SESSION – 1

1. Ans: [a]

Let $x = 0.0512512....$

$10000x = 512.512512512....$

$(-) \quad 10x = 0.512512512...$

$9990x = 512$

$x = \frac{512}{9990}$

2. Ans: [c]

For a number to be divisible by 12, it should satisfy the criteria's of 3 and 4.

Criteria for 3

Sum of the digits of the given number should be divisible by 3.

Criteria for 4

Last two digits of the given number should be a multiple of 4.

Given number $43xy20xy$

Sum of the digits = 9.

xy should be the multiple of 4

So possible numbers for x and y are

$x = 1 \quad y = 2$

$x = 2 \quad y = 4$

$x = 3 \quad y = 6$

$x = 4 \quad y = 8$

$x = 6 \quad y = 0$

$x = 7 \quad y = 2$

$x = 8 \quad y = 4$

$x = 9 \quad y = 6$

Totally 8 possibilities are there.

3. Ans: [c]

Given $N = 5ab42ab$

For a number to be divisible by 180, it should satisfy the criteria's of 4, 5 and 9. Because $180 = 5 \times 4 \times 9$. So obviously b = 0 (or) 5, then only it will be a multiple of 5. But b = 5 is not possible because it should satisfy the criteria of 4 also, but no multiple of 4 end in 5. Finally the sum should be divisible by 9. The only possibility is a = 8, b = 0

The number is 5804280. Sum of this number is 27.

4. Ans: [d]

We know that product of the two numbers $= HCF \times LCM$

$x \times 365 = 73 \times 2555$

$\Rightarrow x = 511$

5. Ans: [d]

Longest four digit number = 9999

LCM of 12, 14, 33 and 42 = 924

So add 5793 and 9999. We will get 15792.

Divide 15792 by 924, we get remainder as 84, that should be subtracted from 9999

The answer is 9999 – 84 = 9915

6. Ans: [b]

The number which is divisible by 10, 13, 15 and 26 = LCM of (10, 13, 15, 26) = 390

The largest 5 digit number is 99999.

Largest 5 digit multiple of 390 is $390 \times 256 = 99840$

Common difference is 6.

So subtract it from the number.

Required answer is $99840 - 6 = 99834$

7. Ans: [d]

Let $a = k \times p, \quad b = k \times q$ [p and q are co-primes]

So LCM $= k \times p \times q$ HCF = K

It is given that $HCF + LCM = 77$

$k + (kpq) = 77$

$k(1 + pq) = 77$

77 can be written as 1×77

7×11

11×7

Case I: $1 \times 77 = 7$

$k = 1 \quad 1 + pq = 77$

$pq = 76$

Possible pairs are (4, 19), (1, 76)

Case II: $7 \times 11 = 77$

k = 7 $1 + pq = 11$

$pq = 10$

Possible pairs are (5, 2) (1, 10)

Case III: $11 \times 7 = 77$

$k = 11 \quad 1 + pq = 7$

$pq = 6$

Possible pairs are $(1, 6)(2, 3)$

8. Ans: [c]

Let the two number be x and y

$x = k \times a \quad y = k \times b$ [a and b are coprimes]

$x \times y \Rightarrow k^2 \times a \times b$

$xy \times (HCF)^2 = 240$

$k^2 \times a \times b \times k^2 = 240$

$a \times b \times k^4 = 240$

Prime factorization of 240 $=2^4\times3\times5$

So $k=2$ possible pair = (3, 5)

We also have one more possibility if k = 1

So possible pairs are $\left[\left(2^4\times3\right),5\right]$

$\left[3,\left(2^4\times5\right)\right]$

$\left[2^4,\left(3\times5\right)\right]$

$\left[1,\left(2^4\times3\times5\right)\right]$

Totally 5 possible pairs.

9. Ans: [c]

$pqpq=101\times pq$

It is given that pq has 3 divisors.

$\Rightarrow$ It is a square of a prime number.

$=101\times(\text{prime})^2$

$=(1+1)(2+1)$

$=2\times3=6$

10. Ans: [b]

Total number of divisors

$1400=2^3\times5^2\times7$

$=(3+1)(2+1)(1+1)$

$=(4\times3\times2)$

= 24 factors

First we are going to find how many perfect square factors are there in 1400.

Any factor of 1400 can be written as $2^a\times5^b\times7^c$

a can take values 0 and 2

b and take values 0 and 2

c can take the value 0. $\Rightarrow2\times2\times1$

Totally there are 4 possibilities

So the remaining 20 factors are not perfect squares.

11. Ans: [a]

Total no. of divisors of 2016

$2016=2^5\times7\times9$

$\Rightarrow(5+1)(1+1)(1+1)$

$\Rightarrow6\times2\times2=24$ factors

Odd factors $\Rightarrow$ only we have to take

7×9 $(1+1)(1+1)=4$ factors

Even factors $=24-4=20$

12. Ans: [c]

Sum of the divisors of 2475.

Sum of the factors for a number $N=P^a\times q^b\times r^c$

$\left(\frac{p^{a+1}-1}{p-1}\right)\left(\frac{q^{b+1}-1}{q-1}\right)\left(\frac{r^{c+1}-1}{r-1}\right)$

2475 can be written as $3^2\times5^2\times11$

Using the above we get

$\left(\frac{3^3-1}{3-1}\right)\left(\frac{5^3-1}{5-1}\right)\left(\frac{11^2-1}{11-1}\right)=4836$

13. Ans: [b]

Here $N=2^7\times3^3\times11^2$

Any factor of N can be written as $2^a\times3^b\times11^c$

'a' can take the values 0, 2, 4, 6

'b' can take the values 0, 2

'c' can take the values 0, 2

Total possible factors which are perfect squares $=4\times2\times2=16$ factors

14. And: [d]

Any number of the form $p^a\times q^b\times r^c$ will have $(a+1)(b+1)(c+1)$ factors

In order for the number to be a perfect cube a, b, c will have to be multiples of 3.

We can assume that a = 3m, b = 3n, c = 3l.

This tells us the number of factors will have to be of the form $(3m+1)(3n+1)(3l+1)$.

In other words $(a+1)(b+1)(c+1)$ all leave remainder of 1 on division by 3.

So the product of these numbers should also leave a remainder of 1 on division by 3.

Out of the given four numbers 10 and 49 can be written in this form.

15. Ans: [d]

We know that the last two digits of 127! is zero. The remainder when it is divided by four is zero. If the remainder is zero, the answer is last value in the cycle of 7

$\Rightarrow7,9,3,\mathbf{1}$.

16. Ans: [b]

$80^1=80$

$80^2=6400$

$80^3=512000$

$80^4=40960000$

$80^5=3276800000$

$80^6=262144000000$

.

.

.

$80^{1230} \Rightarrow$ the last non zero digit of this number is

$R\left(\frac{1230}{4}\right)=2$

Answer is 4.

17. Ans: [d]
When the unit digit for our given number is 2.

Divide the power by 4, check the remainder $R\left(\frac{52^{52}}{4}\right)=0$

The answer is last value in the cycle of 2
2 4 8 **6**

18. Ans: [b]

$5 \mid 229$
$5 \mid 45$
$5 \mid 9$
1

$45+9+1$
One five and one two will give one zero.
Number of five's will be less than number of two's.
Number of five's = 55

19. Ans: [a]
24! has 4 zeros
25! has 6 zeros
124! has 28 zeros
125! has 31 zeros
So the answer is (a)

20. Ans: [a]
128! have 31 zeros (31 fives) (63 fours)(30 nines)

The greatest value n that exactly divides 180^n

$180=2^2\times3^2\times5$

SESSION – 2

1. Ans: [b]

$N=Dq_1+6$ ... (1)

$N=3Dq_2+19$ ... (2)

Dividing (2) by D, we get remainder as

$R\left(\frac{N}{D}\right)=R\left(\frac{3Dq_2}{D}\right)+R\left(\frac{19}{D}\right)$

$=R\left(\frac{19}{D}\right)$

$\therefore R\left(\frac{19}{D}\right)=6$ by (1)

$\Rightarrow D=13$

$2N=2Dq_1+12$ by (1)

$R\left(\frac{2N}{13}\right)=R\left(\frac{12}{13}\right)=12$

2. Ans: [a]

$R\left(\frac{6^{90}-5^{90}}{91}\right)=?$

$6^{90}-5^{90}=\left(6^3\right)^{30}-\left(5^3\right)^{30}=216^{30}-125^{30}$

a^n-b^n is divisible by a – b

$\therefore 6^{90}-5^{90}$ is divisible by 91

So the remainder is 0.

