TABLE OF CONTENTS

Averages:

1. Since all the total 100 elements of sets A, B, C are the natural number upto. Thus the average of these first 100 natural number is the required average.
   Avg = 1+2+3+4....100/100
   100*101/2*100=50.50

2. Except to 2 there are all the even numbers upto 100 so, the required average
   = (2+4+6+...100)-2/49
   =50*51-2/49
   =2548/49=52

3. The total value of all the 25 elements of set A
   =25*42.4=1060
   Since there are 25 prime number upto 100 in the Set A again in the Set A and C there are 50 odd number and one even number .so the sum of all the element of A and C
   = (1+3+5+7...99) +2
   = (50)22 +2=2502
   Therefore the sum of all the element of SetC
   =2502-1060=1442
   Hence, the average of the Set C=1442/26
   =55.4615

4. Hence, the average of all the element of the Set A and C
   =2502/51=49.0588

Solution for Question number 5 to 15:

SET	**NO.OF ELEMENTS**	**AVERAGE**	**LEAST ELEMENT**	**GREATEST ELEMENT**
A	25	42.4	2	97
B	49	52	4	100
C	26	55.46	1	99

5. Since the value of element which is transferred to Set B is less than 50, which in turn less the average of Set B, Hence the average of set B decreased.

6. The least possible numbers of set A. Which are greater than 50 are 53 and 59 whose average is always greater than the average of C. Hence the average of C will necessarily increase.

7. Can’t say, since we don't know which 10 number are being transferred.
Whether their average is greater, less or equal to the avg of B.

8. Definitely increases, since the avg of those num is 50 which is greater than the avg of Set A

9. The avg of those numbs is 52. hence avg of A will increase and avg of B will remain constant and the avg of c remains unaffected because Set C is not Involved.

10. Avg=2+4+6+...100/50=51
Hence the new avg of Set B decreases by 1.

11. The perfect square number of the Set C are 1, 9, 25, 49,81 hence, the avg of those number
= 165/5 =33

12. Since there is no net Change. Hence their avg is also same

13. Obviously A. Since the avg of all those 15 elements which are joining the Set A is greater than the Avg of all those 5 elements which are leaving the set A and this difference in avg is largest in companision to Set B or Set C. Even in Set C there is decrease in avg.

14. Thus absolute decrease in Set B
= (26+28+30+32...44)-(23+19+17+13+11)
=350-83=267
Hence, the decrease in total value of Se B
=2548-267=2281
New avg=2281/44 =51.84

15. There is no relevant information regarding the numbers which are being transferred from one set to another set.

16. Avg speed=total distance/total time
=200/5+10/3 =200*3/25=24 km/hr
Since for the first 100 km time required is 100/2=5hrs and for
The last 100 km =100/3=10/3

17. The avg speed =150*3/20=22.5km/hr

18. Avg bonus for 1^{st} 3 months
= $(3000/100)^2$ 2+10=910
Next 5 months= $(5000/100)^2$ 2+10=2510
Last 4 months= $(8000/100)^2$ 2+10=6410
His avg bonus for whole year=(910*3+2510*5+6410*4)/12
=Rs.3410
Hence his avg earning per month
=3410+200 =Rs.3610

19. Total price of 5 shirts =Rs[100+10*$(5)^2$ 2]
=Rs.350
Hence the avg price =350/5 =Rs.70

20. Check the option C
Total price=100+10*$(2)^2$ =Rs.140
Avg price =140/2 =Rs.70

21. Total number of passengers =10*20=200
In the 9 compartments the total number of passengers
=144(=12+13+14+15+16+17+18+19+20)
So the no. of passengers in 10^{th} coach=200-144=56

22.

	o. of 2 Wheelers	o. of wheelers	o. of 4 Wheelers
o of wheels	X *2X=4X	*X=3X	X X*4=8X

23. The average weight of eggs of first generation is k gm and the no of eggs is 'n'.
Let a1, a2, a3...an be the weight of N egg of the first generation
k=a1+a2+a3+...an/n
nk=a1+a2+a3+...an

Where a_1 is the average weight of its 'n' child eggs, a2 is the average weight of its own 'n' child eggs and so on. Child egg is referred to the egg of next generation produced by its mother egg.

a1=a1+b1+c1...n1/n

a2=a2+b2+c2...n1/n

a3=a3+b3+c3...n1/n etc

So nk= (a1+b1+c1)+(a2+b2+c2..)+ (a3+b3+c3...)/n

Therefore n^2k is the total weight of all the eggs of second generation.

Hence in the third generation total weight will be n^3k . Thus the weight of all the egg of r^{th} generation is $n^2 r k$.

Solution for Question number 24 to 27:

Before going for the final solution we need to look for fundamental concept of averages i.e., if a person of higher age than the average age of the group leaves the group, then the average age of the group decreases. Also if the person of less age than the average age of the group decreases.

Besides it we also know that the average age of the same group after k years increases by K years. 176 =148 +3+25, implies that due to 3 existing professors their total age will be increased by 3 years after one year time period and 25 years age will be added due to a new entrant in the faculty of LR.

Faculty of LR

year	No. of faculty	Avg Age	Total Age
2004	3	49.33	148
2005	4	44	176=148+3+25
2006	4	45	180=176+4
2007	4	46	184=180+4

Faculty of DI:

year	No. of faculty	Avg Age	Total Age
2004	4	50.5	202
2005	4	51.5	206=202+4
2006	4	52.5	210=206+4
2007	5	47.8	239=210+4+25

Faculty of English:

year	No. of faculty	Avg Age	Total Age
2004	5	50.2	251
2005	4	49	196=251+5-60
2006	5	45	225=196+4+25
2007	5	46	230=225+5

Faculty of Quant's:

Year	No. of faculty	Avg Age	Total Age
2004	6	45	270
2005	7	43	301=270+6+25
2006	7	44	308=301+7
2007	7	45	315=308+7

24. In the year 2006, a new faculty member joined the engine faculty.

25. The new faculty member who joined on April 1, 2005 because 27 years old on April 1, 2007.

26. From the faculty of English a professor retired on April 1, 2005

27. Age of Sarvesh on April 1, 2004=52 years+4months=52 years

Similarly age of Manish on April 1, 2004 =49 years+4months =49

Age of the third professor on April 1, 2004 =148-(52+49)=47 years

Hence the age of the third professor on Apr 1, 2009 =47+5=52 years

ALLIGATION:

1. Let x liter Pepsi is required.

6 4

9

X 15
(10 - 9) = 1 : 3 = (9 - 6)
Therefore,
x/15 = 1/3
x = 5litres.

2. Go through options.
90* 2 + 85 *4 = 520
If 2 wheelers be 90 then the four wheelers will be, 85 = (175 - 90)

3. Go through the options:
30 *50 + 50*20= 2500paisa
Alternatively:
Since the average price of a coin,
= 2500 / 80
= 31.25 paisa

$$\begin{array}{ccc} 20 & & 50 \\ & 31.25 & \\ 18.75 & & 11.25 \end{array}$$

So the ratio of no. of 20 paisa coins to the no. of 5o Paisa coins
= 18.75: 11.25
= 75:45 = 5: 3
Therefore, the no. of coins of the denominators of 50 paisa is 30.

4. Go through the option:
24* 4*+ 36* 2 =168

$$\begin{array}{ccc} 2 & & 4 \\ & 2.8 & \\ 1.2 & & 0.8 \\ 3 & : & 2 \end{array}$$

Therefore, the ratio of men and sheep is 3: 2.

5. Total quantity of mixture = 75 liter
Therefore

Milk		Water
4	:	1
16L		15L
60L		20L
3	:	1

+ 5L

6. Since the ratio of no. of female and male employees is 4: 7 so, the ratio of no. of employees must be the multiples of 11. Hence the possible answer is 231.

$$\begin{array}{ccc} 21 & & 32 \\ & 28 & \\ 4 & & 7 \end{array}$$

7. Since the ratio of car sold at profit of 9% to the 36% is 19: 8. Hence the no. of cars sold at 36% profit is 32.

$$\begin{array}{ccc} 9 & & 36 \\ & 17 & \\ 19 & & 8 \end{array}$$

8. Hence each girl receives 50 paisa and each boy receives 10 paisa and the average receiving of each student
= 6900 / 115 = 60 paisa

$$\begin{array}{ccc} 50 & & 100 \\ & 60 & \\ 40 & & 10 \\ (G)\ 4 & : & (B)\ 1 \end{array}$$

Thus the no. of girls = 92,
Number of boys = 23

9. Profit = 12.5% = 1/8
Hence the ratio of water to spirit is 1: 8
Since the ratio of water to spirit is 1: 8
Since profit% = profit = (profit / cost)*100

10.

$$\begin{array}{ccc} 20 & & 50 \\ & 30 & \\ 20 & & 10 \\ 2 & : & 1 \end{array}$$

since the ratio of 20% wine to 50% is 2:1,
it means there is 2/3 wine which is replaced with wine in which the concentration of spirit is 20%.

11.

$$\begin{array}{ccc} 16 & & 24 \\ & 19 & \end{array}$$

5 3

Thus the cost price of Indian factory is Rs.45 crore. Therefore the selling price of Indian factory is

= 45 + (45 * 16) / 100 = 52.2 crore

12. Milk Water

80% 20%

4 : 1

20L +175 L

20 L 180 L

10% 90%

1 : 9

13. Profit % = 9.09% = 1/11

Since the ratio of water and milk is 1: 11,

Then the ratio of water is to mixture is 1: 12

Thus the quantity of water in mixture of 1 liter

= 1000 X 1/12 = 83.33 ml

14. The selling price of mixture = Rs. 75

The cost price of mixture = Rs. 60

Now we know that if he mixes the spirit (worth Rs.40) with petrol (worth Rs. 60) the cost price of mixture must be less than Rs.60, which is impossible. Hence there is no spirit with the petrol.

15. -6 15

9

6 15

2 : 5

Thus the ratio of B/W TV sets to the no. of color TV sets is 2:5

Therefore, no. of B/W TV sets = 90

16. Since we do not know either the average weight of the whole class or the ratio of no. of boys to girls.

17.

The S.P of Desi Chai = Rs.18

The S.P of Videshi Chai = Rs. 30

The C.P of Desi Chai = Rs. 20

The C.P of Videshi Chai = Rs. 25

The S.P of mixture = Rs.27.5

The C.P of mixture = Rs.22

20 25

22

3 : 2

Therefore the ratio of Desi Chai is to Videshi Chai is 3:2.

18.

16.66 18.75

17.5

(Boys) x (girls) y

(50/3) *(4/4) (75/4) *(3/3)

(35/2) X (6/6)

x y

200/12 225/12

210/12

10/12 15/12

3 : 2

Thus the no. of girls = 16, and no. of boys = 24.

19. W_1**:** A_1 W_2**:** A_2 W_N**:** N_N

2: 3 4: 5 5:7

$(W_1/W_1+A_1)=2/5$ $(W_2/W_2+A_2)=4/9$ $W_N/(W_N+A_N)=5/12$

= 72 / 180 = 80 /180 =75/180

72/ 180 80/180

75/180

5/180 3/180

5 : 3

Therefore the ratio is 5:3.

20. Since the average marks of sections B and C together are equal the average marks of all the four sections (i.e., A,B,C and D), therefore the average marks of the remaining two sections A and D together will also be equal i.e. 60%

45   80

         60

20   15

4   :   3

Hence the required ratio is 4: 3

21. Wine   Water

8L   32L

1   :   4

20%   80 %(original ratio)

30%   70% (required ratio)

Hence the percentage of water being reduced when the mixture is being replaced with Wine. So the ratio of left quantity to the initial quantity is 7: 8

Therefore (7 / 8) = [1 – (K / 40)]

7/8 = [(40 – K) / 40]; K = 5litres.

22. Therefore no. of boys: no. of girls = 13: 27

20   30

         23.25

6.75   3.25

27   :   13

23. Since, there is insufficient data

24. Milk   water

74 %   26% (initially)

76%   24 %(after replacement)

Left amount = initial amount (1- replaced amount/total amount)

24=26(1- 7/k)

12/13 =(1-7/k)

1/13 =7/k;   k= 91 liter

25.   6   x

         15

6=2k   3k=9

Therefore x=21 %

26. Copper in 4 kg = 4/5 kg

	1st alloy		2nd alloy	
	Iron	Copper	Iron	Copper
	4	3	6	1
Proportion of iron in the alloys	4/7 ⇩ *2 8/14		6/7 ⇩ *6 36/42	

And zinc in 4 kg = 4*4/5=16/5 kg

Copper in 5 kg = 5*1/6=5/6kg

And zinc in 5 kg = 5*5/6=25/6 kg

Therefore copper in mixture = 4/5+5/6 = 49/30kg

And zinc in mixture = 16/5+25/6=221/30 kg

Therefore the required ratio = 49:221

27) Milk   water

9   :   1

405 L   45L

             +90L

405L   135L

3   :   1

28) Petrol: Kerosene

3:2(initially)

2:3(after replacement)

Remaining (or left) quantity / initial quantity= (1 – (replacement quantity/ total quantity))

(For petrol) 2/3 = (1 – 10/k)

⇨ 1/3 = 10/k

⇨ K=30 liter

Therefore, the total quality of mixture in the container is 30 liter

29) $9/25 = (1- (6/k))^2$

3/5 = (1-(6/k))

k = 15 liter

<u>Ratios and Proportion and Variation:</u>

1. Ratio of copper to iron=12:44=3:11hence (d)

2. P+R=340

2P+4R=1060

Solve these two equation and you will get the Answer. Option (b)

3. By the replacement formula

(1701+27)=1728 unit of kerosene and the decreased amount of kerosene is 27 units.

$27=1728(1-6/k)^3$ 3

k=8 liter

4. The value of 25 liter does not matter the basic thing is that the amount of mixture in all the quantities is same

So the total quantity of milk in mixture = 105=56+80=241

So the total amount of water in mixture [(3*140)-241]=179 liter

Therefore ratio of water to milk in the new mixture=179:241

5. Profit = 331/3% it means cost price =Rs.15

By alligation:

(X+7)-15/ (15-x)=3/4

⇨ x=11

So x=11 and (x+7)=18

Thus the total value of the prices=11+18=29

6. A1 Copper=1/4

A2 Copper=2/7

Required copper=3/11

So required ratio is 4:7

Since it is clear from the above values (1+2=3 and 4+7=11)

7. Ratio of W1 M1=1:3

W2 M2=2:3

W3 M3=2:5

Proportion of water 1/4:2/5:2/7

35/140:56/140:40/140

Now since all these three mixtures are mixed in the ratio of 2:3:5

Therefore new ratio =

35/140*2/2:56*3/140*3:40*5/140*5

=70/280,168/420,200/700

Now the amount of water=70+168+200=438+the amount of milk= (280+420+700-438=962

Ratio of milk to water=962:438

8.B1:B2:B3=3X:4X:5X

Again B1:B2:B3=5y:4y:3y

5x=3y

hence 3x:4x:5x

9y/5:12y/5:15y/5=9y:12y:15y

5y:4y:3y

25y:20y:15y

Increases in first basket=16

Increase in second basket=8

So the ratio =2:1

9. Amount of Alcohol in first vessel=0.25*2=0.5litre

Amount of alcohol in second vessel=0.4*6=2.4litre

Total amount of alcohol out of 10 liters mixture is 0.5+2.4=2.9 liter

Hence the concentration of the mixture is 29 %(2.9/10*100)

10. Assume the weight of Alloy A is 100 kg

	Gold	Silver	Copper
A	40kg	60kg	0kg
B	140kg	160kg	100kg
total	180kg	220kg	100kg

The weight of Alloy B is 400 kg

Ratio of gold and silver in new alloy =180/500:200/500=36%:44%

11. Urea Dia

N P K N P K

x y 0 20% 70% 10%

Mixture

N P K

26% 68% 6%

This 6% of K is obtained only from Dia.

Urea Dia

N P K N P K

x y 0 120 420 60

Mixture

N P K

260 680 60

$N_U + N_D = N_M$ ⇨ $N_U + 120 = 260$

N= Nitrogen, P=Phosphorous

and $P_U + P_D = P_M$

$P_U + 420 = 680$

U,D,M = Urea,Dia and Mixture

Amount of Nitrogen in Urea=140

And amount of Phosphorus in Dia =260

Ratio of N : P = 7:13

⇨ 35:65

⇨

12. Copper 2/9=4/18

Copper 5/9=10/18

By alligation:

Amount of X=1/6*42=7kg

And amount of Y=5/6*42=35kg

13. Copper in first alloy=1/3

Copper in second alloy=3/4

Copper in required alloy=2/3

By Alligation 1:4

Therefore second alloy be mixed 4 times the first alloy.

14. Note in this type of question individual price does not matter. To prove this solves it algebraically.

Exchanged amount=3*150+5*90/2*(3+5)=450/8 =56.25litre

Here 3 and 5 are obtained from the ratio of amounts i.e from 90 and 150.

15. Here the Ratio of mixtures (i.e., milk, water) does not matter. But the important point is that whether the total amount (either pure or mixture) being transferred is equal or not. Since the total amount (i.e., 5 cups) being transferred from each one to another,hence A=B.

16. Cp.of rasgulla =Rs.9

By Alligation

(9-3x)/7x-9) =3/5

X=2

So the price of sugar=7X=Rs.14 per kg.

<u>**Percentage:**</u>

1. Total Students

Boys (60) Girls (40)

Hockey Badminton Badminton Hockey

(24) (Don't Know) (0) (30)

Since we do not have information that whether the rest of the boys playing badminton or not. So we cannot determine the total no. of students who are not playing any of the two games.

2. Go through option. Let us assume option (C)

10 = 2*5 =5*2=1*10*10*1

Consider the proper fraction 2/5

[Since the given percentage values are 25% and 20% that's why we have picked up option (C)].

2/5 $\longrightarrow$ 4/5 $\longrightarrow$ 5/20

To verify: 2/5*5/8 = ¼ = 5/20

Hence, presumed option is correct.

Alternatively:

x/y $\longrightarrow$ x^2/y^2 $\longrightarrow$ 1.25 $x^2/0.8y^2$ $=25x^2/16y^2$

Now since $25x^2/16y^2$ = (5/8)* (x/y)

x/y =2/ 5

3. Income = Expenditure + savings

8x = 5x + 3x

-x

10 x= 8x + 2x

Now the Deficit = (3x-2x) = x = 3500

The new salary = 10 x = 35000.

4. Go through the options

2457 – 2143 = 314

Again (2457+2143)+41 = 4641

Now 4641/0.85 $\longrightarrow$ 5460

Again 5460*45/100 = 2457

Hence the presumed option is correct.

Alternatively: Let there be total x eligible voters and the number of votes goes to loser is k then

0.85x-41 = 2k + 314

K +314 = 0.45x

Therefore x= 5460

Then 5460 * 0.85 = 4641

Again 4641 – 41 = 4600

Again k+(k+314)=4600

K=2143(loser)

And k+314 = 2457(winner)

5. Income $\rightarrow$ 4 4.4 4.8 5.2] 18.4 Lakh

Saving ⟶ 2 1.76 1.44 1.0] 6.24 Lakh
Exp. ⟶ 2 2.64 3.36 4.16] 12.16 Lakh
So, 6.24/12.16 * 100 = 51 6/19%

6. Let there be x voters and k votes goes to the loser then
0.8x – 120 = k + (k + 200)
K + 200 = .41x
K=1440.
And k + 200 = 1640
Therefore 1440/3200*100 = 45%.

Solution for 7-9:

P+R= 30,000 ……. (1)
N= R – 8000 ……. (2)
(R+N)=233.3(P)
⇨ 3(R+N)=7P
6r-7p=24,000 ……(3)
R=18,000
P=12,000
N=10,000

7. $\frac{P+R+N}{3} = \frac{40,000}{3} = 1333.33$

8. Can't determined

9. (8/10)*100=80%

10. (Bonus) commission=$\frac{20*10,00,000}{100} = 2$ lakh
But total profit=net profit+ (10/100)* net profit
1.32 lakh = 1.1 x net profit
Net profit = 1.2 lakh= 1,20,000
Commission = total profit – net profit
= 1, 32,000 – 1, 20,000 = 12,000
Total earning = 2, 00,000+12,000
= 2, 12,000

11. Let Mr.Scindia has x shares of 5.5%
X*92=32,200
X=350 shares
Income = 350 * 5.5 = 1925
Now, after investment his income is
$\left(\frac{1}{3} * \frac{32200}{92} * 4.5\right) + \left(\frac{2}{5} * \frac{3220}{115} * 5\right) + \left(\frac{4}{5} * \frac{32200}{56} * 6\right)=$
525+560+920=2005
Profit = 2005 – 1925 = Rs. 80

12. The surface area of cube = 6a² = 6*(side)²
New surface area= 6 * 1.44 a²

$$\frac{0.44a^2}{a^2} * 100 = 44\%$$

Solution for 13 and 14:
Pati -> Pt, Pani -> Pn, Who -> W
(Pt+Pn)=2W ………… (i)
(Pn+W) =4Pt ………… (ii)
Solving equation (i) and (ii) we get

$$\frac{Pn}{W} = \frac{7}{5} \quad and \quad \frac{Pt}{W} = \frac{3}{5}$$

Pt : Pn: W= 3:7:5
Again (Pt +Pn) = 2W …..(iii)
(Pn+W)*7=8*Pt …..(iv)

Therefore $\frac{Pn}{W} = \frac{3}{5}, \frac{Pt}{W} = \frac{7}{5}$
=> Pt: Pn: W = 7:3:5
Gain of pati = 7x-3x = 4x = 800
X=200

	Patti	Patni	Who
Amount at the beginning of Game	600	1400	1000
Amount at the end of the Game	1400	600	1000

13. Only patni has suffered the loss

14. $\frac{1400-600}{1400}$ * 100 - 57.1428%

15. RM+MC = Total Cost
Total cost + Profit = sale price
70+30=100 100+10 =110
+80%
84+42=126 126+72 =198
Therefore profit % = (72/126)* 100 = 57.14%

16. A+B+C+D=56
B+C+D= 4.6 A
A+B+C+D= 5.6A

56 lakh = 5.6A

⇨ A=10 lakh

Similarly A +C+D = 11B/3

⇨ A+B+C+D = 14B/3

⇨ B = 12lakh

Similarly 4(A+B+C+D) =C

⇨ A+B+D = 2.5 C

⇨ A+B+C+D = 3.5 C;C= 16 lakh

Therefore D= (A+B+C+D) – (A+B+C) = 18 lakh

17. Losing candidate =0.3 x

∴ Other two candidates= 0.7x

The share of winding candidate = 0.36 x

And the second ranker = 0.34

∴ Margin (min. possible) = 0.02 x

⇨ 2% of x

Let the minimum possible voters be 50 then
(2*50)/100 =1
The minimum possible margin of votes = 1

18.

Day	Initial Amount	Sales	Remaining Overnight	Rotten	Stock For next day
1	x	0.5x	0.5x	0.05x	0.45x
2	0.45x	0.225x	0.225x	0.0225x	0.2025 x
3	0.2025x	0.10125 x	0.10125x	0.010125x	

Total rotten amount = 0.082625x = 1983

X = 24000

19. Check through option

Alternatively:

Let the initial amount be x(with gambler),

Then {{(x+100)1/2+100}1/0+100}1/2+100}1/2 = x/2

X=700/3

20. Non defective products

25 * 0.98 + 35*0.96 + 40*0.95/100*100=96.1

21.

No of machine	Output	Manf. Cost	Est. cost	Total Cost	Profit
12	48,000	24,000	10,000	34,000	14,000
11	44,000	22,000	10,000	32,000	12,000

Profit = output – Total cost

= 44,000 – 32,000 = 12,000

Initial value of shareholders = 14,000 * 10/100
=1400

Changed value of shareholders = 12,000*10/100
= 1200

% decrease = 200/1400 *100 = 14.28%

22.

Rice	Wheat
25	9
*x	*5x
25x	45x

70x=350.X = 5.

Hence the price of rice = Rs.5 per kg.

Price of wheat = Rs 25 per kg.

Now the price of wheat = Rs 30 per kg

Let the new amount of rice be M kg,

Then M * 5+9*30=350; M = 16.

Hence decrease (in %) of amount of rice
= 25-16/25*100 = 36%

23.

Year	Rate of commission	Commission in values
1	20% 25%(bonus)	0.2*20,000=4000 .25*4000 =1000
2	16%	.16*20,000 = 3200
3	12%	.12 *20,000=2400
4	10%	0.1*20,000 =2000
5-10	4%	6*0.04*20,000=4800

Total commission
=(4000 + 3200 + 2400 + 2000+4800)+ (1000)
=17,400

24. Since we don't know the number of female employees in the Texas office this year so we can't determine

25. 1100+600=1700

26. There is no need to use the no. of goats i.e., (34, 398) let initially there be 1000 goats then
1000 → 1400 → 980 → 1247 → 1146.6
Thus the % increase=(1146.6 – 1000)*100/1000
=14.66%

27. In 2002 (980 goats) as per the flow chart

Optional	science	Commerce	Engineering	Total
	5000	3000	8000	16,000
Finance	1000	1200	680	2880
HR	1600	720	1040	3360
Marketing	2400	1080	6280	9760

28. 6280 students engineering opted marketing

29. (720 * 100)/ 16,000 = 4.5 %

30. Marketing, since maximum students have opted marketing.

31. Consider some values and then verify the option.

32. Go through option :

700
↓
91%=(100-9)%
↓
637
↓
80%
↓
509.6 =510 persons
↓
70 % (completely cured out)
↓
357
↓
(partially cured) 153 = (510 – 357)
Hence, the presumed option is correct.

33. Total expenditure per kg= 3.2+1.8 +2+3 =10 = cost price
Selling price = Rs. 18 (per kg)
Gross profit = Rs. 8 per kg =(18-10)
Net profit =8*(80/100)
(since 20 % is tax) = Rs. 6.4
Hence the net profit of the factory
6.4 * 50,00,000 = Rs. 3,20,00,000 = Rs. 3.2 crore

34. Let the percentage marks in
QA= (10 a + b) %
Let the percentage marks in DI= (10 b+a)%
Let the percentage marks in VA =x%
Then ((10a+b)+x+(10b+a))/3=x
11a+11b+x=3x
X=11*(a+b)/2

35..P_1 = k (T/V)
P_2 = k (1.4 T/0.8) = k (7T/ 4V)
(P_1 - P_2)/ P_1 = ((7/4) (T/V) – (T/V)) / (T/V)=
((3/4) (T/V))/(T/V) = 3/4
Hence, the new pressure will be increased by 75%.

36. 20 * 0.92 => 10 minutes.
$$\frac{23*40*0.90}{20*0.92} = 45$$
Thus the required time is 45 minutes than the previous time
Hence, 450 minutes = 7(1/2) hrs

37. Original volume = 16 * 12 * 5 = 960 $(\text{inch})^3$

Required capacity = 1120 $(\text{inch})^3$

Increased in area = (1120/5) – 16 *12

= 224 – 192= 32 $(\text{inch})^2$

% increase = (32 /192) * 100 = 16.66%

38. The total passengers in each compartment = 25 * (7/5) = 35

Total no. of seats = $(35)^2$ = 1225

Maximum available capacity = 1225 * 80/100 = 980 seats

39.

	Tata	Reliance
Prepaid	100	81
Post paid	90	72

Thus the % decrease in talk time = (90 – 72) /90*100 = 20%

40. Half Year Exam

100

Pass(70) Fail (30)

Annual exam

$\underbrace{70 * 0.6}_{42} + \underbrace{30 * 0.8}_{24}$

Total pass in annual exam= 42+24 = 66

41. The percentage of passed students = 68% [100-32] %

Number of girls passed the exam = 408

Number of boys passed the exam = 476

Total passed students = 884

Therefore total no. students =(884/68)* 100 = 1300

Solution for 42-45:

Name	Horse	Chariot	Land	Total (in Rs.)
Ram	2 lakh (10)	80,000 (10)	20 acre=1 lakh	3.8 lakh
Sita	1.6 lakh (8)	80,000 (10)	8 acre = 40,000	2.8 lakh
Laxman	1 lakh (5)	2 lakh (25)	20 acre= 1 lakh	4 lakh
Urmila	1.4 lakh (7)	40,000 (5)	16 acre = 80,000	2.6 lakh

R+S = L+U and R.S and L>U

Horse (R+S):(L+U)= 3x:2x= 18x:12x

Again Ram have 1/3 rd horses

Therefore 30x*(1/3) =10x

Therefore the horse of sita = 18x – 10x = 8x

⇨ X=1

Therefore the horse of ram = 10 and Laxman =5

No. of chariots of Sita = No. of chariots of Ram = k/5

⇨ And no. of chariots of Laxman = k/2

Hence the no. of chariots of Urmila = k-(k/5+k/5+k/2)= k/10

⇨ Again k/2 – k/10 = 20
⇨ K = 50 chariots
⇨ Now the 50% property of laxman = 25 chariots = 2,00,000
⇨ Hence the total property of Laxman = 4,00,000
⇨ Thus the area of Land of laxman = (2,00,000 – (5* 20,000))/5000
⇨ Total property of urmila = 1, 40,000 + 40,000+ 80,000 = 2,60,000
⇨ Thus the total property of Laxman and Urmila = 6.6 lakh

42. 3.8 – 2.6 = 1.2 lakh

43. Value of chariots of laxman = 2 lakh

44. Now since only ram has the horses of worth Rs. 2 lakh. So only Ram can exchange with Laxman.

45.(7.2-6.0)*100/6.0 = 20%

46. Total cubes 160+56=216

Therefore the side of cube = 6 unit

No. of cubes without any exposure = $(6-2)^3$ = 64
Thus 64 cubes will be inside of the big cube
Now rest of the cubes =160 – 64 = 96
Again the No. of cubes with one face outside = 6* (4*4) = 96
Hence the required percentage = (96* 100)/216 = 44.44%

47.

(Qualified CAT)

↓

X boys and x girls

↓

(Qualified G.D)

↓

0.4 x boys

↓

(interview)

IIM –A	IIM-B
[0.2x	0.2x] appeared
↓	↓
Qualified	Qualified
↓	↓
0.8*0.2x	0.4 * 0.2x
= 0.16x	=0.08x

Total boys qualified the final stage = 0.24%
Thus 0.24 x = 24
⇨ X=100

48. Go through option and consider some appropriate values
p/(100+p)=q/100;
100(p-q)=pq;
(p-q)=pq/100

49. Let the original price be P, then the decrease in value of after first cycle
$=p*(x/100)^2$ = 21205 …..(i)
Again the final value after second cycle
P*(1+(x/100))(1-(x/100))(1+(x/100))(1-(x/100))= 484416
$P[1-(x/100)^2]^2$ = 484416
Dividing equation (ii) by equation (i)
$1-(x/100)^2/(x/100)$ = 48/10
Let x/100= k, then
$1-k^2/k$ = 48/10
K= 5 or -1/5
So x=20%
Hence, $p(x/100)^2$ = 21205
From (i) p=525625

50. Men * time =work

Men	*	time	=work
100	*	1	= 100 unit
150	*	1	= 150 unit

Extra power required = 50
But since new workers are 5/4 times as efficient as existing workers.
Actual no. of workers =50/(5/4)=40 men
Hence required % = 40*100/100 = 40%

Profit Loss and Discount:

1. Just a sitter but a logical problem.
CP of 5 bikes = 67500 + 232500 = 300000
Now, since we require 17.5% profit, so
SP = 300000 x (117.5/100) =Rs. 352500

2. CP = 100, SP (with tax) = 120
New SP = 100 – 5 = 95
Therefore, Effective discount = 120 - 95 = 25
So, at SP of 95 → discount = 25 and at SP of 3325 → discount = 25/95 x 3325 = 875

3. Let the CP of a bicycle = Rs. 100
Now, since profit 140%
Therefore, SP = 240
Now, 7 bicycles are being sold instead if 1 bicycle, but the sale price of new bicycle = Rs. 120
Therefore total sale price of new sale of bicycles = 7*120 = 840 and the CP=7*100 =700
So, the new profit = 840 – 700 = Rs. 140
Since the initial profit is same as the new so there is no increase in percentage.

4. **CP** **SP** **MP**

$$100 \xrightarrow{32\%} 132 \underset{-12\% = (12/100)\downarrow}{\overset{12/88\uparrow}{\rightleftarrows}} 150$$

[From percentage change graphic]

5. Linc pens Cello pens

CP: SP CP: SP

37: 50 37: 24

Profit % = (13/37) x 100 and

Loss % = (13/37) x 100

Since Profit = Loss

Hence option (d) is correct.

6.

SP	A	B	C
	8	9 :	5
	1/7 ↑ ↓ 1/8 :	1/8 ↑ ↓ 1/9 :	1/4 ↑ ↓ 1/5
	7	8	4

Since 14.28% = 1/7

So, the ratio of profit percentage of

A		B		C
8	:	7	:	14
↓		↓		↓
1/7		1/8		1/4

Thus the ratio of CP of A : B : C

7: 8: 4

$$\% \text{ profit} = \frac{(8 + 9 + 5) - (7 + 8 + 4)}{(7 + 8 + 4)} * 100$$

= (3/19) x 100 = 15.78%

7.

		A	B		C	M
CP	→	100	120	132	(120 + 12) = 132	
SP	→	120	132	120		143
CP	→	143 ←				

Loss of A = 143 – 120 =23

% loss of A = (23/100) x 100 = 23%

8. Total wages = no. of employees x wage per employee

60xy = 3 x * 20y

54xy= 2x * 27y

Profit (%) = (60-54) / 60 x 100 = 10%

9. If I had Rs. 100

Discount = 25 = cost of my sister's watch

Then cost of my own watch = 75

Thus the ratio of cost of my own watch to that of my sister's watch = 3: 1

10. Ratio of profit of A : B

(Excluding commission of A) = 3: 5

Now the share of profit of B =3600–1800=Rs.1800

So the share of profit of A (including commission) = Rs. 1080

So the commission of A = 1800 – 1080 = 720

Then the required % = (720 x 100) / 3600 = 20%

11. Profit % = 25/100 = (120 + k)(Profit) / 880 (save) → K = 100

Therefore, net profit % = (100 x 100) / 1000 = 10%

12. SP = 12/ 11 of CP

48 = 12/11 of CP → CP = 44

Now, by allegation

48 k

44

12 3

4 : 1

K = 28

Thus, the price of brand is Rs. 28/liter.

