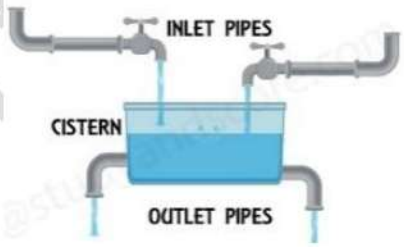
5 MARKS QUESTIONS

60. A cistern has three pipes A, B and C. Pipes A and B are inlet pipes whereas C is an outlet pipe. Pipes A and B can fill the cistern separately in 3 hours and 4 hours respectively; while pipe C can empty the completely filled cistern in 1 hour. If the pipes A, B and C are opened in order at 5, 6 and 7 a.m. respectively, at what time will the cistern be empty?

[5M, March, 2024]

CASE-BASED QUESTIONS

61. A, B and C are three pipes connected to a tank. A and B together fill the tank in 6 hours. B and C together fill the tank in 10 hours. A and C together fill the tank in 7.5 *hours*. Based on above information answer the following questions.



(i) In how much time will A, B and C fill the tank?

(ii) In how much time will A separately fill the tank?

(iii) In how much time will B separately fill the tank?

OR

In how much time will C separately fill the tank?

[4M, SQP, 2023- 24]

62. For providing water to the families of a colony, a large water tank with two inlet pipes A and B and an outlet pipe C, is installed. Pipes A and B can fill the tank in 10 hours and 12 hours respectively; whereas pipe C can empty the tank in 15 hours.

Based on the above information, answer the following questions:

(i) If both pipes A and B are opened together, then find the time in which the tank will be filled completely.

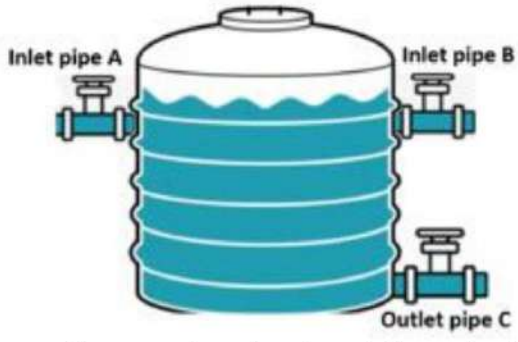
(ii) If both pipes A and C are opened together, then find the time in which the tank will be filled completely.

(iii) If all the three pipes A, B and C are opened together, then find the time in which the tank will be filled completely.

OR

Pipes A and B are opened together for some time and then pipe B is turned off after some time. If the tank is completely filled in 6 hours, then after how many hours is pipe B turned off?

63. An overhead water tank has three pipes A, B and C attached to it (as shown in figure (II)). The inlet pipes A and B can fill the empty tank independently in 15 hours and 12 hours respectively. The outlet pipe C alone can empty a full tank in 20 hours. Based on the above information, answer the following questions. Show steps to support your answers.



(i) For a routine cleaning of the tank, the tank needs to be emptied. If pipes A and B are closed at the time when the tank is filled to two-fifth of its total capacity, how long will pipe C take to empty the tank completely?

(ii) How long will it take for the empty tank to fill completely, if all the three pipes are opened simultaneously?

(iii) On a given day, pipes A, B and C are opened (in order) at 5 am, 8 am and 9 am respectively, to fill the empty tank. In how many hours will the tank be filled completely?

OR

(iv) Given that the tank is half-full, only pipe C is opened at 6 AM, to empty the tank. After closing the pipe C and an hour's cleaning time, tank is filled completely by pipe A and B together. What is the total time taken in the whole process?

[4M, SQP, 2022- 23]