SSC Mains Test- No. 5 Solution

1.(A) $$\frac{3\frac{1}{4}-\frac{4}{5}of\ \frac{5}{6}}{4\frac{1}{3}\div\frac{1}{5}-\left(\frac{3}{10}+21\frac{1}{5}\right)}=\frac{\frac{13}{4}-\frac{4}{5}\times\frac{5}{6}}{\frac{13}{3}\times5-\left(\frac{3}{10}+\frac{106}{5}\right)}$$

$$=\frac{\left(\frac{13}{4}-\frac{2}{3}\right)}{\frac{65}{3}-\left(\frac{3+212}{10}\right)}=\frac{\frac{31}{12}}{\frac{65}{3}-\frac{215}{10}}=\frac{12}{5}=\frac{31}{12}\times\frac{30}{5}=\frac{31}{2}$$

$\because \frac{32}{2}-\frac{1}{2}=15$

$\therefore$ Required least fraction $=\frac{1}{2}$

2.(A) $$\frac{1}{\sqrt{12-\sqrt{140}}}=\frac{1}{\sqrt{7+5-4\times7\times5}}$$

$$=\frac{1}{\sqrt{\left(\sqrt{7}\right)^2+\left(\sqrt{5}\right)^2-2\sqrt{7}\sqrt{5}}}=\frac{1}{\sqrt{\left(\sqrt{7}-\sqrt{5}\right)^2}}$$

$$\frac{1}{\sqrt{7}-\sqrt{5}}=\frac{\sqrt{7}+\sqrt{5}}{\left(\sqrt{7}-\sqrt{5}\right)\left(\sqrt{7}+\sqrt{5}\right)}=\frac{\sqrt{7}+\sqrt{5}}{7-5}$$

$$=\frac{\sqrt{7}+\sqrt{5}}{2}$$

Similarly,

$$\frac{1}{\sqrt{8-\sqrt{60}}}=\frac{1}{\sqrt{5+3-4\times5\times3}}=\frac{\sqrt{5}+\sqrt{3}}{5-3}=\frac{\sqrt{5}+\sqrt{3}}{2}$$

and,

$$\frac{2}{\sqrt{10+\sqrt{84}}}=\frac{2}{\sqrt{7+3+4\times7\times3}}=\frac{2}{\sqrt{\left(\sqrt{7}+\sqrt{3}\right)^2}}$$

$$=\frac{2}{\sqrt{7}+\sqrt{3}}=\frac{2\left(\sqrt{7}-\sqrt{3}\right)}{\left(\sqrt{7}+\sqrt{3}\right)\left(\sqrt{7}-\sqrt{3}\right)}=\frac{2\left(\sqrt{7}-\sqrt{3}\right)}{7-3}$$

$$=\frac{\sqrt{7}-\sqrt{3}}{2}$$

So, now the whole expression,

$$=\frac{\sqrt{7}+\sqrt{5}}{2}-\frac{\sqrt{5}+\sqrt{3}}{2}-\frac{\sqrt{7}-\sqrt{3}}{2}$$

$$=\frac{\sqrt{7}+\sqrt{5}-\sqrt{5}-\sqrt{3}-\sqrt{7}+\sqrt{3}}{2}=\frac{0}{2}=0$$

3.(B) Let the two number be a and b respectively
Then, $a \times b = 24 \times (a - b)$
$\Rightarrow ab = 24a - 24b$ _____(i)
and $\because a + b = 14$
$\Rightarrow b = 14 - a$ _____(ii)
From (i) and (ii),
$a(14 - a) = 24a - 24(14 - a)$
$\Rightarrow 14a - a^2 = 24a - 336 + 24a$
$\Rightarrow 14a - a^2 = 48a - 336$
$\Rightarrow a^2 + 34a - 336 = 0$
$\Rightarrow a^2 + 42a - 8a - 336 = 0$
$\Rightarrow (a - 8)(a + 42) = 0$
$\Rightarrow a = 8$ and $a = -42$
Putting vaule $a = 8$ in Eq. (ii),
we get $b = 6$
$\therefore$ Larger number = 8.

4.(C) Let x = no. of benches
So, ATQ,
$6(x + 1) = 7x - 5$
or $7x - 6x = 6 + 5$
$\Rightarrow x = 11$
So, No. of students = $6(x + 1) = 72$

5.(C) If P is a prime number and (p + 2) is also a prime number, then p (p +2) +1 will be a perfect square.