13.

	A	B	C
Investment	3x	4x	5x
Rate of return	6y%	5y%	4y%
Return	18xy/100	20xy/100	20xy/100

Total = (18 + 20 + 20) = 58xy/100

B's earnings – A's earnings = 2xy/100 =250

Total earning = 58xy/100=7250

14.

MP	After first discount	After second discount
100	90	85.5

So the net discount= 100 – 85.5 = 14.5%

15. MP CP total CP

100 —— 80 —— 72 —— 79.2

-20% -10% +10%

SP= 125% of CP

SP=1.25*79.2

SP=99

So, initially market price=100 $\longrightarrow$ 8, 00,000

Final sale price = 99 $\longrightarrow$ 7, 92,000

16. Price of 10 chairs = 10*200=2000

Price of 12 chairs (without discount)=

12*200 =2400

Price of 12 chairs with discount

= 10*200 + 2*80= 2160

Therefore discount= 2400 – 2160 = 240

Hence discount % = (240/2400) *100 = 10%

17. Amount paid in 1st service = 100 (suppose)

Amount paid in 2nd service=90

Amount paid in 3rd service=81

Amount paid in 4th service=72.9

Amount paid in 5th service= 60

Total amount paid 403.9

Discount = 500-403.9=96.1

Discount % = 96.1 *100/500=19.42%

18. Consider some proper value and check out.

19. CP: SP 3: 4

Profit on 3 apple =Re1(consider CP = Re 1)

Profit = 33.33%

And discount = 11.11%

Since CP SP MP

3 4 4.5

(a) (0.5)

Profit is double that of discount

So, the percentage point difference =

33.33% - 11.11% =22.22%

20. Total cost of 4 cars = 1+2 = 3 lakh

Total SP of 4 cars = 3 * 1.5 = 4.5 lakh

SP of 1 car = 1.2 lakh

SP of rest 3 cars = 4.5 -1.2 = 3.3 lakh

Average SP of all the 3 cars=1.1 lakh

21. Setup cost = Rs. 2800

Paper etc. = Rs. 1600

Printing cost = Rs. 3200

Total cost = Rs.7600

Total sale price = 1500*5 =7500

Let the amount obtained from advertising is x

then (7500 + x) – 7600 = 25 % of 7500

X=1975

22. Charge of 1 call in February= 350/150 = 7/3

Charge of 1 call in March = (350 + 50 1.4)/250

= 420/250 =42/25

% cheapness of a call in March =

((7/3)-(42/25))/ (7/3) *100 = 28%

23. Let the CP be 100 and % markup be k% then

MP=100+k

K%

100 ⌒ (100+k) MP (also expected SP)

But actual SP =(100+k)/2

((100+k)/2)/k= 200/(3*100)=66.66%

K=300

Therefore CP MP (initially)

100 400

Finally SP = (400/2)

Discount = (200/400)*100 = 50%

24. Let the CP and SP of 1g = Re 1, then

He spends Rs. 2000 and purchase 2200g and he charges Rs. 2000 and sells 1800g

Profit (%) = goods left / goods sold *100

= 400*100/1800= 22(2/9) %

25. Fresh Grapes ➔ Water (80%): Pulp (20%)

➔ 4:1

Dry Grapes ➔ Water (25%): Pulp (75%)➔1:3

So (5 kg: 15 kg) out of 20 kg of dry grapes

Thus to make dry grapes similar to the fresh grapes, Akram requires 55 kg of water with 20kg of dry grapes.

Profit (%) = (55/20)*100=275%

26. Let the total profit be Rs 100.

Amount left after donation = 80,

Amount left after reinvestment = 20

Now, (5x/8)-(3x/8) =1200

Where x is the amount left after reinvestment

(2x/8) =1200➔ x=4800

Total profit = 48000*5=24000

27. Total cost = Rs 50000, Total sales price or Revenue = 2000*9+6000*10=78000
Profit (%) =2800/50000 *100 = 56 %

28. Maximum possible profit = maximum possible difference in s.p and c.p
It means SP be maximum and CP be minimum =
CP (min) =Rs 399
19 m =399
➔ m is an integer
SP (max) =Rs 697, which is close to 699. Here 697= 17k, k is a positive integer.
So the maximum profit is = 697-399= Rs 298

29. Total C.P= 1000*1.2= Rs 1200
Expected Selling price = 700*x=1200*1.1666=1400
X=Rs 2 per day.
Real selling price = 750*2 =Rs 1500
Profit = Rs 300, profit (%) =(300/1200) * 100= 25%

30. Chandhary's Profit = 10 %, Anupam's profit = 20 %, Bhargava's Profit = 25 %
100(20%)➔120(25%)➔150(10%)165
B: D = 120:165➔ 2040:2805 (both are 17 times greater).

31. From the statements it is clear that he purchases 119$ instead of 100 g and he sells 85 g instead of 100 g. Therefore in this whole transaction he saves 19+15=34g
Profit = (34/85)*100= 40%

32. You must know that the company is able to deliver only 90% of the manufactured pens .So k be the manufacturing price for a pen.
Total income (including 25 % profit)=(8000*k)*1.25 also this same income is obtained by selling 90 % on the manufactured pens at Rs 10 which i9s equal to 7200*10
Thus, (8000*k) 1.25 = 7200 *10
k=Rs 7.2(90% of 8000 =7200)

33. Let the number of diaries (produced) be 100 and the price of the diary be Re 1 then.
Total cost incurred = 100* 1 = 100
Total sale price = 32 * 0.75 +60 *1.4 =108
Profit = Rs 8
Thus there is 8% profit.

34. Let the number of sweets be 100 and C.P of one piece of sweet = Re 1.
Total cost price = 100*1=Rs 100
Total Sale price = 40*1.4+30*1.2+30*1.05=123.5
Profit (%) = 23.5 % (=123.5-100)

35. C.P= 500, S.P = 576, M.P = 900
Again S.P = MP $[(1\text{-}r/100)^2]$
$576=900*(1\text{-}r/100)^2 2$
24/30= (1-r/100)➔r=20%
Again new SP = MP$(1+r/100)^2$
=900*(1+20/100)^2➔1236
Profit % = (1296-500)/500 *100 = 159.2 %

36. Consider actual price of 1 g goods = Re 1, then he sells product equal to Rs 90 only.
Again M.P = Rs 1.8 and S.P= 1.35 for 1 g
Thus he gives the goods worth Rs 90 and charges Rs 135 after 25 % discount .
Thus the profit %= (135-90)/90 *100 = 50 %

37. CP =100/120=10/12
S.P = 135/90=3/2=18/12
Profit % = (18/2-10/12)/(10/12) *100 = 80 %

38.Let the actual Cost price of an article be Rs 1 .
Now he purchases goods worth Rs 120 and Pays Rs 80.
CP = 80/120=2/3
MP=180,Sp= 135 .
Thus the trader sells goods worth Rs 90 instead of 100 g and charges Rs 135.Therefore the effective SP = 135/90=3/2
Profit (%) = (3/2)-(3/2)/(2/3) *100 = 125 %

39. Anjuli ➔ 100-20=80-5=76
Bhomika ➔100-15=85-10=76.5
Chawla ➔100-12=88-13=76.56
Maximum discount is availed by Anjuli.

40. CP of one egg (in 1 st case) = 1/3 =33.33 paise
CP of one egg (in 2nd case)=1/6=16.66 paise .
Average CP of one egg = (33.33+16.66)/2
=25 paise
SP of one egg =200/9

Loss % =25-(200/9)/25 *100 =11.11 %

41. The question is based on fundamental concept of percentage

Virendra $=CP_v \xrightarrow{P\%} SP_v$

Q% ←

Gurindra $= CP_G \longrightarrow SP_G$

CP(v)=CP(g) and SP(v)=SP(g)

P is not equal to Q.

P % of CP(v)= Q % of Sp (g)

Q= 41(2/3) % of p =(125/3*p/100)➔p/100+p * 100

p/100+p * 100=125/3*p/100 ; p=140

CP=100 when SP = 2140

Again Sp for Amrindra = 240+140%of 240 = 576

42. Let the CP of one article be Rs 1

SP be Re 1.25

Again, the new SP be (1.25)*1.2 = 1.5

If he sells 100 articles, CP=100*1=Rs 100

SP=100*1.25 =Rs 125

Now S.P =75*1.5 =112.5 , Profit % = 12.5 %

43. By Replacement Formula

80/120=100/120(1-k/120)

K=24 l

If the new price of misture be Rs 1 , then the price of replaced misture be Rs 2.

Total Sp = 120*1+24*2 = 168

CP= 100*1 =100

Profit % = 68 %

44. C= 2a

Profit = 10(b-a)=3d,Loss= 10(c-d)=4b

Profit (%) = 3d/10 a * 100

Loss (%) = 4b /10 c * 100

Again 3d*100/10a =4b*100/10 c]

3d/a=4b/c ➔3d/a = 4b/2a

b/d=3/2

	CANDLE	BULB
CP	a	c
SP	b	d

45. Let the CP of each motor cycle be x , then

2(1.15x)+4800=2(1.2x)

0.x=4800➔x= 48000

<u>CI/SI/INSTALLMENTS</u>

1. CI for 2 years = Rs. 756

SI for 2 years = Rs. 720

It means the interest on the interest of 1 year = Rs. 36 (=756-720)

This implies that the rate of interest is 10%

As $\frac{36}{360}$ x 100 = 10 %

It means the principal for first year was Rs. 3600

$$\frac{P*10*1}{100} = 360$$

P = 3600

Now, $\frac{P*k*k}{100} = \mathrm{SI}$

$\frac{3600*k^2}{100} = 900$

$$k = 5$$

2. 3000(1+1.1+ (1.1)^2) – 3000(1+1.1+1.2)

⇨ Rs. 300

30,000 $(1+\frac{10}{100})^2$ - $\frac{30000*10*2}{100}$

⇨ RS.300

⇨

3. Interest received from Bribal= $\frac{pr}{100}$

Interest received from Chanakya = $\frac{2\frac{pr}{100}x\frac{r}{2}}{100}$

$=p(\frac{r}{100})^2$

4. 100(1.3)^3 = 219.7

⇨ CI = 119.7

And SI = $\frac{100*3*30}{100}$ = 90

The CI is greater than SI by Rs.29.7 (119.7– 90)

Therefore % increase = $\frac{29.7}{90}$ x 100 = 33.0%

5. The best way is to go through options

$$\frac{2200*4*3}{100} + \frac{1300*6*3}{100} = Rs.498$$

Hence the presumed option is correct.

Alternatively:

(35/35)* 4 6*(35/35)

166/35

44/25 26/3

22 : 13

Average % rate = $\frac{\mathbf{166}}{\mathbf{35}}$ %

$$\left[\therefore\ 498 = \frac{3500 * r * 3}{100}\right] => r = \frac{166}{35}\%$$

Thus the ratio of principal at 4% and 6% will be in the ratio of 22: 13 respectively.

6 .

$$\frac{Decreases\ in\ second\ year}{Decreases\ in\ third\ year} = \frac{100}{100 - r}$$
$$= \frac{10}{9}$$

- ⇨ R=10%
- ⇨ Let the population of vultures 3 years ago be p, then
  P(1-(10/100))^3 = 29160
- ⇨ P=40000

7. On the second year (in terms of CI) is

$$\frac{P(1 + \frac{r}{100})^2}{(P + \frac{Pr}{100})} = \frac{6}{5} \quad => \left(1 + \frac{r}{100}\right) = \frac{6}{5}$$

⇨ r=20%

8. Balance price to be paid in installments
= Rs 1150
Therefore (1500-350) = 1150
Now, the total amount for the next 3 installments at the end of 3 rd month will be
{1150 + 1150* r * 3/12 * 100} =
[400 + {400 + 400 * r *1/100 * 12} + {400 + 400*r*2/100 * 12}]
{46000 + 115r}/40 = {1200 + {400*3r}/1200}
r = 80/3 = 26.66%

9. A: p=p*4*r/100
R=25%.
B: p{1+25/100}^{2}= 25P/16
Again 25p/16*50/100=25p/32
Therefore total amount of A after 4 years= 2p
And total amount of B after 4 years
= 25P/16 +25 p/32 = 75P/32
Therefore difference in amount
= 75p/32 – 2p = 11p/32 = 2750.
P=8000

10. Go through options
1.8 + 1.8* 6 * 10/100 = 1.6 + 1.6*8*10/100
Hence d is correct.
Alternatively: P1 + p1*6*10/100
= p2 + p2*8*10/100
P1/p2=9/8.

11. Amount which is to be returned on completion of studies
= 600000 * (1.08)^2 = 699840
But only half of 699840 is return which is 349920.
Therefore Amount returned after two Year of completion of studies
= 349920 {1 + 10/100}^{2}
= 423403.2
Total amount returned
= 349920 + 423403.2 = 773323.2
=Rs.7.73323 lakhs

12. 1000 → 1100
↓
2200 → 2420
↓
4840 → 5324
↓
10648

13. Note that .ultimately 8 % interest is charged.
So the net value after 3 years = 125971.2

14. Total Time =25 +5 =30 years.
Again no of time periods for cost increment = 30/6 =5.
And no of time periods for rupee depreciation = 30/5=6
Now, the net value of the plot = 1000*(1.05)^2 * (0.98)^6

15. A/B = 12*x/3*y =28/15;
A/B=7/15.

16. We can find the profit of B but not investment.

17. We don't know the rate of interest.

18. 10500 = x [10/11+ (10/11)^2]

x=6050.

19. Let the amount of investment with each one be Rs.400, then

Hari Lal Hari Prasad

$[400(1.1)^2] = [100(1.1)^2] + [300+300*r*2/100]$

r=10.5%.

20. Best way is to go through options

$1000*(1.2)^2$=2488.32 = 2490

21. Amount earned by HDFC = 1000000 + 1000000* 10 * 2/100

= 1200000.

Amount earned by HUDCO =$1000000(1.1)^3$

= 1331000

Net Earnings of HUDCO = 13310001200000

=131000

22. Interest paid by Ram Singh = Rs 48000

Now go through option

48000 = 100000/100 (6 * 4 + 4 * 6) = 48000.

Hence proved that option (b) is correct. Its means Ram Singh availed the discount after 4 years of loaning.

23. Worth of Hotel after 3 years = $1000000(1.2)^3$

= 1728000

Worth of car after three years = $1600000(3/4)^3$

= Rs. 675000

So, the difference in their worth (pertaining to hotel and car) is

= 1728000 – 675000 = 10, 53,000.

TIME AND WORK

1. C
2. B
3. A
4. C
5. C
6. C
7. A
8. B
9. D
10. B
11. C
12. B
13. D
14. B
15. C

Time speed distance:

1.

	Cycle	Auto	Car
Speed	x	(5x-20)	5x
Time		(t+1)	t
Distance (in km)	120	120	120

$$\frac{120}{(5x-20)} - \frac{120}{5x} = 1$$

$x^2 - 4x - 96 = 0$

x = 12

$$\text{Average speed} = \frac{360}{(10+3+2)} = 24 \text{ km/h}$$

2. Time taken by cycle $=\frac{120}{12}$ = 10 h

Time taken by auto = $\frac{120}{40}$ = 3h

Time taken by auto = $\frac{120}{60}$ = 2h

Total time = 15 h

3. In last 5 hours she covers 240 km (120 +120)

4. New time = 3 + 3 + 2 = 8 h

Hence, decrease in time = 7 h (15-8)

Therefore, Percentage change = $\frac{7}{15}$ x 100

= 46.66%

5. Time taken to meet bipasha and malika

= 1080/(60+120) = 6 h

So, in 6 hours Bipasha covers 360km and this 360 km distance Rani covers in 360/90 = 4h. Hence, Rani leaves Kolkata 2 hours later than Bipasha i.e. , at 8am. Rani leaves Kolkata.

6. Note here the length of the train in which passenger is travelling is not considered since we are connected with the passenger instead of train. So, the length of the bridge will be directly proportional to the time taken by the passenger respectively.
Therefore, t1/t2 = l1/l2
t =Time, l= length of bridge
7/4= 280/x
x = 160m

7. A__________C_____________B
← 4x → ← 5x →
P→ ---------------------------
----------------------------←R

Note that the distances covered by them to meet at C are in the direct ratio of their speeds.
Therefore AC : BC = 4x : 5x
Now, for any particular person(say pathik) the time required to cover different distances is diretly proportional to the different distances. So, time taken by Pathik to cover AC and BC are the ratio of 4:5(excluding staying or halt time at Chandni Chowk).
Thus time required to cover AC is 52 minutes only since he covers BC in 65 minutes.
But since he leaves Chandni Chowk for Bhavnagar at 9 : 27 am i.e., 67 minutes later, when heleft Andheri .It means he must have stayed at C for (67 – 52) =15 minutes

8. Let the length of the train be L meters and speeds of the train Arjunand Srikrishna be R,A and k respectively, then
L/(R-A) = 36 ------(1)
and L/(R+k) = 24 ------(2)
From eq. (1) and (2)
3(R-A) = 2(R+K)
R = 3A+2K
In 30 minutes (i.e., 1800 seconds), the train covers 1800R(distance) in the same time.
Therefore distance between Arjun and Srikrishna, when the train has just crossed Srikrishna
=1800(R-A)-24(A+K)
Therefore, Time required = 1800(R-A)-24(A+K)/(A+K) =(3600-24) =3576s
Since (R = 3A +2K)

In 30 minutes(i.e. ,1800 seconds), the train covers 1800R (distance) but the Arjun also covers 1800A (distance) in the same time.

	First hour	Second hour	Third hour	total
Initial speed	x	3x	2x	6x
New speed	3x	3x	3x	9x

Therefore distance between Arjun and Srikrishna, when the train crossed Srikrishna
1800(R-A)-24(A+K)
Time required =(1800(R-A)-24(A+K)) /(A+K)

9. →Kareena C ←Shahid
|—————|—————|
kurla shantakruji Worli
Let th e time taken by Kareena is going from K to s is x minutes and the time taken by Shahid in going from Worli to Shantakruji be y min.
Since, the new speed of kareena is 2/3, therefore time taken in returning = 3/2x.
Therefore x + 3/2x =120
x = 48 min
But x = y
Again since the speed of Shahid is 4/3, therefore the time taken in returning = 3/4 y.
Therefore, Total time = y+3/4 y
= 48 + 36 = 84 min

10. Time taken to collide the two trains =3/2h
So, in 3/2h bird travels (3/2)*60 = 90 km.
11. Let there be l steps in the escalator and x be the speed (in steps/second) of escalator, then
l/(5+x)= 10 and l/(5-x) = 40
then 5+x/5-x =40/10 ⇒ x = 3
Therefore, Number of steps in the escalator =
l= 8*10=80

12. Let the radius be r, then difference in the distance
=(πr – 2r)= r(π - 2)
= r(22/7 – 2)= 60 *3
2r =315 m
[Πr ⟶ semiperimeter and 2r ⟶ diameter]

13. Time taken by trains to collide
=560 /70 =8h

In 8 h sparrow will cover 8 * 80 = 640km

14. P K

← 600 →

In 18 h plane will cover 18 * 120 =2160km

Now, 2160 = (600 * 2) + 600 +360

So, the plane will be 360 km away from kargil it means it will be 240km (600 – 360) away from pukhwara.

15.

Therefore, Percentage increase in speed

= 3x / 6x * 100 =50%

Since speed is increased by (50%)1/2

Therefore, time will reduce by (33.33%) 1/3.

16. P ⟷ Q

They will be together at every two hours.

Therefore in 12h they will be (6+1) = 7 times Together at P and they will never meet altogether at Q.

17.

Mathura Kurushetra Hastinapur

← 400 km →← 300 km →

← 700 km →

Consider only one person either Arjun or Srikrishna since their speed is same and move together .

Now, the distance covered by Arjun and Abhimanyu is in the ratio of their speed.

So, Arjunwill cover total 500 km to meet Abhimanyu and thus Arjun has to return back 100 km for Kurushetra.

Therefore, Arjun will cover total 600km distance.

18. Total time = 600/25 = 24 h

19.

A ________________________ B

D ←——— C

D ———→

A is the starting point of journey.

B is the destination.

C = where salman has got off.

D = where priyanka picks up Akshay

Let AD= l and BC = k and CD = x

Then CD + DB/ BC = 50/10

2x + k / k = 5/ 1

x / k = 2/1

Again AC + CD /AD = 50/10

2x +l / l =5/1

x/l = 2/1

x= 2k =2l or k= l =x/2

Therefore k + x+ l =120

k = 30 km, x = 60 km and l = 30 km

Total distance travelled =

AC + CD + DB= l +x+x+x+k = 240 km

Therefore, Time required = 240 /50 = 4.8 h

20.

Barabanki Fatehpur

300

120 180

Lets the speeds of Ajai, Kajol and Shahrukh be x.y and z respectively, then

y/x =180/120 ⟹ x = 2y/3

Note Kajol is faster since she covers 180 km while Ajai covers only 120km in the same time.Shahrukh meets Kajol 1.5 hours after Shahrukh himself starts and 2.5 hours Kajol starts.

Hence, 2.5y + 1.5z =300

z = 600 – 5y /3

Since z ≥ (y+20) ⟹ 600-5y/3 ≥(y+20)

y ≤ 67.5

Or x ≤ 45 km/h

21. Let t be the time after Kajol starts, when she meets Ajai, then

t = 300 /(x+y)

This should be less than 2.5 or (x+y)> 120

Since y = 3x / 2 ⟹ y>72

This (y>72) is greater than 67.5km/h and hence shahrukh will always overtake Ajai before he meets Kajol.

22. Speed of Raghupati (Rp)= 60 km /h

Speed of Raghav (Rv)= 36 km/h

Speed of Raja Ram (RR) = 18 km/h

AB = AC = BC

Time taken to cover AB by (RR) is 2 hours

Therefore, Time taken to cover AB by Raghav is 1 hour.
Therefore, Time taken to cover AB by Raghupati = 36 min.
[tRV: tRV:tRR = 1/ SRP:1/SRV:1/:SRR]
t = Time, s = Speed
AB = 2* 18 =36 KM

23. Time = 3* 36 /60 = 9/5h =1h 48 min

24. Distance from Barelley = 60/ (60+18) * 36
= 360 /13 = 27*(9/13) km

25. → A
(Shantipur)S—————H (Hulchulpur)
←

B→
← 180 km →

Since the speed of bike and walking are different. So, two people partially travelled by bike and rest by walking since all the three persons take equal time to reach the destination. It means initially Mohan will carry either Namit or Pranav to a point A, then this person reach to H by walking and Mohan return to B where he will pick up the third person and reach at H at the same time as the second person.
SB = k, AB= x and AH = l
Now, SA + AB / SB =36/6
2x + k / k= 6/ 1
x/k = 5/2
And AB + BH /AH = 36/6
2x + l/l =6/1
x/1 = 5/2
Therefore, x:k:l = 5:2:2
x+k+l = 180
x = 100, k =40 and l =40 km
Total distance travelled by bike
= SA + AB + BH
K + 3x + l = 380 km

26. 2x+k/k = 42/6 =7/1
x / k = 3/1
Similarly x/l = 3 /1
Therefore x: k: l = 3:1:1
Therefore x = 180, k =36, l=36 km
Total distance travelled = k+ 3x +l = 396 km
Therefore, Required time = 396/42 = 9(3/7) h

27. Let the buses leave from both the stations at time intervals of T, then the distance between any two Consecutive buses coming opposite to me = the distance between any two consecutive buses Coming in the same direction as me = VT.(where V is the velocity of the buses).Let the speed of walking be w , then VT / V+W = 20 and VT/ V-W =30
(V+W)/(V-W)= 30/20 =3/2
V/W = 5/1
VT/ V+W = 20
5/6* T = 20; T= 24 min

28. Time taken by Abhinav = 36 h
Ideal time required by Abhinav=600/25 = 24 h
It means Abhinav rests forn (36-24) = 12 h
The required time for Brijesh=600/30=20h
But Brijesh utilised those 12 hours in which Abhinav rests, so he needs only (20-12) = 8 hours extra.
The total time taken by Brijesh=36+8 = 44 min.

29. Downstream(steamer) = 40 min
Downstream (Boat) = 60 min
Upstream (steamer) = 60 min
Upstream (boat) = 90 min
Required time = 40+30+45 = 115 min.

30. A → P ← B
▪————▪————▪
L ← 2x →← x →J

These trains meet only P and L i.e., there are only two points.

31. For the first meeting they have to cover only 2x + x =3x distance and for the further meeting for each next meeting they have to cover 6x distance together.

Distance covered by A	2x	2x	4x	2x
2Distance covered by B	x	4x	2x	4x
Point of meeting	P	L	P	P
Total distance travelled	3x	6x	6x	6x

When Aand B meet at P for the third time A goes 10 x and B goes 11x.
Thus, the required ratio = 10:11.

32. ← 1h →← x km →

H ▪————▪————▪ O

(Home) A→(1h) (Office)

speed Time

1/6 ↓ 1/5 ↓= 20

Actual time required for(x–80) km =5*20=100min

It means he can move = x – (x -80) = 80 km in (180 – 80) = 80 min

It means his actual speed = 60 km/ h

Thus, the total distance from his home to his office= 60 * 1+60*3 = 240kms

33. $\frac{\text{Speed of wind(sound)}}{\text{Relative speed of solider and terrorist}} = \frac{\text{Time utilised}}{\text{Difference in Time}}$

1188/x = 330/5, x= 18 km/h

34. In case of increasing gap between two objects.

$\frac{\text{Speed of sound}}{\text{speed of tiger}} = \frac{\text{Time utilised}}{\text{Difference in Time}}$

1195.2/x = 83/7

x =100.8 km/h

35. In 20 minutes the difference between man and his son =20*20 = 400m

Distance travelled by dog when he goes towards son = 400/40 * 60

= 600m and time required is 10 minutes

In 10 minutes the remaining difference between man and son.

400-(20*10)= 200m

Note: Relative speed of dog with child is 40km/h and the same with man is 100km/h.

Time taken by dog to meet the man = 200/100 = 2min.In 2 min the remaining distance between child and man 200 – (2*20) = 160m

Now, the time taken by dog to meet the child again = 160/40 = 4 minIn 4 minutes he covers 4*60 =240m distance while going towards the son.

In 4 minutes the remaining distance between man and child = 160-(4*20) = 80 m

Time required by dog to meet man once again = 80/100 = 0.8 min

In 0.8 min remaining distance between man and child = 80 -(0.8*20) = 64m.

Now, time taken by dog to meet the child again = 64/40 *8/5 min.

Therefore, Distance travelled by dog = 8/5 *60 = 96 m.

Thus, we can odserve that every next time dog just go 2/5th of the previous distance to meet the child in the direction of child. So.We can calculate the total distance covered by dog in the direction of child with the help of GP formula.Here, first term (a) = 600 and common ratio (r) = 2/5.

Sum of the infinite GP = a/ (1-r)

= 600/(1-(2/5))= 600/(3/5) = 1000m

36. Let Amarnath express takes x hours, then Gorakhnath express takes (x -2) hours.

Therefore 1/x + 1/(x-2) =60/80

x= 4h

37.Distance travelled by them in first floor =12km

Distance travelled by them in second floor =13km

Distance travelled by them in third floor = 14 km and so on. Thus, in 9 hours they will cover exactly 144 km and in 9h each will cover half-half the total distance.

(8*9 = 72 and 4+5+6+7+8+9+10+11+12 = 72)

38. Speed of tiger = 40 m/min

Speed of deer = 20 m/min

Relative speed = 40-20 = 20 m/min

Difference in distance = 50*8 = 400m

Therefore, Time taken in overtaking (or catching) = 400/20 = 20 min.

Distance travelled in 20 min= 20*40=800m

39. The sum of their speeds = 615/15 = 43km/h

Notice that they are actually exchanging their speeds. Only then they can arrive at the same time at

their respective destinations. Its means the difference in speeds is km/h.

Thus, x + (x+3) = 43

⟹ x =20 and x+3 =23

The concept is very similar to the case when after meeting each other they returned to their own places of departure. It can be solved through option also.

40. Let pele covers x km in 1 hour. So maradona takes(2h-40min) = 1 h 20 min to cover x km. Let speed of Maradona and pele be M and P respectively than

x= M* 4/3 and x= P*1

M/P=3/4

Again 300 /M – 300/P = 1

300/3k – 300/4k = 1

k=25

M = 3k = 75 km/h

P = 4k = 100 km/h

41. Initial speed of police = 10 m/s

Increased speed of police = 20 m/s

Speed of thief = 15 m/s

Initial difference between thief and police = 250 m after 5 seconds difference between thief and police=250 – (5*10)= 200 m

After 10 seconds more the difference between thief and police = 200 + (5*10)=250 m

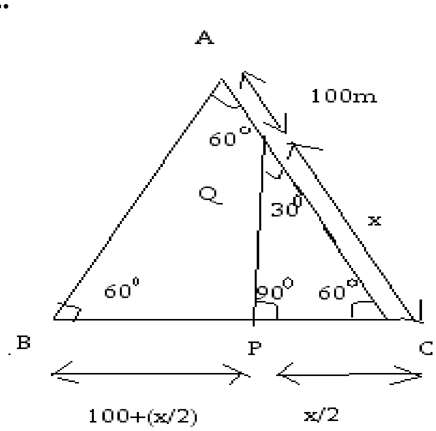
Now, the time required by police to catch the thief = 250/5 = 50 s

Distance travelled = 50*20=1000 m

Total time = 50+15 = 65s

Total distance = 1000+ (15*10) = 1150 m

42.



Speed of Bajrang/ speed of angad

200+x/200 = (100+x)/(x-5)

(200+x)(x-50)=200(100+x)

x=200 km

Therefore distance between ayodhya and banaras is 300 km since AB=BC=AC.

43. Basically they will exchange their speeds just after half of the time required for the whole journey. It means after covering 210 km distance they will exchange their speeds. Check it out graphically for more clarification.

44. The ratio of speeds = The ratio of distances, when time is constant,

the ratio of distances covered by leopard to the tiger = 12:25

again, ratio of rounds made by leopard to the tiger = 12:25

Hence, the leopard makes 48 rounds, when tiger makes 100 rounds

45. Length of DC = 6000/13

total distance covered in the returning by Jai= AD + CD

= 2500/13 + 6000/13 = 8500/13 km

required time = (8500/13)/(500/13) = 17h

Total distance covered by Jaya while returning = BD+DC=17. Both will reach at the same time.

46. The distance of route ADC = $\frac{8500}{13}$

And the distance of route BNC = 1300

And the time taken by jai is $\frac{8500/13}{500/13}$ =17h

And the time taken by jaya is $\frac{1300}{1200/13}$

$= \frac{169}{12}$ h = 14 $\frac{1}{12}$

= 14 h 05 min

Hence, option (c) is correct.

47. Time saved in percentage = $\frac{175}{1020}$ x 100 = 17.5%

48. Husband takes 17 hours and she takes 14h 05 min + 3h= 17 h 05 min than her husband

So, she becomes late by 05 min than her husband.

49. $x^2 + (x+100)^2 = (500)^2$ (Using Pythagoras theorem)

=> $x=300$ km

Now, let they change their speeds after t_1 hours and then the rest time t_2 then

$30\,t_1 + 40\,t_2 = 800$ ……….(i)

$40\,t_1 + 30\,t_2 = 900$ ………..(ii)

Solving Eq. (i) and (ii), we get

$t_1 = \frac{120}{7}$

and $t_2 = \frac{50}{7}$

50. Since it moves only one radian on every path and it has to move 2π radian to reach directly eastward. Hence, it has to run on more than 6 paths i.e., the last path is 7^{th} one(or P_7) (Therefore, n x 1 radian $\geq 2\pi$ radian)

$n \geq 2r$

or n=7, for integer values

Hence, option (c) is correct.

51. Since it stops directly eastward of the shop so the total distance covered so for

$= 7 + (1 + 2 + 3 + 4 + 5 + 6 + 2) = 30$ km.

Actually it has to cover total 2π radian distance but on 6 paths it covers only 6 radian hence, the remaining distance which will be covered on the 7^{th} path i.e., $2\pi - 6 = 2 * 22/7 - 6 = 2/7$ radian.

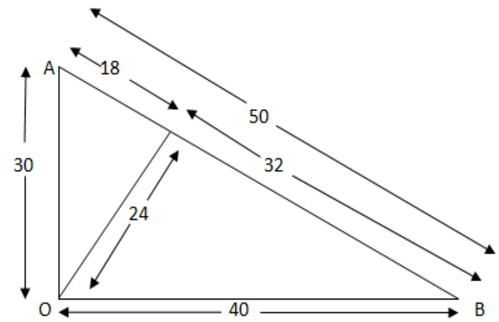
But, the radius of the last path (i.e., P_7) = 7 km.

Hence, the distance covered in km = $2/7 * 7 = 2$ km.

Thus, on the last path it moves only 2km. Hence, (a) is the correct choice.

52. The ratio of distance covered on P_2 and P_7 = $2/2 = 1/1$.

53. Since it is clear from the statement itself that Δ AOB is a right angle triangle and further OP must be perpendicular to AB then we can find that AO = 30 km and BO = 40km by using Pythagoras theorem and its corollaries.



54. Again, since jackal and train both arrive at A at the same time and let the train was x km away from A, before entering into the tunnels, i.e., when it makes a whistle then the ratioof distances covered by train and jackal.

$=x/30 = (x+50)/40$

➔ X=150 km

➔

55. Since, when the trains arrive at A, the jackle can move 30 km. So, at the time when train is at A the jackle will cover 6 km from P on PA in addition to 24 km at OP. Now, the rest distance at AP is 12 km this remaining distance will be covered by train and jackal according to their respective speeds.

So, distance covered by train = $12*5/6=10$ km and distance covered by jackal = $12*1/6 = 2$ km

Hence, jackal will meet with train at M_1 which is 10 km away from A (inside AB).

56. It is obvious from the path of cat that if cat moves in the POA directions it will never meet with accident and now jackal follows the path OPB. Again when the train is at A then jackal will cover 30 km (i.e., 24 (OP) + 6km on PB).

So, the ratio of distances covered by jackal is to train = ratio of their respective speeds.

