Quant Session 6 – Arithmetic + Word Problems

Concept # 1: Overlapping Sets – 2 variables (2 way matrix approach)

1. How many attendees are at a convention if 150 of the attendees are neither female nor students, one-sixth of the attendees are female students, two-thirds of the attendees are female, and one-third of the attendees are students?
   300 450 600 800 900

2. At least 100 students at a certain high school study Japanese. If 4 percent of the students at the school who study French also study Japanese, do more students at the school study French than Japanese?
   1) 16 students at the school study both French and Japanese.
   2) 10 percent of the students at the school who study Japanese also study French.

3. One night a certain motel rented 3/4 of its rooms, including 2/3 of its air-conditioned rooms. If 3/5 of its rooms were air-conditioned, what percent of the rooms that were not rented were air-conditioned?
   (A) 20% (B) 33.33% (C) 35% (D) 40% (E) 80%

Concept # 2: Overlapping Sets – 3 variables (3 circles approach)

4. In a group of 68 students, each student is registered for at least one of three classes – History, Math and English.
   Twenty-five students are registered for History, twenty-five students are registered for Math, and thirty-four students are registered for English. If only three students are registered for all three classes, how many students are registered for exactly two classes?
   13 10 9 8 7

Concept # 3: Percentages – (MIND THE LANGUAGE) – these questions test more of reading ability and less of math – read very carefully in such questions:

5. Before being simplified, the instructions for computing income tax in Country R were to add 2 percent of one's annual income to the average (arithmetic mean) of 100 units of Country R's currency and 1 percent of one's annual income. Which of the following represents the simplified formula for computing the income tax, in Country R's currency, for a person in that country whose annual income is A?
   50+A/200 50+3A/100 50+A/40 100+A/50 100+3A/100

6. A certain city with population of 132,000 is to be divided into 11 voting districts, and no district is to have population that is more than 10 percent greater than the population of any other district. What is the minimum possible population that the least population district could have?
   10700 10800 10900 11000 11100

7. In May Mr. Lee's earnings were 60 percent of the Lee family's total income. In June Mr. Lee earned 20 percent more than in May. If the rest of the family's income was the same both months, then, in June, Mr. Lee's earnings were approximately what percent of the Lee Family's total income?

8. Three grades of milk are 1 percent, 2 percent, and 3 percent by volume. If x gallons of 1 percent grade, y gallons of 2 percent grade, z gallons of 3 percent grade are mixed to give x + y + z gallons of a 1.5 percent grade, what is x in terms of y and z?

9. Whenever Martin has a restaurant bill with an amount between $10 and $99, he calculates the dollar amount of the tip as 2 times the tens digit of the amount of his bill. If the amount of Martin' most recent restaurant bill was between $10 and $99, was the tip calculated by Martin on this bill greater than 15 percent of the amount of the bill?
   (1) The amount of the bill was between $15 and $30 (2) The tip calculated by Martin was $8

10. A school‟s annual budget for the purchase of student computers increased by 60% this year over last year. If the price of student computers increased by 20% this year, then the number of computers it can purchase this year is what percent greater than the number of computers it purchased last year?
    33.33% 40% 42% 48% 60%

11. A contractor combined x tons of a gravel mixture that contained 10% gravel G, by weight, with y tons of a mixture that contained 2% gravel G, by weight, to produce z tons of a mixture that was 5% gravel G, by weight. What is the value of x?
    1. y = 10 2. z = 16

12. Henry purchased 3 items during a sale. He received a 20 percent discount of the regular price of the most expensive item and a 10 percent discount off the regular price of the other 2 items. Was the total amount of the
    3 discounts greater than 15 percent of the sum of regular prices of the 3 items?
    (1) The regular price of the most expensive item was $50, and the regular price of the next most expensive item was $20.
    (2) The regular price of the least expensive item was $15

Concept # 4: Ratio / Equations:

13. In a demographic study, the population and total income of a certain region were estimated from other data, and both estimates had upper and lower limits. At the time of the estimates, was the per capita income for the region greater than $16,500?
    (1) The lower limit for the estimate of the population was 330,000 people.
    (2) The lower limit for the estimate of the total income was
    $5,500,000,000.