6.(C) LCM of number = 84
HCF of number = 21
Let the number are x and $4x$
$\therefore 4x^2 = 84 \times 21$
$\Rightarrow x^2 = (21)^2$
$\Rightarrow x = 21$
$\Rightarrow$ The larger no. $= 4x = 4 \times 21 = 84$

7.(B) $$\frac{(53)^{82}+53}{54}=\frac{(53)^{82}}{54}+\frac{53}{54}$$

now, $\frac{(53)^{82}}{54}$; Remainder =1

$$\left[\because \frac{(a-1)^{even}}{a};\text{Remainder}=1\right]$$

and, $\frac{53}{54}$; Remainder =53

So, net remainder = Remainder of $\left(\frac{1+53}{54}\right)=0$

8.(C) $$\left(\frac{2+1}{2}\right)\left(\frac{3+1}{3}\right)\left(\frac{4+1}{4}\right).....\left(\frac{120+1}{120}\right)$$

$$=\frac{3}{2}\times\frac{4}{3}\times\frac{5}{4}\times.....\frac{121}{120}=\frac{121}{2}=60.5$$

9.(C) Let the number of workers be x.
ATQ,
$\Rightarrow x \times 8500 = 7 \times 10000 + (x - 7)\ 7800$
$\Rightarrow 85x = 700 + 78(x - 7)$
$\Rightarrow 85x - 78x = 700 - 546$
$\Rightarrow 7x = 154$
$\Rightarrow x = \frac{154}{7} = 22$

10.(B) Let the number in the given A.P. be n.

$\therefore$ $S_n = \frac{n}{2}[2a+(n-1)d]$

$\therefore$ $125n = \frac{n}{2}[2 \times 148 + (n-1)(-2)]$

$\Rightarrow$ $125n = 148n + n - n^2$

$\Rightarrow$ $24n - n^2 = 0$

$\Rightarrow$ $n = 0$ & $n = 24$

So, the number of terms = 24

[$\because$ $n \neq 0$]

11.(B)Let the average expenditure per students = ` x

$\Rightarrow$ Original total expenses = ` $35x$

Now total expenses = ` $(35x + 42)$

& New average expenditure per student = ` $(x-1)$

$\therefore$ $\frac{35x+42}{35+7} = \frac{35x+42}{42} = (x-1)$

$\Rightarrow$ $35x + 42 = 42x - 42$

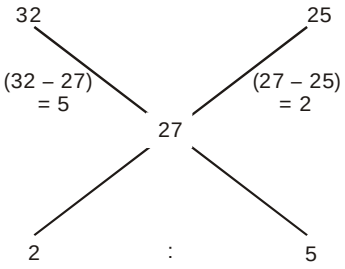
or, $x = 12$,

$\therefore$ The original expenditure = 35×12 = ` 420

12.(A) S.P. of mixture = ` 32.40

Profit % = 20%

$\therefore$ C.P. of mixture = $\frac{32.40 \times 100}{120}$ = ` 27



$\therefore$ Required ratio = 2 : 5.

13.(B) Alcohol = $\left(\frac{15}{100} \times 400\right)$ ml

= 60ml

Water = 340ml.

Let, x = amount of alcohol to be added

So, $\frac{60+x}{400+x} \times 100 = 32$

So, $\frac{60+x}{400+x} = \frac{32}{100} = \frac{8}{25}$

or, $1500 + 25x = 3200 + 8x$

or, $17x = 1700$

or, $x = 100$

14.(D) Age of man = 50 years

$\therefore$ age of his elder brother = 50 + 7 = 57 years

Age of his sister = 57 – 12 = 45 years

$\Rightarrow$ Difference in the age of the man and his sister = (50 - 45)yrs. = 5 yrs.

Thus when the age of his sister was15 years, then the age of the man was = 15 + 5 = 20 yrs.