Now let the jackal and train meet each other at AB, (6+x) km away from P towards B, then

$(x/(24+x))=1/5$

➔ $4x=24$ ▯ $x = 6$

Hence, train meets with jackal at $(18+6+6) = 30$ km away from A.

Alternatively: $(150+18+6+X) / (30+X) = 5/1$

➔ $X = 6$

Hence, $18 + 6 + 6 = 30$ km.

Thus, option (b) is correct.

57. The ratio of time taken by the cat and jackal = $\frac{72/3}{96/5} = \frac{5}{4}$

Hence, option (c) is correct.

58. ((6-x) = (8-1.5x)

x=4 cm

So, it will take 4 hours to burn in such a way that they remain equal in length.

59. Total distance covered by them when they meet = 2W

And Total time = $\frac{2W}{b_1 + b_2}$

Therefore, $d_1 = \frac{2W}{b_1 + b_2} \quad b_1$

And $d_2 = \frac{2W}{b_1 + b_2} \quad b_2$

60. Let the speed of boat be B and that of river be R. in 12 minutes the distance between boat and hat

=12(B-R) + 12R = 12 B

Now time taken by boat to reach to the hat

$= \frac{12B}{(B+R) - R} = 12$ min

Total time = 24 min

In 24 minutes had flown off = 3 km

Therefore $\frac{24}{60}$ x R =3 ;R = 7.5 km/h

61. Akhar meets Birbal once= $\frac{500}{20-15}$ =100 s

Birbal meets Chanakaya once= $\frac{500}{20+25}$

$= 11\frac{1}{9}$ s

Akhar meets Chanakaya once= $\frac{500}{15+25}$ =12.5 s

62. Time taken by them to meet

= (600) / (30-20) = 60s

Time taken to meet 5th time = 5 * 60 = 300s

Total duration of race = 3000/30 = 100s

So, they will not meet 5th time in the race of 3000 meter.

63. Length of the track = 2*22 / 7 * 175=1100 m

Distance to be covered for the first meeting =550 m

Speed of Akkal = 1100/100 = 11 m/s

Speed of Bakkal = 1100/50 = 22 m/s

Time taken from the start of the first meeting = (550) / (11+22) = 50/3 s

Time taken for Akkal and Bakkal to meet again at Love point = LCM of times taken by them to go around the track once.

= LCM of 1100/11 and 1100/22

= LCM of 100 and 50= 100 s

So, the total required time = (50/3) +100+100 = 650/3=216 2/3 s

64. Since both rest for 6 seconds so when B is just about to start the journey A reaches there at the shallow end so they meet at the shallow end.

65. B runs around the track in 10 min.

i. e., Speed of B = 10 min per round

Therefore, A beats B by 1 round

Time taken by A to complete 4 rounds =

Time taken by B to complete 3 rounds

= 30 min

Therefore, A's speed = 30/4 min per round

= 7.5 min per round

Hence, if the race is only of one round A's time over the course = 7 min 30 sec.

66. The ratio of speeds of A, B, C = 10/49: 9/50: 8/51

Hence, A is the fastest.

67. Speed of this car = (400+200) / (20) * (18/5) km/h= 108 km/h

68. The speeds of two persons is 108 km/h and 75 km/h. The first person covers 1080 km in 10 hours and thus he makes 12 rounds. Thus, he will pass over another person 12 times in any one of the direction.

69. Angle between two hands at 3:10 am = (90+5)-60 = 35^{o}

So, the required angle = 70^{o} , after 3:10 am

Total time required to make 70° angle when minute-hand is ahead of hour-hand = (90+70)/(11/2)= 320/11 min.
So, at 3 h 320/11 min the required angle will be formed.

Alternatively: Check through options.

70. For the first watch: When a watch creates the difference of 12 hours, it shows correct time. So to create the difference of 12 h required time = (60*12)/24 = 30 days.
For the second watch: To create the difference of 12 h required time = (30*12) / 24 = 15 days
So, after 30 days at the same time both watches show the correct time.

71. To show the same time together the difference between two watches must be 12h.
Now, since they create 3 min difference in 1 h
So, they will create 12 h difference in (1/3)*(12*60/24) = 10 days later.

72. To show the correct time again, watch must create 24 h difference.(Since in one round hour-hand covers 24 h).
So, the required time=(4/3)*(60*24/24) = 80 day.

73. (n+1) times in n days.

74. Actually the watch gains (12+16) = 28 min in 7*24*60 min.
Thus, it gains 1 min in 360 minutes.
Therefore, it will gain (12+8) min in (20*360)/(60*24) = 5 day.
Hence, (b) is the correct choice.

75. Actually they create a difference of 3 min per hour and the two watches are showing a difference of 66 minutes. Thus, they must have been corrected 22 hours earlier.
Now, the correct time can be found by comparing any one of the watch.
Since, second watch gains 1min in 1 hour so it will must show 22min extra than the correct time in 22 hours.
Hence, the correct time can be found by subtracting 22min from 10:06.
Hence, (d) is the correct answer.

76. Incorrect watch covers 1452 min in 1440 min.
So, it will cover 1min in 1440/1452 min.
Therefore it will cover 4840 min in 1440/1452 * 4840 = 4800 min = 80 hr
Therefore 80h = 3days and 8h

77. You must know that a correct watch coincide just after 65 (5/11) min.Therefore in every 65(5/11) hours the watch gains 2/11.
Hence, in 24 hours it will gain 2/11 * 11/720 *24*60 =4 min.

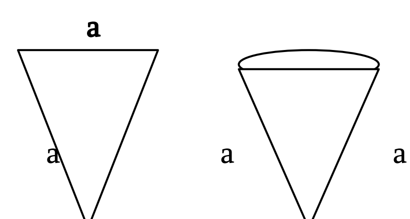
78. In 72 hours my watch gains (8+7) =15 min. To show the correct time watch must gain 8 minutes.
Since the watch gains 15 min 72*60 min.
Therefore, the watch will gain 8 min in (72*60*8)/15 min
= (72*60*8)/15 =38h 24min
Hence, (a) is the correct choice.

79. C

80. To exchange the position both hands to cover 360° together. In one minute, hour-hand moves 1°/2 and in one minute, minute-hand moves 6°.
Let the required time be t min, then
6t + 1/2 t = 360
➔ t = 360/13 *2 = 720/13 = 55 5/13 min

<u>MENSURATION:</u>

1. $2\pi r = a$

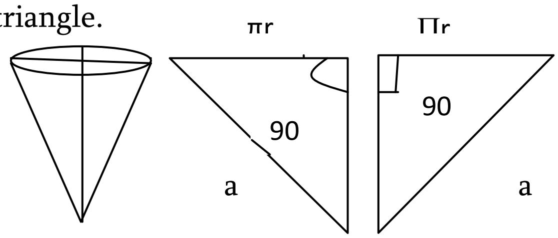


Also, Slant height (l) = a
Therefore, $r = a/2\pi$

2. $l^2 = h^2 + r^2$
$\Longrightarrow$ $h^2 = l^2 - r^2 = a^2 - (a/2\pi)^2$
$h^2 = a^2((4\pi^2 - 1)/4\pi^2)$
Therefore, $h = a/2\pi\,(\sqrt{4\pi^2-1})$

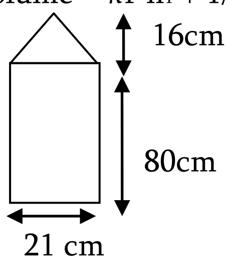
Therefore, Volume = $1/3\ \pi r^2 h$
$= 1/3\ \pi *(a^2/ 4\pi^2)* a / 2\pi(\sqrt{4\pi^2-1})$
$= a^3 / 24\pi^2 (\sqrt{4\pi^2-1})$

3. It will be in the form of the right angled triangle.



4. $2\pi r (r+h) = 1540\ cm^2$
And $(r+h) = 35$ cm
$2\pi r = 1540 / 35 = 44$ cm

5. Total volume = $\pi r^2 h_1 + 1/3\ \pi r^2 h^2$



$= \pi r^2 [h1 + h^2/3]$
$= 22/7*(21)^2[80+ 16/3]$
$= 22/7 * 441 * 256/3$
Weight = $22/7 *441 * 256/3 * 8.45/1000$
=999.39 kg

6. ABCD is a square, each side of square is 'a'.

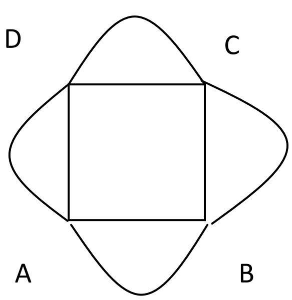


Figure 1

In figure (2),
DOC = 120 °
and ∠ODC = 120° ∠ OCD = 30 °

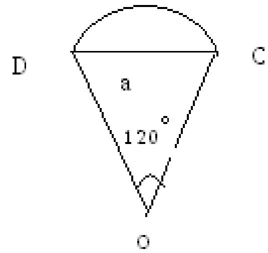


FIGURE 2

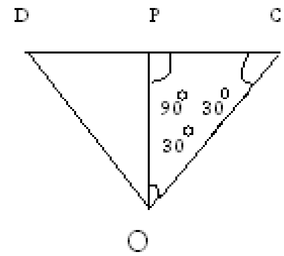
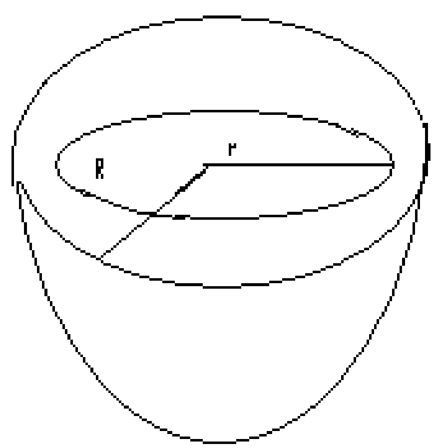


FIGURE 3

In figure(3),
PC / OC = sin 60
$(a/ 2) / OC = \sqrt{3}/2$
⇒ $OC = a/ \sqrt{3}$ ⇒ radius of the arc 'CD'.
16 cm riangle OCD = 1/2* CD * OP
$= ½ * a * a /(2\sqrt{3}) = a^2 / 4\sqrt{3}$
[OP/PC = tan 30 and tan 30 = $1/\sqrt{3}$]
And area of sector COD (figure 2)
$= \pi r^2\ 120/360$
$= \pi *[a/\sqrt{3}]^2* 1/3 = \pi a^2 / 9$
Area of segment =(Area of sector – Area of triangle)
$= 4(\pi a^2 / 9 – a^2 /4\sqrt{3})$
Total area of all the four segments = $4(\pi a^2/9 – a^2/4\sqrt{3})$ and the total area of all the four segments
$= a^2 + 4(\pi a^2 / 9 – a^2 /4\sqrt{3})$

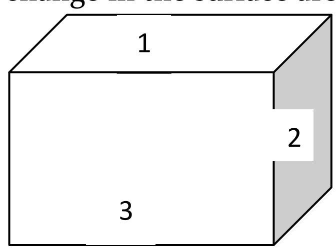
7. 2 (l+b) = 26 ⇒ l + b = 13
12+1 =13
11+2= 13
10+3=13
9+4=13
8+5= 13
7+6=13
Since, l>b, therefore, there are only 6 integral values of the length viz., 7,8,9,10,11 and 12.

8. Total surface area = $2\pi R^2 + 2\pi r^2+ (\pi R^2-\pi r^2)$



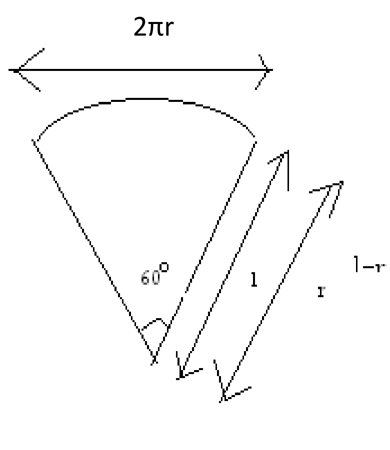
$=3\pi R^2 + \pi r^2$
$=\pi(3R^2 + r^2)$
$1436\ (2/7) = \pi\ (3^*\ (12)^2+r^2)$
$10054 / 7 * 1/\pi = 432 + r^2$
$r = 5$ cm
Therefore, Internal volume of hemisphere = 2/3 $\pi(R^3-r^3)$
$= 2/3\ \pi((12)^3-(5)^3)$
$= 3358\ (2/3)$ cm^3

9. Since, there are 3 faces which are visible in a corner cube. When the cube of a corner is removed then the 3 faces of other cubes will be visible from outside. So, there will not be any change in the surface area of this solid figure.



10. Number of sphere = $4/3\ \pi\ (15/3)^3\ /\ 4/3\ \pi\ (3/2)^2$
= 125 spheres
Surface area of a large = $4\ \pi^*(\ 15/2)^2$
and surface area of small sphere = $4\ \pi\ (3/2)^2$
and total surface area of all the smaller spheres
$= 125 * 4\ \pi\ (3/2)^2$
% change in area = $[((500\ \pi\ (3/2)^2 - 4\ \pi\ (15/2)^2)/4\ \pi\ (15/2)^2) * 100] = 400\%$

11. Let the radius of cone be R and
Radius of sector = r

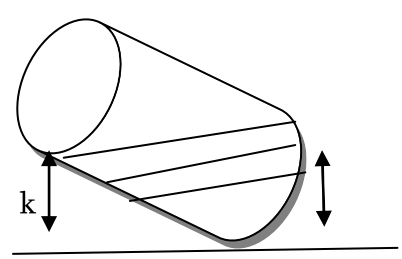


l = r
Then the slant height of cone (l) = r
And $2\ \pi R = 2\pi r * (60/360)$
$R= r/6 = 14/6 = 7/3$ cm
Therefore, Total surface = $\pi r(l+r)$
$= 22/7 * 7/3\ (14+7/3)$
$=119.78$ cm^2

12. Between 26 poles, total length is $(26-1)^* \ 4 =$ 100m
It means the length of each side of a square field is 100m.
Therefore, Area of field=$(100)^2$=10000m^2=1 hectare

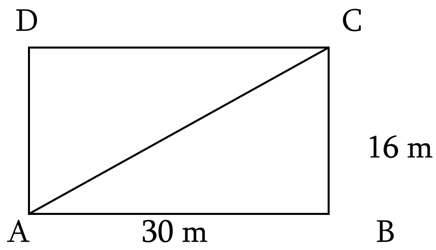
13. It is clear that length of the lawn is 2m more than the breadth of lawn.
To solve this problem quickly, go through options.
Let us take option (c).
$l=10m \Longrightarrow b = 8m$
Area of path = $(l+b+2w)2w$
$= (10 +8+4)4=88$ m^2
And Area of lawn = $10*8 = 80$ m^2
Reduced area of lawn = $8*8 = 64$ m^2
New area of path = $88 +(80-64) = 104$ m^2
Ratio of areas of path = $104 / 88 = 13 /11$
Hence, option (c) is correct.

14. From the figure you can see that just half of the liquid has been flown off and half the liquid is remained in the cylindrical jar.



Thus it is clear that the capacity (or volume) of the cylinder
$= 2 * 2.1 = 4.2$ L

15. When the height and base of the cone are same as that of the cylinder, then the volume of cone is 1/3 that of the cylinder.
Thus the capacity of cone = $1/3 * 4.2 = 1.4$ l
Thus the remaining volume = $2.1 - 1.4 = 0.7$ l
Therefore, the required ratio = $0.7 / 4.2 = 1/6$
16. AC $=\sqrt{(30)^2+(16)^2}$
AC = 34m

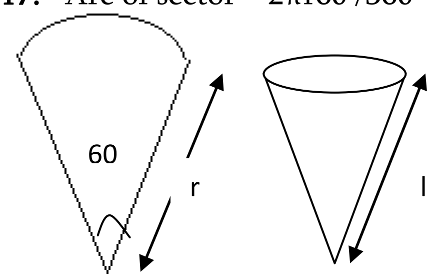


But since elephant is itself 4m long. So he has to travel long

(34-4) = 30 m.

Therefore, the speed of element = 30 /15 = 2 m/s

17. Arc of sector = $2\pi r 60/360 = 2\pi r / 6$



This arc of sector will be equal to the perimeter of cone. Let the radius of cone be R,

Then $2\pi R = 2\pi r / 6 \Longrightarrow$ $R = r/6$

Further the radius of sector will be equal to the slant height of cone

Therefore, $l=r$

Now since $=l^2 = h^2 + R^2$

$h = \sqrt{(l^2 - R^2)}$

$h = \sqrt{(r^2 - (r/6)^2)}$

$h = \sqrt{(35/6)}\, r$

18. The diagonal of cube will cube equal to the diameter of sphere.

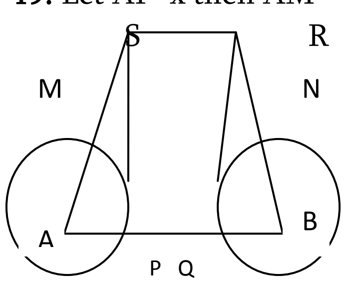
Therefore, Volume of sphere = $4/3\ \pi(d/2)^2 = \pi d^3/6$

and each side of cube = $a = d/\sqrt{3}$

Volume of cube = $a^3 = d^3/3\sqrt{3}$

Remaining volume = $\pi d^3/6 - d^3/3\sqrt{3} = d^3/3\,(\pi/2 - 1/\sqrt{3})$

19. Let AP=x then AM = x and MS = x

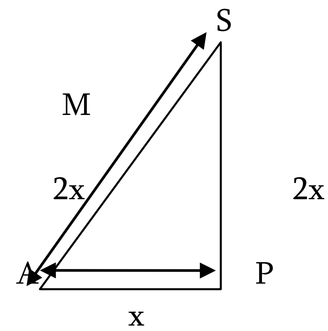


AS = AM + MS

AS = 2x

$PS = \sqrt{(AS^2 - AP^2)}$

$PS = \sqrt{3}x$

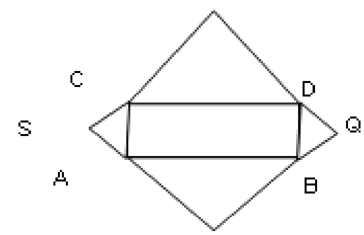


Area of square PQRS = $(\sqrt{3}x^2) = 3x^2$

Area of circle = $\pi r^2 = \pi * x^2 = \pi x^2$

Required ratio = $2\pi x^2 / 3x^2 = 2\pi/3$

20. Let the length of rectangle be ‘ l ’ and breadth be ‘b’, then



$2(l+b) = 12$

$l+b = 6$ cm

and area of larger equilateral triangle

$= \sqrt{3}/4\ l^2$

similarly area of smaller equilateral triangle = $\sqrt{3}/4\ b^2$

Total area of all the 4triangles = $2 * \sqrt{3}/4\ (l^2 + b^2) = 10 = \sqrt{3}$

$l^2 + b^2 = 20$

$(l+b)^2 = l^2 + b^2 + 2lb$

$36 = 20 + 2lb$

$lb = 8$

$(l-b)^2 = l^2 + b^2 - 2lb = 20-16$

$(l-b)^2 = 4$

$\Rightarrow$ $l-b = 2$

$l+b = 6$ and $l-b = 2$

$l=4$ and $b=2$

area of triangle = $4 * 2 = 8\text{cm}^2$

Total area of the figure = $8 + 10\sqrt{3}$

$= 2(4+5\sqrt{3})$ cm2

21. Area of each square = 16 cm^2

Area of Quadrant ADMB = $(1/4) * \pi * 4 * 4 = 4*\pi$

And radius of smaller quadrant

CPMQ = CM = AC – MA

$= 4(\sqrt{2} - 1)$

Area of smaller Quadrant = $\frac{1}{4} \pi [4(\sqrt{2} - 1)]^2 = 4\pi (3- 2\sqrt{2})$

Area of shaded region inside the square ABCD = $16 - [4 \pi + 4 \pi (3-2\sqrt{2})]$

$= 8[2-2 \pi + \sqrt{2} \pi]$

Now, area of quadrants = AEG + EFG = 2AEG

$= 2 * \frac{1}{4} * \pi * 4^2 = 8 \pi$

Area of inner square= $8(\pi-2)$

Ratio= $[2+ \pi(\sqrt{2} - 2)]/(\pi-2)$

22. Given that AB/BC=AD/DF

Also BE=BC

Let AD=1 and AE=x

AE/EF = AE/AD = AE/BC=x

AE/EF=AD/AB (AD=BC=BE and AB=AE-BE)

X/1=1/X-1

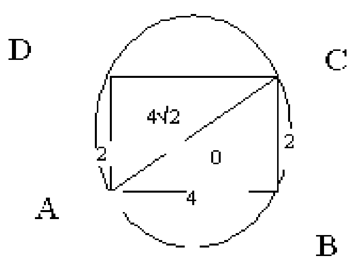
$X^2-X-1=0$

$X=\frac{(1 \pm \sqrt{5})}{2}$

$X= \frac{(1 +\sqrt{5})}{2}$

Since the ratio of two sides can never be negative

Solution for question number 23 to 25



AB=4

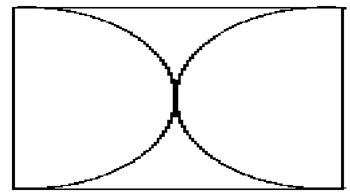
$AO = AC = \frac{4\sqrt{2}}{2} = 2\sqrt{2}$

Are of Circle ABCD= $\pi *[2*2\sqrt{3}]^2=8 \pi$

Area of region 2(only left part)

$= \frac{\text{Area of circle- Area of Square}}{4}$

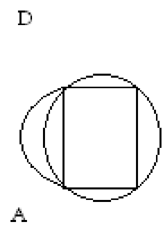
$= \frac{8 \pi-16}{4} = (2 \pi-4)$



Area of region 3= Area of Square-2(Area of Semicircle)

$=16-2(1/2* \pi*4)$

$=16-4 \pi=4(4- \pi)$ cm^2



Area of Region 1=Area of Semicircle AD-Area of region^2

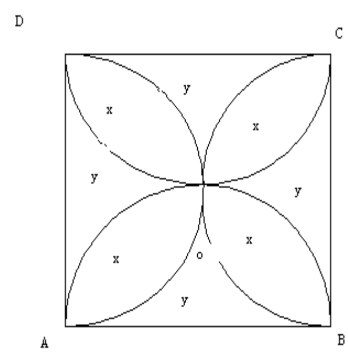
$\frac{1}{2} \pi * (2)^2-(2 \pi -4)= 4$ cm^2

23. Total area of region1=2*4=8 cm^2

24. Total area of region2=2*(2 π-4)= 4(π -2) cm^2

25. Total area of region3= 4(4-π) cm^2

26. Total area of square=64 cm^2



4(x+y)=64

➔ x+y=16 ….(i)

Again in a semicircleAOB = x+y+x=1/2 $\pi*(4)^2$

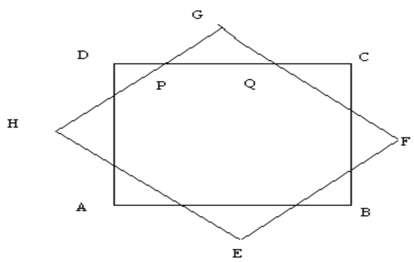
2x-y=8 π …(ii)

For eq.(i) and(ii), we get X=8 π -16

Total area of shaded region =4(8 π -16)

=32(π -2) cm^2

27. You can see in the figure that the sides of one square is parallel to the diagonal of the other square.



Let DP = a, then

DC = DP + PQ + QC

$= a + a\sqrt{2} + a$

Dc= $a(2 + \sqrt{2})$

Area of PGQ=$1/2 * a * a = a^2/2$

Area of the entire triangle outside the square ABCD

$=4*a^2/2 = 2a^2$

But DC = $a(2+\sqrt{2}) = 4$ cm

$a= 4/(2+\sqrt{2})$

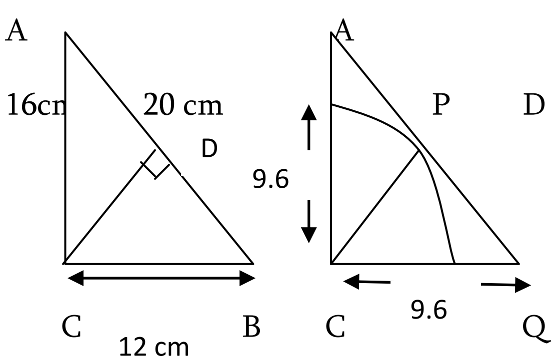
$2(a)^2 = 2*(4/(2+\sqrt{2}))^2= 16(3-2\sqrt{2})$

And Area of square = 16 cm

Total area of the figure = $16 + 16(3-2\sqrt{2})$

$= 32(2+\sqrt{2})$ cm2

28. When l =CD ,then the volume of cone will be maximum where l is the slant height of the cone and the largest possible angle at the vertex of cone is 90 degree.



CD = 12 * 16 /20 = 9.6cm,

This is the radius of the sector.

Therefore, arc of the sector = $2\pi *96 * (90/360) = 4.8\pi$

Let the radius of the cone be r, then

$2\pi r$ = arc of the sector

$2\pi r = 4.8\pi$

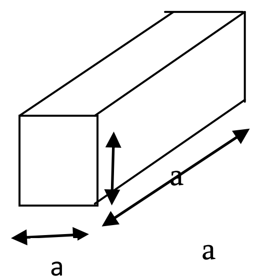
r = 2.4

Height of the cone (h) $=\sqrt{l^2 - r^2} = \sqrt{((9.6)^2 - (2.4)^2)}$

$= 2.4\sqrt{15}$ cm

Volume of the cone = $1/3\ \pi r^2 h = 1/3 * 22/7 * (2.4)^2 * 2.4\sqrt{15} = 56.1$ cm^3

29. To increase the value (or price of diamond) they should cut (divide) the diamond in such a way that the surface area will be maximum.



Thus , when four parts are parallel to each other.

In this way total surface area $= 6a^2 + 2a^2 + 2a^2 + 2a^2 = 12a^2$

Actual surface area of cubical diamond = $6a^2$

Therefore, percentage increase in area = $(12a^2 - 6a^2) / 6a^2 * 100 = 100\%$

Remember that for the given volume, minimum surface area is possessed by a cube. So to maximize

The area we have to increase the maximum possible difference between the edges of cuboids.

30. Side of square 1 = a

Side of square 2 = $a/\sqrt{2}$.

Side of square 3 = a/2

Side of square 4 = $a/2\sqrt{2}$

Side of square 5 = a/4.

Therefore, sum of perimeters of all the squares = $4(a + a/\sqrt{2} + a/2 + a/\sqrt{2} + a/4)$

$=4a(1+ 1/\sqrt{2} + 1/2 + 1/\sqrt{2} + 1/4)$

$=4a((4 + 2/\sqrt{2} + 2 + \sqrt{2} + 1)/4) = a(7+3\sqrt{2})$

31. Total area of the five squares = $a^2 + (a/\sqrt{2})^2 + (a/2)^2 + (a/\sqrt{2})^2 + (a/4)^2$

$= a^2(1+ (1/2) + (1/4) + (1/8) + (1/16))$

$= a^2(16+ 8 + 4 + 2 + 1) / 16$

$= a^2 * 31/16 = 31a^2/16$

32. $(n-2)^3$

33. $6(n-2)^2$

34. $12(n-2)^2$

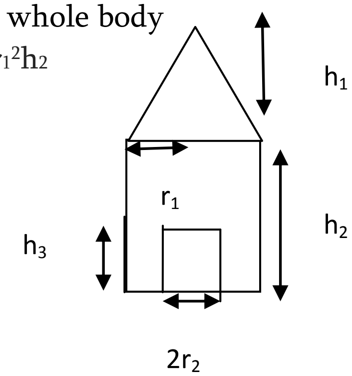
35. These are the 8 cubes at the corners, which is always fix.

36. Volume of the whole body

$V_1 = 1/3\ \pi r_1^2 h_1 + \pi r_1^2 h_2$

But $h_1 / h_2 = 2/3$

$V_1 = \pi r_1^2\ (11h_1/6)$



And $h_3 = 2/3\ (h_1+h_2) = 5h_1/3$

Hence, Volume of the hole(V_2)= $\pi r_2^2 h_3$

$= 5/3 \pi r_2^2 h_1$

But it is given that $(V_2) = (V_1 - V_2) / 3$

$V_1 = 4\ V_2$

$4 * 5\pi r_2^2 h_1$

$= \pi r_1^2 * 11/6 h_1$

$r_2 = \sqrt{(55/8)}$ cm

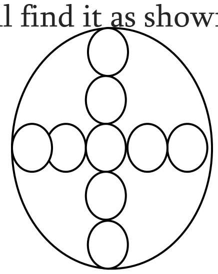
37. 19 * 19 =361

Thus, We make equal 19 measurements each of 19 degree,

Then we get

(361-360)=1 degree angle at the centre. Thus, moving continuously in the smiliar fashion, we can get all the 360 degree angle i.e , 360 equal sectors of 1 degree.

38. When we open the paper after cutting it, we will find it as shown in the following figure.



Radius of the larger circle = 5cm.

Area of larger circle = 25π

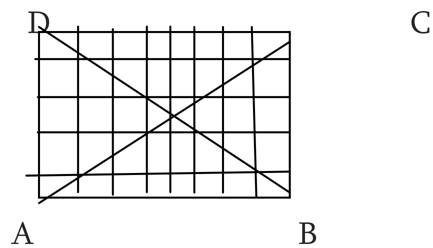
And the radius of smaller circle is 1cm.

Therefore, total area of all the 9circles $=9\pi(1)^2 = 9\pi$

Remaining area = $(25 - 9)\ \pi = 16\pi$

Hence, the required ratio = 25:16

39. In the above layer we can see that total 13 cubes get a cut.



So, in 7layers total 13 * 7=91 cubes will get a cut and

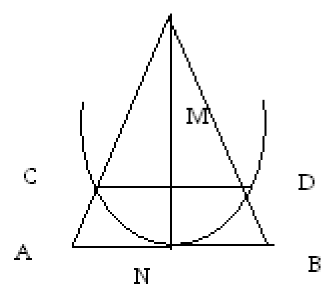
the remaining $(7^3*91)=252$ cubes are without any cut.

Total number of pieces which are not a cube = 12 *2*7 + 4*7 =196

(Since 84 cubes are diagonally cut into two parts and 7 cubes which are in the centre are divided into 4 parts.)Thus total 96 children will get one-one piece and 2 adults get one–one piece. Thus total 252+196 = 448 people can get a piece of cake.

Solutions for questions number 40 to 42:

Diameter (2R) of the outermost circle is equal to the diagonal of larger square. Hence, the side of square = $2\ R/\sqrt{2}$.



Once again the diameter of the mid-circle is equal to the diagonal of smaller square. Hence, side of the smaller square = R. Similarly the diameter of innermost circle is equal to the side of the smaller square. Hence, radius of the innermost circle = R/2.

40. R/2

41. Area of larger square = $(\sqrt{2}R)^2 = 2R^2$

And area of smaller square = R^2

Therefore, Total area of both squares = $3R^2$

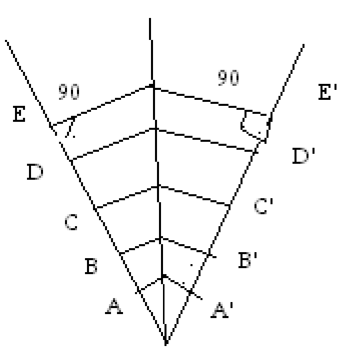
42. Sum of all the circumferences = $2\pi(R + R/\sqrt{2} + R/2)$
$= 2\pi R (2 + \sqrt{2} + 1)/2$
$=(3+\sqrt{2})\pi R$
Sum of perimeters of all the squares $=4(\sqrt{2}R+R)$
$=4R(\sqrt{2}+1)$
Required ratio= $((3 + \sqrt{2})\pi R) / (\sqrt{2} + 1)4R = ((3 + \sqrt{2})\pi) / ((\sqrt{2} + 1)4)$

Solutions for questions number 43 and 44:
Each side of outer (larger) hexagon is equal to the radius of circle which is R.Now, OC =ON = OD radii of the inner (smaller) circle
But ON/OA = sin 60 = $\sqrt{3}/2$
ON = $\sqrt{3}/2$ OA $=\sqrt{3}/2$ R,
Radius of the inner circle and this is also equal to the side of the inner hexagon.

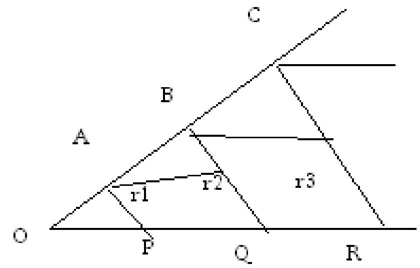
43. Sum of perimeter of both the hexagons = $6R + 6 * \sqrt{3}/2\, R$
$=6R(1 + \sqrt{3}/2) = 3(2 +\sqrt{3})R$
44. Area of inner circle / Area of outer circle = $\pi[(\sqrt{3}/2)R]^2 * 1/\pi(R)^2= 3/4$

45. Radius of the first hexagon = R
Radius of the second hexagon = $\sqrt{3}/2$ R
Radius of the third hexagon = ¾ R
Radius of the fourth hexagon = $(3\sqrt{3} / 8)$ R
Required ratio = $R / ((3\sqrt{3} / 8)R) = 8 / 3\sqrt{3}$

46. From the concept of similarity of triangles. All t6he five quadrilaterals viz., AOA',BOB', COC', DOD' and EOE' are similar.