14. According to the directions on a can of frozen orange juice concentrate, 1 can of concentrate is to be mixed with 3 cans of water to make orange juice. How many 12 ounce cans of the concentrate are required to prepare 200 6-ounce servings of orange juice?
    1) 25 2) 34 3) 50 4) 67 5) 100

15. In a certain senior class, 72 percent of the male students and 80 percent of the female students have applied to college. What fraction of the students in the senior class is male?
    (1) There are 840 students in the senior class
    (2) 75 percent of the students in the senior class have applied to college.

16. A construction company was paid a total of $500,000 for a construction project. The company's only costs for the project were for labor and materials. Was the company's profit for the project greater than 150,000?
    (1) The company's total cost was three times its cost for materials.
    (2) The company's profit was greater than its cost for labor.

17. Each employee of Company Z is an employee of either Division X or Division Y, but not both. If each division has some part-time employees, is the ratio of the number of full-time employees to the number of part-time employees greater for Div X than for Company Z?
    (1) The ratio of the number of full-time employees to the number of part-time employees is less for Div Y than for Company Z.
    (2) More than half of the full-time employees of Company Z are employees of Div X, and more than half of the part-time employees of Company Z are employees of Div Y

18. Of the 60 animals on a certain farm, 2/3 are either cows or pigs. How many of the animals are cows?
    (1) The farm has more than twice as many cows as pigs
    (2) The farm has more than 12 pigs

Concept # 5: Speed and Distance

Average Speed = Total Distance / Total Time

Time to overtake (same directions) = Gap distance / difference of speeds

Time to meet (opposite directions: towards each other) = Gap distance / sum of speeds

19. Lexy walks 5 miles from point A to point B in one hour, then bicycles back to point A along the same route at 15 miles per hour. Ben makes the same round trip, but does so at half of Lexy's average speed. How many minutes does Ben spend on his round trip?
    40 80 120 160 180

20. Triathlete Dan runs along a 2-mile stretch of river and then swims back along the same route. If Dan runs at a rate of 10 miles per hour and swims at a rate of 6 miles per hour, what is his average rate for the entire trip in miles per minute?
    1/8 2/15 3/15 ¼ 3/8

21. What is the distance between Harry"s home and his office?
(1) Harry"s average speed on his commute to work this Monday was 30 miles per hour.
(2) If Harry"s average speed on his commute to work this Monday had been twice as fast, his trip would have been 15 minutes shorter.

22. The „moving walkway" is a 300-foot long conveyor belt that moves continuously at 3 feet per second. When Bill steps on the walkway, a group of people that are also on the walkway stands 120 feet in front of him. He walks toward the group at a combined rate (including both walkway and foot speed) of 6 feet per second, reaches the group of people, and then remains stationary until the walkway ends. What is Bill"s average rate of movement for his trip along the moving walkway?

2 feet per second 2.5 feet per second 3 feet per secon
4 feet per second 5 feet per second

23. John and Jacob set out together on bicycle traveling at 15 and 12 miles per hour, respectively. After 40 minutes, John stops to fix a flat tire. If it takes John one hour to fix the flat tire and Jacob continues to ride during this time, how many hours will it take John to catch up to Jacob assuming he resumes his ride at 15 miles per hour? (Consider John's deceleration/acceleration before/after the flat to be negligible)
3 3.33 3 ½ 4 4 ½

24. During a 40-mile trip, Marla traveled at an average speed of x miles per hour for the first y miles of the trip and at an average speed of 1.25x mph for the last 40-y miles of the trip. The time that Marla took to travel the 40 miles was what percent of the time it would have taken her if she has traveled at an average speed of x miles per hour for the entire trip?
1) x = 48 2) y = 20