15.(C) Suppose the cost price of article = ` x

Then, $x \times \frac{(100+x)}{100} = 144$

$\Rightarrow$ $x^2 + 100x = 14400$

$\Rightarrow$ $x^2 + 100x - 14400 = 0$

$\Rightarrow$ $x^2 + 180x - 80x - 14400 = 0$

$\Rightarrow$ $x(x + 180) - 80(x + 180) = 0$

$\Rightarrow$ $(x - 80)(x + 180) = 0$

$\Rightarrow$ $x = 80$ and -180

(*but* $\because x \neq -180$)

So, cost price of the article is ` 80

16.(A) Suppose Tulsiram's salary = ` x

Then, $x \times \frac{4}{100} = 720$

$\Rightarrow$ $x = \frac{100 \times 720}{4}$ = ` 18000

$\therefore$ Kashyap's salary

$= 18000 \times \frac{100}{120}$ = ` 15000

17.(A) Let the side of square plot = a metres

$\therefore$ length of the diagonal of the square plot = $a\sqrt{2}$ m

$\therefore$ % distance saved by not walking along the edges = $\frac{2a - a\sqrt{2}}{2a} \times 100\%$

$= \left(\frac{2-\sqrt{2}}{2} \times 100\right)\% = 29.3\% = 30\%$

18.(B) Let the numbers be x and y and $x > y$.

$\Rightarrow$ $x - y = 1660$ ..... (i)

ATQ, $6\frac{1}{2}\%$ of $x = 8\frac{1}{2}\%$ of y

or, $\frac{13}{2}\%$ of $x = \frac{17}{2}\%$ of y

or, $13x = 17y$

or, $x = \frac{17}{13}y$ ..... (ii)

From (i) and (ii),

$\frac{17}{13}y - y = 1660$

or, $\frac{17y - 13y}{13} = 1660$

or, $4y = 1600 \times 13$

$\Rightarrow$ $y = \frac{1660 \times 13}{4} = 5395$

19.(D) Let the number of boys and girls be $4x$ and x respectively.

$\therefore$ Number of boys who hold scholarship

$= \frac{75}{100} \times 4x = 3x$

and number of girls who hold scholarship

$= \frac{70 \times x}{100} = \frac{7x}{10}$

$\therefore$ Number of students who do not hold scholarship

$= 5x - \left(3x + \frac{7x}{10}\right) = 2x - \frac{7x}{10}$

$= \frac{20x - 7x}{10} = \frac{13x}{10}$

$\therefore$ The required percentage $= \frac{\frac{13x}{10}}{5x} \times 100 = 26\%$

20.(C) Suppose the cost prize of each TV = ` x
Then, $(x - 9400) = 2(10600 - x)$
$\Rightarrow x - 9400 = 21200 - 2x$
$\Rightarrow 3x = 21200 + 9400$
$\Rightarrow 3x = 30600$
$\Rightarrow x = \frac{30600}{3} =$ ` 10200

21.(B) Let the C.P. be ` x
ATQ, % loss = % gain

$\frac{x - 50}{x} \times 100 = \frac{70 - x}{x} \times 100$

$\Rightarrow x - 50 = 70 - x$
$\Rightarrow 2x = 120$
$\Rightarrow x = \frac{120}{2} = 60$

$\therefore$ Loss % $= \frac{60 - 50}{60} \times 100 = \frac{50}{3} = 16\frac{2}{3}\%$

22.(C) Let the labelled price = ` x

$\therefore$ Cost price of article two Jeveen = ` $\frac{70x}{100}$

$= $ ` $\frac{7x}{10}$

Now, selling price of article = ` $\frac{112}{100}x =$ ` $\frac{28x}{25}$

$\therefore$ Gain% = ` $\left(\frac{28x}{25} - \frac{7x}{10}\right)$

$=$ ` $\frac{56x - 35x}{50} =$ ` $\frac{21x}{50}$

$\therefore$ Gain % $= \frac{21x/50}{7x/10} \times 100\% = \frac{21 \times 10 \times 100}{7 \times 50}\%$
$= 60\%$

23.(C) Let the C.P. of each article by ` 1
For 15 books , the tradesman gives 1 book free.
$\therefore$ C.P. of 15 book = ` 16
$\therefore$ S.P. of 15 book

$= 16 \times \frac{135}{100} =$ ` $\frac{108}{5}$

$\therefore$ S.P. of 1 book

$= \frac{108}{5 \times 15} =$ ` $\frac{36}{25}$

Now, 96% of marked price $= \frac{36}{25}$

$\therefore$ Marked price $= \frac{36 \times 100}{25 \times 96} = \frac{3}{2} =$ ` 1.5