From the figure(2)
$r_2 - r_1 / r_2 + r_1 = r_3 - r_2 / r_3 + r_2$
$= r_4 - r_3 / r_4 + r_3$
$= r_5 - r_4 / r_5 + r_4 = k$
$r_2 / r_1 = r_3 / r_2 = r_4 / r_3 = r_5 / r_4 = k$
(By Componendo and Dividendo)



It means all the radii are in GP
Therefore, $r_5 / r_1 = (K)^4 = 81 / 16 = (3/2)^4$
⇨ K= 3/2; $r_3 = r_1(k)^2$ D
⇨

46. $r_3 = r_1 * 9/4 = 9r_1 / 4 = 9/4 * 1$ M36cm

47. Else $r_1 = 16$, $r_2 = 24$, $r_3 = 36$… Etc
Therefore, QP / AP = OQ /BQ C D
$(h + r_1) / r_1 = (h+ 2r_1 + r_2) / r_2$
$(h + 16) / 16 = (h + 56) / 24$;
⇨ h =64 cm

48. 60 = 1*1*60
= 1*2*30
= 1*3*20
= 1*4*15
= 1*5*12
= 1*6*10
= 2*2*15
= 2*3*10
………………..
= 3*4*5
Out of the given different combinations the first combination (=1*1*60) gives maximum length of diagonal of cuboid, but in this case two of the edges are same. So, the second combination gives the proper value i.e., which gives the maximum length of diagonal whose all sides are different. Hence, the length of such a pencil is equal to the diagonal of cubiod. = $\sqrt{(1^2+ 2^2 + 30^2)}$ **=$\sqrt{905}$**

49.

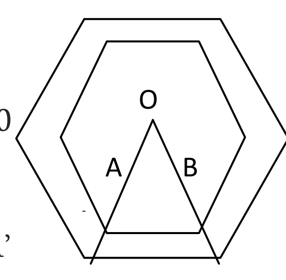


Figure 1

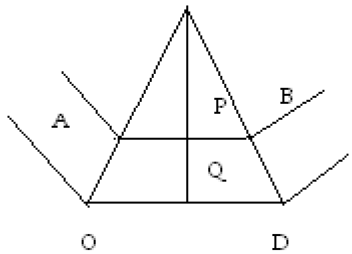


Figure 2

In figure (2)

OP = √3 / 2 OA = 4√3 cm

Again OP / OQ = OA / OC

4√3 / 6√3 = 8/OC (OQ = OP + PQ = 4√3 + 2√3)

OC 12 cm

Each side of the outer hexagon is 12 cm.

Required area = (Area of outer hexagon – Area of inner hexagon)= 3√3 / 2 (12^2 - 8^2)

= 120√3 cm^2

50. Area of region x = Area of square – Area of inscribed circle = (4- π)

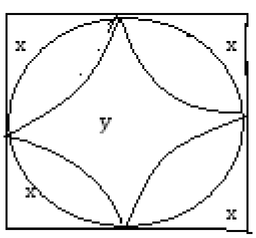


Figure 1

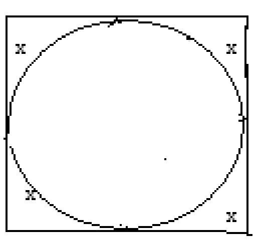


Figure 2

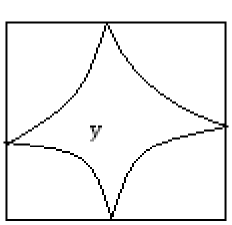


Figure 3

Area of region y = Area of square – 4 (area of quadrant) = 4 -4 [(1/4) π * $(1)^2$] = (4- π)

Required area (of shaded region)

= Area of square – [Area of region x + Area of region y]

= 4 – [4- π+4- π] = 2 π -4

51. Let the volume of solid block be V and radius of the spheres formed from the first block be r_1, then the volume of each sphere be V_1.

Similarly, let the radius of each sphere obtained from second block be $r_2(=2r_1)$, then the volume of each sphere be

$V_2 = (8V_1)$ (1)

$V = KV_1 +14$

and $V = lV_2 +36$

or $V = 8\,lV_1 +36$ (2)

From equation(1) and equation(2)

$kV_1 +14 = V = 8\,lV_1 +36$

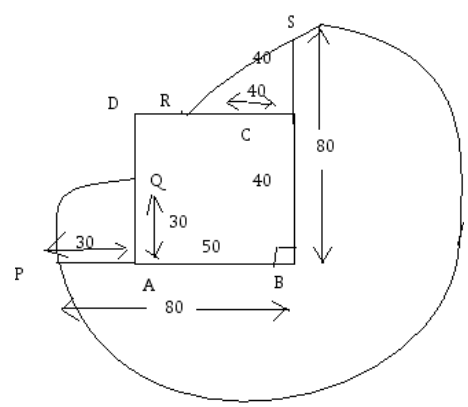
$V_1(k – 8l) = 22$

The possible value of V_1 =22, 11, 2 or 1

But V_1 can never be equal to or less than 14 (since remainder is always less than divisor) so, the possible value of V_1 =22

$V_2 = 8 * V_1 = 176$ cm^2

52. The length of tether of the horse is 80 m.



Area grazed by horse = [π $*(80)^2$ * (270/360)+ π $(30)^{2}$* (90/360) + π * $(40)^2$*(90/360)]

=π[6400 * (3/4)+ 900 * (1/4) + 1600 * (1/4)]

= π (21700/4)

= 5425π m^2

53. Here each side is broken up into 6 parts

i.e., n =6

Now, $N_0 = (n-2)^3 = (4)^3 = 64$

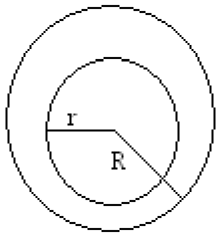
$N_1 = 6(n-2)^2 = 6 * (4)^2 = 96$

$N_2 = 12(n-2)^1 = 12\ (4) = 48$

$N_0 : N_1 : N_2 = 64:96:98 = 4:6:3$

54. Let the radius of seed be r and radius of the whole fruit (pulp+seed) be R, then the thickness of the pulp =(R-r)

Volume of mango fruit = 4/3 πR^3



And Volume of pulp = 4/3 $\pi(R^3 - r^3)$

but = 4/3 $\pi(R^3 - [(2/7)R]^3)$

[r/ (R-r) = 2/5; r =(2/7)R]

Percentage of volume of pulp to the total volume of fruit

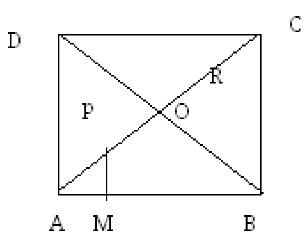
={4/3 πR^3[1-(8/343)]} / (4/3 πR^3)

= (335 / 343) * 100 = 97.66%

55. Let the radius of each smaller circle is r and radius of the larger circle is R, then

$\pi R^2 = 4\ \pi R^2$

R = 2r



OR =OP = R +r = 3r

Also PM =r

(PM is perpendicular on AB)

AP =√2 r

AO = AP +PO

= r√2 + 3r = r(3+√2)

AC =2AO = 2r (3+√2), which is the diagonal of square

Required ratio = (2r(3+√2)) / √2r = (2 + 3√2)

56. Initial radius =14cm

Radius at a time when the balloon explodes = 35cm

Change in volume = 4/3 π $[(35)^3-(14)^3]$

= 4/3 $\pi(7)^3$[125-8]

=4/3 π *343*117

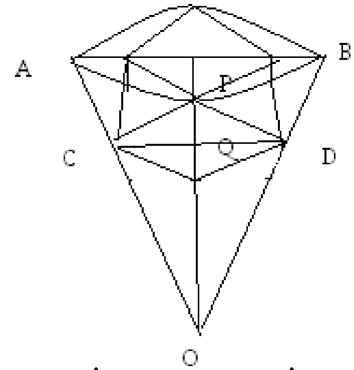
Required time to explode = (4/3 π *343*117) / 156

= 1078 s

57. Let the each side of cube be a, then CD =√2 a

CD = a/√2

Let the radius of cone be r and height be h, thenr = h√2.



In △ APO and △CQO (similar triangles)

AP /PO = CQ/OQ =r/h = (a/√2) / (h-a)

(a/√2) / (h-a) =√2

a = 2(h-a)

h =3a/2

r= 3a/2 * √2

and h =3a/2

Volume of cone =1/3 π *$(3a\sqrt{2} / 2)^{2}$* 3a/2

= 9/4 a^3 π

and volume of cube = a^3

Required ratio = (9/4 a^3 π) / a^3 = 9/4 π =2.25 π.

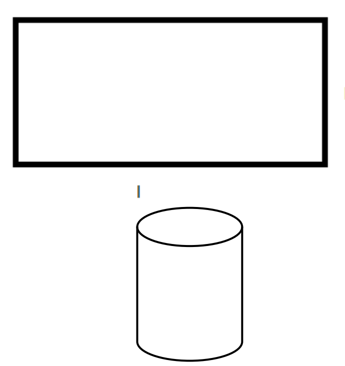
58. For the given volume, cube has minimum possible length of diagonal.

Therefore each side of cube = 4cm

and its diagonal =4√ 3cm.

l=2 πr ➔r=l/2π

59.

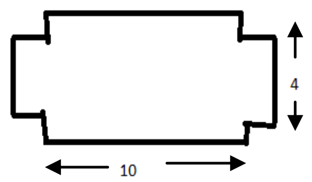


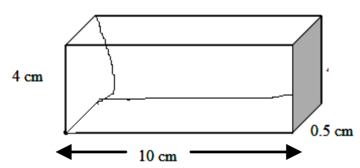
Where r is the base radius of cylinder and l is the length of paper and h=b,where h is the height of cylinder and b is the breadth of the paper.

Volume of cylinder=$\pi r^2 h = \pi(1/2\ \pi)^2$ *b

$\Pi^* l^2 b/4\ \pi^2$ =48.125=385/8

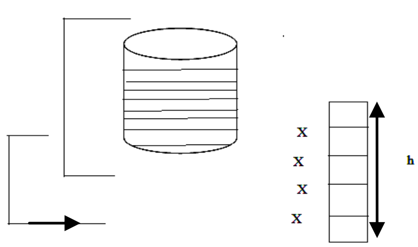
$l^2 b=11*11*5$
$l=11$ and $b=5$
Volume of the box=l*b*4
$=10*4*0.5=20cm^3$





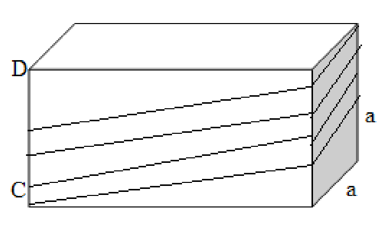
60. Vertical spacing between any two turns= Height of cone/Number of turns=h/n

61. Number of turns=h/x
Lengths of string in each turn = $2\pi r=2\pi*4/\pi=8$ cm

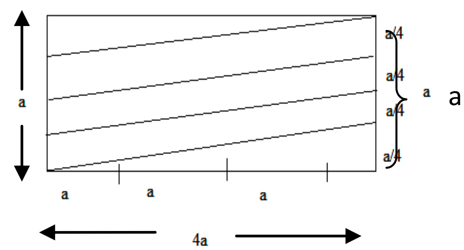


Lengths of string in all the n turn
=h/x*8=8h/x cm

62. Total length of string = 8n cm
Since total length of string
= number of turns * perimeter of cylinder
= 8*n=8n cm

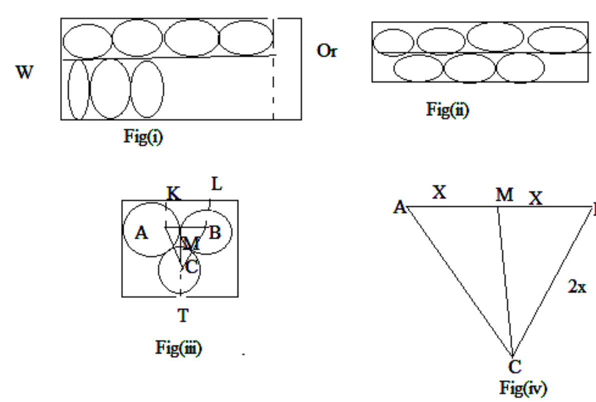


Length of string required fro 1 turn(or round)
=8n/4=2n
But $2n=\sqrt{(a/4)^2+(4a)^2}$



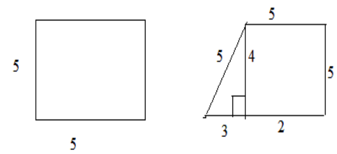
$a=8n/\sqrt{257}$
Where a is the side of cube

63. From the sheet of 10 ft long, maximum 10/2= 5 circular discs
Can be cut along the length of the iron sheet
$CM=\sqrt{(AC^2-AM^2)}=\sqrt{(4x^2-x^2)}$
$CM=x\sqrt{3}=\sqrt{3}$ Ft
Since x=1ft)Width of the sheet= AK+MC+CT



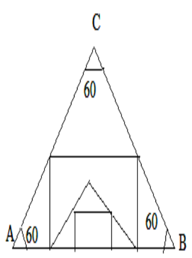
$=1+\sqrt{3}+1$
$=(2+\sqrt{3})$ ft

64. Recall that dor given perimeter the polygon of minimum number of sides has minimum area and the polygon of maximum number of sides has maximum area. So, the correct relation is h>s>r
Thus, Hexagon(6 sides) has maximum area.
Now, between square and rhombus, square has greater area than rhombus .For easier understanding consider some values.

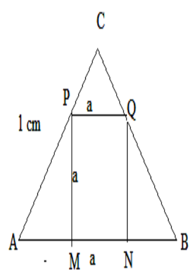


Area=25 cm^2 Area=base*height =5*4=20 cm^2

65.

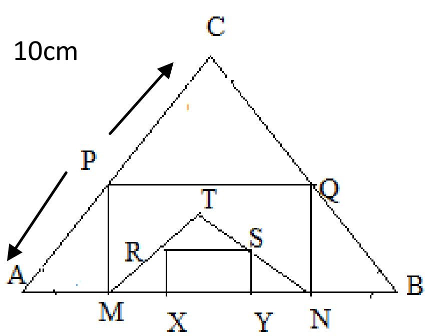


Fig(i)



Fig(ii)

PCQ is also an equilateral triangle
PC=PQ=PM=a
$a/PA=\sqrt{3}/2$
$PA=2a/\sqrt{3}$
$AC=Ap+PC=2a/\sqrt{3}+a=1$ cm
$A=\sqrt{3}/(2+\sqrt{3}=\sqrt{3}(2-\sqrt{3}$
Now in figure (iii)

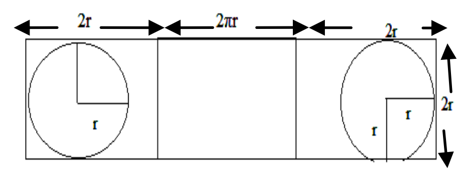


Fig(iii)

PM=MT=a
Let the each side of square RSYT be k, then RT=K also (since RTS is an equailteral triangle)
$K/RM=\sqrt{3}/2$
$RM=2K/\sqrt{3}$
$MT=RT+RM=K+2K/\sqrt{3}$
$MT=(\sqrt{3}+2)/\sqrt{3}K$
But MT=a

$a=\sqrt{3}(2-\sqrt{3})$
$K=\sqrt{3}/(\sqrt{3}+2)[\sqrt{3}(2-\sqrt{3})]$
$K=3(2-\sqrt{3})/2+\sqrt{3})*(2-\sqrt{3})/(2-\sqrt{3})$
$K=3(2-\sqrt{3})^2/1=3(7-4\sqrt{3})$
Area of square RSYX$=K^2=[3(7-4\sqrt{3})]^2$
$K^2=9(49+48=56\sqrt{3})$
$K^2=(873-504\sqrt{3})cm^2$

66. For the minimum wastage of sheet he has to cut the sheet in the given manner.



Total area of sheet required
$(2\pi r+4r)*2r=4r^2(\pi+2)$
Area of sheer utilised$=(2\pi r*2r)+2(\pi r^2)=6\pi r^2$
Area of wastage sheet$=4r^2(\pi+2)- 6\pi r^2$
$=8r^2- 2\pi r^2$
Required ratio$=8r^2 -2\pi r^2/6\pi r^2$
$=2r^2(4- \pi)/6r^2 \pi=1/11$

67. Very quickly check the options. If all the options have values.

68. Let the initial radius be r and Volume be V, then, $V= \pi r^{2}*4$
Ist case: $V_1= \pi(r+12)^2*4$
IIst case: $V_2= \pi r^{2}*(4+12)$
But $V_1=V+K$
And $V_2=V+K$
$V_1=V_2$

- ⇨ $\Pi(r+12)^2*4=r^2(16)$
- ⇨ R=12 ft

Increased volume$= V_1=V_2$
$= \pi*(24)^2*4$
$=2304\ \pi$ cubic ft

__TRINOMETRY:__

1. Let $z= \sin\theta + \cos\theta$
 $z^2 = 1+ \sin 2\theta$
$0<\theta<90°$ so $\sin 2\theta<1$, so that $z^2 < 2$,
Thus $z<\sqrt{2}$ i.e., z is greater than one

2. Go through the option Answer: d

3. Sin θ – cos θ = 0
Sin θ = cos θ
Tan θ = 1 => θ=∏/4

4. go through the option
Answer : c

5. c

6. a

7. √(1-sin θ) / √ (1+cos θ) + √(1+sin θ) / √ (1-sinθ)
= ((1-sin θ) + (1+sinθ)) / cos θ
= 2 sec θ

8. $a^3 + b^3 = (a+b)^3 - 3ab(a+b)$
Let a = $\sin^2\theta$, b= $\cos^2\theta$, so that a+b =$\sin^2\theta + \cos^2\theta$ =1
$\sin^6\theta + \cos^6\theta = 1 - 3\sin^2\theta\cos^2\theta$.

9. cos x =1/p and sin x =1/Q
$1 = \cos^2 x + \sin^2 x = 1/P^2 + 1/Q^2$
$P^2 + Q^2 = P^2 Q^2$

10. $\sin^2 A\,(1-\sin^2 B) - (1-\sin^2 A)\sin^2 B = \sin^2 A - \sin^2 B$

11. n/1 = sin 2x / sin 2y
n+1 / n-1 = sin 2x +sin 2y / sin 2x – sin 2y
= 2sin(x+y)cos(x-y) / 2cos(x+y)sin(x-y)
= tan(x+y) / tan (x-y)

12. The value is least when θ= 90°

13. b

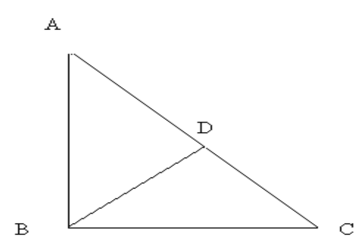
14. log tan 1° + log tan 89° =
log tan 1 ° + log tan (90 – 1)
= log tan 1° + log cot 1°
= log tan 1°. Cot 1 ° = log 1 =0
Similarly, log tan 2° + log tan 88° =0
Also, log tan 45° = log 1 =0
Thus the value of expression is zero.

15. sin(-566°) = -sin(566°) =-sin(90*6+26)
= sin 26°a

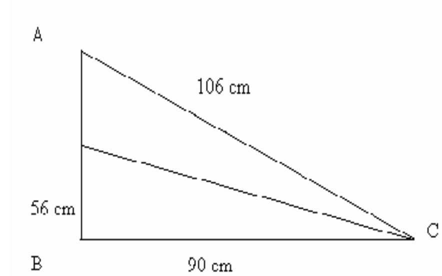
16.a
17. b
18. c
19. d
20. d
21. d
22. b
23. c
24. d
25. c
26. b
27. c
28. b
29. c
30. b
31. c
32. a
33. d
34. b
35. a

GEOMENTRY

1. BD = 53cm
AD = CD = BD =53 cm



AC = 2*53 = 106 cm
= 242 cm
AB + BC = 146 cm
Let AB = x cm
BC = (146 – x) cm
$AB^2 + BC^2 = AC^2$
$X^2 + (146 - x)^2 = (106)^2$ ....(1)
Solving the equation (1), we get x= 56 and x= 90



Consider AB = 56cm

Then BC = 90 cm

Longest median will fall on the shorter side.

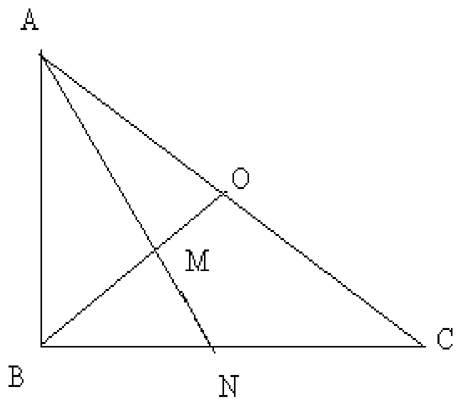
Now, the area of $\triangle$ ABCD = ½ * BD * BC

= ½ * 28 * 90 = 1260 cm^2

2. Let AB = BC= a

Then AC = $\sqrt{2}$a

AO = Oc = BO = $\sqrt{2}$a/2 = a/$\sqrt{2}$



Now, by angle bisector theorem

AB/AO = BM.MO => BM/MO = a/a/$\sqrt{2}$ =$\sqrt{2}$/1

MO = 20 cm, BM = 20$\sqrt{2}$ cm

BO = 20 + 20$\sqrt{2}$ = 20 = 20 (1 + $\sqrt{2}$) cm

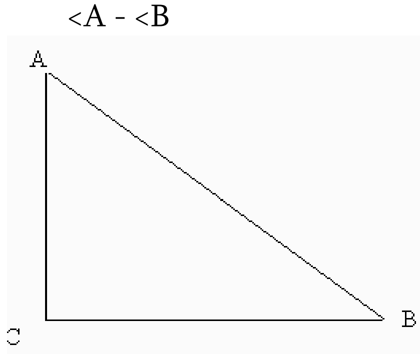
Now since, BO = a/$\sqrt{2}$ = AB/$\sqrt{2}$

AB = $\sqrt{2}$ (BO) = 1.41.[20 (1 + 1.414)]

= 68.2679 = 68.27 cm

3. <A + <B = 90^0

<A - <B



89 – 1 =88

88 – 2 = 86

87 – 3 = 84

…. ….. ……

45 – 45 0

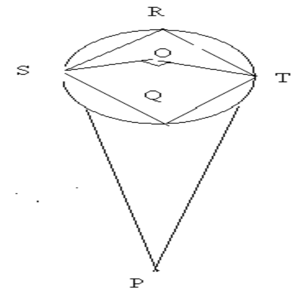
44 – 46 = -2

…… ……. …..

1 – 89 = -88

Thus k can assume total 44+1+ 44 = 89 Values

4. <SPT and <SOT are supplementary,

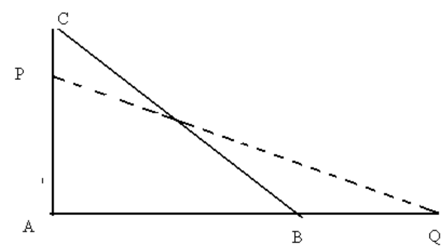


<SOT = $180^0 - 50^0 = 130^0$

<SRT = ½ (<SOT) = 65^0

<SQT = 180 – 65^0 = 115^0

5. Let BC be the ladder, then



BC = 6.5 cm and AB = 5.3m

AC = $\sqrt{(BC)^2 - (AB)^2}$

AC= 3.9 m

Now $PQ^2 = PA^2 + AQ^2$

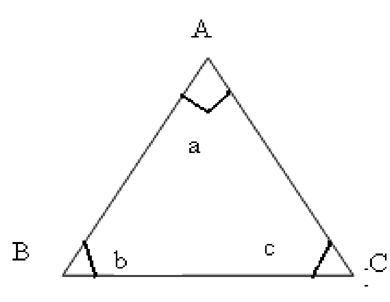
$(6.5)^2 = (2.5)^2 + (AQ)^2$

AQ = 6m

BQ = AQ – AB = 6 – 5.3 = 0.8m

The foot of the ladder will slip by 0.8 m

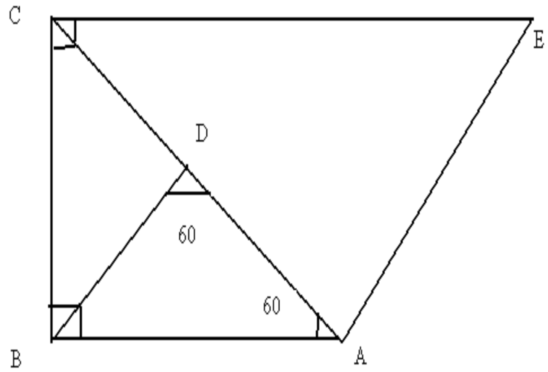
6. <A + <B + <C = 180



Any one of angle can posses the the values from 1 to 178

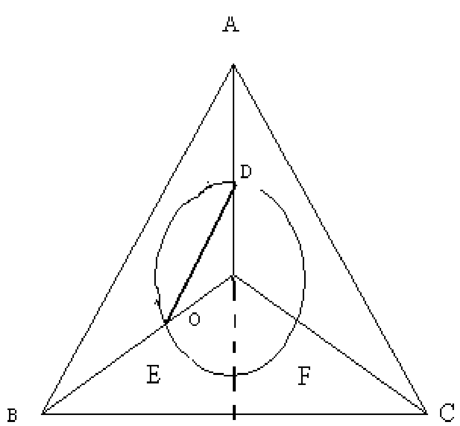
7. Cannot determine

8. $\triangle$ ABC is right angled



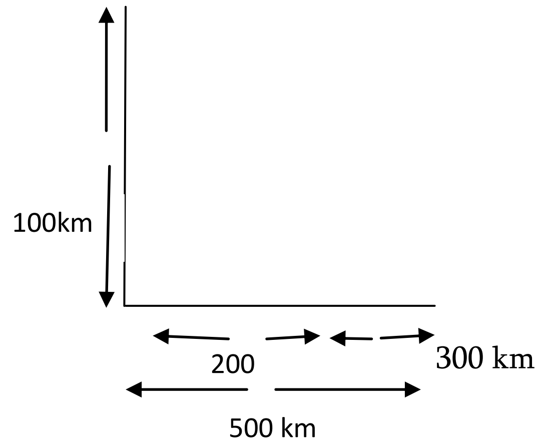
And $<ABC = 90^0$
Let AB = x
Then AB = D = CD = BD =x
ABD is equilateral triangle
$<CAE = 60^0$
$<BCA = 30^0$
$< ACE = 60^0$
$< CEA = 60^0$, also
Hence, $\triangle$ ACE is an equilateral triangle
Thus AC = AE = CE = 2x
And BC/AB = tan 60^0 = √3
BC = AB√3 = x√3
BC/AE =x√3/2x =√3/2

9. $\Pi r^2 = 3\pi \Rightarrow r\sqrt{3}$
$DE = 2r^2 - 2r^2\cos 120^0$
$DE = r^2$
But AB = 2DE



$AB = 2r^2 = 2^*(\sqrt{3})^2 = 6$
(D and E are the mid-point of OA and OB)
Perimeter of triangle ABC = 3* 6= 18 unit

10. time taken in the collision of the two trains:
=500 / (40 + 60) = 5h

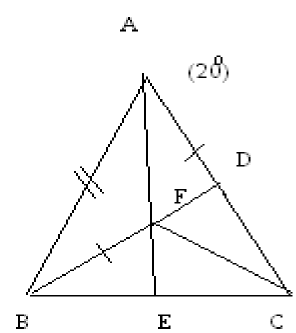


In 5 hours, plane will cover 5 X 200 = 1000 km distance.

11. Two trains meet with accident at a place 200(= 40 X 5) away from Patiyala.
The required distance = 200 km.

12. Area of ΔBDE =(1/2) *(2 / 5)AB*(2 / 7)BC
= (4 / 35) X (1 / 2)(AB X BC)
= (4 / 35) area of Δ ABC
Area of Δ ABC = (35 / 4) X 20 = 175 cm^2

13. Let E be on BC and BE = EcLet F be on AE sothat triangle FBC is equilateral.



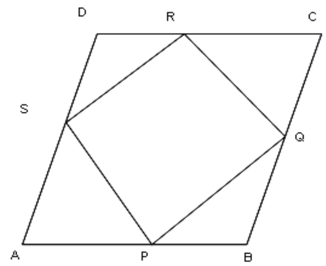
∠DAB = ∠ ABF = 20°
And DA = BF
Trapezoid ADFB is isosceles,
∠FAD = ∠DBF = 10°
Therefore ∠DBC = 10 + 60 = 70°

14. Calculate them physically or manually

15. AB = 6 cm, ∠c = 60°
And ∠A = ∠B = 60°
Δ ABC is an equilateral triangle
Area of triangle ABC = (√3/4) X 6^2 = 9√3

Area of $(\Delta ADE+ \Delta BFG)=2*(\sqrt{3}/4)*(2)^2=2\sqrt{3}$
Area of pentagon = $9\sqrt{3} - 2\sqrt{3} = 7\sqrt{3} cm^2$

16. Since PQRS is a parallelogram



$\angle PSR = 90°$ **(**$\angle PSR + \angle PQR = 180°$**)**

17. Best way in to go through option

$r>1$ and $r = 1$

Let us assume $r = 2$

$w = a$

$x = ar$

$y = ar^2$

and $z = ar^3$

$ar^3 – a = a(r^3 – 1) = 168$

$a(2^3 – 1) = 168 :a = 24$

Note only option (a) gives a value (168) which is divisible by 7 Now. A = 24, ar = 48, $ar^2 = 96$, and $ar^3 = 192$

This value satisfies all the required conditionals hence it is correct.

18. $<ROQ = 180 – 50 = 130^0$

Now, since RT = TM and qs = sm

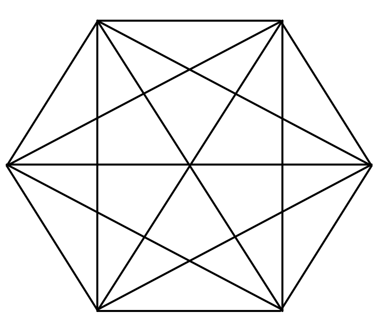
Also OR =OM = OQ

<ROT = <TOM and <MOS = <SOQ

<SOT = ½<ROQ

$<SOT = 130/2 = 65^0$

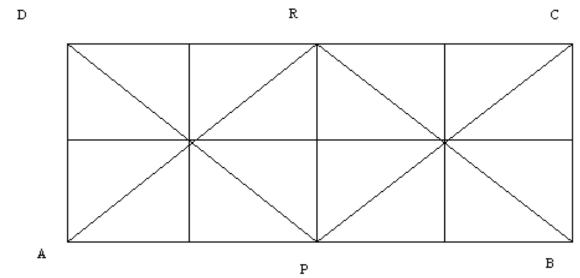
19. 12 + 6 + 1 = 19



20. There are total 16 similar triangle each with equal area. Here, 4 out of 16 triangle are taken.

So the number of shaded triangles = 4 and number of unshaded trianglr = 12

Required ratio =1/3



21. Number of total rectangle $={}^4C_2*{}^3C_2= 6*3 =18$

22. $<PDB = <QEA = 80^0$

$<PED = <QDE = 10^0$

$<DRE = 180 – (10 + 10) =160^0$

$<PRD = 180 - <DRE = 20^0$

23.OC= AB/2

AO = OC = OB

<OAC = <OCA

$= <BCO = <OBC = 45^0$

$<ACB = 90^0$

24. Notice that all the triangle are equilateral Area of shaded region = $[3 \Pi r^2 60/360 - \sqrt{3} * r^2]$

$= [r^2/2 \Pi - 3\sqrt{3}/2]$

25. D

26. Notice $<ORP = 90^0$(OP is a diameter of a smaller circle)

<OS = 5 cm and OR = 4 cm

SR = $\sqrt{(5)^2 – (4)^2}$ = 3 cm

SP = 2(SR) = 6 cm

(Since, OR passes through center O and perpendicular to SP therefore OR bisects SP)

27. AD/AB = DO/BO = 1

OB = OD = 8cm

ABCD is a cyclic quadrilateral

DO * BO = CO * AO

8 * 8 = 4 * AO

AO = 16 cm

AC = 16 + 4 = 20 cm

28. At $<A = 90^0$, BC = b=c

And at $<A = 90^0$,BC=$\sqrt{2}$b =$\sqrt{2}$c

$60^0 < A < 90^{0,}$ BC = c<a<c$\sqrt{2}$

29. $OR^2 = (QO)^2 + (RQ)^2$

$OQ^2 = 5OQ^2$

Radius(r) = OQ$\sqrt{5}$

OQ = r/$\sqrt{5}$

Again $OC^2 = OH^2 + HC^2$

$R^2 = (OQ + OH)^2 + (QH)^2$

$R^2 = (r/\sqrt{5} + QH)^2 + (QH)^2$

(QH) = r r/$\sqrt{5}$

HC = r/$\sqrt{5}$ = RQ/2

RC = $\sqrt{(RD)^2 + (DC)^2}$

= $\sqrt{(r/\sqrt{5})^2 + (r/\sqrt{5})^2}$ = r 2/5

RC +FS =2r $\sqrt{\ }$ 2/5

30. Best way is consider some values and verify the results.

31. $<OCT = 90^0$, $<DCT = 45^0$

$<OCB = 45^0$

$< COB = 45^0$(BOC is a right angled triangle

$<AOC = 180^0 - 45^0 = 135^0$

Now CD = 10 => BC = 5cm = OB

OC = 5 $\sqrt{2}$ am = OA

Again $AC^2 = OA^2 + OC^2 - 2OA . OC \cos 135^0$

$= 2(OA)^2 - 2(OA)^2. \cos135^0$

$= 2(5\sqrt{2})^2 - 2(5\sqrt{2})^2 \ (-1/\sqrt{2})$

$= 100 + 100/\sqrt{2}$

$AC^2 = 170.70$

AC = 13 cm (APP)

Perimeter of OAC = OA + OC + AC

= 5$\sqrt{2}$ + 5$\sqrt{2}$ + 13 = 27 cm

32. $\angle ACB = 60°$ $(\angle ACB + \angle ADB = 180)$

$\angle CAB = 30$ $(\angle ACB + \angle CAB = 90)$

AC + 2 X 6 = 12cm^2

(BC / AC) = sin 30 = ½

BC = 6cm

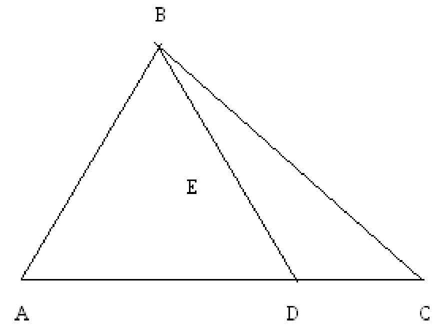
(BC / AB) = tan 30 = 1 / $\sqrt{3}$

AB = 6$\sqrt{3}$ cm

Area of Δ ABC = (1/ 2) X 6 X 6 $\sqrt{3}$ = 18$\sqrt{3}$

33. Area of a Δ BAE = (1/4) AC (1/3) BD

= (1/12 Area of Δ ABC)



34. (AE/EC) = (AB /BC) = (7.5 / 10.5) = (5/7)

NOW, $AB^2 + BC^2 = AC^2$

$(5k)^2 + (7k)^2 = (18k)^2$

$74k^2 = 324 \Rightarrow k^2 = 321/74$

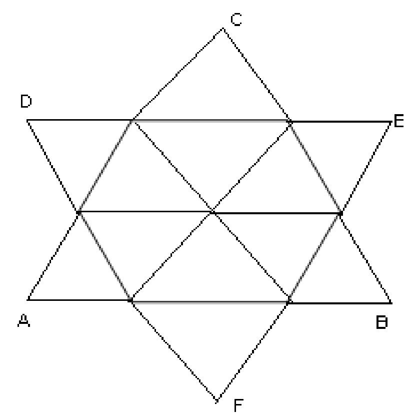
Area of a Δ ABC = (½)*AB* BC=(1/2) * 5k* 7k

= (35/2) k^2 = (35/2) X (324 / 74)

= 76.621 cm^2

35. There are total 12 similar triangles each with equal area. But a larger triangle ABC (or DEF) has only 9 smaller triangles. Out of 9 triangles only 6 triangles are common .