3. Ans: [c]

$3^{5555}+5^{3333}=\left(3^5\right)^{1111}+\left(5^3\right)^{1111}$

$=(243)^{1111}+(125)^{1111}$

a^n+b^n is divisible by $a+b$ when n is odd.

$\therefore 243^{1111}+125^{1111}$ is divisible by 368

Since 23 is a factor of 368, $243^{1111}+125^{1111}$ is divisible by 23.

$\therefore$ Remainder = 0

4. Ans: [a]

$R\left(\frac{23^{24^{25}}}{7}\right)=R\left(\frac{23}{7}\right)^{24^{25}}=R\left(\frac{2^{24^{25}}}{7}\right)$

Cyclicity of powers of 2 divided by 7.

$R\left(\frac{2}{7}\right)=2$

$R\left(\frac{2^2}{7}\right)=4$

$R\left(\frac{2^3}{7}\right)=1$

Cyclicity 3
On dividing the exponent by 3, we get remainder as 0.
$\therefore$ Remainder = 1

5. Ans: [d]

$R\left(\frac{35^{182}}{37}\right)=?$

Since 37 is prime and 35 is co-prime to 37, by Fermat's theorem,

$R\left(\frac{35^{36}}{37}\right)=1$

$\Rightarrow R\left(\frac{35^{182}}{37}\right)=R\left(\frac{35^{36}}{37}\right)^5 R\left(\frac{35^2}{37}\right)$

$=1(-2)(-2)=4$

$\therefore$ Remainder = 4

6. And: [d]

$$R\left(\frac{3451+3452+...+3794}{345}\right)=R\left(\frac{3451}{345}\right)+R\left(\frac{3452}{345}\right)+...+\left(\frac{3794}{345}\right)$$

$$=R\left(\frac{1+2+...+344}{345}\right)$$

$1+2+...+344=\frac{344(345)}{2}$, multiple of 345

$\therefore$ Remainder = 0

7. Ans: [c]

A number that leaves a remainder of 2 on division by 5 and a remainder of 5 on division by 7 is 12. (first such number)

The other numbers are $12+35,12+35(2),...$

The numbers which satisfy the given condition from 1 to 500 is $12+35(0),12+35(1),...12+35(13)$.

8. Ans: [b]

$N=33q+10$

$$R\left(\frac{N}{22}\right)=R\left(\frac{33q}{22}\right)+R\left(\frac{10}{22}\right)$$

i) $R\left(\frac{33q}{22}\right)$

By cancelling the common factor 11. We get $R\left(\frac{3q}{2}\right)$

It has two possible remainders 0 and 1.

So (i) has two possible remainder 10 and 11.

$\therefore$ n can take 2 values.

9. Ans: [c]

$$R\left(\frac{2^{64}}{160}\right)=R\left(\frac{2^4\times2^{60}}{2^4\times10}\right)$$

By cancelling the common factor, we get $R\left(\frac{2^{60}}{10}\right)$

Finding the above remainder is same as finding the unit digit of 2^{60} and that is 6.

$\therefore$ Required remainder $=16\times6=96$

10. Ans: [a]

The last two digits of the expression is 80.

11. Ans: [c]

$31^{77}=11 \quad (3\times7=21)$

$75^{84}=25 \quad (7\times4=28)$

Last two digits of $31^{77}\times75^{84}=11\times25$

$=75$

12. Ans: [a]

$59^{27}=\left(59^2\right)^{13}\cdot59=81^{13}\cdot59=(....41)(59)$

Last two digits = 19

13. Ans: [b]

$78^{35}=(39)^{35}\cdot2^{35}$

$39^{35}=\left(39^2\right)^{17}\cdot39=(21)^{17}\cdot39$

$=(...41)(39)=99$

$2^{35}=2^{20}.2^{10}\cdot2^5=(...76)(...24)(...32)$

$=68$

Required answer = 32

14. Ans: [a]

$16^{26}=\left(2^4\right)^{26}=2^{104}=\left(2^{20}\right)^5\cdot2^4$

$=(...76)(16)=16$

15. Ans: [c]

$31^{15}=(...51)$

$24^{15}=\left(2^3\right)^{15}\cdot3^{15}=2^{45}\cdot\left(3^4\right)^3\cdot3^3$

$=\left(2^{20}\right)^2\cdot2^5\cdot(81)^3\cdot27$

$=76.32\cdot(....41)\cdot(27)=24$

Required answer $=51-24=27$

16. Ans: [b]

$140^5=\left(2^2\times7\times5\right)^5=2^{10}\times7^5\times5^5$

$=(2\times5)\times\left(2^9\times7^5\times5^4\right)$

The number of factors that have at least one zero

$=10\times6\times5=300$

17. Ans: [b]

The number that has exactly three factors is square of a prime number. [Since 40! Has two 19 in it i.e. (38)]

$\therefore K=19^2=361$

$K-1=360=2^3\times3^2\times5$

Number of factors $=4\times3\times2=24$

18. Ans: [a]

2N has 28 factors $(28=7\times4)$ $2n=2^6*3^3$

3N has 30 factors $(30=6\times5)$ from this $n=2*2^5*3^3$

$\Rightarrow N=2^5\times3^3$ $3n=2^5*3^4$

$6N=2^6\times3^4$ which has $7\times5=35$ factors. from this $n=3*2^5*3^3$

19. Ans: [d]

$38^{38^{38}}$

We know that cyclicity of 8 is 4.

$$R\left(\frac{38^{38}}{4}\right)=R\left(\frac{2^{38}}{4}\right)=0$$

So the unit digit is 6.

20. Ans: [b]

$$25!=2^{22}\times3^{10}\times5^{6}\times7^{3}\times11^{2}\times13\times17\times19\times23$$

$$=\left(2^{6}\times5^{6}\right)\times2^{16}\times3^{10}\times7^{3}\times11^{2}\times13\times17\times19\times23$$

Last non-zero digit is 4.

SESSION – 3

1. Ans: [b]

Let the weight of the new person be *x* kg.

The decrease in weight for 5 men $=5\times3=15$ kg

Hence $x=(150-15)$ kg

= 135 kg

Hence the weight of the new person = 135 kg.

2. Ans: [a]

Distance travelled in the 1^{st} quarter = 8 km

Distance travelled in the 2^{nd} quarter = 6 km

Distance travelled in the 3^{rd} quarter = 40 km

$\Rightarrow$ Distance travelled in 3 quarters = (8 + 6 + 40) km = 54 km

$\Rightarrow$ Distance travelled in the fourth quarter $=\frac{54}{3}=18$ km

$\Rightarrow$ Distance travelled in the entire journey = (54 + 18) km = 72 km

$\Rightarrow$ The average speed of the train = 72 km/h.

3. Ans: [c]

Average salary of 17 teachers = Rs.45000

$\therefore$ Total salary = Rs.45000 × 17 = Rs.765,000

New average after 3 teachers left = Rs.45000 – Rs.2500 = Rs.42500

$\therefore$ New total = Rs.42500 × 14 = Rs.595,000

$\therefore$ Sum of the salaries of the teachers who left

= Rs.765,000 – Rs.595,000 = Rs.170,000

4. Ans: [b]

The average of 71 results = 48

$\Rightarrow$ The total of 71 results $=48\times71=3408$

The average of the first 59 results – 46

$\Rightarrow$ The total of the first 59 results $=46\times59=2714$

Let the 60^{th} result be *x*.

The average of the last 11 results = 52

$\Rightarrow$ The total of the last 10 results $=52\times11=572$

$$3408=2714+x+572$$

$$\Rightarrow x=3408-(2714+572)=3408-3286=122$$

Hence, the 60^{th} result is 122.

5. Ans: [a]

Average marks of A, B, C = 48

$\Rightarrow$ Total marks $=3\times48=144$

Average marks of A, B, C, D = 46

$\Rightarrow$ Total marks $=46\times4=184$

Marks obtained by D = 40

Marks obtained by E = 43

$\therefore$ Total of A, B, C, D and E = 184 + 43 = 229.

Total of B, C, D and E = 180

Hence the marks obtained by A = 227 – 180 = 47.

6. Ans: [b]

The first 5 multiples of 7 are 7, 14, 21, 28, 35.

$$\text{Average}=\frac{7+14+21+28+35}{5}=\frac{105}{5}=21$$

7. Ans: [b]

Let the number of men in the group be 'n' when a person aged 18 years is replaced by a person aged 38 years, the total age of the group goes up by 20 years.