25. A hiker walking at a constant rate of 4 miles per hour is passed by a cyclist travelling in the same direction along the same path at a constant rate of 20 miles per hour. The cyclist stops to wait for the hiker 5 minutes after passing her while the hiker continues to walk at her constant rate. How many minutes must the cyclist wait until the hiker catches up?
6.66 15 20 25 26.66

Concept # 6: Work:

If A alone takes X hours and B alone takes Y hours to do a piece of work, and if Z is the total time taken when they work together, then we have: 1/X + 1/Y = 1/Z or Z = XY/(X + Y)

A"s contribution = Y/(X + Y) B"s contribution = X/(X + Y)

It is best to take the LCM of times taken to avoid using fractions in such questions.

26. Machine A and Machine B can produce 1 widget in 3 hours working together at their respective constant rates. If Machine A's speed were doubled, the two machines could produce 1 widget in 2 hours working together at their respective rates. How many hours does it currently take Machine A to produce 1 widget on its own?
½ 2 3 5 6

27. Tom, working alone, can paint a room in 6 hours. Peter and John, working independently, can paint the same room in 3 hours and 2 hours, respectively. Tom starts painting the room and works on his own for one hour. He is then joined by Peter and they work together for an hour. Finally, John joins them and the three of them work together to finish the room, each one working at his respective rate. What fraction of the whole job was done by Peter?
    1/9 1/6 1/3 7/18 4/9

28. Machine A can fill an order of widgets in a hours. Machine B can fill the same order of widgets in b hours.
    Machines A and B begin to fill an order of widgets at noon, working together at their respective rates. If a and b are even integers, is Machine A's rate the same as that of Machine B?
    (1) Machines A and B finish the order at exactly 4:48 p.m.
    (2) $(a + b)^2 = 400$

29. Six machines, each working at the same constant rate, together can complete a certain job in 12 days. How many additional machines, each working at the same constant rate, will be needed to complete the job in 8 days?
    A) 2 B) 3 C) 4 D) 6 E) 7

30. Pumps A, B and C operate at their respective constant rates. Pumps A and B, simultaneously, can fill a certain tank in 6/5 hours. Pump A and C, operating simultaneously, can fill the tank in 3/2 hours; and pumps B and C, operating simultaneously, can fill the tank in 2 hours. How many hours does it take pumps A, B, and C, operating simultaneously, to fill the tank?
    (A) 1/3 (B) 1/2 (C) 2/3 (D) 5/6 (E) 1

Concept # 7: Compound Interest formula: $A = P\left(1 + \frac{R}{100}\right)^n$ **CI = A – P.**

For half yearly calculation of the interest:

$A = P\left(1 + \frac{R}{200}\right)^{2n}$ For quarterly calculation

of the interest: $A = P\left(1 + \frac{R}{400}\right)^{4n}$

In all these results: A = Final Amount, P = Principal (Initial Amount), R = Rate per annum, n = number of years.

$$Final = Initial\,[Factor\ of\ Multiplication]^{\frac{Total\ Time\ Available}{Time\ interval\ required\ for\ one\ Multiplication}}$$

31. A certain investment grows at an annual interest rate of 8%, compounded quarterly. Which of the following equations can be solved to find the number of years, x, that it would take for the investment to increase by a factor of 16?
    $16 = (1.02)^{x/4}$ $2 = (1.02)^x$ $16 = (1.08)^{4x}$ $2 = (1.02)^{x/4}$ $1/16 = (1.02)^{4x}$

32. An investor purchased a share of non-dividend-paying stock for p dollars on Monday. For a certain number of days, the value of the share increased by r percent per day. After this period of constant increase, the value of the share decreased the next day by q dollars and the investor decided to sell

the share at the end of that day for v dollars, which was the value of the share at that time. How many working days after the investor bought the share was the share sold,

if ?

2 3 4 5 6

33. If a certain culture of bacteria increases by a factor of x every y minutes, how long will it take for the culture to increase to ten-thousand times its original amount?

(1)

(2) In two minutes, the culture will increase to one-hundred times its original amount.