Area of common region =(6/9)* 198=132cm^2



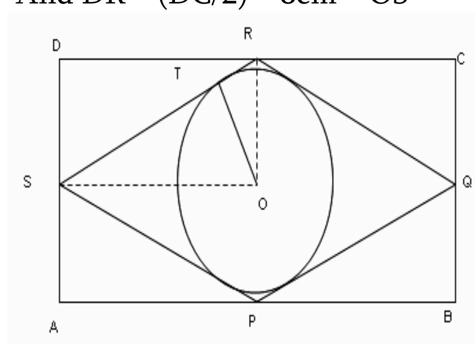
36. 9 X (180 - 2) X 360 = 180 X 5 = 900°

since {n X (180 – 2) X 360 }

= 180 (n-4)

37. DS = (AD/2) = 6cm

And DR = (DC/2) = 8cm = OS



SR = 10cm and OR = 6cm

Area of Δ QRS = [(OS *OR)/2] = (SR*OT) / 2

(8 *6) / 2 = (10* OT) / 2

OT = 48/10 cm

Area of circle = $\pi r^2 = \pi*(48/10)^2$

=(576/25)π

38. 200 = $2^3 * 5^2$

Number of total factors = (3+1) X (2+1) = 12

Total number of required rectangles = 12/2 =6

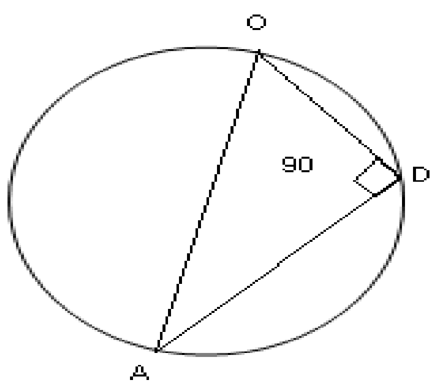
Area = b X l

200 = 1 X 200 = 2 X 100

= 4 X 50 = 5X 40 = 8 X 25 = 10 X 20

39. Maximum probable number of circles = ${}^8C_3$

(Since a circle can pass through any three non-



collinear points)

But since 4 points are lie on the same circle so which reduces the formation of some circles.

Actual number of circles =${}^8C_3$- ${}^4C_3$+1

=56-4+1 =53

40 .Here, AC and BC are the secants of the circle and AB is tangent at D

AE X AC = AD^2

AE X 4 = $(3)^2$ => AE = 9/4

CE = 4 – (9/4) = 7/4

CE : (AE + AD)= 7/4 : [(9/4) + 3]

= (7/4) : (21/4) = 1 : 3

41.$\angle$ADO is a right angle (angle of semicircle)

Again when OD perpendicular on the chord AC and OD passes through the centre of the circle ABC, then it must bisect the chord AC at D.

AD = CD = 6cm

42. $<CED = 120^0$

$<BED = 60^0$

$<EDB = 90^0$

BD/BE = $\cos 30^0$

6/BE = $\sqrt{3}/2$

BE = $4\sqrt{3}$ cm

BC = BE + CE= $4\sqrt{3} + 5\sqrt{3} = 9\sqrt{3}$ cm

Now, since AB and CB are the secants of the circle

BD * BA = BE * BC

6 * BA = $4\sqrt{3} * 9\sqrt{3}$

BA = 18 cm

Again ACB is a right angled triangle

AC = AB sin 30^0

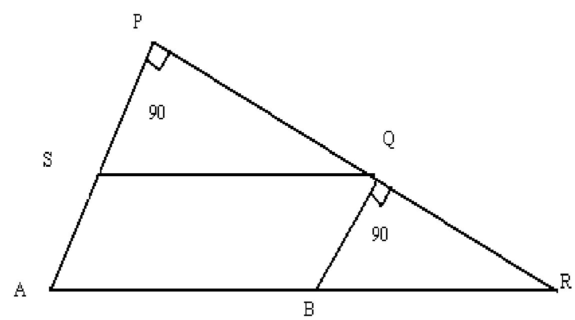
AC = 9 cm (Alternatively apply Pythagoras theorem)

And AD = AB – BD = 12 cm

AC/AD = 9/12 = ¾

43. AB = SQ = 25 cm

PQ = 24 cmSP = 7 cm



AP = 12 cm and SP = 7 cm

(PSR and QBR and PAR are similar)

AS (= BQ) = 12 – 7 = 5 cm

PS/SQ = PA/AR

7/25 = 12/AR => A = 300/7

BR = AR – AB= 300/7 – 25

BR = 125/7

AB/BR = 25 * 7/125 = 7/5

44. SP/PQ = BQ/QR

7/24 = 5/OR => QR = 120/7

Area of APR/Area of BQR= ½ * AP * PR/ ½ * BQ * QR = 12 * 288/7/ 5 *120/7

= 133/25

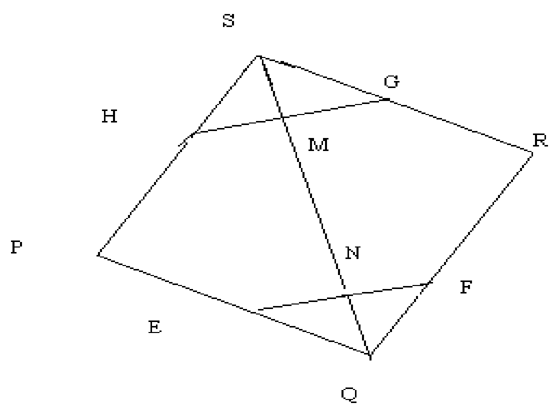
45. $x^2 + y^2 + z^2 = xy + yz + zx$

$x^2 + y^2 + z^2 – xy – yz –zx=0$

$2(x^2 + y^2 + z^2 – xy –yz –zx) = 0$

$(x^2 + y^2)+(y^2+z^2)+(z^2+x^2) -2xy-2yz-2zx = 0$
$(x-y)^2 + (y-z)^2 + (z-x)^2 = 0$
$x = y = z$
The given triangle is an equilateral triangle

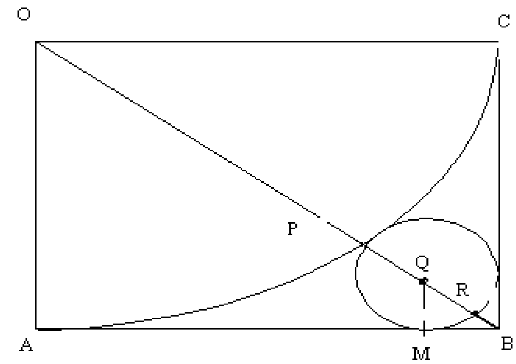
46. Let AD = 3a and DC = 6a
DH = HG = GC = 6a/3 = 2a
HM = MG = 2a/2 = a= SM
NQ = a
SQ = SM + MN + NQ
A + 3a + a= 5a
Since diagonal of square SQ = 5a



But, diameter of circle SQ = diagonal of square SQ
Radius of the circle 5a/2
Area of the circle = $\Pi * (5a/2)^2$
Here Area of circle/Area of rectangle
= $25/4(a^2\ \Pi)/3a * 6a = 25\ \Pi/72$

47. Area of hexagon ABCDEF = $6*\sqrt{3}/4 * (6)^2$
$54\sqrt{3}$ cm^2
Area of BDF = ½ (Area of hexagon)
=$27\sqrt{3}$ cm^2

48. OA = AB = BC = OC = OP
Let OA = R (radius of the larger circle) then OB = $R\sqrt{2}$
Similarly PQ = MQ = QR = r(Radius of smaller circle)
Then BQ = $r\sqrt{2}$
BP = $r + \sqrt{2}$

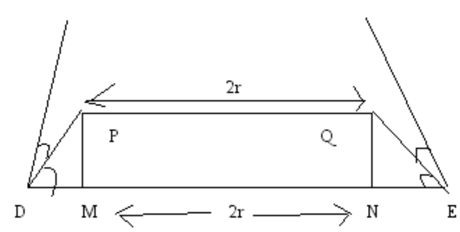


And BP = OB – OP = $R\sqrt{2} - R$
$R\sqrt{2} - R = r + r\sqrt{2}$
$R(\sqrt{2} - 1) = r(\sqrt{2} + 1)$
$R = (\sqrt{2} - 1)^2$
$R = (3 - 2\sqrt{2})$
Area of larger circle/Area of smaller triangle = $\Pi R^2/4\ \Pi r^2$
$R^2/4(3 - 2\sqrt{2})^2 R^2$
= $\frac{1}{4}(17 - 12\sqrt{2})$

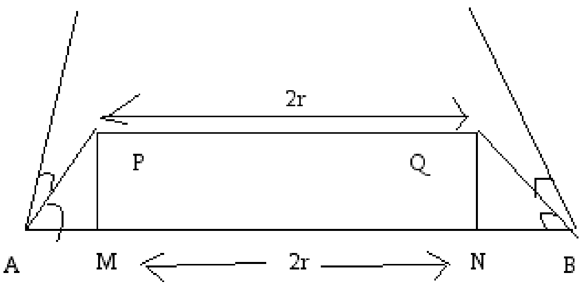
49. Apply the same logic as in the previous problem.

50.(Area of Δ ABC / Area of Δ AED) = (BC / 0.65 BC)^2 = (1/ 0.4225)
Area of Δ AED = 0.4225 X 68 = 28.73 cm^2

51. Let the radius of each circle be r units then
PQ = QR = PR = 2r
$\angle PDM = \angle QEN = 30°$



Again (PM / AM) = tan 30° = $1/\sqrt{3}$
r/ AM = $1/\sqrt{3}$
AM = $r\sqrt{3}$ = BN
AB = AM + MN + NB
= $r\sqrt{3} + 2r + r\sqrt{3} = 2r(1 + \sqrt{3})$
AB = BC = AC = $2r(1 + \sqrt{3})$
Ratio of equilateral triangle = ratio of their sides
Ratio of perimeter of Δ ABC : ΔDEF : ΔPQR
= $2(1+\sqrt{3}) : (2 + + \sqrt{3}) : 2$



52. Δ APQ ~ Δ ACB, BC = 2PQ and BC || PQ

AE = 2AF

AE = EF Again Δ RGH ~ ΔRPQ

And PQ = 2GH

(by the mid – point theorem)

RJ = 2Rk

RK = JK

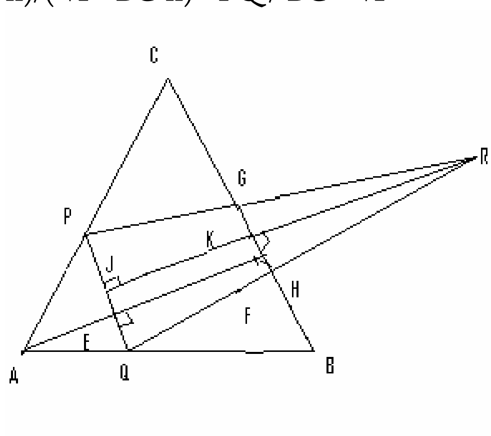
But since EF = JK

AE = EF = JK = RK

RJ = RK + JK and AF = AE + EF

RJ = AF =h(say)

Then (Area of ΔPQR / area of Δ ABC) =(½ X PQ X h)/(½ * BC*h)= PQ / BC = ½

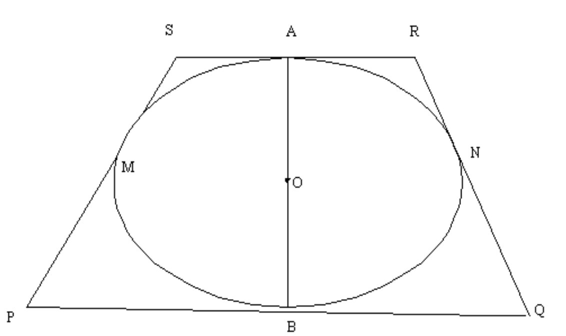


53. It can be solved using the property of tangents. (Tangents on the circle drawn from the same points are same in length)

Points M , A , N and B are the points of tangent.

PS + QR = PQ + SR = 2(21) = 42 cm

Perimeter of trapezium = 2 (42) = 82 cm



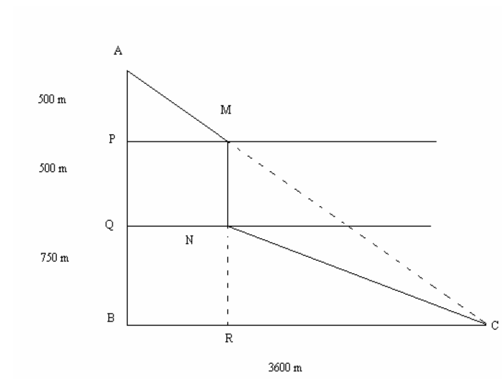
54. Let MN be the bridge

Δ APM ~ Δ ABC

(AP/PM) = (AB/BC)

(500/PM) = (1500/ 3600)

PM = 1200 = QN = BR



RC = BC – BR = 2400m

And NR = BQ = 700m

NC = $\sqrt{NR^2 + RC^2}$

NC = 2500 m

AM = $\sqrt{AP^2 + PM^2}$

AM = 1300 m

Total distance to be travelled = AM + MN + NC

= 1300 + 300 + 2500

= 4100 M

55. Let AD = h (say)

Then Area of Δ ABC = (1/2) bc sin 120°

= ($\sqrt{3}$/4) bc

Area of Δ BAD =(½) ch sin 60°

= ($\sqrt{3}$/4) ch

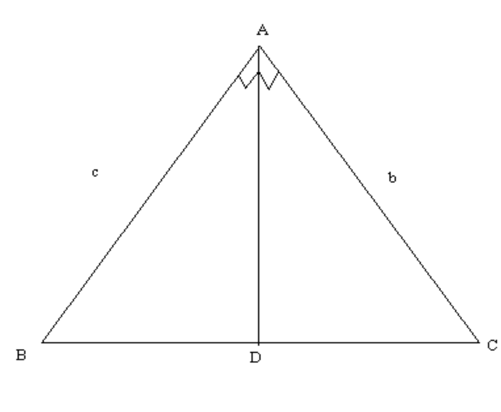
And Area of Δ CAD = (1/2) bh sin 60°=($\sqrt{3}$/4) bh

Now, A (ΔABC) = A (ΔBAD) + A(ΔCAD)

($\sqrt{3}$/4) bc = ($\sqrt{3}$/4) ch + ($\sqrt{3}$/4) bh

⇨ **bc = h (b + c)**

⇨ **h = (bc) / b + c**



ELEMENTS OF ALGEBRA:

1. If $x + y + z$ is constant, the product xyz takes maximum value when each of x, y, z takes equal value.

$a + b + c = 13$

$(a - 3) + (b - 2) + (c + 1) = 13 - 3 + 1 = 9$

For the maximum value of $(a - 3)(b - 2)(c + 1)$

$= (a - 3) = (b - 2) = (c + 1) = 9/3 = 3$

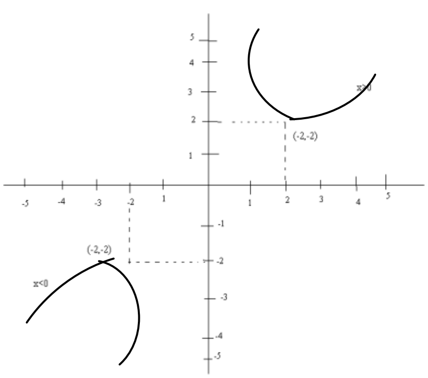
So, $(a - 3)(b - 2)(c + 1) = 3*3*3 = 27$

2. If xyz is constant, then the sum of x, y, z (i,e $x + y + z$) takes minimum value when each of x, y, z takes equal values. Minimum value of $a + b + c + d$ for given constant product abcd will be when $a = b = c = d$

$a = b = c = d = 3 + 3 + 3 + 3 = 12$

3. For $x \le 0$, $x + 1/x \ge 2$

And for , ≤ 0, $x+1/x \le 2$



Graph of (x + 1/x)

4. This is the standard inequality formula.

5. This is the standard inequality formula.

6. $x^2y^3+y^2x^3 = 25$

$x^2y^2(x+y) = 25$

⇨ $(xy)^2(x+y) = 25$

⇨ $(xy)^2 = 1$

⇨ $Xy = +-1$

⇨

7. $x>0$ and $y>u$

Therefore, $(x+y)[(1/x)+(1/y)]$ $2+ x/y + y/x$

$= 2+[k+ 1/k]$,

Where $k=x/y$

Since the minimum value of the expression $[k+1/k]$ is 2.

Therefore, Minimum value of the given expression is 4.

8. If $a + b + c + d$ is constant then the product abcd is maximum

when $a = b = c = d$.

$(a + 1) = (b + 1) = (c + 1) = (d + 1)$

Given that $(a + 1) + (b + 1) + (c + 1) + (d + 1) = 8$

$4(a + 1) = 8$

$(a + 1) = 8$

Maximum value $= 2*2*2*2 = 16$

9. As $x + y + z = 1$

$[(1/x) - 1][(1/y) - 1][(1/z) - 1] = (y+z/x) . (z+x/y) . (x+y/z)$

$(y + z)/2 \ge yz$ etc

Hence LHS $\ge 8xyz/xyz = 8$

10. As $x + y + z = 4$ and As $x^2 + y^2 + z^2 = 6$

$y + z = 4 - x$

and $y^2 + z^2 = 6 - x^2$

$yz = ½ [(y + z)^2 - (y^2 + z^2)]$

$= I / 2 [(4 - x^2) - (6 - x^2)]$

$yz = x^2 - 4x + 5$

hence y and z are the roots of

$t^2 - (4 - x)t + (x^2 - 4x + 5) = 0$

Since the roots y and z are real

$(4 - x)^2 - 4(x^2 - 4x + 5) \ge 0$

$3x^2 - 8x + 4 \le 0$

$(3x - 2)(x - 2) \le 0$

$x \varepsilon [2/3, 2]$

by symmetry y and z also $\varepsilon [2/3, 2]$

11. $1/x^2 + 1/y^2 = (x^2 + y^2)/(xy)^2$

$\dfrac{(7 + 4\sqrt{3})^2 + (7 - 4\sqrt{3})^2}{[(7 + 4\sqrt{3})(7 - 4\sqrt{3})]^2} = \dfrac{2(49 + 48)}{(1)^2}$

$= 194$

12. AM >= GM

⇨ $(a+b+c) / 3 >= (abc)^3$

AM Arithmetic Mean

GM Geometric mean

And $1/3\,(a+b+c) >= (1/abc)^{1/3}$

$1/3\,(a+b+c)1/3(1/a + 1/b + 1/c) >= (abc)^{1/3}(1/abc)^{1/3}$

$= 1$

$(a+b+c)1/3(1/a +1/b +1/c) >= 9$
Putting a=b=c=1, expression takes the value 9, which is therefore, its least value.

13. If ab is constant, then (a + b) takes minimum value when a = b, a=b=1

$(1 + a)(1 + b) = (1 + 1)(1 + 1) = 4$

14. $[(a + b + c)(ab + bc + ac)] / abc =$

$(a + b + c) [(ab / abc) + (bc/abc) (ac/abc)]$

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

$= (a + b + c)(1/c + 1/b + 1/a) > 9$

(see the problem number 12 in this exercise)

15. The expression will have minimum value of the expression when a =b=c
Therefore the required minimum value

$= [(1+1+1)/1] * [(1+1+1) /1] *[(1+1+1)/1]= 27$

16. $\max(x/y) = \max(x) / \max(y) = 2/3$

17. $1/a + 1/b +1/c= 1$

$(bc + ac + ab) / abc =1$

$bc + ac + ab = abc$

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

$(a + b + c)^2 = a^2 + b^2 + c^2 + 2abc$

$(3)^2 = 6 + 2abc \Rightarrow abc = 3/2$

18. $2^x = 4^y = 8^z \Rightarrow 2^x =2^{2y} = 2^{3z}$

$x= 2y= 3z = k(say)$

then $xyz = k^3 /6 =288 \Rightarrow k = 12$

$x =12, y=6, z=4$

$1/2x + 1/4y + 1/8z = 11/96$

19. $a =c^z$

$\Rightarrow a = (b^y)^z$

$\Rightarrow a = b^{yz}$

$\Rightarrow a = (a)^{yz}$

$\Rightarrow a = a^{xyz}$

$\Rightarrow a^1 = a^{xyz}$

$xyz = 1$

20. $7x + 2y = 220$

$7x = 220 – 12y$

$x= (220 – 12y) / 7 = 4(55 – 3y) / 7$

it means 55 – 3y must be divisible by 7, since 4 is not divisible by 7.

At $y = 2,9,16$

We get $x = 28.16,4$ thus we have three solutions of x,y

$(x,y) = (28,2), (16,9), (4,16)$

21. $a^x . a^y . a^z = (x + y + z)^{x+y+z}$

$a^{x+y+z} = (x + y + z)^{x+y+z}$

$a = x + y + z$

$(x + y + z)^y = a^x = (x + y + z)^x$

$x= y$

Similarly $y = z$ and $z = x$

$x = y = z = a/3$

22. Let $x/a = y/b = z/c = k$

$x = ak, y = bk, z = ck$

$(x + y + z) = k (a + b + c)$

$(x + y + z)^2 = k^2 (a + b + c)^2$

$x^2 + y^2 + z^2 + 2(xy + yz + zx) = k^2 (a + b + c)^2$

$2(xy + yz + zx) =k^2(a + b + c)^2 - (x^2 + y^2 + z^2)$

$xy+yz+zx =k^2/ 2 (a +b+c)^2 -1/ 2 (x^2 + y^2 + z^2)$

$[x^2 (a + b + c) – a^2 (x^2 + y^2 + z^2)] / 2 a^2$

since (k = x/a)

23. Let x and y be the number of deer and ducks respectively.

$x+y = 14$ and ………………(1)

$4x + 2y = 38$ ………………….(2)

(A deer has 4 legs and a duck has 2 legs)
By solving the above two equations (1) and (2) , we get

x= 5 qnd y=9

Thus the number of deer is 5.

24. Going through the options, we find that option (d) is correct i.e.,

600 [200 X 2 = 400 / 400 X 4 = 1600] 2000

No. of vehicles no.of tyres

25. Go through the options. Let us consider option d.

125 [100 X 5 = 500
25X 3 = 75] 575

No. of raths No. of horses

26. Let us assume option a is correct

Then the no. of coolers =150000/3000 = 50

90 [50 X 4 = 200
40 X 3 = 120] 320

The number of coolers = 50

The number of fans = 40 (90 - 50)

Thus the assumed option a is correct

27. Let us assume option c, then,

90 [40 X 2 =80 80 X 2 800
50 X 3 = 150 150 X 5 250] 3050

Thus the assumed option c is correct.

28.

Step 1: 20 X 7 = 14

Step 2: 176 – 140 = 36

Step 3: 36 /3 = 12 -> weight of mangoes initially

Step 4: 20 – 12 = 8 -> weight of apples initially

Number of mangoes = 12 X 10 = 120

Number pf apples = 8 X 7 = 56

Again since she is left with 13kg pf mangoes and apples containing 121 fruits (176 – 55 = 12)

Step 1: 13 X 7 = 91

Step 2: 121 – 91 = 30

Step 3: 30/3 = 10 -> weight of mangoes

Step 4: 13 – 10 = 3 -> weight of apples

Thus the number of apples left with vendor = 3 X7 = 21

29. Since we know that Ritika has purchased 2kg mangoes and 5kg apples. Thus she spent (2 X 35 + 5 X 40) = Rs.45.

30.

	Mangoes	Apples
SP ……..	35	40
CP ……..	30	30
New SP……	40	35

Therefore CP = 30 * 10 + 30 *3 = 390

And new SP = 40 * 10 + 35 * 3 = 505

Profit = 505 – 390 = 115

Profit % = 115/390 * 100 = 29.48%

31. Solving with the help of options: In this type of questions we start with least valued options and tend towards higher valued options.

Option a: If we take 4 coins of Re.1, then

(5 X 1) + (2 X 21) = 47 ≠ 43 (48 -4 = 44)

(5 X 2) + (2 X 20) = 50≠ 44 and (26 – 4 = 22)

Option b: If we take 5 coins of Re.1, then

(5 X 1) + (2 X 20) = 45 ≠ 43

(43 = 48 - 5)

(5 X 2) + (2 X 19) = 48≠ 43

(21 = 26 - 5)

Option c: If we take 7 coins of Re.1, then

5 X 1 + 2 X 18 = 41 = 41

(48 – 7 = 41)

(26 – 7 = 19)

Thus the option c is correct.

32. go through options.

<u>THEORY OF EQUATION:</u>

1. Best way is to go through options.

Consider option (b)

$|3^4 - 1|^{log_3 3^8 - 2\, log_{81} 9} = (3^4 - 1)^7$

$|80|^{log_3 3^8 - log_{81} 81} = (80)^7$

$8log_3 3 – log_{81} 81 = 7$

8-1 =7

Hence option b is correct

2. Putting x=1/y, we get

$27 y^3 + 54y^2 + cy -10 =0$

This above eq. (i) must be in AP.

Let the roots of equation in y be

α-β,α,α+β (roots are in AP)

Σ α =α-β+α+α+β=3α

3α= -54/27 => α=-2/3

Now $\alpha=-2/3$ will satisfy the eq. (i) we get

$27 * -8/27 + 54 * 4/9 - 2c/3 - 10 = 0$

C=9

3. $\log_{100}|x+y| = ½ \Rightarrow 100^{1/2} = |x+y|$

⇨ $|x+y| = 10$ ………..1

Again, $\log_{10} y - \log_{10}|x| = \log_{100} 4$

$\log_{10} y - \log_{10}|x| = \log_{10} 2$

$\log_{10} y/|x| = \log_{10} 2$

$Y = 2|x|$ …………….2

From eq. (2) we can conclude that y is always positive.

Now, when x>0 and y>0 (always)

$|x+y| = 10 \Rightarrow |x+2|x||=10$

$X+2|x|=10$

$X+2x=10$

$X=10/3$

$Y= 20/3$

Again , x<0 and y> 0 (always positive)

$|-x+2|-x|| =10$

$|-x+2x|=10$

$|x|=10$

X=-10

Y=20

Hence , x=-10, y=20 and x=10/3 and y = 20 /3

4. $2\log_2 \log_2 x + \log_{1/2}\log_2(2^{2x}) = 1$

$2\log_2 \log_2 x + \log_2 \log_2(2^{2x}) = \log_2 2$

$\log_2(\log_2) - \log_2[\log_2 2^{2x}] = \log_2 2$

$\log_2 \frac{(\log_2 x)^2}{\log_2 2\sqrt{2x}} = \log_2$

$\frac{(\log_2 x)^2}{\log_2 2\sqrt{2x}} = 2$

$(\log_2 x)^2 = 2\log_2(2\sqrt{2x}) = 2\log_2(2^{3/2} x)$

$(\log_2 x)^2 = 2[3/2 \log_2 x + \log_2 x] = 3 + 2\log_2 x$

$(\log_2 x)^2 - 2\log_2 x - 3 = 0$

$\log_2 x = -1$ or $\log_2 x = 3$

X=1/2 or X=8

But for x=1/2, $\log_2 \log_2(1/2)$ is undefined

Only possible value of x=8.

5. Consider $x^2+4x+3>=0$

Then $(X^2+4X+3)+2x+5=0$

X=-2 and x=-4

But x=-2 does not satisfy eq 1

$x^2+4x+3<0$

Then $-(X^2+4X+3)+2x+5=0$

$X=-1-\sqrt{3}$ or $x=-1+\sqrt{3}$

But only $x=-1-\sqrt{3}$ satisfies the eq. 2.

Hence the solution set of x is $(-4,-1-\sqrt{3})$.

Alternatively, check the option by substituting the values from the options given in the question.

6. X_1,x_2,x_3 are in A.P

$X_1= a-d,\ x_2=a,\ x_3= a+d$

Where d is common difference

Now, since x_1,x_2,x_3 are root of given equation

$X^3-x^2-\beta x+\gamma=c$

So, $\Sigma\alpha = x_1+ x_2 +x_3=1$

$(a-d)+a+(a+d)= 1$ ………………(1)

$\Sigma\alpha\beta= x_1x_2+x_1x_3+x_2x_3$

$\beta=(a-d)a+a(a+d)+(a-d)(a+d)$ ………………..(2)

And $\Sigma=\alpha\beta\gamma=x_1x_2x_3= -\gamma=(a-d)(a)(a+d)$ …………………(3)

hence from 1 we get a=1/3

and from 2 we get

$\beta= 3a^2-d^2$

$\beta= 1/3 - d^2$

$\beta=1/3 - d^2\leq 1/3$

$\beta\leq 1/3$

$\beta\varepsilon(-\infty,1/3]$

Again from equation 3

$A(a^2 - d^2) = -\gamma$

$(1/27) + (-d^2/3) = -\gamma$

$\Gamma = d^3/3 - 1/27$

$\gamma\geq -1/27$

Hence option (a) is correct.

7. a) -> $e^x < 1+x$

b) -> $e^x> (1+x)$ $\log_e (1+x)$ ⇔

c) -> $\sin x >x$

d) -> $e^x < x$ ⇔ $\log_e x>x$

Option c is clearly wrong

8. Let us consider some value of p=3 (say), then

$x^2 - 4x +1$

And $(\alpha,\beta) = 2\pm\sqrt{3}$ (α,β are roots)

Now, $\alpha^n + \beta^n$ wil always be an integer, for the validity of statement you put n=1,2,3 …. Etc in eq(i)

Similarly for p=4,5,6 ……. Etc. we can conclude the same results.

9. Just assume some values of α,β conforming the basic constraints of the problem .

e.g., $\alpha=-2,\beta=8$, then the equation becomes $x^2 -6x - 16$

b=-6 and c=-16

$1+ c/a + | b/a | = 1- 16 +6 =-9$

The value of the expression is negative; hence choice (a) is correct

10. Since p and q are the roots of given equation $x^2+px+q=0$

Then p+q=-p

q=-2p

pq=q

p=1

so, when p=1,then q=-2

Again ,when q=0,then p=0 hence,

P=1,0 and q=-2,0

Thus option (b) is most appropriate.

11. p,q,r are in AP.

$Q=\frac{p+r}{2}$

For the roots $q^2-4pr>=0$

$(\frac{p+r}{2})^2-4pr>=0$

$P^2+r^2-14pr>=0$

$(p/r)^2-14(p/r)+1>=0$

$(p/r-7)^2>=48$

$(p/r-7)>=4\sqrt{3}$

12. The given equation is $|x-2|^2+|x-2|-2=0$.

Let us assume $|x-2|=m$

$M^2+m-2=0$

(m-1)(m-2)=0

Only admission value is

M=1

|x-2|=1

x-2=1

x=3

-(x-2)=1

X=1

X=1,3

Sum of the roots of equation=1+3=4.

13. Just consider an option, and then substitute the values of A and B from assumed option, if the roots p,q,r,s are in A.P.,then the presumed option is correct, else not.

Thus we get option a,b and c are incorrect, hence D is the Answer.

14. Let $f(x) =x^2 - 2ax + a^2 + a -3$

Since f(x) has real roots both less than 3, therefore, D>0 and f(3)>0

$A^2-(a^2 + a-3) > 0$

$A^2 - 5a+6 > 0$

A<3 and (a-2) (a-3)>0

A<3 and a<2 or a>3

A<2

15. Considering the given constraints in the problem. Let us consider α,β = (-3,2)

Then the given equation becomes

$X^2 + x - 6=0$

B=1 and c=-6

Now, we check for the givem choices, which satiafy the aforesaid conditions

a) It is clearly wrong

b) It is correct

c) It is also wrong

d) It is also wrong

Hence option b is correct

16. Let us assume a=3, b=4 given that a<b then the given equation becomes

(x-3)(x-4)-1=0

$X^2 - 7x + 11 =0$

$X= 7\pm\sqrt{(49 -44)}\ /2 \Rightarrow x= 7\pm\sqrt{5}/2$

$X=7 +\sqrt{5}/2 >4$ and $7 -\sqrt{5}/2 <3$

Hence only option d is satisfied, hence correct.

17. $A\beta=p$ and $\gamma\beta=q$

Now since $\alpha,\beta,\gamma,\delta$ are in GP and integral values. So option b abd c are ruled out as they have no required integral factors. Now let us look for option (a). We see that

$\alpha\beta= -2 = -1*2$

$\gamma\delta= -32=-4*8$

So, -1, 2, -4 ,8 are in GP satisfying the above conditions. Again in option (d) the two values don't have the factors with common ratio, hence its wrong and hence option a is correct.