Since this leads to an increase in the average by 5 years, we can say that the number of persons in the group $=\frac{20}{5}=4$.

8. Ans: [a]

Let the equal distance be d km.

$$\therefore \text{Average speed}=\frac{d}{\frac{d}{x}+\frac{d}{y}+\frac{d}{z}}\text{ km/h}$$

$$=\frac{xyz}{yz+zx+xy}$$

$$=xyz/(xy+yz+zx)$$

9. Ans: [d]

The passed students in the four classes are 2, 6, 18, 40.

$$\therefore \text{Pass percentage}=\frac{2+6+18+40}{10+20+30+40}=\frac{66}{100}=66\%$$

Hence, the pass percent of the entire school is 66.

10. Ans: [a]

To find the mode, first arrange the numbers either in ascending or descending order.

The numbers can be arranged in the ascending order as follows.

1, 1, 3, 3, 3, 3, 3, 3, 3, 6, 6, 6, 6, 9, 9, 9, 9, 12, 12, 15

The number '3' occurs maximum number of times (7 times).

Hence, the mode is 3.

Hence, option (a).

11. Ans: [a]

Let the number of persons be *x* and the charge per person be Rs.*y*.

$\therefore xy = \text{Rs.}720 \Rightarrow y = \frac{720}{x}$

$(x+4)(y-6) = 720$

$\Rightarrow (x+4)\left(\frac{720}{x} - 6\right) = 720$

$\Rightarrow 720 - 6x + \frac{2880}{x} - 24 = 720$

$\Rightarrow -6x + \frac{2880}{x} - 24 = 0$

$\Rightarrow \quad x - \frac{480}{x} + 4 = 0$

$\Rightarrow \quad x^2 + 4x - 480 = 0 \Rightarrow (x+24)(x-20) = 0$

$\Rightarrow x = 20 \qquad [\because x \text{ is positive}]$

Hence, the required number of persons = 20.

Solutions for Q12 to Q14:

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43.

Sum of eleven player's scores should be a multiple of 11.

[$\because$ p Avg is also a whole number]

Total $\Rightarrow$ 281 is not a multiple of 11.

$\therefore \frac{275}{11} \Rightarrow \text{Avg} = 25$ [25 is not a prime number]

Next multiple of 11 $\Rightarrow \frac{264}{11} \Rightarrow 24$ [24 . . .]

Next multiple of 11 $\Rightarrow \frac{253}{11} \Rightarrow 23$

Out of these 14 prime numbers eliminate three numbers to get the average as 23. [281 – 253 = 28]

28 $\Rightarrow$ 2 + 3 + 23 or 2 + 7 + 19

If we eliminate 2, 7, 9 then 23 is one of the player's score and also the average. Since it is not possible we eliminate 2, 3, 23.

5, 7, 11, 13, 17, 19, 29, 31, 37, 41, 43 are the scores of 11 players and 23 was their average.

12. Ans: [b]

13. Ans: [a]

14. Ans: [c]

15. Ans: [c]

$\frac{A+B+C}{3} = 84 \Rightarrow A+B+C = 252$

$\frac{A+B+C+D}{4} = 80 \Rightarrow 252 + D = 320$

$D = 320 - 252 = 68$

$D = 68$

$E = 71$

$\frac{E+B+C+D}{4} = 79$

71 + B + C + 68 = 316

B + C = 316 – 71 – 68

B + C = 177

A + B + C = 252

A + 177 = 252

A = 252 – 177

$\boxed{A = 75}$

16. Ans: [b]

Bowling Avg = $\frac{\text{Runs}}{\text{No. of wickets}}$

$12.4 = \frac{R}{W}$

$R = W \times 12.4$

New Bowling average = $\frac{R+26}{W+5}$

$12 = \frac{R+26}{W+5}$

$12(W+5) = 12.4W + 26$

$12W + 60 = 12.4W + 26$

$0.4W = 34$

$W = 85$

17. Ans: [b]

There are 7 consecutive numbers. Then the average of those 7 will be the middle term. [4th term]

For the first 5 terms average was the 3rd term which is n.

3rd term $\rightarrow$ n

4th term $\rightarrow$ n + 1

18. Ans: [d]

At most 19 numbers can be greater than zero and one can be less than zero.

19. Ans: [b]

Number of sheets typed by A in 1 hr $= \frac{60}{6}$

Number of sheets typed by B in 1 hr $= \frac{60}{7}$

Number of sheets typed by C in 1 hr $= \frac{60}{9}$

Hence the required average $= \frac{\frac{60}{6} + \frac{60}{7} + \frac{60}{9}}{3}$

$= \frac{60}{3} \times \frac{53}{126} = \frac{530}{63}$

20. Ans: [d]

The average of 5 positive integers is 40.

$\Rightarrow$ the sum of the integers $= 5 \times 40 = 200$

Let the least of these 5 numbers be *x*.

Then, the largest of these 5 numbers will be $x + 10$.

If the largest of these numbers have to be maximised, we have to minimise the other numbers.

$\Rightarrow$ 4 of these numbers are all at the least value possible $= x$.

So, $x + x + x + x + x + 10 = 200$

$\Rightarrow 5x = 190$

$\Rightarrow x = 38$

So the largest of these 5 integers $= 38 + 10 = 48$.

SESSION – 4

1. Ans: [b]

Let the number of ladies be x.

The total consumption for 8 males $= 15 \times 8 = 120$ kg.

The total consumption for x ladies $= 6 \times x = 6x$ kg.

$$\therefore \text{Average} = \frac{120 + 6x}{8 + x} = 10.8$$

$$\Rightarrow 120 + 6x = 86.4 + 10.8x$$

$$\Rightarrow \quad 4.8x = 33.6$$

$$\Rightarrow \quad x = \frac{33.6}{4.8} = 7$$

Hence, the required number of ladies = 7.

2. Ans: [c]

The total weight of 40 teachers $= 40 \times 80 = 3200$ kg.

Let the weight of the principal be x kg.

$$\therefore \frac{3200 + x}{41} = 79$$

$\Rightarrow 3200 + x = 3239$

$\Rightarrow x = 3239 - 3200 = 39$ kg.

Hence the weight of the Principal = 39 kg.

3. Ans: [a]

Let the average of the team be 'k' years.

$\Rightarrow$ Total age of the team = 11k years.

If 26, 29 are excluded, the average becomes $k - 1$

$\Rightarrow$ Total age of 9 members $= 9(k-1)$ years.

$$9(k-1) + 26 + 29 = 11k$$

$\Rightarrow 9k - 9 + 55 = 11k$

$\Rightarrow 2k = 46 \quad \Rightarrow k = 23$ years.

4. Ans: [c]

The average of 50 observations = 36

$\Rightarrow$ The total of 50 observations $= 36 \times 50 = 1800$

Correct sum $= 1800 + 48 - 23 = 1825$

$$\Rightarrow \text{Correct average} = \frac{1825}{50} = 36.5$$

5. Ans: [d]

Since the month begins on a Sunday, there are 5 Sundays in the month.

$$\therefore \text{Required average} = \frac{5 \times 510 + 25 \times 240}{30}$$

$$= \frac{2550 + 6000}{30} \quad = \frac{8550}{30} = 285$$

6. Ans: [b]

Number of sheets typed by A in 1 hr $= \frac{60}{6}$

Number of sheets typed by B in 1 hr $= \frac{60}{7}$

Number of sheets typed by C in 1 hr $= \frac{60}{9}$

$$\text{Hence the required average} = \frac{\frac{60}{6} + \frac{60}{7} + \frac{60}{9}}{3}$$

$$= \frac{60}{3} \times \frac{53}{126} = \frac{530}{63}$$

7. Ans: [d]

The average of 5 positive integers is 40.

$\Rightarrow$ the sum of the integers $= 5 \times 40 = 200$

Let the least of these 5 numbers be x.

Then, the largest of these 5 numbers will be $x + 10$.

If the largest of these numbers have to be maximised, we have to minimise the other numbers.

$\Rightarrow$ 4 of these numbers are all at the least value possible $= x$.

So, $x + x + x + x + x + 10 = 200$

$\Rightarrow 5x = 190$

$\Rightarrow x = 38$

So the largest of these 5 integers $= 38 + 10 = 48$.