18. When this problem will be solved by algebraic methods, it will take too much time to solve beyond the normal required time so the best way to get the correct and quick answer is to assume some simple roots then go through option

19. Let us consider choice a. when we put the values of A and B respectively, we get the values of α,β,γ and δ as -1 , 1/3,1/5,1/3, which are not in HP. So this option is correct .Now for our convenience we consider choice C. then by substituting the values of A and B, we get the values of α,β,γ and δ as 1,1/2,1/3 and ¼ which are in the HP. Hence this could be the correct choice.

20. Assume some convenient and appropriate values of a,b,c as

A=3, b=4, c=6,

Then $(x-3)(x-4)-6=0$

$X^2-7X+6=0$

$A=6,\beta=1$

Again$(x-6)(x-1)+6$

$X^2-7X+6+6=0$

$X^2-7X+12=0$

The roots $k_1=3$

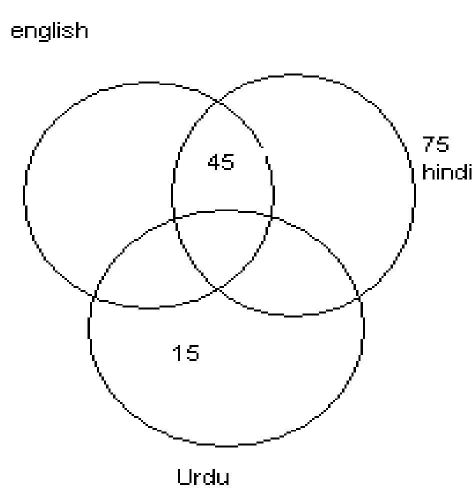
$k_2=4$

Which are same as a and b

Hence, option (C) is correct.

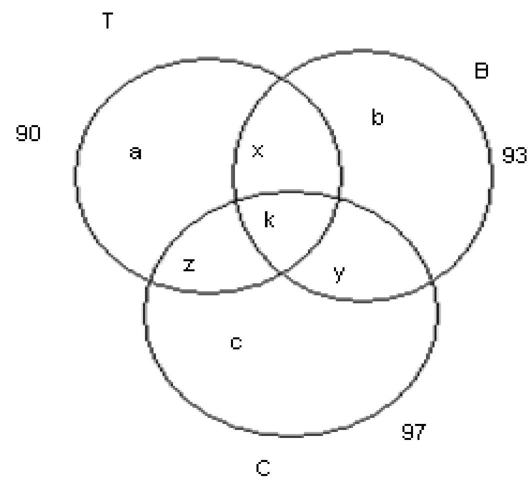
SET THEORTY:

1. It is clear that 45% people cannot read another third news paper. Besides them all of the rest people can read Urdu news paper.



Hence maximum 55% (100 – 45) people can read Urdu newspaper.

Solution for question number 2 -5 :



$a+b+c = \alpha$, $x+y+z= \beta$, $k=\gamma$

$\alpha+\beta+\gamma = 170$

$\alpha+2\beta+3\gamma= 90+93+97=280$

$\gamma:(\beta+\gamma) = 2:9$

$\gamma:\beta = 2:7$

and $\alpha:(\beta+\gamma) = 8:9$

$\alpha:\beta:\gamma = 8:7:2$

$\alpha=80,\beta=70$ and $\gamma= 20$

$a+b+c = 80$, $x+y+z =70$

$k=20$

again $c-b = 14$ and $a-b = 12$

on solving eq. (1) and (2) we get a= 30, b=18, c=32

again $(a+x+k+z) - (a+k) = (x+z)$

$= 90 - (30 + 20) = 40$

And $(x+y+z) - (x+z) = y = 70 - 40 = 30$

Similarly x=25 and z=15

2. 20

3.80

4.70

5. 14

6. $\alpha+\beta+\gamma = 68$

$\alpha+2\beta+3\gamma=(38 +26+36) = 100$

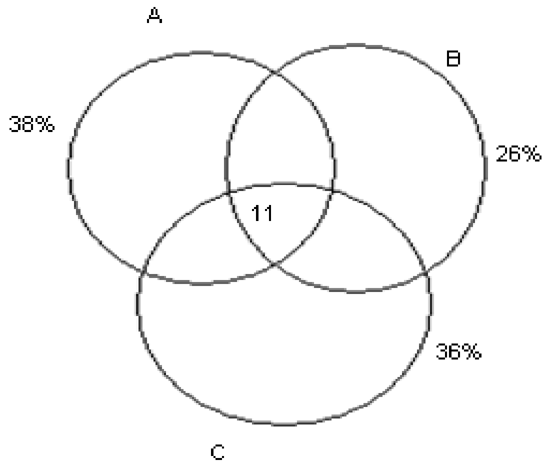
and $\gamma=11$

$(\alpha+2\beta+3\gamma)-[(\alpha+\beta+\gamma)+\gamma] = \beta+\gamma$

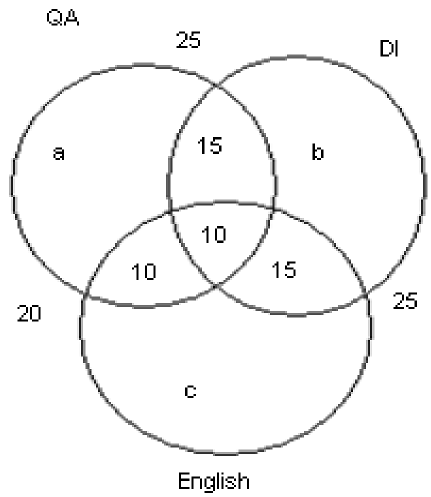
$= 100 - [68 + 11]$

$= 21$

Hence 21% favoured more than one magazine.



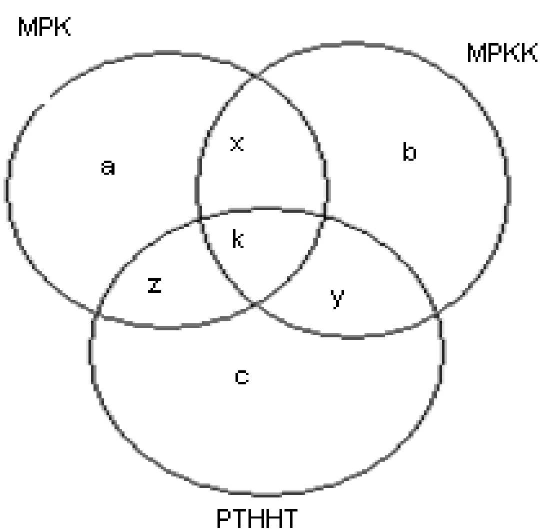
Solution for question number 7-8:



7. Since we don't know how many students failed in all three subjects, questions cannot be answered. Hence (d).

8. (a+b+c) = 80- [(15+15+10)+(10)] = 30

9. $\alpha+\beta+\gamma = 97\%$



$\alpha+2\beta+3\gamma = 41+35+60 = 136\%$

But $\beta = (x+y+z) = 27\%$

$(\alpha+2\beta+3\gamma)- (\alpha+\beta+\gamma) = \beta+2\gamma = 39\%$

$(\beta+2\gamma) - \beta = 2\gamma = 39 - 27 = 12\%$

$\Gamma= 6\%= (k)$

6% people watch all the three movies

10. z+k = 16 => z=10

y+k = 14

y=8

x=9

b= 35 – (x+k+y) = 35 – (9+6+8) = 12%

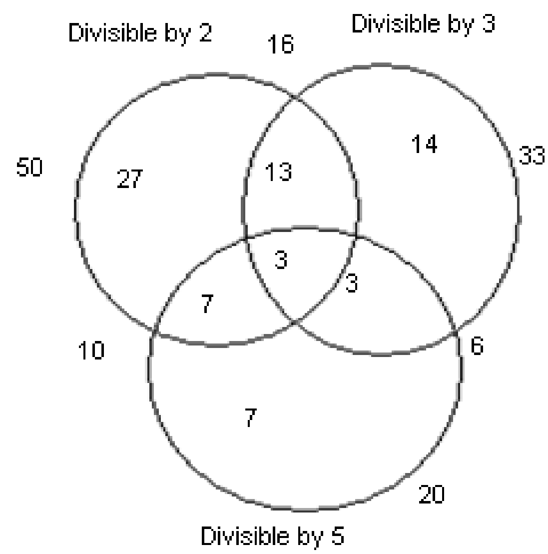
11. Total numbers divisible by 2 upto 100 = 50

Total numbers divisible by 3 upto 100 = 33

Total numbers divisible by 5 upto 100 = 20

Total numbers divisible by 2&3

i.e., 6 upto 100 = 16



Total numbers divisible by 3 & 5 i.e., 15 upto 100=6

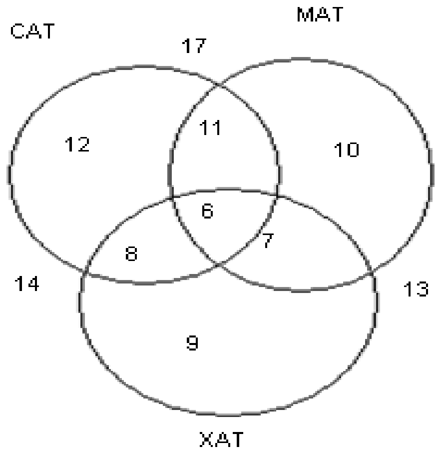
Total numbers divisible by 2 and 5 i.e., 10 upto 100 =10

Total numbers divisible by 2,3 and 5 i.e., 30 upto 100 = 3

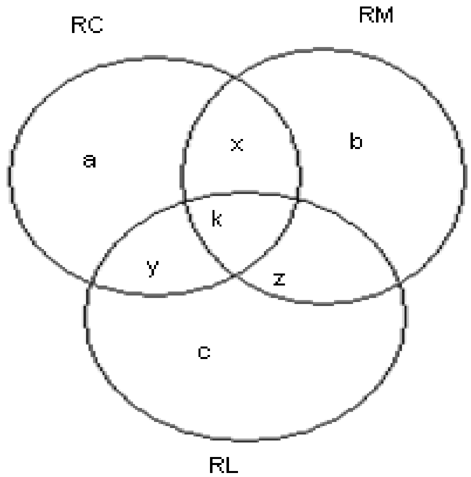
12. Total number of members upto 100 which are divisible by at least one of 2,3 and 5 =74

Total number of numbers upto 100 which are not divisible by any 2,3 or 5 = 100 – 74 =26

Hence there are 12 students who appeared in CAT but not in MAT or XAT



13. $\beta= (x+y+z) = 55$
$\alpha = (a+b+c)=70$
$\gamma= k$



let m people listen none of the three channels, then $m=\gamma=k$

$(\alpha+\beta+\gamma)+m = 151$

⇨ $\alpha+\beta+\gamma+\gamma = 151$

⇨ $(55+70) + 2\gamma = 151$

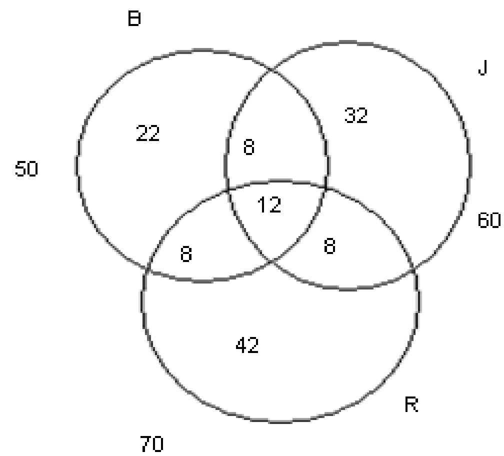
⇨ $\Gamma= 13$

Hence, there are 13 people listen all three channels.

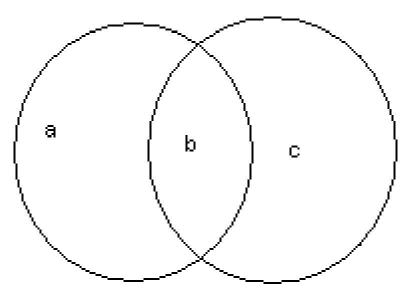
14. $\alpha = a+b+c$
$\beta = x+y+z$
$\gamma = k$
Here $\gamma = ½ \beta$ => $2\gamma = \beta$
Again $x=y=z=p$
$\beta=3p$
$\gamma=3/2\ p$
Now, $\alpha+2\beta+3\gamma= 50 + 60 + 70 = 180$
⇨ $\alpha+7\gamma=180$ 1
Again $\alpha+\beta+\gamma=132$
$\alpha+3\gamma= 132$ 2

From eq. (!) and (2), we get
$\gamma= 12$
Hence 12 people like all 3 sweets.

15. $\gamma=3/2p$ => $12=3/2p$
⇨ $p=8$
Hence the number of persons who like Rasgulla or jalebi but not barfi
$=32+8+42 =82$



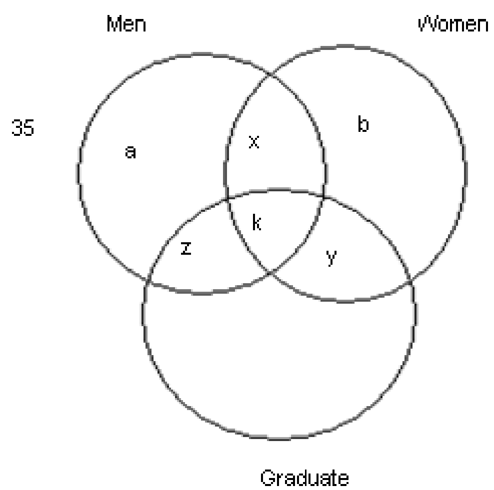
16. Let a be the number of engineers only
c be the number of MBAs only
b be the number of employees who are both engineers and MBAs and
d be the number of employees who are neither engineer nor MBA



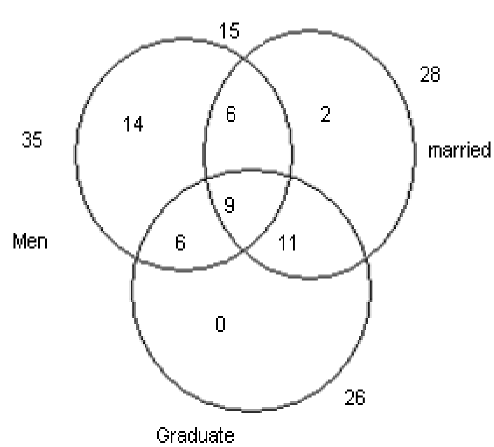
$a+b+c+d = 80$ ....(1)
$(a+b) = 2(b+c)$ => $(a-b) = 2c$ ....(2)
And $c+d = 32$
And $a+d = 56$
And $b=2c$
From eq. (2) and (5), we get
$a=2b$
from eq. (1) and (3), we get
$a+b=48$
from eq. (6), we get
$b=16$
$a=32$
$c=8$

d=24
Hence 24 employees are neither engineer nor MBAs.

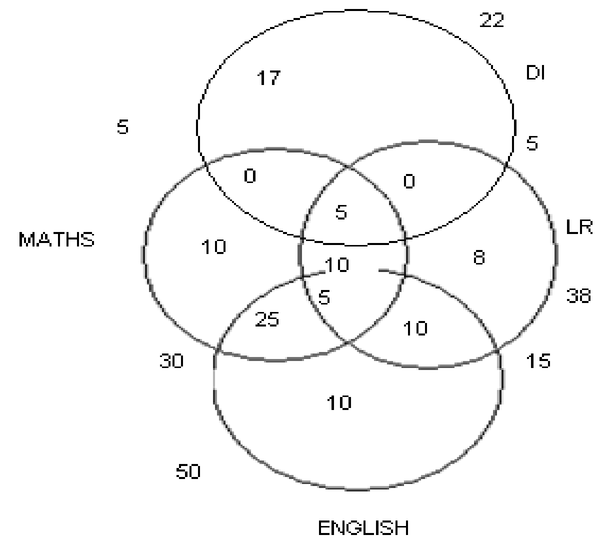
Solutions for question number 17-19:
Total number of employees = 60
Women = 25
Men =35
Married workers = 28
Graduate workers =26
a-> unmarried men who are not graduate
b-> married women who are not graduate
c-> unmarried women who are graduate
x-> married men who are not graduate
y-> married women who are graduate
z-> unmarried men who are graduate
k-> married men who are graduate
p-> unmarried women who are not graduate
According to the given information the venn diagram can be completed as given below



17. No one unmarried woman is graduate. Hence(c)



18. Number of unmarried women =60-[14+2+6+6+11+9]=12
19. There are 9 graduate men who are married
Solutions of question number 20-23:



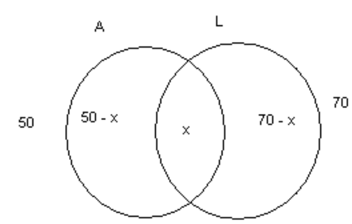
20. 17

21. 10

22. 55

23. 0

24. For the minimum value of x people who like only arrange marriage must be greater



x= (70+50) – 80 =40
For the maximum value of x: (50 – x) and (70-x) must not be negative, therefore max. Possible value of x is 50.

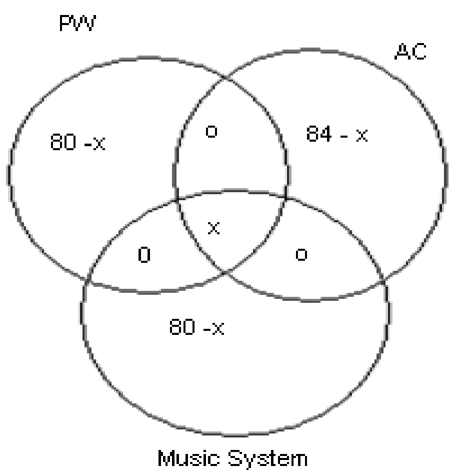
25. 80 cars were decorated with power windows it means at least 40 cars were decorated with AC or music system or both.
84 cars are decorated by ACs which means at least 36 cars were decorate power windows and music systems.

80 cars were decorate with music system means at least 40 cars were decorate with power windows or ACs

It means if there is no intersection in these three, then at most 40 + 36 + 40 =116 cars had been decorated with one or two accessories.

Hence at least 4 cars would have been decorated with all three accessories.

For maximum value of x:



Total number of cars =(80–x)+(84-x) +(80–x)+x120 = 244 – 2x

⇨ 2x=124

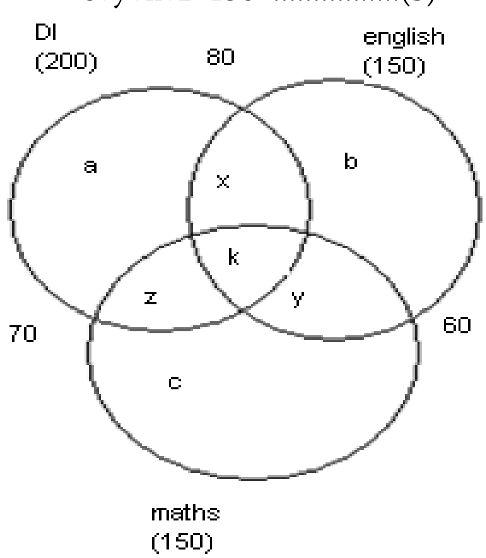
⇨ X=62

Minimum -> 4 cars and maximum -> 62 cars

26. a+x+k+z=200 ....(1)

b+x+k+y=150 ....(2)

c+y+k+z=150 ....(3)



but since diwakar teaches only 80 students of DI.

Therefore, a=180

Hence, x+k+z=120

But (x+k)+(k+z)=150

K=30

Hence, x=50, z=40, y=30, b=40

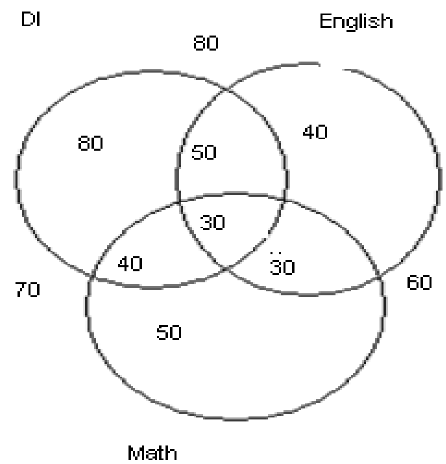
No of students taught by diwakat = a=80

No. Of students taught by Priyanga =b=40

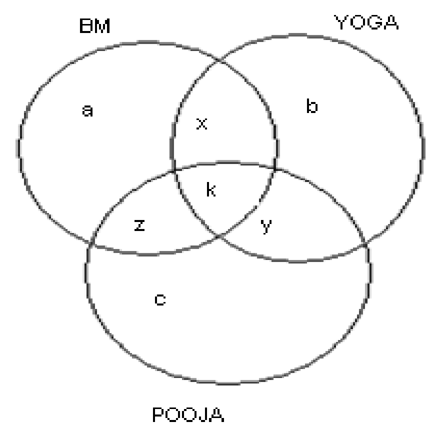
No. Of students taught by varun = c=50

No. Of students taught by sarvesh = x+y+z+k = 150

Hence choice (a) is correct.



Solutions for question no. 27-29:



Remember: maximum number of volunteers are involved in yoga.

Now,

B=k+y

C=2k

A+x+k+z=17

A=c-1

X+k+z=10

From eq. (3) and (5), we obtain

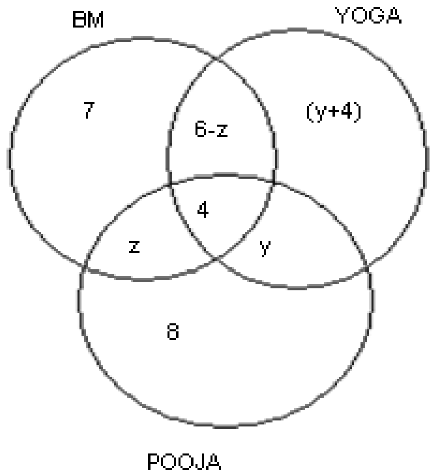
A=7

And from eq. (4) and (6), we obtain

C=8 => k=4

(z+X) = 6 => x=(6-z)

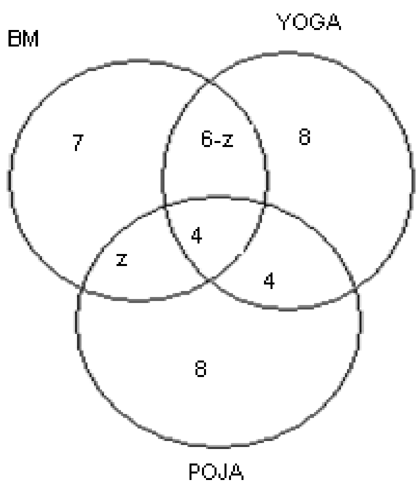
B=(y+4),



Again $7+(6-z)+4+z+(y+4)+y+8=37$

$Y=4$

27. Since no. of volunteers involved in yoga are maximum so we can compare it from the no. of volunteers involved in pooja and that of body massage.



Since

$6-z > z \quad z \varepsilon (0,1,2,3 \ldots\ldots)$

$Z= 0, 1,2 \Rightarrow (6-z)=4,5,6$

The minimum possible value of $(6-z) = 4$.

28. See the venn diagram shown in solution no. 27, then you will notice that you are required to know the value of y.

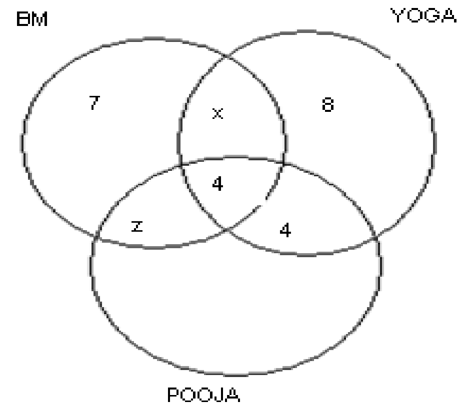
Thus from the data provided by choice (a) enable us to calculate all the required details.

$\{(6-z)\} + 4+4+8\}_{yoga} = 20$

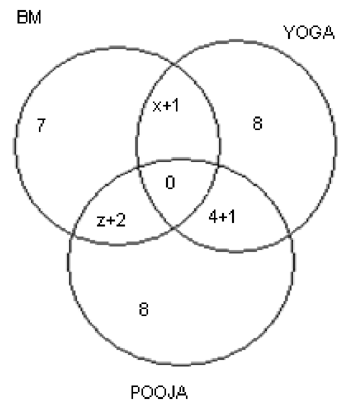
$Z=4$

Hence, we can find the exact number of volunteers involved in various projects.

29. Initially:



After the withdraw of volunteers:



The volunteer who is opted out of the IBM will be involved in the yoga and pooja.

Similarly the volunteer who opts out of pooja will be involved in the BM and yoga.

And remaining two volunteers who are opted out of yoga will be involved in BM and pooja.

Total no. of volunteers in BM = $7+(x+1) + 0 +(z+2)=16$

Since we know that $x=4,5,6$

Therefore corresponding values of $z = 2,1,0$

No. of volunteers involved in yoga = 18,19 or 20

And no. of volunteers involved in pooja= 17, 16 or 15

Hence it is clear that choice (b) is correct.

<u>**LOGARITHMS:**</u>

1. A

2. A

3.

$log_2(x/y) + log_2(x/y)^2 + log_2(x/y)^3 + \ldots\ldots$

$= log_2(x/y) + log_2(x/y) + log_2(x/y) + \ldots.$

$=log_2((x/y)*(x/y)*(x/y)*.......ntimes)$
$= log_2(x/y)^n = nlog_2(x/y)$

4. $logm + logm^2 + logm^3 + ... + logm^n$
$=log(m.m^2.m^3....m^n)$
$= logm^{(1+2+3+....+n)}$
$= log(m)^{(n(n+1))/2}$
$= (n(n+1) * logm)/2$

5. Given that $9^n < 10^8$
Taking log to both sides
$log9^n < log10^8$
2n log 3 < 8 log 10
2n x 0.4771 < 8
n x 0.9542 < 8
n < 8/0.9542
n< 8.3839
n=8

6. Taking log of both sides with base 3 we have,
$[log_3x^n + (log_3x)^2 - 10]log_3x = -2log_3x$
$\rightarrow$ $log_3x = 0$
or $(log_3x)^2 + 2log_3x - 3 = 10$
$\rightarrow$ x=1, $(log_3x + 4)(log_3x - 2) = 0$
$\rightarrow$ x=1,$log_3x = -4$and $log_3x = 2$
$\rightarrow$ x=1, x=1/81 and x=9
x={1,$\frac{1}{81}$, 9}

7. (x-3)>0 $\rightarrow$ x>3
and (2-x)>0 and 2-x ≠ 1
therefore x<2 and x ≠ 1
clearly there is no single value for which these inequalities are satisfied. Thus the set of its solution is empty.

8. $log_330 = \frac{1}{a} \rightarrow$ a=$log_{30}3$ and $log_530 = \frac{1}{b}$
$\rightarrow$ b=$log_{30}5$
$3log_{30}2 = 3[log_{30}(30/15)]$
$= 3[log_{30}30 - log_{30}15]$
$= 3[log_{30}30 - (log_{30}3 + log_{30}5)]$
=3[1-a-b]

9. $x^{log_x|3-x|^2} = 4$
$|3-x|^2 = 4$ (-2 is inadmissible)
(3-x) = 2 or -(3-x) = 2
x=1 or x=5

10. Let $2^{x^2+2} = t$, then
$4^{x^2+2} - 9.2^{x^2+2} + 8 = 0$ becomes
$t^2 - 9t + 8 = 0$
t = 1,8
$2^{x^2+2} = 1$
$x^2+1=0$ but this has solution
If $2^{x^2+2} = 8$
$x^2+1=3$
$x^2 = 1$
x=$\pm$1

11. taking log of both sides, we get
$$\left[(log_3x)^2 - \frac{9}{2}\, log_3x + 5\right] log_3x = \frac{3}{2}$$
$2(log_3x)^3 - 9(log_3x)^2 + 10(log_3x) - 3 = 0$
$(log_3x - 1)(log_3x - 3)(2log_3x - 1) = 0$
$log_3x = 1$, log_3x=3, $2log_3x = 1$
x=3, x=27, x=$\sqrt{3}$
i.e., x=($\sqrt{3}$, 3, 27)

12. $x^2 + 6x+8>0$ and $2x^2+2x+3>0$
(x+4) (x+2) >0 and $(x+\frac{1}{2})^2 + \frac{5}{4} >0$
x ε (-∞, -4)U (-2, ∞)
The given equation can be written as
$log_{(2x^2+2x+3)}(x^2 - 2x) = 1$
$x^2 -2x=2x^2 + 2x +3$
$x^2 + 4x +3 =0$
x= -1, -3
But at x=-3, $log_{(x^2+6x+8)}$ is not defined
Hence, x= -1

13. Let u=log_{10}p, then the given inequality reduces to
$(2+u)^2 + (1+u)^2 + u \le 9$
$2u^2 + 7u +5\le 9$
$2u^2 + 7u -4\le 0$
$2u^2 + 8u -u-4\le 9$
2u(u+4)-1(u+4)≤0
(u+4)(2u-1)≤0
-4≤u≤1/2
-4≤log_{10}p≤1/2
$10^{-4}\le p\le 10^{1/2}$

14. Let u = log_2 x, then
$2log_2 log_2 x + log_{1/2} log_2(2\sqrt{2}x) =1$

$$2\log_2 u + \log_{1/2}(\log_2 2^{3/2} + u) = 1$$
$$\log_2 u^2 - \log_2 (3/2 + u) = 1$$
$$\log_2\left(\frac{u^2}{\frac{3}{2}+u}\right) = 1$$
$$u^2 = 2\left(\frac{3}{2} + u\right)$$
$$u^2 - 2u - 3 = 0$$
$$u = -1, 3$$
$$x = \frac{1}{2}, 8$$

But at $x=\frac{1}{2}$, $2\log_2 \log_2 x$ is undefined

Hence, $x=8$

15. By changing the base to 2 the give equation becomes

$$\frac{\log_2 x^2}{\log_2 x/2} + \frac{40 \log_2 \sqrt{x}}{\log_2 4x} - 14\frac{\log_2 x^3}{\log_2 16x} = 0$$
$$\frac{2\log_2 x^2}{\log_2 x - 1} + 20\frac{\log_2 x}{2 + \log_2 x} - 42\frac{\log_2 x}{4 + \log_2 x} = 0$$

Let $t=\log_2 x$, then we have

$2t(4+t)(2+t) - 42t(t-1)(t+2) + 20t(t-1)(t+4)=0$

$2t\ [t^2 + 6t + 8 - 21t^2 - 21t + 42 + 10t^2 + 30t - 40]=0$

$t\,[2t^2 - 3t - 2]=0$

$t=0,\ t=2,\ t=-\frac{1}{2}$

$x=1,\ x=4,\ x=\frac{1}{\sqrt{2}}$

16. $m>0$ and $n>0$ and $m\neq 1$

i.e., $25-x^2>0$ and $x \neq \pm 3$

and $24-2x-x^2>0$

$-5<x<5,\ x\neq\pm3$

And $x^2+2x-24<0$

$-5<x<5,\ x\neq\pm3$

And $-6<x<4$

$x \varepsilon (-5, 4)-\{-3,3\}$ …………………… (1)

case 1. $0<m<1 \Rightarrow 9<x^2<25$

$X\varepsilon(-5,-3)U(3,5)$ …………………… (2)

Therefore the given inequality can be written as

$$\frac{24-2x-x^2}{14} < \frac{25-x^2}{16}$$

⇨ $x^2 + 16x - 17 > 0$

⇨ $(x+17)(x-1)>0$

⇨ $x<-17$ or $x > 1$

from (1) and (2), we have

$x\ \varepsilon\ (3,4)$

case 2. If $m>1$, i.e., $\frac{25-x^2}{16} > 1$

⇨ $x\varepsilon\ (-3,3)$

…………………… (3)

The given inequality reduces to

$$\frac{24-2x-x^2}{14} > \frac{25-x^2}{16}$$

⇨ $x^2 + 16x - 17 < 0$

⇨ $-17<x<1$

Thus combining with (3), we get

$x\ \varepsilon\ (-3,1)$

But $x\ \varepsilon\ \{-5,4)$ ~ $\{-3,3\}$ by (1)

Thus $x\varepsilon\ (-3,1)$

Hence the required value of x should lie in $(-3,1)U(3,4)$

17. $\log_2 (5/2)=(\log_2 5) - 1$

But $(\log_2 5) - 1>(\log_2 4) - 1$

Therefore $\log_{3/10}\left[\frac{10}{7}(\log_2 5 - 1)\right] <$

$\log_{\frac{3}{10}}\frac{10}{7} < \log_{\frac{3}{10}} 1 (= 0)$

($\log_a x<\log_a y$ if $x>y$ for $o<a<1$)

Since $\log_{\frac{3}{10}}\frac{10}{7}(\log_2 5) < 0$

Hence, the first inequality is true only if

$$\sqrt{(x-8)(2-x)} = 0$$

⇨ $X=8$ or $x=2$

If $x=8$, then $\frac{2^x}{8} - (2^5 - 1)=1>0$

If $x=2$ then $\frac{2^x}{8} - (2^5 - 1) = \frac{1}{2} - (2^5 - 1) < 0$

Hence $x=8$ is the required value.

18. $2\log_{10} x - \log_x \frac{x}{100} = 2\log_{10} x - \frac{\log_{10} 10^{-2}}{\log_{10} x}$

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

$= 2\left(\log_{10} x + \frac{1}{\log_{10} x}\right)$

Since $x>1 \Rightarrow \log_{10} x>0$

But since AM ≥ GM

$$\frac{\log_{10} x + \frac{1}{\log_{10} x}}{2} \geq \sqrt{\log_{10} x \times \frac{1}{\log_{10} x}}$$

⇨ $\log_{10} x + \frac{1}{\log_{10} x} \geq 2$

⇨ $2\left(\log_{10} x + \frac{1}{\log_{10} x}\right) \leq 4$

⇨ For $x=10$, $2\left(\log_{10} x + \frac{1}{\log_{10} x}\right) \leq 4$

Hence the least value of $\left(\log_{10} x - \frac{1}{\log_{10} x}\right)$ is 4

19. we have, $x^{\left[\left(\frac{3}{4}\right)\left(log_2 x\right)^2 + log_2 x - \left(\frac{5}{4}\right)\right]} = \sqrt{2}$

=> $\log_x\sqrt{2} = \frac{3}{4}(\log_x x)^2 + \log_x x - \frac{5}{4}$

=> $\frac{log\sqrt{2}}{\log x} = \frac{3}{4}(\log_x x)^2 + \log_x x - \frac{5}{4}$

=> $log\sqrt{2} = \log x\ [\frac{3}{4}(\log_x x)^2 + \log_x x - \frac{5}{4}]$

=> $log_2\sqrt{2} = log_2 x\ [\frac{3}{4}(\log_x x)^2 + \log_x x - \frac{5}{4}]$

=> $\frac{1}{2} = \alpha\ [\frac{3}{4}\alpha^2 + \alpha - \frac{5}{4}]$ (say $\alpha = log_2 x$)

=> $2 = 3\alpha^3 + 4\alpha^2 - 5\alpha$

=> $3\alpha^3 + 4\alpha^2 - 5\alpha - 2 = 0$

=> $(\alpha - 1)(3\alpha^2 + 7\alpha + 2) = 0$

=> $\alpha = 1$ => $log_2 x = 1$ => $x=2$

Again $3\alpha^2 + 7\alpha + 2 = 0$

=> $\alpha = -2,\ -\frac{1}{3}$

=> $log_2 x = -2$ and $log_2 x = -\frac{1}{3}$

=> $x = \frac{1}{4}$ => $x = 2^{-1/3}$

Hence $x = 2, \frac{1}{4}, 2^{-1/3}$

Thus option (d) is most appropriate.

20. $2x+3>0$ and $2x+3 \neq 1$

=> $x > -\frac{3}{2}$ and $x \neq -1$

And $3x + 7 > 0$ and $3x+7 \neq 1$

⇨ $x > -\frac{7}{3}$ => $x \neq -2$

⇨ now, $\log_{(2x+3)}(6x^2 + 23x + 21) = 4 - \log_{(3x+7)}(4x^2 + 12x + 9)$

⇨ $\log_{(2x+3)}(2x+3)(3x+7) = 4 - \log_{(3x+7)}(2x+3)^2$

⇨ $\log_{(2x+3)}(2x+3) + \log_{(2x+3)}(3x+7) = 4 - 2\log_{(3x+7)}(2x+3)$

⇨ $1 + \log_{(2x+3)}(3x+7) + 2\log_{(3x+7)}(2x+3) - 4 = 0$

⇨ $\frac{2\log(2x+3)}{\log(3x+7)} + \frac{\log(3x+7)}{\log(2x+3)} - 3 = 0$ ……1

Putting $\frac{\log(2x+3)}{\log(3x+7)} = y$ in eq. (1), we get

$2y + \frac{1}{y} - 3 = 0$ => $2y^2 - 3y + 1 = 0$

$(2y-1)(y-1)=0$

⇨ $y = ½$ and $y=1$

Now, when $y = 1/2$

Therefore $\frac{\log(2x+3)}{\log(3x+7)} = \frac{1}{2}$

⇨ $(2x+3)^2 = (3x+7)$

⇨ $4x^2 + 9x + 2 = 0$

⇨ $(4x+1)(x+2) = 0$

$x = -\frac{1}{4}, -2$

Again if $y=1$, then $\frac{\log(2x+3)}{\log(3x+7)} = 1$

$2x+3 = 3x+7$

$X = -4$

Since we know that $x > -\frac{3}{2}$ and $x > -\frac{7}{3}$

Therefore x=-2 and x=-4 are not admissible values

Again since $x \neq -1$ and $x \neq -2$

Hence x=-2 is also inadmissible value

Thus, x= -1/4 is only possible value.

Option (b) is correct.

21. $x>0. x \neq 1$

Since exponential function assumes positive value, so we must have $(x-1)^7 > 0$ i.e, $x>1$.

Taking algorithm on both sides, we get

$(\log_3 x^2 - 2\log_x 9)\log(x-1) = 7\log(x-1)$

Either $\log(x-1) = 0$ i.e, $x = 2$

Or $\log_3 x^2 - 2\log_x 9 = 7$

$2(\log_3 x) - 4\log_x 3 = 7$

$2t - 4/t = 7$

$2t^2 - 7t - 4 = 0$

$t = 4, -1/2$

$\log_3 x = 4 \quad x = 81$

If $\log_3 x = -1/2$, then $x = 3^{-1/2} < 1$, which is not the case

Hence, $x = 2, 81$

<u>**FUNCTIONS AND GRAPHS:**</u>

Solution for question number 1 to 10:

P_0	P_1	P_2	P_3	P_4	P_5	P_6
0	1	1	0	-1	-1	0
Q_0	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6
0	1	1	2	3	5	8

P_7	P_8	P_9	P_{10}	P_{11}	P_{12}
1	1	0	-1	-1	0
Q_7	Q_8	Q_9	Q_{10}	Q_{11}	Q_{12}
13	21	34	55	89	144

1. D

2. B

3. C

4. D

5. $Q_{13} = 233$, $P_{14} = 1$
$Q_{13} + P_{14} = 234$

6. $Q_{10} + P_{10} = 55 + (-1) = 54$

7. $Q_6 = 8 : Q_8 = 21$
(i,e) $Q_{[q(6)]} = Q_{[8]} = 21$

8. (a), (b) and (c) are wrong

9. $[Q_5)^{P_5} = (5)^{-1} = 1/5 = 0.2$

Solution for question number 11 to 14:

11. p[k(3)] = 3Q [k(3)] – 4
= 3 (2R[k(3)] + R [k(6)] -4
= 3(2(s[k(6)]) –s [k(3)] + (d[k(12)] - s [k (6)])) – 4
= 3 (2 (22 -13) + (51 -22)) -4
=3 (18 + 29) – 4 =141 – 4 =137

12.S [k (1)] = 7
R [k (7)]= S [k (14)] – S [k (7)]
= 59 – 31 =28
Q [k(28)] = 2R[k(28)] + R [k (56)]
= 2(S[k(56)] – S [k(28)] = S [k(112) – S(k(56))]
= 2 (227 – 115) + (451 – 227)
= 2(112) + (224) = 448
QRS[k(1)]= QR[k(7)] = Q[k(28)] = 448

13. R[k(5) = S[k(10) – S[k(5)]
=43-19=24
And S[k(10)]=43
R[k(5)] – S[k(10)] = 24 – 43 = -19

14 . x<0, R [k(x)] and S [k(x)] are equal to zero.
Therefore the whole product will be zero.

Solution for question number 15 to 20:

15. $(3x^4 + 2x^2 + 5x) + (2x^4 + 3x^3 + 7x^2)$
$= 5x^4 + 3x^3 + 9x^2 + 5x$
= (5,4,3,3,9,2,5,1)

16.(6,5,7,4,8,3) – (3,5,5,3,7,1)
$= (6x^5 + 7x^4 + 8x^3) - (3x^5 + 5x^3 + 7x)$
$= (3x^5 + 7x^4 + 3x^3 - 7x)$
= (3,5,7,4,3,3,-7,1)

17. $(1,1,2,0) \rightarrow (x+2)$
$(x+2)^3 = x^3 + 6x^2 + 12x + 8$
=(1,2,6,2,12,1,8,0)

18. (3,3, -10, 2, 7, 1) / (3,2, -7, 1)
$= (3x^3 - 10x^2 + 7x) / (3x^2 - 7x)$
$= (x(3x^2 - 10x + 7) / x(3x - 7)$
$= x(x-1)(3x - 7)/ x(3x - 7)$
=(x -1) = (1, 1, -1 ,0)

20.$(4x^4 + 3x^3) * (2x^2 + x) + (2x^2 + x) - (3x^5 + 2x^4)$
$=(8x^6 + 10x^5 + 3x^4) + (2x^2 + x - 3x^5 - 2x^4)$
$=(8x^6 + 7x^5 + x^4 + 2x^2 + x)$
=(8, 6, 7, 5, 1, 4, 2, 2, 1, 1)

Solution for question number 21 to 25:

21. h(3, 2, 8, 7) / g(4, 7, 10, 8) = 2/4 =1/2

22. h(fg(2, 5, 7, 3,),9) = h(f(2, 5, 7, 3)*
G(2, 5, 7, 3),9)
= h((7* 2),9) = h(14,9) = 5

23.h(h(7, 13, 5, 9), h(4, 6, 12, 14)) = h(1, 0)
=1/0, which is not defined

24. A = 9, B = 20, C = 20, D = 14
B = C > D > A
Hence (b) is the appropriate answer

25. $h(h(a_1, b_1, c_1, d_1), h(a_2, b_2, c_2, d_2)) = h(0,0)$
=0/0 is not defined, while 0*0 = 0 is defined

Solution for question number 26 to 32: In case of x>0, we get the following pattern.
f(1) = b +c – 2c + a = a + b – c
f(2) = b + c – 4c + a + b – c = a + 2b -4c
f(3) = b + c -6c + a + 2b -4c = a + 3b -9c
f(4) = b + c – 8c + a + 3b -9c = a + 4b -16c
(i,e.., $f(x) = a + bx - cx^2$

26. Hence $f(8) = a + 8b - 64c = a + 8 (b - 8c)$

27. $f(-19) = 2b * (-19) + f(-(-19))$
$= \quad -38b + f(19)$
$= \quad 38b + a + 19 b - 36c$
$= \quad a - 19b - 361c = a - 19 (b + 19c)$

28. $f(7) = a + 7b - 49c$
When $a = 15, b = 11$ and $c = -3$
$f(7) = 15 + 7 * 11 - 49(-3)$
$= 15 + 77 + 147 = 239$

29. $f(-10) = a - 10b - 100c$
At $a = 10, b = -7$ and $c = 6$
$f(-10) = 10 - 10(-7) -100 *6$
$=10 + -600 = -520$

30. $f(x) = a + b(x) - c(x)^2$ for every x
$0 = 4 - 17x + 18x^2$
Now, for convenience go through options.

31. $f(x) < 0$
⇨ $a + b(x) - c(x)^2 < 0$
⇨ $12 + 10(x) - 8(x)^2 < 0$
Now, for convenience go through options.

32. $f(1) = a+ b -c = -a$
$f(f(1) = f(-a)$
$= a + b(-a) -c(-a)^2$
$= a -ab - ca^2= a + a^2 - a^3$

Solution for question number 33 to 37:
$F(y , 0) = y+f(y - 1,0)$
$= y + (y-1) + f(y-2,0)$
$= y - (y-1) + (y-2) + ...+ 1+ f(0,0)$
$= y(y+1)/2 + 1$
And $f(0,y) = y-f(0, y-1)$
$= y-[(y-1)-f(y-2,0)]$
$= 2+f(0, y-4)$
Thus, $f(0,y) =$ $y-1/2$, if y is odd
$y+2/2$, if y is even

33. $f(y_1, y_2,y_3,......y_n)$ is not defined for every odd n.
Here $n=27$

34. $f(0,1,0,1) = f(0,1) + f(1,0) + (0+1+0+1) = 0+2+2=4$

35. $f(8,8,8,2,2,2) = f(8,2)+f(8,8,2,2) + (8+8+8+2+2+2)$
$= 9 + [38]+30 =77$

36. $f(1,1,3,1,1,3) = f(1,3) + f(1,3,1,1) + (1+1+3+1+1+3)$
$= f(3,0) + f(0,1) +[f(1,1)+f(3,1)+(1+3+1+1)] + 10$
$= 17 + [2+0+2+1+6]$
$=28$

37. $f(9,2,k,0,9,4) = f(9,4) + f(2,k,0,9) +(9+2+k+0+9+4)$
$= 98 + 2k + f(k,0)$
$= 98 + 2k +[k(k+1)/2 + 1] =124$
$k^2 + 5k - 50 = 0$
$K=-10$ or $k=5$
Since k is a positive integer, hence k=5

38. $f(128) = 1.2^2 + 2.2^1 + 8.2^0$
$4 + 4 + 8 = 16$
$f (16) = 1.2^2 + 6.2^0 = 2 + 6 = 8$

39. $f (888222) = 8.2^2 + 8.2^1 + 8.2^0 + 2.2 + 2.2^2 + 2.2^1 + 2.2^0$
$= 2^8 + 2^7 + 2^6 + 2^3 + 2^2 + 2^1$
$= 2^6(7) +14$
$= 448 + 14 = 462$
$f (462) = 4.2^2 + 6.2^1 + 2.2^0 = 30$
$f (30) = 3.2^1 + 0.2^0 = 6$
Again $f (113113) = 1.2^5 + 1.2^4 +3.2^3+1.2^2+1.2^1 + 3.2^0$
$= 32 + 16 + 24 + 4 + 2 + 3 = 81$
$f (81) = 8.2^1 + 1.2^0 = 16 + 1 = 17$
$f (17) = 1.2^1 + 7.2^0 = 2+ 7 = 9$
$f [f (888222) + f (113113]) = f (6 + 9) = f (15) = 1.2^1 + 5.2^0 =2 + 5 =7$

40. $f (9235) = 9.2^3 + 2.2^2 + 3.2^1 + 5.2^0$
$= 72 + 8 + 6 + 5 = 91$
$f (91) = 9.2^1 + 1.2^0 = 19$
$f (19) = 1.2^1 + 9.2^0 = 11$
$f (11)\ 1.2^1 + 1.2^0 = 3$
$f (9430) = 9.2^3 +4.2^2 +3.2^1 + 0.2^0$
$= 72 + 16 + 10 = 98$
$f (98) = 9.2^1 + 8.2^0 = 26$

$f(26) = 2.2^1 + 6.2^0 = 10$
$f(10) = 1.2^1 + 0.2^0 = 2$
$f(9235) + f(9430) = 3 + 2 = 5$

SEQUENCE SERIES AND PROGRESSIONS:

1. Total number of bacteria after 10 seconds = $3^{10}-3^5 = 3^5(3^5-1)$ since just after 10 seconds all the bacteria (i.e. 3^5)are dead after living for 5-5 seconds

2. $S_{20} = 2^{66}-2^{65}-2^{64}-2^{63}-2^{62}-\ldots\ldots-2^{47}$
$= 2^{65}(2-1)-2^{64}-2^{63}-2^{62}-\ldots\ldots-2^{47}$
$=2^{65}-2^{64}-2^{63}-2^{62}-\ldots\ldots-2^{47}$
…… ……..
…… …….
$=2^{47}$

3. Since $S_{67} = 2^0$ $(s_n = 2^{67-1})$
$S_{66} = 2^1$
$S_{65} = 2^2$
$S_{64} = 2^3$
………
$S_{34} = 2^{33}$ etc.
Now, $U_m = S_m + S_{m+1} + S_{m+2} + \ldots\ldots + S_{m+(m-1)}$
$U_{34} = S_{34} + S_{35} + S_{36} + \ldots\ldots + S_{67}$
$U_{34} = 2^{33} + 2^{32} + 2^{31} + \ldots\ldots + 2^0$
$U_{34} = (2^{33} - 1)$

4. Consider an A.P, then go through options let 1, 2, 3,4,5,6 be an A.P with 6 terms i.e. 3n=6, 2n=4 and n=2 , S3-S2-S1 , = (1+2+…6)-(1+2+3+4)-(1+2) =21-10-3=8
Choice (a) gives
S3-s2-s1=3a-2n-d=3-4-1
= -2 hence wrong
Check the choice (d)
S3-S2-S1=2n^2d=8 hence it is correct.

5.

$T_n = n$	N+3	N+5	N+7	N+9
$T_1 = 1$	4	6	8	10
$T_2 = 2$	5	7	9	11
$T_3 = 3$	6	8	10	12
$T_4 = 4$	7	9	11	13
$T_5 = 5$	8	10	12	14
$T_6 = 6$	9	11	13	15
$T_7 = 7$	10	12	14	16
$T_8 = 8$	11	13	15	17
$T_9 = 9$	12	14	16	18

In general when n=4,9,13,17, ….., 99 does not contain 5 or its multiple.
Hence out of 99 sets does not contain the 5 or its multiples.
Thus the required number of sets = 99-20 =79

6. let S = 1+2+2+2+3+3+3+3+3+………..+10
S= 1+3(2)+5(3)+……..19(10)
Since $T_n = (2n-1)n$
$S_n = \text{sum}(2n^2 - n)$
$= n(n+1)(4n-1)/6$
$S_{10} = 715$

7. Let s=1+1+1+2+2+2+2+2+ ……..+17+17
S=1(3)+2(5)+3(7)+ …… +17(35)
$T_n = (2n+1)n$
$S_n = \text{sum}(2n^2 + n)$
$= n(n+)(4n+5)/6$
S= 17*18*73/6 = 3723

8. This can be done only by giving the number of coins as 2^0 2^1 2^2 ^3 2^4 2^5,….etc so , the amount are 1 2 4 8 16 32 37 hence (c) is the correct answer

9. (1+37) = (32+4+2) hence, 3 people are required
10.(1+2+37) = (32+8) hence, 2 people are required

11. C

12. 1 2 4 8 16 32 64 73

13. Since there are only 5 people left with their amount 1, 4,16,64,73, (excluding 2 8 32)
So total number of combination are 2^5-1=32 so total number of combination are 2^5 -1 = 31
Hence option (c is correct

14. 1+2+4+8+16+32=63
3(1+2+4+8+16+32)=189
200-189=11

15. First of all choice © is ruled out since 'a' cannot be zero

Again choice (a) is ruled out because |r| not less than 1

Now let us check the option (b)

$S_\infty = 3 + (-3/2) + 9/4 + (-27/8) + \ldots\ldots + \infty$

$S_\infty = 3/(1-(-1/2)) = 2$

Hence, choice (b is the appropriate choice.

16. When you check option a it will proved wrong. Again for convenience consider option c

2 5 8 11

Then first term of that G.P=3

And the common ratio of G.P=2

Hence G.P=3 6 12 24

=155.

This is also correct. Hence choice (c) is correct.

17. a/r-1 = 162,

$a(1-r^n)/(1-r) = 160$

$r^n = 1/81$

now since 1/r belongs to z

$1/r^n = 81$

=> $1/r = 3^{4/n}$

Here 1,2 ,3 are factors of 4.

Hence option (d).

n	r	a
1	1/81	160
2	1/9,-1/9	144 and 180
4	1/3, -1/3	108 and 216

18. C

<u>PERMUTATION AND COMBINATION:</u>

1. ${}^6P_2 = 30$

2. ${}^6C_2 = 15$

3. 3 lines intersect ${}^3c_2 = 3$ points,

3 circles intersect $= {}^3p_2 = 6$ points

Every line cuts 3 circles into 6 points.

Therefore 3 lines cuts 3 circles into 18 points.

Therefore maximum number of points

=3+6+18=27

4. 8! /(4!*4!) =70

5. Required number of triangles

$= {}^{m+n}C_3 - {}^mC_3 - {}^nC_3 - {}^kC_3.$

6. Number of even places = 4

Number of even digits = 5(2, 2, 8, 8, 8)

Number of odd places = 5

Number of odd digits = 4(3, 3, 5, 5)

Odd digits can be arranged in 4! / (2!*2!) Ways

=6 ways.

Even digits can be arranged in 5! / 2! * 3!

=10ways.

Hence the required number of ways =6 *10

= 60 ways.

7. Required number of triangles

$= {}^{m+n+k}C_3 - {}^mC_3 - {}^nC_3 - {}^kC_3.$

8. Let n = 2m + 1, for the three numbers are in AP we have the following patterns

Favorable no of ways

(n – 2) + (n – 4) + (n – 6) + …… + 3 + 1

= m/2 (n – 2 + 1)

$= (n-1)/2 \cdot (n-1)/2 = (n-1)^2/4.$

Common Differences	Numbers	Number Of Ways
1	(1, 2, 3)(2,3,4)..(n-2,n-1,n)	(n-2)
2	(1,3, 5)(2, 4, 6)..(n–4,n–2,n)	(n– 4)
3	(1, 4, 7)(2, 5, 8)..(n–6,n–3,n)	(n– 6)
……	…… …….. …….	
	…….. …… …….	…
m	(1 , m + 1 , 2m + 1)	1

9. Required number of parts

$= 1 + \sum_{r-0}^{8} r$

= 1+ (8*9)/2 =37

10. 240/4n+2= k ∈ I

$k = 120/2n+1 = 2^3 * 3 * 5/$*2n+1*

Since probable divisors are

1,3,5,7,9,11,13,...(2n+1) but we have only 4 possible divisors 1,3,5,15 .

11. Total number of rectangles = (1+2+3+....+12)*(1+2+....+8)
= (12*13/2)*(8*9/2) =2808
Total number of squares
= (12*8+ (11*7) + (10*6) +.....+ (5*1) =348
Required number of rectangles =2808 -348 =2460.

12. Required number of triangles=
$({}^{2n}C_3 - {}^{n}C_3 - {}^{n}C_3)+(n*n)$
$= n^2(n-1)+n^2 = n^3$

13. There are 12 ways as follows:
(9,0,0),(8,1,0),(7,2,0),(6,3,0),(5,4,0),(7,1,1),(6,2,1),(5,3,1),(5,2,2),(4,4,1),(4,3,2),(3,3,3)

14. Each one has 4 coins , So we are left out with =30-(6*4)=6 coins
These remaining coins be distributed in
${}^{6+6-1}C_{6-1} = {}^{11}C_5 = 462$ ways

15. Required number of circles $= {}^{10}C_3 - {}^{7}C_3 = 85$

16. 0 cannot be placed in the left most digit. So we have only 9 digit to placed.
Required numbers=9C2+9C3+9C4+….+9C9=502

17. There are total of 9 ways.

***18.*.** Total permutations =8!=40320
No of permutations LURY occurs=(8-4+1)!==>5!=120
No of permutations MINA occurs=5!=120
No of permutations BOTH OCCURS =3!=6
Requires no = 40320-(120+120)+6=40086

19. 5students can be selected out of 10 student s in ${}^{10}C_5$ ways remaining 5 students can be selected in 5c5 ways. These students (in each row) can be arranged mutually in 5!*5! Ways
$= {}^{10}C_5 * (5!)^2 * 2 = 7257600$

20. ${}^{n}C_2 + 2n = 65$

21. First of all deduce 3 x 10 = 30 marks to assign at least 3 marks to each of the 10 students. Now remaining 20 marks can be assigned to 10 students in ${}^{20+10-1}C_{10-1}$ ways = ${}^{29}C_9$ ways.

22.[1/3] = [1/3 + 1/100] = [1/3 + 2/100] = …[1/3 + 65/100] = [1/3 + 66/100] = 0 and
[1/3 + 67/100] = [1/3 + 68/100] = [1/3 + 69/100] = … [1/3 + 98/100] = [1/3 + 99/100] = 1
Hence, E = [1/3] + [1/3 + 1/100] + … + [1/3 + 99/100]
= 33 x 1 = 33.

23. Total numbers = 10^6 (1, 2, 3, 4, …., 10^6)

$n^2 \Rightarrow \left\{\begin{array}{l} 1, 4, 9, 16, 25, \ldots\ 10^6 \\ 1, 2, 3, 4, 5, \ldots\ (10^3) \end{array}\right\} \longrightarrow 10^3 = 1000$

$n^3 \Rightarrow \left\{\begin{array}{l} 1, 8, 27, 64, 125, \ldots\ 10^6 \\ 1, 2, 3, 4, 5, \ldots\ (10^2) \end{array}\right\} \longrightarrow 10^2 = 100$

$n^4 \Rightarrow \left\{\begin{array}{l} 1, 16, 81, 256, \ldots\ 923521 \\ 1, 2, 3, 4, \ldots, 31 \end{array}\right\} \longrightarrow 31$

Hence the number of numbers which are either perfect square or perfect cube or perfect fourth powers or all of these = $n^2 + n^3 + n^4 - (n^2 \cap n^3 + n^3 \cap n^4 + n^2 \cap n^4) + n^2 \cap n^3 \cap n^4$ = 1131 – 44 + 3 = 1090.
Hence, the required number of ways = Total numbers – Numbers which are perfect squares or perfect cubes or perfect fourth powers = 10^6 – 1090 = 998910.

24. Total number of required seats = 1+ m+ 2n.
The Grandchildren can occupy the n seats on either side of the table in $({}^{2n}P_{2n})$ ways. Remaining seats are (1+m).
Since grandfather cannot occupy adjacent seats of the grandchildren hence the grandfather can access only m+1-2=m-1 seats. Hence he can occupy a seats in ${}^{(m-1)}P_1$ ways.
Now the remaining seats can be occupied in ${}^{m}P_m$ ways by the 'm' sons and daughters.
Hence the required number of ways = ${}^{2n}P_{2n}$ x ${}^{m}P_m$ x ${}^{m-1}P_1$= (2n!)(m!)(m-1)

25.The 4 possible cases are as follows:
C_1 → First column
C_2 → Second column
C_3 → Third column

C_1	C_2	C_3
2	3	1
2	2	2

1	4	1
1	3	2

Hence, the required number of ways:

$= {}^{2}C_{2} \times {}^{4}C_{3} \times {}^{2}C_{1} + {}^{2}C_{2} \times {}^{4}C_{2} \times {}^{2}C_{2} + {}^{2}C_{1} \times {}^{4}C_{4} \times {}^{2}C_{1} +$
${}^{2}C_{1} + {}^{2}C_{1} \times {}^{4}C_{3} \times {}^{2}C_{2}$

$= 1 \times 4 \times 2 + 1 \times 6 \times 1 + 2 \times 1 \times 2 + 2 \times 4 \times 1$

$= 8 + 6 + 4 + 8$

$= 26$

26. The total number for balls in the box = 2+3+4 = 9.
Total number of selection of 3 balls out of 9 balls $= {}^{9}C_{3}$
Number of selections in which no any green ball is selected $= {}^{6}C_{3}$
Hence the required number of selections $= {}^{9}C_{3} - {}^{6}C_{3} = 64$.

27. There are four possible cases:
H → Husband's
Relatives
W → Wife's relatives

Burfi	3	2	1	0
Rasgulla	0	1	2	3

M → Male
F → Female

	H	W
M	0	3
F	3	0

H	W
1	2
2	1

H	W
2	1
1	2

H	W
3	0
0	3

Hence, the required number of ways:

$= ({}^{4}C_{3} \times {}^{4}C_{3}) + ({}^{3}C_{1} \times {}^{4}C_{2}) ({}^{4}C_{2} \times {}^{3}C_{1}) + ({}^{3}C_{2} \times {}^{4}C_{1}) ({}^{4}C_{1} \times {}^{3}C_{2}) + ({}^{3}C_{3} \times {}^{3}C_{3})$

$= (4*4)+(3*6*6*3) + (3 \times 4 \times 4 \times 3) + (1 \times 1) = 485$

28. Let the number of men participating in the tournament be n. Since every participant played two games with every other participant.
Therefore the total number of games played among men is $2 \times {}^{n}C_{2} = n(n-1)$.
And the number of games played with each woman = 2n, but since there are two women, hence the total number of games men played with 2 women = 2 x 2n = 4n
Therefore, $\{n(n-1)\} - 4n = 66$

$n^2 - 5n - 66 = 0$

$n = 11$ (Since, $n < 0$, is not possible)

Therefore, Number of participants
= 11 men + 2 women = 13.

29. Number of games played by them is $2({}^{13}C_{2}) = 156$.

30. There are two possible case in which 12 sweets can be distributed among ten girls.
i) any 9 girls get one sweet each and remaining one girl gets 3 sweets.
ii) any 8 girls get one sweet each and remaining 2 girl gets 2 sweets each.
CASE 1 : 3 pieces of sweet can given to the girl in the following four way:
After giving 3 pieces of sweets to a single girl. We can distribute the remaining. 9 sweets to 9 girls in following ways:

${}^{9}c_{3} * {}^{6}c_{6} + {}^{9}c_{4} * {}^{5}c_{5} + {}^{9}c_{5} + {}^{4}c_{4} + {}^{9}c_{6} * {}^{3}c_{3} = 2({}^{9}c_{3} + {}^{9}c_{4})$

One particular girl can be chosen in ${}^{10}c_{2}$ ways.
Therefore 3 sweets can be given to a single girl in ${}^{10}c_{1} * 2 * ({}^{9}c_{3} + {}^{9}c_{4}) = 4200$ ways.
CASE 2. We can give two sweets to two girls (say A and B) in following ways:

A	Burfi	2	1	0	2	1	0	2	1	0
	Rasgulla	0	1	2	0	1	2	0	1	2
B	Burfi	2	2	2	1	1	1	0	0	0
	Rasgulla	0	0	0	1	1	1	2	2	2

Then the remaining 8 sweet can be distributed to remaining 8 girls in following ways

$=({}^{8}c_{2} * {}^{6}c_{6}) + ({}^{8}c_{3} * {}^{5}c_{5}) + ({}^{8}c_{4} * {}^{4}c_{4}) + ({}^{8}c_{3} * {}^{5}c_{5}) + ({}^{8}c_{4} * {}^{4}c_{4}) + ({}^{8}c_{5} * {}^{3}c_{3}) + ({}^{8}c_{4} * {}^{4}c_{4}) + ({}^{8}c_{5} * {}^{5}c_{5}) + ({}^{8}c_{6} * {}^{2}c_{2})$

$=2({}^{8}c_{2}) + 4({}^{8}c_{3}) + 3({}^{8}c_{4})$

Further, 2 girls can be selected in ${}^{10}c_{2}$ ways.
Therefore 2 girls can get two sweet each in $({}^{10}c_{2})[2({}^{8}c_{2}) + 4({}^{8}c_{3}) + 3({}^{8}c_{4})] = 22050$ way

Number of digits	Total number of numbers
1	7
2	$6*6= 6^2$
3	$6*7*6= 6^2 * 7$
4	$6*7*7*6= 6^2 * 7^2$
5	$6*7*7*7*6= 6^2 * 7^3$
6	$6*7*7*7*7*6= 6^2 * 7^4$

Hence, the required number of ways = 4200+ 22050=26250.

31. Number of common children of Mr. John and Ms. Bashu = 10 - (x+x+1) = 9 – 2x
Let N = The number of fights between children of different parents
= (Total number of fights that can take place among all the children) –
(The number of fights among the children of same parents)
$= {}^{10}C_2 - ({}^{x}C_2 + {}^{x+1}C_2 + {}^{9-2x}C_2)$ ……………… 1
$= 45 - ((x(x-1))/2 + ((x+1)(x))/2 + ((9-2x)(8-2x))/2)$
$=45 - ½ (x^2-x+ x^2 +x +72 - 34x +4 x^2)$
$= 397/12 - (3(x-(17/6))^2)$
For N to be maximum, x must be 17/6. As x cannot be in fractional, we take x=3(approximately equal to 17/6). Thus, maximum value of N=33 which is attained at x=3.
Alternatively: After making the equation (1) goes through options.

32. Let the form of required numbers be a_1 , a_2 , ….. a_9 where $0<= a_1 <= 1$ and $0<= a_i <=2$ for i=2,3,….9 and where all a_1 , a_2 , ….. a_9 cannot be equal to zero.
Now, we can choose a_1 in two ways (0 or 1) and a_i for i=2, 3… 8 in ways (0, 1, 2).
After selecting a_1, a_2 , ….. a_8 we find the sum s= a_1 +a_2 + …….. a_8 which is of the form 3m-2, 3m-1 or 3m. Now we select a_9 in just one way.
Actually a_9 can be selected out of 2,1 or 0 depending on whether s=3m-2, 3m-1 or 3m.
Therefore, we can choose the numbers in $2* 3^7 * 1$ = 4374 ways.
But this includes the case in which each of a_i =0.
Thus, the required number of numbers = 4374 – 1 =4373

33. The digits which can be recognized as digits on the screen of a calculator when they are read inverted i.e., upside down are 0,1,2,5,6,8 and 9. Since a number cannot begin with zero hence left most digit and right most digit can never be 0 as when an 'n' digit number read upside down it will become a number of less than n digit. Hence,

1st mark	2nd mark	3rd mark	4th mark	Total
0	0	1	2	3
0	1	0	2	3
1	0	0	2	3
1	1	1	0	3
1	0	1	1	3
0	1	1	1	3

Thus, the number of required numbers
$= 7 + 6^2 + 6^2 * 7 +………+6^2 * 7^4$
$= 7 + 6^2 (7^5 - 1)/(7-1) = 7 + 6 (7^5 - 1)$
$=6.\ 7^5 + 1 =100843$

34. Since rings are distinct, hence they can be named as R1, R2,R3, R4 and R5.
The ring R1 can be placed on any of the four fingers in 4 ways.The ring R2 can be placed on any of the four fingers in 5 ways since the finger in which R1 is placed now has 2 choices, one above the R1 and one below the ring R1.Similarly R3, R4 and R5 can be arrange in 6,7 and 8 ways respectively.Hence, the required number of ways = 4 *5*6*7*8 = 6720

35. We can select first object out of *n* objects in ${}^nC_1$ ways.
Now, number of ways of choosing two objects such that they are always together (n-4) ways. Since we assume two objects as a single object. Further we can select three objects viz., the one

object which has been already selected and two objects of one either side of the first object.
Therefore the number of ways of choosing two objects such that they are not together
$= {}^{(n-3)}C_2 - (n-4) = \frac{1}{2}(n-4)(n-5)$
Since these two objects can be arranged in 21 ways, the number of ways of choosing three objects(in order of the first, second and third) is
$n \times \frac{1}{2}(n-4)(n-5) \times 2 = n(n-4)(n-5)$
But, since the order in which the objects are taken is immaterial, the number of ways of choosing the objects is $1/6\ n(n-4)(n-5)$

36.

Number of similar letters	Number of different letters	Number of selections
5	0	${}^1C_1 = 1$
4	1	${}^4C_1 * {}^2C_1 = 8$
3	2	${}^3C_1 * {}^4C_2 = 18$
3 of one type and 2 of another type	0	${}^3C_1 * {}^3C_1 = 9$
2 of one type and 2 of another type	1	${}^4C_2 * {}^3C_1 = 18$
2	3	${}^4C_1 * {}^4C_3 = 16$
0	5	${}^5C_5 = 1$

Hence, the total number of selections= 1+8+18+9+18+16+1=71

37.