8. Ans: [d]

The average age of 35 students = 16

$\Rightarrow$ The total age of 35 students $= 35 \times 16 = 560$

The average age of 21 students = 14

$\Rightarrow$ The total age of 21 students $= 21 \times 14 = 294$

$\therefore$ The total of the remaining 14 students = 560 – 294 = 266

$$\Rightarrow \text{The average age of 14 students} = \frac{266}{14} = 19 \text{ years.}$$

9. Ans: [b]

Let the 5 consecutive numbers be

$x, x+1, x+2, x+3, x+4$

$$\text{The average} = \frac{x + x + 1 + x + 2 + x + 3 + x + 4}{5}$$

$$= \frac{5x + 10}{5} = x + 2$$

$$\text{Average of 7 numbers} = \frac{5x + 10 + x + 5 + x + 6}{7}$$

$$= \frac{7x + 21}{7} = x + 3$$

Hence, the average increases by 1.

10. Ans: [c]

Let the average amount paid by all be Rs.x.

$\Rightarrow$ Total amount paid by all = Rs.$20x$.

$16 \times 50 + x + 10 + x + 15 + x + 25 + x + 30 = 20x$

$\Rightarrow 880 + 4x = 20x \Rightarrow 16x = 880$

$\Rightarrow x = \text{Rs.}55$

Hence, total bill $= 20x = \text{Rs.}55 \times 20 = \text{Rs.}1100$

11. Ans: [a]

Sum of 11 players age = 28 × 11 = 308

Sum of Group I $\Rightarrow 3 \times 25 = 75$

Group II $\Rightarrow 3 \times 28 = 84$

Group III $\Rightarrow 3 \times 30 = 90$

$\overline{249}$

308 – 249 = 59 [must be age of captain & youngest player]

$C + Y = 59$

$C - Y = 11$

$\overline{2C = 70}$

$\boxed{C = 35}$

12. Ans: [d]

$$\frac{15(x+6.75)+12x}{27} = 36$$

$$15x + 101.25 + 12x = 972$$

$$27x = 870.75$$

$$x = 32.25$$

13. Ans: [b]

Avg went up by 1.8 for 10 numbers.

$\therefore$ 18 has been increase in total.

Originally $\rightarrow$ xy

10x + y

After Interchange $\rightarrow$ yx

10y + x

(10y + x) – (10x + y) = 18

9y – 9x = 18

y – x = 2

14. Ans: [a]

The maximum possible value for the smallest number is 25. [Since the average is 25]

If we replace 25, 0, the average will be decrease by 5. So x < 5.

15. Ans: [c]

Group I	$\Rightarrow$	1,	2,	3	–	–	
Group II	$\Rightarrow$	4,	5,	6	–	–	
Group III	$\Rightarrow$	7,	8,	9	–	–	(or)
Group IV	$\Rightarrow$	10,	11,	12	–	–	
Group V	$\Rightarrow$	13,	14,	15	–	–	

Avg of 3, 6, 9, 12, 15 [Medians]

$\Rightarrow 9$

Group I	$\Rightarrow$	–	–	23,	24,	25
Group II	$\Rightarrow$	–	–	20,	21,	22
Group III	$\Rightarrow$	–	–	17,	18,	19
Group IV	$\Rightarrow$	–	–	14,	15,	16
Group V	$\Rightarrow$	–	–	11,	12,	3

Avg [23, 20, 17, 14, 11]

Avg = 17

Average of Medians M [smallest] = 9

Average of Medians M [largest = 17

16. Ans: [a]

40 students average weight $\Rightarrow 40$

Total weight = 40 × 40 = 1600

$$\frac{1600+mn}{40+m} = \text{Avg}$$

We know that m + n = 50

Take m = 1, n = 49

$$\frac{1600+49}{40+1} \Rightarrow 40.219$$

If m = 5, n = 45

$$\frac{1600+5(45)}{45} = 40.55$$

If m = 9, n = 41

$$\frac{1600+9(41)}{49} = 40.183$$

$\therefore$ The maximum possible average weight of class = 40.18 kg.

17. Ans: [b]

2:5:13

Day 1 $\Rightarrow 15 \times 2 = 30$

Day 2 $\Rightarrow 7.5 \times 5 = 37.5$

Day 3 $\Rightarrow 2.5 \times 13 = 32.5$

$\overline{100}$

$$\text{Avg} = \frac{\text{Rs.}100}{20} \Rightarrow \text{Rs.}5$$

18. Ans: [a]

Initially $\Rightarrow 35x$

Now $42x - 42 - 35x = 42$

$7x = 84$

$x = 12$

Original expenditure $\Rightarrow \text{Rs.}(12 \times 35) = \text{Rs.}420$

19. Ans: [d]

$$\text{Avg} = \frac{\text{sum}}{n}$$

$$18.5 = \frac{\text{sum}}{4}$$

sum = 4 × 18.5 = 74

20% (18.5) = 3.7

Including the coach 5 persons age has to be increased by 3.7 $\Rightarrow$ Totally 18.5 has to be increased from the old average 18.5.

$18.5 + 18.5 = 37$

20. Ans: [a]

Let the sales of the last month be Rs.x.

$$\therefore \frac{12000 \times 11 + x}{12} = 11375$$

$$\Rightarrow x = 11375 \times 12 - 132000$$

$$= 136500 - 132000 = \text{Rs.}4500$$

SESSION – 5

1.(b)	2. (d)	3. (c)	4. (c)	5. (d)
6. (a)	7. (c)	8. (d)	9. (a)	10. (a)
11. (a)	12. (c)	13. (b)	14. (c)	15. (a)
16. (c)	17. (c)	18. (b)	19. (b)	20. (c)

SESSION – 6

1. Ans: [c]

$(a+b+c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$

$= 364 + 2(ab + bc + ca) = 26^2 = 676,$

So $ab + bc + ca = 156$.

Let us denote $b = aq$ and $c = aq^2$ (geometric progressions).

We have

$a + b + c = a + aq + aq^2 = 26$ and $ab + bc + ca$

$= a^2q + a^2q^3 + a^2q^2 = 156\ a(1 + q + q^2)$

$= 26$ and $a^2q\ (1 + q + q^2) = 156 = 6.26.$

We divide both equations and get

$(a^2q(1 + q + q^2))/(a(1 + q + q^2)) = 6,$

$aq = 6 = b.$

2. Ans: [b]

$|t_8| = |t_{16}|$. This can happen under two scenarios $t_8 = t_{16}$ or $t_8 = -t_{16}$.

If $t_8 = t_{16}$, the common difference would be 0 suggesting that t_3 would be equal to t_7.

However, we know t_3 is not equal to t_7, so the common difference cannot be zero.

This tells us that $t_8 = -t_{16}$

Or, $t_8 + t_{16} = 0$.

If $t_8 + t_{16} = 0$, then $t_{12} = 0$. $t_{12} = t_8 + 4d$, and $t_{16} - 4d$

So, $t_{12} = (t_8 + t_{16})/2$.

For any two terms in an AP, the mean is the term right in between them.

So, t_{12} is the arithmetic mean of t_8 and t_{16}.

So, $t_{12} = 0$.

Now, $S_{23} = 23 \times t_{12}$. We know that average of n terms in an A.P. is the middle term. This implies that sum of n terms in an A.P., is n times the middle term.

So, $S_{23} = 0$.

3. Ans: [b]

First Let us assume that in the A.P., a = 1, d = 4

$S_{2n} = 2n/2\ [2 \times 1 + (2n - 1)4]$

$S_{2n} = n(2 + 8n - 4) = n(8n - 2) = 8n^2 - 2n$

For the second AP, a = 56, d = 2,

$S_n = n/2\ [2 \times 56 + (n - 1)2]$

$S_n = n/2\ [112 + 2n - 2] = n/2\ (110 + 2n)$

The sum of 2n terms of AP {1, 5, 9, 13, ...} is greater than sum of n terms of A.P. = {56, 58, 60, ...}

$8n^2 - 2n > n/2\ (110 + 2n)$

$16n^2 - 4n > 110n + 2n^2$

$14n^2 > 114n$

$7n > 57$

$n > 57/7$

The smallest value n can take = 9.

4. Ans: [a]

Median is the first term => Common ratio has to be negative.

Because When a > 0,

If r > 1, this will be an increasing G.P.

If r lies between (0, 1), this will be a decreasing G.P.

In both cases, the middle term will be the median. If a < 0, the order will be the other way around, but the middle term would still be the median.

If the middle term is not the median, we can say that r < 0. Now, let us go the solution

b = 10, a and c should be negative. Solution, a + b + c cannot be 15.

$a + b + c = -15$

$10/r + 10 + 10r = -15 \Rightarrow 2/r + 2r = -5$

Solving the quadratic, we will get $r = -\frac{1}{2}$ or -2.