	1st paper	2nd paper	3rd paper	4th paper
Max. marks	n	n	n	2n

Let us , consider n=1. Then a candidate required 3 marks out of 5 marks, which can be done in the following ways:

Hence, there are total 7 ways.
Now, go through options.
Let us consider options (b).
Putting n=1, we get
$(1/6)*(1+1)*(5*1^2 + 10*1 + 6) = 7$
Hence choice (b) is correct answer.

38. Do this problem similar as previous problem.

<u>Probability:</u>

1. Total number of words that can be formed from the letters of the word MISSISSIPPI is 11!/4!4!2!
When all the S's are together then the number of words can be formed = 8!/4!2!
Required probability = (8!/4!2!)/(11!/4!4!2!) = 4/165

2. Since each of the coefficients a, b and c can take values from 1 to 6. Therefore the total number of equations = 6*6*6 =216

Hence the exhaustive number of cases = 216
Now, the roots of the equation $ax^2 + bx + c = 0$ will be real if $b^2 - 4ac \geq 0 \Rightarrow b^2 \geq 4ac$
Following are the number of favorable cases:

a	c	ac	4 ac	b^2 (≥4ac)	b	Number of cases
1	1	1	4	4,9,16,25,36	2,3,4,5,6	1*5 = 5
1 2	2 1	2	8	9,16,25,36	3,4,5,6	2*4 = 8
1 3	3 1	3	12	16,25,36	4,5,6	2*3 = 6
1 2 4	4 2 2	4	16	16,25,36	4,5,6	3*3 = 9
1 5	5 1	5	20	25,36	5,6	2*2 = 4
1 2 3 6	6 3 2 1	6	24	25,36	5,6	4*2 = 8
2 4	4 2	8	32	36	6	2*1 = 2
3	3	9	36	36	6	1*1 = 1
					Total	**= 43**

Note ac = 7 is not possible
Since $b^2{}_{(max)}$ = 36 and 4 ac ≤ b^2 hence ac = 10,11, 12, . . . etc., is not possible.
Hence, total number of favorable cases = 43
So, the required probability = 43/216.

3.6 can be thrown with a pair of dice in the following ways (1,5), (5,1), (2,4), (4,2), (3,3)
So, probability of throwing a '6' = 5/36
And probability of not throwing a '6' = 31/36
And 7 can be thrown with a pair of dice in the following ways. (1,6), (6,1), (2,5), (5,2), (3,4), (4,3)
So, probability of throwing a '7' = 6/36 = 1/6 and probability of not throwing a '7' = 5/6
Let E_1 be the event of the throwing a '6' in a single throw of a pair of dice and E_2 be the event of throwing a 7 in a single throw of a pair of dice.
Then $P(E_1) = 5/36$, $P(E_2) = 1/6$
And $P(E1) = 31/36$, $P(E2) = 5/6$
A wins if he throws '6' in first or third of fifth.. throws. Probability of A throwing a 6 in first throw = $p(E_1)$ = 5/36 and probability of A throwing a 6 in third throw = $P(E1 \text{ n } E2 \text{ n} E_i)$ = $P(E1)\ P(E2)P(E_1)$ = 31/36 * 5/6 * 5/36
Similarly, probability of A throwing a '6' in fifth throw
= $P(E1)P(E2)P(E1)P(E2)P(E1)$
= $(31/36)^2$ x $(5/6)^2$ x 5/36
Hence, probability of winning of A
= $P[E_1 U (E1 \ \Pi \ E2 \ \Pi E1)U(E1 \ \Pi \ E2 \ \Pi \ E1 \ \Pi \ E2 \ \Pi \ E1)U..]$
= $P(E_1) + (E1 \ \Pi \ E2 \ \Pi \ E1)+(E1 \ \Pi \ E2 \ \Pi \ E1 \ \Pi \ E2 \ \Pi \ E1)+]$
= (5/36) + (31/36 * 5/6) x (5/36) + $(31/36 * 5/6)^2$ * 5/36 +…..
= (5/36) / (1-(31/36)*(5/6)) = 30/61
Thus, probability of winning of B = 1-(30/61) = 31/61

4. Let A be the event of getting exactly 3 defectives in the examination of 8 wristwatches. And B be the event of getting ninth wristwatch defective. Then
Required probability = $P(A \cap B) = P(A)\ P(B/A)$
Now, $P(A) = ({}^4C_3 * {}^{11}C_5) / ({}^{15}C_8)$
And P(B/A) = Probability that the ninth examined wristwatch is defective given that there were 3 defectives in the first 8 pieces examined = 1/7
Hence, required probability = $({}^4C_3 * {}^{11}C_5) / ({}^{15}C_8)$ * 1/7 = 8/195

5. let E_1 ,E_2, E_3, and A be the events defined as following :
E_1 = the Examinee guesses the answer
E_2 = the Examinee copies the answer
E_3 = the examinee knows the answer and
A =t the examinee answers correctly
We have $P(E_1) = 1/3$, $P(E_2)= 1/6$
$P(E_1) +P(E_2) +P(E_3) = 1$
$P(E_3)$ = ½
If E_1has already occurred, then the examinee guesses. Since there are four choices out of which only one is correct, therefore the probability that he answers correctly given that he has made a guess is ¼ i.e., $P(A/E_1)$ = ¼
It is given that $P(A/E_2) = 1/8$ and $P(A/E_3)$ is the probability that he answer correctly given that he knew the answer =1
By Baye's rule,
Required probability= $P(E_3/A)$
$P(E_3)P(A/E_3)/(P(E_1)p(A/E_1) + P(E_2)P(A/E_2)+P(E_3)P(A/E_3)$ = 24/29

6. Let x and y both the two non-negative integers
Since x+y =200
$(xy)_{max}$ = 100*100 = 10000 (xy_{max} at x=y)
Now, xy not less than 3* 10000/4 => xy≥ 3 * 10000/4
⇨ xy≥ 7500
⇨ x(200 –x) ≥ 7500
⇨ 50≤x≤150
So favorable number of ways = 150 – 50 + 1 = 101
Total number of ways = 200
Hence, required probability = 101/200

7. Let E_i (i = 1,2,3 etc.) denote the event of drawing an event numbered card in i^{th} draw and F_i (i=1,2,3) denote the event of drawing an odd numbered card in i^{th} draw, then required probability

$= P[(E_1 \cap F_2 \cap F_3) \cup (F_1 \cap E_2 \cap F_3) \cup (F_1 \cap F2 \cap E_3)]$

$= 4/9 * 5/9 * 5/9 + 5/9 * 4/9 * 5/9 + 5/9 * 5/9 * 4/9$

$= 3* 4 * (5)^2 / 9^3 = 100/243$

8. Consider the following events

A = The first number is less than the second number

B = The third number lies between the first and the second.

Now, we have to find P(B/A).

Also, we have $P(B/A) = P(A \cap B) / P(A)$

Any 3 numbers can be chosen out of n numbers in ${}^nC_3$ ways. Let the selected numbers be x_1, x_2, x_3. Then they satisfy exactly one of the following inequalities.

$x_1 < x_2 < x_3$, $x_1 < x_3 < x_2$, $x_2 < x_1 < x_3$, $x_2 < x_3 < x_1$, $x_3 < x_1 < x_2$, $x_3 < x_2 < x_1$

the total number of ways of selecting three numbers and then arranging them $= {}^nC_3 * 3! = {}^nP_3$

$P(A) = {}^nC_3 * 3 / ({}^nC_3 * 3!)$

And $P(A \cap B) = {}^nC_3 / {}^nC_3 * 3!$Hence

$P(B/A) = P(A \cap B) / P(A) = 1/3$

9. Since b and c each can assume 9 values from 1 to 9.

So , total number of ways of choosing b and c is $9*9 = 81$Now, $x^2 + bx + c > 0$ for all x belong to R

⇨ $D<0$

⇨ $B^2 - 4ac < 0$

⇨ $B^2 - 4c < 0$

⇨ $B^2 < 4c$

Now, the following table shows the possible values of b and c for which $b^2 < 4c$

C	b	total
1	1	1
2	1,2	2
3	1,2,3	3
4	1,2,3	3
5	1,2,3,4	4
6	1,2,3,4	4
7	1,2,3,4,5	5
8	1,2,3,4,5	5
9	1,2,3,4,5	5
32		

So, favorable number of cases = 32

Hence required probability = 32/81

10. We have, $P(A \cup B \cup C) = 3/4$

i.e., $P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(A \cap C) + P(A \cup B \cup C) = 3/4$

And $P(A \cap B) + P(B \cap C) + P(A \cap C) - 2 P(A \cup B \cup C) = 1/2$

And $P(A \cap B) + P(B \cap C) + P(A \cap C) - 3 P(A \cup B \cup C) = 2/5$

Solving the above equation (last two), we get

$P(A \cup B \cup C) = 1/2 - 2/5 = 1/10$

$P(A) P(B) P(C) = 1/10$

Pmc =1/10

Also, $P(A) + P(B) + P(C) - [P(A \cap B) + P(B \cap C) + P(A \cap C) + P(A \cup B \cup C)] = 3/4$

$P+m+c - (1/2 + 2/10) + 1/10 = 3/4$

$P+m+c = 27/20$

11. Let E, F, G be the events that the student is successful in tests A,B and C respectively. Then the probability that the probability that the students is successful is

$= P(E)P(F)P(G \text{ bar}) + P(E)P(F \text{ bar})P(G) + P(E) P(F) p(G)$

$= pq(1-1/2) + p(1-q)(1/2) + pq(1/2)$

$= p(1+q)/2$

But the probability that the student is successful $= 1/2$

$P(1+q)/2$ ½

This is satisfied by p=1, q=0
Also there are other values (infinite numbers) of p,q for which the above relation is satisfied.
Hence, (d) is the correct option.

12. Since 1+4p/p, 1-p/4, 1-2p/2 is the probabilities of 3 mutually exclusive events, therefore

$0 \le 1+4p/p \le 1$, $0 \le 1-p/4 \le 1$, $0 \le 1-2p/2 \le 1$
And $0 \le 1+4p/p + 1-p/4 + 1-2p/2 \le 1$

- ⇨ $-1/4 \le p \le 3/4$, $-1 \le p \le 1$, $-1/2 \le p \le 1/2$
  And $1/2 \le p \le 5/2$
- ⇨ Max { -1/4 , -1 , -1/2 , ½ } ≤ p≤ min { ¾ , 2, ½ , 5/2}
- ⇨ $1/2 \le p \le 1/2$
- ⇨ P=1/2
- ⇨

13. ASSISTANT -> AA I N SSS TT
STATISTICS -> A II C SSS TTT
Here N and C are not common and same letters can be A, I, S, T. Therefore
Probability of choosing A = $^{2}c_1 / {}^{9}c_1 * {}^{1}c_1 / {}^{10}c_1$ = 1/45
Probability of choosing I = $1/{}^{9}C_1 * {}^{2}C_1 / {}^{10}C_1$ = 1/45
Probability of choosing S= $^{3}C_1 / {}^{9}C_1 * {}^{3}C_1 / {}^{10}C_1$ = 1/10
Probability of choosing T = $^{2}C_1 / {}^{9}C_1 * {}^{3}C_1 / {}^{10}C_1$ = 1/15
Hence, probability = 1/45+1/45+1/10+1/15
= 19/ 90

14. Out of 30 numbers 2 numbers can be chosen in $^{30}C_2$ ways.
So, exhaustive number of cases = $^{30}{}_2$ = 435
Since $a^2 - b^2$ is divisible by 3 different ways either a and b divisible by 3 or none of a and b is divisible by 3. Thus, the favorable numbers, of case = $^{10}C_2 + {}^{20}C_2$ = 235
Hence, required probability = 2235 / 435 = 47/87

15. The man will be step away from the starting point if (A) either he is one step ahead or (B) one step behind the starting point.
Therefore, required probability = P(A) + P(B)
The man will be one step ahead at end of eleven steps if he moves six steps backward and five steps forward.
The probability of this event $^{11}C_6\,(0.4)^6\,(0.6)^5 + {}^{11}C_6\,(0.6)^6\,(0.4)^5 = {}^{11}C_6(0.24)^5$

16. There are 6 vertices in a hexagon. Using 3 vertices out of 6 vertices we can from $^{6}C_3$ triangles. But there can be only two triangles out of $^{6}C_3$ triangles which are equilateral.
Hence, the required probability = $2/{}^{6}C_3$ = 2/20 = 1/10

17. Let F, B, L and R denote the forward, backward, left and right steps (or movements) then the following mutually exclusive ways are possible.

FBLR	FBLR
0045	4500
1134	3411
2223	2322
3312	1233
4401	0144
0054	5400
1143	4311
2232	3222
3321	2133
4410	1044

In this case he cancels out his left or right movement by moving equal number of steps in left and right directions each and he creates a difference of 1 step extra by moving one step extra either in forward or backward directions.
The number of permutations of these five arrangements is
= 4[9!/5!4! + 9!/1!1!3!4! + 9!/2!2!2!3! + 9!/3!3!1!2! + 9!/4!4!1!]
= 4(126 + 2520 + 7560 + 5040 + 630)
= 4 * 15876
But the total number of ways of arranging nine steps = 4^9.
The required probability = $(4 * 15876)/4^9 = 3969 / 4^7$

18. Let E_{rr} denote that a red colour ball is transferred from urn A to urn B tourn then a red colour ball is transferred from urn B to urn A.

E_{rb} denote that a red colour ball is transferred from urn A to urn B then a black colour ball is transferred from urn B to urn A.
E_{br} denote that a black colour ball is transferred from urn A to urn B then a red colour ball is transferred from urn B to urn A.
E_{bb} denote that a black colour ball is transferred from urn A to urn B then a black colour ball is transferred from urn B to urn A. Then
$P(E_{rr}) = (6/10)(5/11) = 3/11$,
$P(E_{rb}) = (6/10)(6/11) = 18/55$,
$P(E_{br}) = (4/10)(4/11) = 8/55$,
$P(E_{bb}) = (4/10)(7/11) = 14/55$
Let A be the event of drawing a red colour ball after these transfers. Then
$P(A/E_{rr}) = 6/10$, $P(A/E_{rb})=5/10$
$P(A/E_{br})=7/10$, $P(A/E_{bb})=6/10$
Therefore, the required probability is
$P(A) = P(E_{rr})P(A/E_{rr}) + P(E_{rb})P(A/E_{rb}) + P(E_{br})P(A/E_{br}) + P(E_{bb})P(A/E_{bb})$
$= 32/55$

19. A number is divisible only if the digits at odd places and sum of ths digits at even places is divisible by 11 i.e., 0,11,22, 33, ……
Here the sum of all the 9 digits is 45.
We cannot create the difference of zero
Since x+y = 45, which is odd hence cannot be broken into two equal parts in intergers.
Now, we will look for the possibilities of 11
Which are as follows:
{1,2,6,8}{1,2,5,9}{1,3,6,7}
{1,3,5,8}{1,3,4,9}{1,4,5,7}
2,3,5,7}{2,3,4,8}{2,4,5,6}
and{4,7,8,9}{5,6,8,9}
the above set of values either the sum of 17 0r 28.
Since if the sum of 4 digits at even places be 17 or 28 then the sum of rest of the digits (i.e., digits at odd places) be 28 or 17 respectively and thus we can get the difference of 11.
Thus the favourable number of numbers = 11*4!*5!
But the total number of ways of arranging a nine digit number is $^9P_9 = 9!$
Exclusive number of cases = 9!
Required probability= 11*4!*5!/9! = 11/126

<u>**CO-ORDINATE GEOMETRY:**</u>

1. The equation of the line with slope 2/3 and intercept on the y-axis 5 is y=2/3x+5(y=mx+c)

2. We have √3x+3y=6
or 3y =-√3x+6
or y=-1/√3xx+2
Comparing the above equation with y=mx+c
We get m= -1/√3 and c=2
Hence slope is (-1/√3) and intercept on the y-axis is 2.

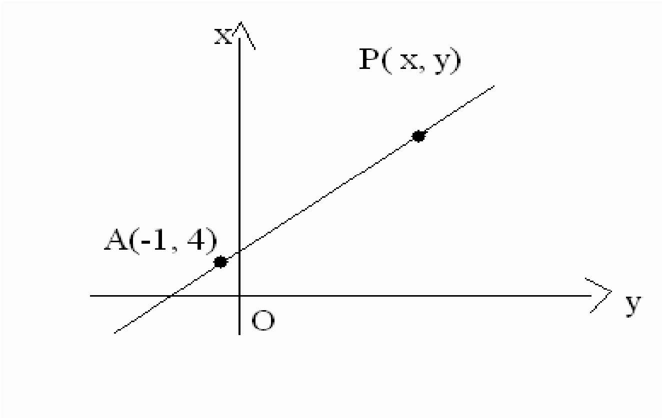
3. We have m=5/4 and $(x_1,y_1)=(2,-3)$
Therefore, the equation of the line as point slope form is
$y-y_1 =m(x-x_1)$
Or y-(-3) =5/4(x-2)
Or y+3 =5/4(x-2)
Or 5x-4y=22

4. Here a=2 and b=3
Therefore, The required equation of the line is x/2+y/3=1
⇨ 3x+2y =6

5. we have 3x + 4y – 12 = 0
=3x + 4y = 12
= 3x/12 + 4y/12 = 1 => x/4 + y/3 = 1
Which is the form of x/a + y/b = 1
The required intercepts on the axes are 4 and 3.

6. The equation of the line through the points (-1, -2) and (-5 ,2) is $(y-y_1) = [(y_2 – y_1)/(x_2- x_1)] (x – x_1)$
Where $(x_1 , y_1) = (-1, -2)$
And $(x_2 , y_2) = (-5 , 2)$
Required equation is
Y – (-2) = [2 – (-2)] / [-5 – (-1)]
Or y + 2 = 4 / -4 (x + 1)
Or x + y + 3 = 0

7. Let (-1 , 4) be the point as shown in figure and let P(x,y) be any point on the line. Then the gradient (or slope) of the line is
(Y – 4) / x-(-1) = 2.5



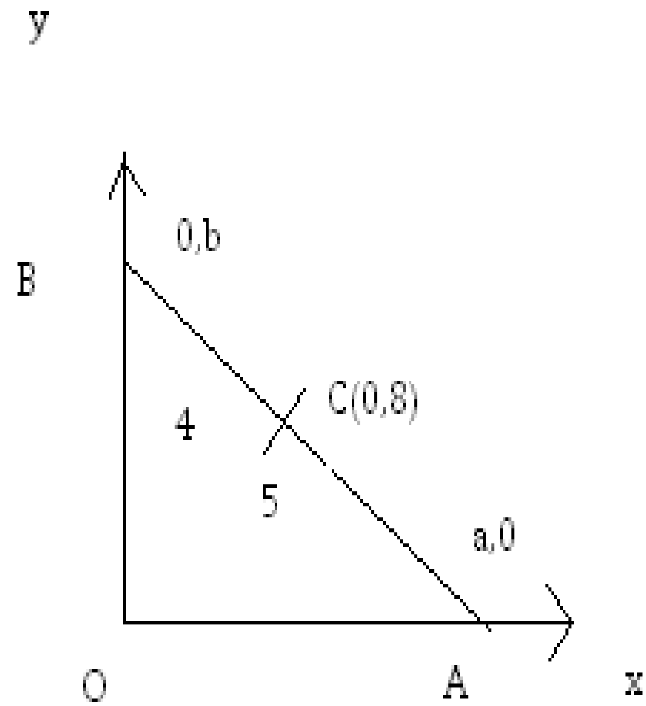
= y – 4 / x -1 = 5 /2
= 5x -2y + 13 = 0

8. Let the equation of the straight line in the intercept from be x/a + y/b=1 1
Since the intercepts are equal, therefore a=b
From equation (1)
x+y =a ⟶ 2
Since this line passes through the points (3,-5)
Therefore, 3+(-5)=a
⇨ a =-2
Therefore, From equation (2), the required equation of the straight line is x+y=-2 or x+y+2=0

9. Let the equation of the straight line be
x/a + y/b =1 ⟶ 1
Since intercepts a,b are equal in magnitude but opposite in sign.
b=-a
Therefore, From eq.(1) x/a + y(-a)=1
Or x-y =a ⟶ 2
Since this line passes through the point (-5,-8).
Therefore, -5-(-8) =a
⇨ a=3
Hence, from (2) the required equation of the line is x-y =3

10. Let m_1 = slope of the line 'joining' (1,2) and (5,6)
Therefore, m1= 6-2 / 5-1 =4/4 =1
If m_2 =-1(Because m_1=1)
Therefore, the required line has slope m_2=-1 and passes through the point (-4,-5)
Hence, the required equation of the line in the point slope form is
$(y-y_1)=m_2(x_2-x_1)$
or y-(-5) =-1{x-(-4)}
or x+y+9=0

11. Let the equation of the line AB be x/a +y/b =1



Then the coordinates of A and B are respectively (a,0) and (b,0).
Since C(8,10) divides AB in the ratio 5:4, we have
(5*0) +(4*a) / 5+4 = 8 & (5*b) +(4*0) / 5+4 = 10
Or a=18 and b=18
Hence from (1), the required equation of the line AB is
x/18 + y/18 =1 or x+y=18

12. Let the equation of the line in the intercept form be x/a + y/b =1
where a and b are intercepts on the axes.
Then a+b=14 or b= 14-a
Since the line x/a + y/b =1 passes through the points (3,4);
Therefore 3/a +4/b =1 or 3/a +4/(14-a) =1
or a^2-13a+42=0
or (a-6)(a-7)=0
Therefore a=6,7
If a=6 then b=8
If a=7 then b=7
Hence the required equation of the line are
x/6 + y/8 =1 and x+y=7

13. Since the line passes through A(a,0) and B(0,b), it makes intercepts a and b on the axes of x and y. Let the equation of the line be

x/a + y/b =1

By the given conditions, $\overrightarrow{AB}$=13 a,b=60

(2)

From (1) $\sqrt{a^2 + b^2}$ =13

$a^2 + b^2$ =169

a+b =+-17

Again $(a-b)^2=(a+b)^2$- 4ab=289-240=49

Therefore, The required equations of the straight line are x/12 + y/5 =1 and x/(-12) +y/(-5)=1

i.e., 5x+12y=60 and 5x+12y+60=0

14. Let the equation of the cost curve as a straight line be y=mx+c

Where x=number of units of a good produced and y =cost of x units in rupees.

Given, when x=50, y=320 and when x=80,y=380

From (1) 320 =50m+c ⟶ 2

And 380=80m+c ⟶ 3

Subtracting (2) from (3), we get m=2

Substituting m=2 in equation(2), we get c=220

Therefore, From (1) y=2x+220

When x=110,y=2*110+220=440

Hence, the required cost of producing 110 units is Rs. 440.

15. Here p=5 and a=60°

Therefore the required equation of the line is x cos α +ysinα =p

or x cos 60°+y sin 60°=5

x+ √3y=10

(Because sin 60°=√3/2 and cos60°=1/2)

16. Here $(x_1,y_1)\cong(3,-4)$ and θ =60° The required equation of the line in the symmetric form is

$(x-x_1)/\cos\theta = (y-y_1)/\sin\theta$

(x-3) / cos 60° = y-(-4)/ sin 60°

√3x-y=4+3√3

17. We have 2x + y = 4……..(1)

And x – y + 1 =0 ………..(2)

Solving equations (1) and (2) we get x = 1, y=2

The point of interaction (1) and (2) is (1, 2)

Again 2x- y -1=0 …….. (3)

x + y – 8 =0 …… (4)

Solving the equations (3) and (4) we get (x,y) = (3,5)

The point of interaction (3) and (4) is (3,5)

The required equation of the straight line joining the points of intersection is

y-2 = [(5-2)/(3-1)] (x- 1)

3x – 2y + 1= 0

18. The equation of the line through the point (4, 5) is

Y -5 = m(x - 4) …………….(1)

Where m is the slope of the line. Now the given line is 2x – y + 7 = 0

Y = 2x + 7 …………….(2)

If m_1 be the slope of the line (2) them m_1 = 2

If equation1(1) makes an angle 45° with equation (2) then we have

Tan 45° = $\frac{m_1 \sim m}{1+m.m_1} = \frac{2-m}{1+2m}$

Either 1 = m – 2/1 + 2m 0r 1 = (2- m) / 1 + 2m

If m – 2/ 1 + 2m =1 then m =-3

If $\frac{2-m}{1+2m}$ = 1 then m = 1/3

Hence from(1) the required equation of the two lines is y – 5 = 3 (x - 4) and Y – 5 = 1/3 (x - 4)

3x-y-17=0 and x-3y+11=0

19. The equation of any straight line parallel to the line 8x + 7y + 5 = 0 is 8x + 7y +c =0…….(1)

Where c is an arbitrary constant. If the line (1) passes through the points (5, -6)

8 X 5 + 7 X (-6) + c = 0 => c = 2.

Hence from (1) the required equation of the straight line is 8x + 7y +2 =0.

20. Solving x + y =8 and 3x – 2y + 1 = 0 , we get the point of intersection.

The point of intersection is (3, 5).

Now the equation of the line joining the points (3,4) and (5,6) is (y - 4) = [(6 -4)/(5 - 3)] (x - 3)

X – y + 1 = 0

The equation of the line parallel to the line x- y +1 = 0 is

X – y + c = 0 ………1)

Where c is an arbitrary constant. If the line passes through the point (3 , 5) then

3- 5 + c = 0 or c = 2 ……(2)

Hence from (2) the required equation of the line is x – y + 2 = 0

21. Length of the perpendicular from the points (3,-2) to the straight line 12x – 5y + 6 = 0 is

$\frac{12 X 3-5 X-2+6}{\sqrt{(12)^2+(-5)^2}} = \frac{36+10+6}{\sqrt{169}}$ = 4 units

22. Putting y = 0 in 5x + 12y – 30 = 0, we get
5x – 30 = 0 or x = 6
(6,0) is a point on the first line 5x + 12y – 30 = 0
Required distance between the parallel lines = perpendicular distance of the point (6,0) from the second line 5x + 12y – 4 =0

$\frac{5.6+12.0-4}{\sqrt{5^2+12^2}} = \frac{30-4}{13}$ = 2 units

23. The equation of the line through the point of intersection of 2x – 3y +1 = 0 and x + y -2 =0 is
(2x – 3y +1) + k (x + y -2) = 0
(2 + k)x + (k - 3)y + (1 – 2k) =0………(1)
If this line is parallel to the y-axis then its equation must be of the form x = h, i.e., the coefficienct of y in (1) must be zero.
k-3 = 0 or k = 3
Hence from (1) the required equation of the line is (2 +3)x + 0 . y+ (1 – 2 X 3) = 0 [putting k = 3]
x= 1

24. The equation of any line passing through the point of intersection of the lines x + 2y – 3 = 0 and 4x – y + 7=0 is
(x + 2y – 3) + k (4x – y + 7) = 0 ……….(1)
(1 + 4k) x(2 - k)y+ (7k - 3) =0…….(2)
m_1 = slope of the line (2) = $\frac{4k+1}{k-2}$
and m_2 = (slope of the line y – x +10 =0)= 1
If the line (1) is parallel to the line y – x + 10 = 0
Then $\frac{4k+1}{k-2}$ =1 => k = -1
Hence from (1) the required equation of the line is
(x + 2y – 3) – 1 (4x – y + 7) = 0
3x – 3y +10 = 0

25. Solving 2x-y+5=0 and 5x+3y-4=0, we get x=-1 and y=3 i.e., the point of intersection of the given lines is (-1,3)
Therefore the equation of any line perpendicular to the line
x-3y+21 =0 is 3x+y+k =0
If this line (1) passes through the point (-1,3), then
3x-1+3+k =0 $\longrightarrow$ k=0
Therefore From (1) the required equation of the line is 3x+y=0

26. The equation of any line passing through the intersection of the lines 3x+4y-7=0 and x-y+2=0 is (3x+4y-7)+k(x-y+2)=0 1
slope of the line = (3+k)/(4-k)=3
k =15/2
⇨ Hence, from (1) the required equation of the line is
(3x+4y-7)+15/2(x-y+2)=0
⇨ 21x -7y +16 =0

27. The equation of any line passing through the point of intersection of the lines
3x-4y+1=0 and 5x+y-1 =0 is
(3x-4y+1)+k(5x+y-1)=0 1
For intercept of this line with the x-axis, y=0
3x+1+k(5x-1)=0
x= (k-1)/(5k+3)
For intercept of the line (1) on the y-axis, x=0
-4y+1+k(y-1) =0
y= (k-1)/(k-4)
Since the intercepts on the axes are equal.
(k-10/(5k+1) = (k-1)/(k-4)
k=1, or x=7/4
but k ≠ 1, because if k=1, the line (1) becomes 8x-3y=0 which passes through the origin and therefore cannot make non-zero intercepts on the axis.
k=-7/4 and from(1), we get
3x-4y+1-7/4(5x+y-1)=0
23x+23y=11, which is the required equation of the line.

28.
We have x/a – y/b =1 $\longrightarrow$ 1
Since (1) passes through the point (8,6)
8/a – 6/b =1 $\rightarrow$ 2
The line (10 meets the x-axis at the point given by y=0 and from (1) x=a i.e., the line (1) meets the x-axis at the point A(a,0).
Similarly, the line meets the y-axis (x=0) at the point B(0,-b).

By the given condition, area of triangle =12

½ ab =12

ab=24

b=24/a

Substituting b=24/a in (2), we get

8/a =6/24/a =1 ; a=4 or -8 b= -6 or -3

Hence, from (1) the equation of the straight line are

$x/4 - y/6=1$ and $x/-8 - -y/-3 =1$

$3x-2y=12$ and $3x-8y+24=0$

29.

The equation of the lines may be written as $3x+4y+2=0$ and $-5x+12y+6=0$ in which the constant terms 2 and 6 are both positive.

The equation of the bisector of the angle in which the origin lies is

$(3x+4y+2) /\sqrt{3^3}+\sqrt{4^2} = (-5x+12y+6) / \sqrt{((-5)^2+(12)^2)}$

$16x-12y-1=0$

The equation of the other bisector is

$(3x+4y+2) /\sqrt{3^3}+\sqrt{4^2} =(-5x+12y+6)/\sqrt{((-5)^2+(12)^2)}$

$x + 8y +4=0$

30. Let the equation of the sides BC,CA and AB of the triangle ABC be represented by

$2y-x =5$

$y+2x=7$

$y-x =1$

Solving the above 3 equations (1),(2) and(3) 30**,** we get A(2,3),B(3,4) and C(9/5 , 17/5)

Therefore, the area of ΔABC

= ½ [2 X 4 – 3 X3 +3 3X (17/5) -4 X (9/5) + (9/5) X 3 – (17/5) X 2]

= ½(8–9+(51/5)–(36/5)+(27/5)–(34/5))

= 3/10 units

31.

Let a(1,2) (2,3), (4,3)

be the vertices of ΔABC

m_1 = slope of BC = (3 - 3)/(4-2) = 0 i.e., BC is parallel to the x-axis

The perpendicular from A(1,2) to BC is parallel to y – axis and its equation is x= h, which passes through A(1,2)

H= 1 i.e., the equation of the perpendicular from A(1,2) on BC is x = 1

m_2 = slope of AC = (3-2) /4-1=1/3

If m_2 be the slope of the perpendicular to AC then

m_2m_2 = -1 or 1/3 . m_2 = -1 or m_2 = -3

The equation of the perpendicular from B(2,3) on AC whose slope is -3 is

$y -3 = -3 (x- 2)$

$3x + y = 9$

The orthocenter is the point of intersection of the two lines (1) and (2)

From (1) and (3) we get 3 X 1 + y = 9

Y = 6

The required coordinates of the orthocenter are (1,6)

32. Let $A(x_1,y_1)$ be the third vertex. Let AD,BE, CF be the perpendiculars from the vertices on the opposite point of intersection of AD,BE, CF.

Since AD i.e., OA is perpendicular to BC.

Slope of BA X slope of BC = -1

$(y_1 -0) / (x_1 -0)$ X [3 – (-1) / -2 – 5] = -1

$Y_1 = 7x_1/4$ …………(1)

Again since OB is perpendicular to CA

⇨ (-1 -0/5-0)X (y_1 -3 / x+2) = -1

⇨ $5x_1 + 10 = y_1 -3$

⇨ $X_1 = -4$

⇨ From (1) $Y_1 = 7x_1/4$ = (7 X -4) / 4 = -7hence the required coordinates of the third vertex A are (x_1, y_1) = (- 4, -7)

33. Let (x_1 , y_1) be third vertex then

$y_1 + x_1 +3$ ………..(1)

The area of the triangle formed by the points (2,1), (3, -2) and (x_1, y_1)

= ½(-4 -3 + $3y_1$ + $2x_1$ + x_1 -$2y_1$)

= ½ ($3x_1$ + y_1 - 7),By the given condition

⇨ $\pm1/2(3x_1 + y_1 -7) = 5$

⇨ $3x_1 + y_1 -7 = \pm10$

⇨ $3x_1 + y_1 = 17$ ……………………..(2)

⇨ $3x_1 + y_1 = -3$ …………………….(3)

Solving (2) and (1) we get x_1=7/3 , y_1 = 13/2

Solving (1) and (3) we get x_1 = -3/2, y_1 = 3/2

Hence the coordinates of the third vertex is either (7/2 , 13 /2) or (-3/2 , 3/2).

34. Equation of any line L perpendicular to $5x - y = 1$ is $x + 5y = k$ ……………………..(1)

Where k is an arbitrary constant.

If this line cuts an x- axis at A and y –axis at B then for A, y=0 and from (1) x =k i.e., A is the point (k,0) for B, x =0 and from (1) y = k/5i.e., B is the point (0, k /5)

Area of the given triangle OAB $= \frac{1}{2}(x_1y_2 - x_2y_1)$

$= \frac{1}{2}(k^2/5 - 0) = k^2/10$

By the given condition $k^2/10 = 5$

Or $k^2 = 50 \Rightarrow k = \pm5\sqrt{2}$

Hence from (1) the required condition of the line is

$X + 5y = 5\sqrt{2}$ or $x+5y = -5\sqrt{2}$

35.

Let ABCD be the square and let (1,2) and (3,8) be the coordinates of opposite vertices A and C respectively.

The equation of the diagonal AC is $y-2 = [(8 - 2)/(3 - 2)](x - 1)$

$3x - y = 1$