The sequence is either $-5, 10, -20$ or $-20, 10, -5$.

a > c => the sequence has to be $-5, 10, -20$.

The product of the first 4 terms

$= -5 \times 10 \times -20 \times 40 = 40000.$

5. Ans: [b]

Common ratio is positive, and one of the terms is positive => All terms are positive

$P_6 = P_5 * t6$ => If $P_6 > P_5$, t6 > 1

$P_7 = P_6 * t7$ => If $P_6 > P_7$, t7 < 1

$t_6 = t_2 * r^4 = 1000r^4$;

$t_7 = t_2 * r^5 = 1000r^5$

$1000r^4 > 1$ and $1000r^5 < 1$

$1/r^4 < 1000$ and $1/r^5 > 1000$.

$1/r = n$.

$n^4 < 1000$ and $n^5 > 1000$, where n is a natural number

$n^4 < 1000 \Rightarrow n < 6$

$n^5 > 1000 \Rightarrow n \geq 4$

n could be 4 or 5. Sum of possible values = 9

6. Ans: [d]

Let a, b, c, d be the four numbers, where a, b and c are in G.P and b, c and d are in A.P

$c = b + 6$, $d = b + 6 + 6 = b + 12$

but $b^2 = ac$

$b^2 = a(b+6)$

$a - b = 12$

$b^2 = (b+6)(b+12) = b^2 + 18b + 72$

$18b = -72, b = -4$

$a = -4 + 12 = 8$

7. Ans: [c]

The number of digits in first group = 1

The number of digits in the second group = 3

The number of digits in the third group = 5

The number of digits in the nth group = 2n – 1

Let first term of nth group be T_n

Let sum of nth group be $1 + 2 + 5 + 10 + ... + T_n$

$T_n = a_1 + (n-1)/2\,(2(a_2 - a_1) + (n+2)(a_1 + a_3 + 2a_2)$

$= 1 + ((n-1)/2)(2 + 2n - 4) = 1 + (n-1)^2$

Sum of the elements in the nth group:

$S_n = ((2n-1)/2)(2(1 + (n-1)^2 + (2n-2).1)$ (where d = 1)

On simplification, we get,

$S_n = (n-1)^3 - n^3$

8. Ans: [c]

$x = (a+b)/2, y = (b+c)/2$

Let $a/b = b/c = r$ (since in G.P)

$(a/x) + (c/y) = 2a/(a+b) + 2c/(b+c) = 2a/(a+c)$

$2/(1 + (b/a)) + 2/((b/c) + 1)$

$= 2/(1+r) + 2/((1/r) + 1) = 2((1+r)/(1+r)) = 2.$

9. Ans: [c]

Let the roots be a – d, a, a + d

So from the equation given:

Sum = 12, Product = 28

$a - d + a + a + d = 12$

$3a = 12$

$a = 4.$

$a(a-d)(a+d) = 28$

$(a^2 - d^2) = 28/4 = 7$

$16 - 7 = d^2$

$d = \pm 3.$

10. Ans: [c]

m A.M's between a and b are:

$A_1 = a + ((b-a)/(m+1));$

$A_2 = a + (2(b-a)/(m+1));$

$A_m = (a + m(b-a))/(m+1)$

Thus $A_7 / A_{(m-1)} = (1 + 7(31-1)/(m+1))/$

$(1 + ((m-1)(31-1)/(m+1)) = 5/9$

$(m + 1 + 210)/(m + 1 + 30m - 30) = 5/9$

$9m + 1899 = 155m - 145$

$146m = 2044$

$m = 2044 / 146$

$m = 14.$

11. Ans: [b]

Adding 6 minutes to the weekly jogging time for each week creates the sequence: 12, 18, 24, ...

This sequence is arithmetic.

$a_n = a_1 + (n-1)d$

$a_n = 60 = 12 + (n-1)6$

$n = 9$ weeks

12. Ans: [c]

The sequence

	180	360	540	...	?
Sides:	3	4	5	...	12
Term:	1	2	3	...	?

This sequence is arithmetic and the common difference is 180. The 12-sided figure will be the 10th term in this sequence. Find the 10th term.

$a_n = a_1 + (n-1)d$

$a_{10} = 180 + (10-1)180 = 1800$

13. Ans: [b]

500 mg of ore. Half-life of one day means that half of the amount remains after 1 day.

Begin of day 1 500 mg	Begin of day 2 250 mg	Begin of day 3 125 mg	...
End of day 1 250 mg	End of day 2 125 mg	End of day 3 62.5 mg	...

Decide to either work with the "beginning" of each day, or the "end" of each day, as each can yield the answer. Only the starting value and number of terms will differ. We will use "beginning":

$a_n = a_1 \bullet r^{n-1}$

$a_8 = 500 \bullet \left(\frac{1}{2}\right)^{7-1} = 7.8125$ mg

14. Ans: [a]

Arithmetic sequence: 16, 48, 80, ...

$a_n = a_1 + (n-1)d$

$a_6 = 16 + (6-1)32 = 176$

The 6th term is 176.

Now, we are ready to find the sum:

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

$S_6 = \frac{6(16+176)}{2} = 576$ feet

15. Ans: [d]

The rhyme is in G.P

a = 7, r = 7, four terms are wives, sacks, cats and kits n = 4.

Sum = $a(r^n - 1)/(r-1)$

Sum = 2800

Total persons are 2800 + 1 man = 2801

16. Ans: [a]
Let the initial population be a1
In two years, population will be 20% of a1 = 120% of a1
It is given it increases geometrically, thus it forms a GP
N = 5 (every two years in 10 years); S = 186624; r = 120% or 1.2
$T_n = ar^{n-1}$ = 186624
Substituting the values,
We get a1 = 90,000

17. Ans: [d]
Original AP is --, --, 280, --, --, 400, --, --, --, --, --
New AP will be 280, --, --, 400, --, --, --, --, --,
In new AP, a1 = 280, a4 = 400, n = 4
Solving we get d = 40.
9th term in new AP is same as 11th term in old AP
So, n = 9, d = 40, a1 = 280
Solving 9thterm a9 = 600.

18. Ans: [c]
Nandhini, 3 friends, 3, ...
so excluding Nandhini it forms a G.P
a = 3 r = 3 n = 4
Sn = 3(1 – 3^4)/1 – 3
= 120 + Nandhini
= 121

19. Ans: [a]
20, 19, 18 ... 1
s20 = 20/2 (20 + 1)
s20 = 210 books

20. Ans: [b]
Let the cost of an equipment is Rs.100.
Now the percentages of depreciation at the end of 1st, 2nd, 3rd years are 15, 13.5, 12, which are in A.P., with a = 15 and d = – 1.5.
Hence, percentage of depreciation in the tenth year = a + (10 – 1) d = 15 + 9 (– 1.5) = 1.5
Also total value depreciated in 10 years
= 15 + 13.5 + 12 + ... + 1.5 = 82.5
Hence, the value of equipment at the end of 10 years = 100 – 82.5 = 17.5.
The total cost being Rs.6,00,000/100 * 17.5 = Rs.1,05,000.

SESSION – 7

1. Ans: [b]
20% of 25% of $\frac{1}{10}$ of 4000
$\frac{1}{10}$ of 4000 = 400
25% of 400 = 100
20% of 100 = 20

2. Ans: [a]
75% of the number – 50% of the number = 500
i.e., 50% of the number = 500
$\frac{1}{4}$ of N = 500
N = 2000
20% of N = $\frac{1}{2}$ X 2000 = 400

3. Ans: [e]
Let the original fraction be $\frac{x}{y}$
Numerator ↑ – 150%
Denominator ↓ – 200%
Now the fraction becomes $\frac{x+\frac{3}{2}x}{y+2y} = \frac{5}{21}$
$\frac{5x}{2(3y)} = \frac{5}{21}$
$\frac{x}{y} = \frac{2}{7}$

4. Ans: [d]
$-a - b + \frac{ab}{100} = -20 - 15 + \frac{300}{100}$
$= -35 + 3$
$= -32$
32% discount

5. Ans: [b]
60 % of $N_1 = \frac{1}{3} N_2$
$\frac{3}{5} N_1 = \frac{1}{3} N_2$
$\frac{N_1}{N_2} = \frac{1}{3} X \frac{5}{3}$
$\frac{N_1}{N_2} = \frac{5}{9}$

6. Ans: [d]
Let us assume the cost price of the article = 100
It is marked up by 25%
MP = 125
Now 2 successive discount of 10%
Total discount = $-10 - 10 + \frac{100}{100}$
$= -20 + 1 = -19$
Total discount = – 19
80 % of MP = 100 = CP
SP = 81% of MP = 100 + 1% of MP
Profit % = $\frac{SP - CP}{CP} X\ 100$
$= \frac{1\%\ of\ MP}{100} X\ 100$
Profit % = 1.25%

7. Ans: [b]
Since both section has equal number of questions (60) we can directly write
= $\frac{90+x}{2} = 80$
= 90 + X = 160
= X = 70

8. Ans: [b]
Savings = 20% of x = 1500
X = 5 × 1500
X = 7500
Total salary = Rs.7500

9. Ans: [d]
150% of 500 = 750
X ? of 700 = 960 – 750
X ? of 700 = 210
30% of 700 = 210
X = 30

10. Ans: [a]
Income of the company in 2007
$\frac{2664000}{(1.2)^2} = \frac{2664000}{1.44} = 1850000$

11. Ans: [a]
2750
50% = 1375
1% = 27.50
3% = 82.50
47% = (50 – 3)% = 1375.0
82.5
1292.5

2990
10% = 299
40% = 1196
1% = 29.9
2% = 59.8
42% = (40 + 2) = 1196.0
59.8
1255.8

1292.50 – 1255.80 = 36.7

12. Ans: [d]
Reduced price = $\frac{25\%\ of\ 160}{4} = 10$ per kg

13. Ans: [a]
$5\frac{1}{4} = \frac{21}{4} \times 100 = 525\%$

14. Ans: [c]
Let X % of $\frac{2}{7} = \frac{1}{35}$
$X = \frac{100\ X\ 7}{2\ X\ 35} = 10$

15. Ans: [c]
$16\frac{2}{3}\% = \frac{50}{3} \times \frac{1}{100} = \frac{1}{6} = 0.167 < 0.3$
$6\frac{2}{3}\% = \frac{20}{3} \times \frac{1}{100} = \frac{1}{15} = 0.067 < 0.3$
Obviously 0.3 > 0.01
The greatest is 0.3

16. Ans: [a]
$L \rightarrow \frac{3}{13}\uparrow$
$B \rightarrow \frac{b-3}{13}\downarrow$
i.e. $\frac{3}{13}\ X\ 100$
$= \frac{300}{13}$
$= 23\frac{1}{13}\downarrow$

17. Ans: [b]
$+x - y - \frac{xy}{100}$ = over all change
$+20 - 20 + \frac{400}{100} = 20 - 20 - 4$
$= -4$
4 % decrease

18. Ans: [d]
Total cost = cost per kg X quantity
Here cost per kg reduces by 20% $\rightarrow \frac{1}{5}$
[if an article decreases by $\frac{1}{n}\downarrow$
additional quantity will be $\frac{1}{(n-1)}\uparrow$]
∴ Quantity he can buy = $\frac{1}{4}x = 3.5$
X = 14kg
Original quantity he bought = 14 kg
Original cost per kg = $\frac{Total\ Cost}{Quantity} = \frac{385}{14}$ = Rs.27.5

19. Ans: [b]
Let the numbers be N_1, N_2 ($N_1 > N_2$)
$N_1 - N_2 = 1660$ (given)
$\frac{13}{2}N_1 = \frac{17}{2}N_2$
$\frac{N_1}{N_2} = \frac{17}{13}$
$N_1 = \frac{17}{13}N_2$
$\frac{17}{13}N_2 - N_2 = 1660$
$N_2[\frac{17-13}{13}] = 1660$
$N_2 = 1660 \times \frac{13}{4}$
$N_2 = 415 \times 13$
$N_2 = 5395$

20. Ans: [a]
Old income = I; Old Expenditure = E = 0.8 I
New Income = 1.40 I; New Expenditure = 0.96 I
Income (I) = Expenditure(E) + Saving(S)
∴ I = 0.8 I + 0.2 I
∴ 1.40 I = 0.96 I + 0.44 I
% increase in savings
= [0.24 I/0.2 I] × 100%
= [600/5]%
= 120%

SESSION – 8

1. Ans: [d]
Let us take the amount of ore to be x kgs.
$\frac{25}{100}\times\frac{90}{100}\times x=45$
$x=200\,kg$

2. Ans: [a]
Starting population = 1,00,000
Every year 10% increase
After 1st year = 1,10,000
After 2nd year = 1,21,000
After 3rd year (i.e., starting of fourth years) = 1,33,100

3. Ans: [c]
Price Consumption
$\downarrow\frac{1}{5}$ $\frac{1}{4}\uparrow$
$\frac{1}{4}(20)=5\,kg$ extra can be bought with the fall in price.

4. Ans: [c]
45% of men = 25% of women
Since it is given that a man will mary only one a woman and viceversa.
$\frac{men}{women}=\frac{25\%}{45\%}=\frac{5}{9}$
$\left(\frac{45\%(5)+25\%(9)}{14}\right)\times100=32.14\%$

5. Ans: [d]
Original price = Rs.100
Number of units = 100
Turn over = Rs.10000
Now, number of units = 80 (20% decrease)
Turnover = Rs.12000 (sales increased by 20%)
Price/unit = $\frac{1200}{80}=Rs.150$
Increase in price% $=\frac{50}{100}\times100=50\%$

6. Ans: [d]
$65\%\ E+82\%H+x\%S=78\%$ over all
$65+82+\frac{x}{100}\times50=\frac{78}{100}\times250$
$147+\frac{x}{2}=39\times5$
$\frac{x}{2}=195-147$
$x=96$

7. Ans: [b]
Let the exam be for 100 marks.
Pass mark = 40
A = 36 marks, B = 32 marks
Sum of A and B = 36 + 32 = 68
C should obtain 28 marks less than 68 $\Rightarrow41\frac{3}{17}\%$

8. Ans: [b]
After calculating the tax i.e., 8%, he has to pay Rs.2916.
If the reduction amount = 216 (Going by options)
2916 – 216 = 2700 (reduced price)
8% (2700) = 216
2700 + 216 = actual price

9. Ans: [a]
$x\left(1+\frac{r}{100}\right)^2=4x\left(1-\frac{r}{100}\right)^2$
Taking square root on both sides
$\left(1+\frac{r}{100}\right)=2\left(1-\frac{r}{100}\right)$
$\frac{3r}{100}=1$
$r=33.33\%$

10. Ans: [c]
From the options
From 1800, 162 is reduced
So, $\frac{162}{1800}\times100=9\%$
1638 again reducing 9% from this, results in the value 147.42.

11. Ans: [c]
3 side painted cube = 8 $(3\times8=24\,sides)$
2 side painted cube = 24 $(24\times2=48\,sides)$
1 side painted cube = 24 $(24\times1=24\,sides)$
Total = 96 sides
Since the outer exposure should be minimized out of 40 cubes, 8 cubes are placed inside 24 cubes are placed as one side painted. Remaining 8 cubes in two side painted.
Now all 3 sides painted and 16 two sides painted will be colourless so $\Rightarrow24+32=56$
$\frac{40}{96}\times100=41.6\%$

12. Ans: [d]
Assume the time as 50, 40 and 20 hours. 10% wasted is not required.
$40\%(50)=20\,hrs$
$30\%(40)=12\,hrs$
$20\%(20)=4\,hrs$
$\frac{36}{110}\times100=32.72\%$

13. Ans: [d]
Runs scored = Over × Run rate
If overs is reduced by 25% run rate will go up by 33.33 %
Hence, Australia would have scored any number of runs.

14. Ans: [b]
20% journey $\Rightarrow 24\%$ fuel is used
So for 1% journey $=\frac{24}{20}$ is used
Likewise for 25% journey $\Rightarrow 30\%$ fuel is used
Now 45% journey = 54% fuel
Remaining is 55% journey, 46% fuel can be used.

$$\Rightarrow \frac{\frac{55}{46}-\frac{45}{54}}{\frac{45}{54}}\times 100$$

$$=43.5\%$$

15. Ans: [a]
Solution = 100 ml and alcohol = 40 ml
1st vessel

$$\frac{40+x}{100+x}=\frac{1}{2}$$ So, x = 20 ml

2nd vessel

$$\frac{40+\frac{3}{5}y}{100}=\frac{1}{2}$$

$$y=\frac{100}{6}\text{ ml}$$

$$\text{Required percentage}=\frac{20-\frac{100}{6}}{\frac{100}{6}}\times 100=20\%$$

Directions for solutions Q16 to Q20:

From start 5
C = 200 B = 300
w.k.t A = 400
From last start E = 200 – 35 = 165

	A	B	C	D	E
Hand	400	300	200	100	200
Spent	360	205	190	30	35
Left with	40	95	10	70	165

16. Ans: [b]

17. Ans: [d]

18. Ans: [b]

19. Ans: [a]

20. Ans: [d]

SESSION – 9

1. Ans: [c]
A:B = 3:4, B:C = 5:6, C:D = 11:9
A:B = 15:20
B:C = 20:24
A:B:C = 15:20:24
= 165:220:264
C:D = 11:9 = 264:216
A:B:C:D = 165:220:264:216
A:D = 165 : 216 = 55:72

Aliter: $\frac{A}{B}\times\frac{B}{C}\times\frac{C}{D}=\frac{A}{D}\Rightarrow\frac{3}{4}\times\frac{5}{6}\times\frac{11}{9}=\frac{55}{72}$

2. Ans: [a]
Let the three numbers be 3*x*, 4*x* and 5*x*.
Given, $(3x)^2+(4x)^2+(5x)^2=1250$

$$(9+16+25)x^2=1250$$

$$x^2=1250/50=25\Rightarrow x=5$$

The sum of the numbers = 15 + 20 + 25 = 60

3. Ans: [d]
Given $x:y=3:5\Rightarrow x=\frac{3y}{5}$

$$x+10:y+10=5:7$$

$$7(x+10)=5(y+10)$$

$$\rightarrow 7(x+10)=5(y+50)$$

Substituting for $x, \frac{7\times 3y}{5}-5y=-20$

$$-4y=-100\Rightarrow y=25\Rightarrow x=\frac{3\times 25}{5}=15$$

Aliter: Take the choices. Added 10 to each number and checking whether the ratio becomes 5:7, the last option becomes 25:35 = 5:7.
Hence, (d) 15, 25.

4. Ans: [b]

	A's Runs		B's Runs		C's Runs
Ratio A:B	4	:	3		
Ratio B:C			3	:	6
Combined Ratio	4	:	3	:	6

∴ The ratio A:C = 4:6 = 2:3

5. Ans: [c]
Let the three number A, B, C be 12*x*, 15*x* and 25*x* respectively.
Sum of the numbers $=12x+15x+25x=312\text{(given)}$

$$\rightarrow x=6$$

A = 72, B = 90 and C = 150
∴ Difference of B and A to difference of C and B
= (90 – 72):(510 – 90) $\rightarrow 3:10$

6. Ans: [b]
Let the prices of the scooter and the television be 3*x* and 2*x* respectively.
Price of scooter – price of television $=3x-2x=6000$
$\rightarrow x=6000$
$\therefore$ The price of television set $=2x\rightarrow Rs.12,000$

7. Ans: [a]
Let the two numbers be 4*x* and 9*x* respectively.
$\therefore 9x-4x=5x=35\rightarrow$ Numbers are 28 and 63.
Therefore, product of the numbers $=28\times63=1764$

8. Ans: [a]
Let B and C together receive *x* part of the amount.
Then, A received $\frac{2}{9}x$.
$\therefore \frac{2}{9}x+x=770\rightarrow x=630$
Therefore, A's share $=\frac{2}{9}x=\frac{2}{9}\times630=Rs.140$

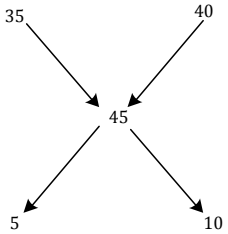
9. Ans: [a]
Let the present ages of Sita and Gita be 4*x* and 3*x* respectively.
Four years before, the ages were $(4x-4)$ and $(3x-4)$
$\therefore (4x-4):(3x-4)=2:1$
$(4x-4)=2(3x-4)\rightarrow x=2$
Therefore, the present age of Sita $=2x\rightarrow4\times2=8$ years

10. Ans: [d]
Let the amount of investment be 3x and 5x respectively.
Then on first investment total earning = (15/100) * 3x = 9x/20
On second investment total loss = (10/100) * 5x = 0.5x
$\therefore$. Net loss = 0.5x – (9x/20) = x/20
His total investment= 3x+5x = 8x
$\therefore$ His total investment on 8x total loss is x/20.
On Rs.100 total loss is $\frac{(x/20)}{8x}$ * 10 = 0.625%

11. Ans: [c]
Milk in 108 kg = 108 * (28/36) = 84 kg and water in it = (108 – 84) = 24kg.
Let x kg of water be added to it then $\frac{84}{24+x}=\frac{3}{1}$
X = 4 litre

12. Ans: [b]
24 litres of mixture contains milk = (24 * (3/8)) = 9 litres
And water =15 litres.
Therefore, new mixture contains milk = 9 + 6 = 15 litres of milk and water 15litres. Ratio is 1:1

13. Ans: [b]



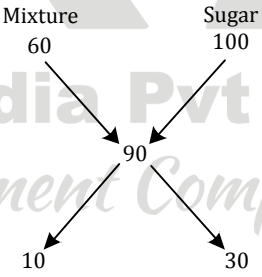
The required ratio is 5:10 or 1:2

14. Ans: [c]
$\frac{(6-25)+)4-30)}{6+4}$ = 270/10
% of milk in the mixture is 27%

15. Ans: [a]
Amount of milk left after 3 operations
= [40 * (1 – $\frac{4}{40}$)^3]
= [40* $\frac{9}{40}$ * $\frac{9}{40}$ * $\frac{9}{40}$] litres
= 29.16 litres

16. Ans: [b]
Ratio 3:1, Milk = 60 litres and water = 20 litres
(60 + x litres of milk) and 20 litres of water = 4:1
1part of water is 20 litres.
Then, 4 parts be 80 litres.
Initially 60 litres of milk was there.
20 litres of milk to be added to get the ratio of 4:1.

17. Ans: [a]
The existing solution has 60% sugar. And sugar is to be mixed; so the other solution has 100% sugar.
By Alligation method,



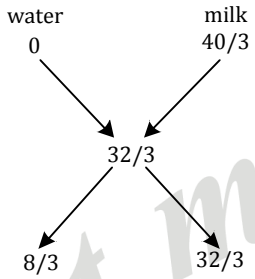
Therefore, the two mixtures should be added in the ratio is 1:3
So, required sugar = 1500 gm

18. Ans: [b]
Amount of water left in container P = p – q/3 – r/2
= (6p – 2q – 3r)/6

19. Ans: [b]
Spirit in vessel 1 = 0.6 of 3 litres = 1.8 litres
Spirit in vessel 2 = 0.8 of 4 litres = 3.2 litres

Total spirit concentration in the mixture = 1.8 + 3.2 = 5
Total mixture content = 3 + 4 = 7 litres
So water content = 7 – 5 = 2litres
Therefore, spirit/water = 5/2

20. Ans: [a]
C.P. of 1 litre of milk = Rs.(20x2)/3 =Rs.40/3
C.P. of 1 litre of water = 0
Mean price = Rs.32/3
By the rule of Alligation, we have:



Ratio of water and milk = $\frac{8}{3} : \frac{32}{3}$ = 1:4

hence, Quantity of water to be added to 60 litres of milk
= $\frac{1}{4} \div 60$ = 15 litres

SESSION – 10

1. Ans: [b]
Gents : Ladies = 2:3
G = 2L/3

$$\frac{G+20}{L}=\frac{3}{2}\Rightarrow 2G+40=3L$$

Substituting for G, $\frac{2.2L}{3}+40=3L$

$$4L+120=9L$$
$$\rightarrow L=24$$

2. Ans: [d]
book : pen = 3:2
Pen = (2/3) × book
Given, 10 books + 6 pens = Rs.63
10 books + 6 × (2/3) books = 63
1 book = $\frac{63}{14}$ = Rs.4.50

3. Ans: [c]
8 times A's share = 12 times B's share = 6 times C's share
Let C's share be *x*.

$\therefore$ B's share = $\frac{6x}{12}$ = 0.5 *x*

and A's share = $12\times\frac{0.5x}{8}$ = 0.75*x*

Therefore, the ratio A:B:C = 0.75*x* : 0.5*x* : *x* → 3:2:4
Total amount = Rs.432

$\therefore$ A gets = 432 × $\frac{3}{9}$ = Rs.144

4. Ans: [b]
Let the share of C be *x*. Then B's = *x* + 8 and A's = *x* + 8 + 7.
Sum of the shares = *x* + *x* + 8 + *x* + 8 + 7 = 53
3*x* = 53 – 23 = 30
x = 10
$\therefore$ Ratio of their shares = 25:18:10

5. Ans: [a]

	Ajay		Aman		Suman		Geeta
Rent share	8	:	15				
			5	:	8		
					4	:	5

$\therefore$ Combined ratio 8:15:24:30
$\therefore$ part of rent paid by Suman $=\frac{24}{77}$

6. Ans: [a]
Let the annual income of the men and his wife be 5*x* and 3*x* and their expenditure be 3*y* and *y* respectively.
$\therefore 5x-3y=20,000$ ... (1)
$3x-y=20,000$ ... (2)
Solving, *x* = 10,000 and *y* = 10,000
$\therefore$ Man's income $=5x\rightarrow$ Rs.50,000 and wife's income $=3x\rightarrow$Rs.30,000

7. Ans: [c]
Let the daily income of A, B and C be 2*x*, 5*x* and 11*x*.
$\therefore B-A=5x-2x=3x=180$ (given) $\rightarrow x=60$
$\therefore$ Income of A = Rs.120, B = Rs.300 and C = Rs.660
Therefore $\frac{B-A}{C-B}=\frac{180}{360}=\frac{1}{2}\rightarrow 1:2$

8. Ans: [a]
High (H) $\propto \sqrt{\text{Age}}$ (A) $\rightarrow H=K\sqrt{A}$
When $A=9, H=4\rightarrow 4=K\sqrt{9}\rightarrow K=\frac{4}{3}$
$\therefore$ When $A=16, H=K\sqrt{A}=\frac{4}{3}\sqrt{16}=5\frac{1}{3}$ ft

9. Ans: [c]
$(Q-p):(Q-q):(Q-r)=2:5:7$

$$\rightarrow\frac{(Q-p)}{2}=\frac{(Q-q)}{5}=\frac{(Q-r)}{7}=k \quad \text{... (1)}$$
$$\rightarrow p=Q-2k, q=Q-5k, r=Q-7k$$

Given, $Q=\frac{p+q+r}{2}=\frac{3Q-14k}{2}\rightarrow Q=14k$ ... (2)
Hence, $p=12k\ q=9k, r=7k$ (using (1))
$\therefore p:q:r=12:9:7$

10. Ans [d]
Old passengers : young passengers = 3:1
3*x* and *x* Total parts = 4
No. of passengers who got down in the first stop in the first step

= 16 (4 in the same ratio of old to young)
Therefore, 12 old passengers and 4 young passengers got down and 6 more young passengers got in.
Now, the ratio of old to young passengers
= (3*x* – 12):(*x* – 4 + 6) = 2:1
$3x - 12 = 2x + 4$
$x = 16$
∴ Total passengers at start = $3x + x = 4x = 64$

11. Ans: [b]
Rate of mixture
$$= \frac{(90 - x) - 80 + 75x}{90} = \frac{(150 - x) - 75 + 80x}{150}$$
x = 56.25 litres

12. Ans: [c]
Assume the volume in each container as 16 Litres
Amount of alcohol at the end of the first process = 12 litres
Amount of alcohol at the end of the second process = 11 litres.
Volume of the 1st vessel at the end of process 1 = 20 litres
Volume at the end of process 2 = 21 litres
Therefore, fractional volume = 11/21

13. Ans: [a]

Solution:	I	II	III
Total volume	2x	3x	5x
Milk: water	4:3	2:1	3:2
Volume of mixture removed}	x	2x	3x
Milk in this removed quantity}	$\frac{4x}{7}$	$\frac{2+2x}{3}$	$\frac{3+3x}{5}$
Water in this removed quantity}	$\frac{3x}{7}$	$\frac{2x}{3}$	$\frac{6x}{5}$

Total milk in the resultant mixture = $\frac{389x}{105}$
Total water in the resultant mixture = $\frac{241x}{105}$
Therefore, Milk : water = 389 :241

14. Ans: [c]
The amount of petrol left after 4 operations
$$= 200 \times \left(1 - \frac{40}{200}\right)^4 = 200 \times \left(\frac{4}{5}\right)^4$$
$$= 200 \times \frac{256}{625} = 81.92\,\text{L}$$
Hence the amount of kerosene
= 200 – 81.92 = 118.08 litres

15. Ans: [a]
Let C.P. of 1 litre milk be Re. 1.
S.P. of 1 litre of mixture = Re.1,
Gain = 50/3%.
C.P. of 1 litre of mixture = 100 x $\frac{3}{350}$ x 1 = 6 / 7

CP of 1 litre of water		CP of 1 litre of milk
0		1
	6/7	
1/7		6/7

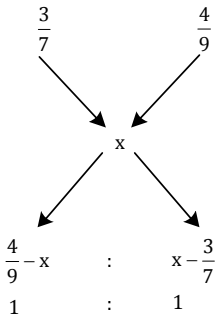
Ratio of milk and water = 1:6

16. Ans: [e]
In this case, the rate per kg of each type of pulse is the attribute while the quantity of pulses used is the weight assigned. The cost of the resultant mixture is nothing but the weighted average of the two costs.
Hence, Cost of resultant mixture
$$= \frac{(10 \times 1) + (20 \times 4)}{(1 + 4)} = \frac{90}{5} = \text{Rs.18 per kg}$$
Hence, option (e).

17. Ans: [c]
Capacity of the vessel = Quantity of milk = 72 litres.
Quantity of milk replaced = Quantity of water added = y litres.
After first replacement:
$$\frac{\text{Quantity of milk remaining}}{\text{Quantity of total mixture}} = \left(\frac{x - y}{x}\right)$$
After second replacement:
$$\frac{\text{Quantity of milk remaining}}{\text{Quantity of total mixture}}$$
$$= \left(\frac{x - y}{x}\right) \times \left(\frac{x - y}{x}\right) = \left(\frac{x - y}{x}\right)^2$$
Thus, after n replacements:
$$\frac{\text{Quantity of milk remaining}}{\text{Quantity of total mixture}} = \left(\frac{x - y}{x}\right)^n$$
Here, the replacement is done twice i.e. n = 2
Also, the final ratio of milk to water is 25:11.
So, the final ratio of milk to solution is 25:(25 + 11)
$$\therefore \frac{25}{25 + 11} = \left(\frac{72 - y}{72}\right)^2$$
$$\therefore \sqrt{\frac{25}{36}} = \left(\frac{72 - y}{72}\right)$$
$$\therefore \frac{5}{6} = \left(\frac{72 - y}{72}\right)$$
$$\therefore 360 = 432 - 6y$$
$$\therefore y = 12\,\text{litres}$$
Hence, option (c).

18. Ans: [b]
The ratio of the students who passed to those who failed in class 1 is 3:4.
Hence, 3/7th of the total students in class 1 have passed.
Similarly, 4/9th of the total students in class 2 have passed.

Also, the number of students in each class is the same.
Hence,



$$\frac{\frac{4}{9}-x}{x-\frac{3}{7}}=\frac{1}{1}$$

$$\therefore \frac{4}{9}-x=x-\frac{3}{7}$$

$$\therefore x=55/126$$

∴ 55/126 of the total students in both the classes put together passed.
∴ The passing percentage of all the students taken together = 55/126 × 100 ≈ 44%
Hence, option (b).

19. Ans: [d]
Equal amounts of each alloy are melted, the contribution to the fractional amount of each metal in the new alloy is 1/3 times its fractional amount in any of the original alloys.
∴ Fraction of copper in the new alloy

$$=\frac{1}{3}\times\frac{3}{7}=\frac{1}{7}$$

Fraction of aluminium in the new alloy

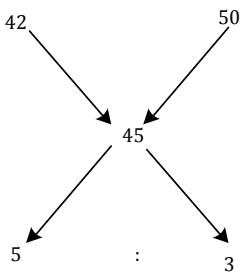
$$=\frac{1}{3}\left(\frac{2}{7}+\frac{1}{4}\right)=\frac{15}{84}$$

∴ The ratio of amount of copper and aluminium in the new alloy

$$=\frac{1}{7}:\frac{15}{84}=84:105=4:5$$

Hence, option (d).

20. Ans: [a]
The shopkeeper sells the mixture at Rs.54 per litre thereby making a 20% profit.
∴ Actual cost of the mixture = 54/1.2 = Rs.45 per litre.
∴ The amounts in which the two mixtures are to be used is given by the allegation rule shown below:



Hence, the Rs.42 and the Rs.50 variants should be mixed in the ratio 5:3.
∴ The juice costing Rs.50 forms 3/8th of the total mixture.
∴ 40 litres of Orange-La (3/8) × 40 = 15 litres of the Rs.50 variant of juice.
Hence, option (a).