$\therefore$ The required % increase

$= \frac{0.5}{1} \times 100 = 50\%$

24.(C) 30% discount on ` 2000

$= 2000 \times \frac{70}{100} =$ ` 1400

& Two successive discounts of 25% and 5% on

` $2000 = 2000 \times \frac{75}{100} \times \frac{95}{100} =$ ` 1425

$\therefore$ Required difference = 1425 – 1400 = ` 25

25.(D) C.P. = ` 900
Gain = 10%

$\therefore$ S.P. = ` $\left(\frac{110}{100} \times 900\right) =$ ` 990

Let the marked price be Rs. x

$\therefore \frac{90}{100}x = 990$

$\therefore x = \frac{990 \times 100}{90} =$ ` 1100

26.(D) Let principle = ` x
t = 7 years and
$S.I.$ = ` 1750

$\therefore 1750 = \frac{x \times 7 \times r}{100}$

$\Rightarrow xr = \frac{1750 \times 100}{7}$

$\Rightarrow xr = 25000$ _____(i)

Now $S.I. = \frac{P \times (r + 2) \times 7}{100}$ _____(ii)

Since there are three unknowns with two equations. Thus it is not possible to solve.

Alternative Method:

Extra S.I. earned = 7 × 2% of Principal
= 14% of Principal
But, principal is not known, so we cannot determined the extra S.I. earned

27.(B) Let the annual instalment be ` x
Amount of Rs. 100 after 4 years

$=$ ` $\left(100 + \frac{100 \times 5 \times 4}{100}\right) =$ ` 120

$\therefore$ Present value of ` 120 due after 4 yrs = ` 100

$\therefore$ Present value of ` $x$ due after 4 yrs = ` $\frac{5}{6}x$

Similarly present value of ` x due after 3

years = ₹ $\frac{20}{23}x$

Present value of ₹ x due after 2 yrs= ₹ $\frac{10}{11}x$

and Present value of ₹ x due after 1 yr = ₹ $\frac{20}{21}x$

$\therefore \quad \frac{5}{6}x + \frac{20}{23}x + \frac{10}{11}x + \frac{20}{21}x = 6450$

$\Rightarrow \quad x$ = ₹ 1800 (approx.)

28.(D) We know that if ₹ P be the principle and r% be the rate of interest, then difference between S.I. and C.I. for 2 years is $\frac{Pr^2}{(100)^2}$

$\therefore \quad 450 = \frac{P(15)^2}{(100)^2}$

$\Rightarrow \quad P = \frac{450\times100\times100}{225}$ = ₹ 20000

29.(A) The difference between C.I. and S.I. for the interest as the first year's interest

S.I. for the first year = $\frac{100}{2}$ = ₹ 50

C.I. – S.I. = 105 – 100 = ₹ 5

Interest on ₹ 50 for 1 year = ₹ 5

or, $5 = \frac{50\times1\times R}{100}$

or, r = 10%

Again S.I. = $\frac{P\times R\times T}{100}$

$\Rightarrow 100 = \frac{P\times10\times2}{100}$

or, P = ₹ 500

30.(C) Given, 2A = 3B _____(i)

and 4B = 5C

$B = \frac{5C}{4}$ _____(ii)

Putting B value in Eq. (i)

$2A = 3 \times \frac{5C}{4} \Rightarrow 8A = 15C$

$\Rightarrow \frac{A}{C} = \frac{15}{8}$ = 15 : 8

31.(B) Let the weigth of Mr. Gupta and Mrs. Gupta be 7x kg and 8x kg respectively.

Then, $7x + 8x = 120$

$15x = 120$

$\Rightarrow x = \frac{120}{15}$ = 8kg

Initially weight of Mr. Gupta = $7x = 7\times 8$ = 56 kg and intially weigth of Mrs. Gupta = $8x = 8 \times 8$ = 64kg

After taking dieting, weigth of Mr. Gupta = 56 - 6 = 50kg and ratio of their weigth = $\frac{50}{60}$ = 5 : 6

So, Mrs. Gupta reduced weigth = 64 - 60 = 4kg.

32.(B) Let number of boys be x.

$\Rightarrow$ No. of girls = $\frac{120}{100}x$

$\Rightarrow \quad x + \frac{120}{100}x = 6$ or, $x + \frac{6x}{5} = 66$

or, $\frac{5x+6x}{5} = 66 \Rightarrow \quad x = \frac{66\times5}{11} = 30$

So, Number of girls = 66 – 30 = 36

Hence, New ratio = 30 : (36 + 4)

= 30 : 40 = 3 : 4

33.(C) A : B = $\frac{1}{2} : \frac{3}{8}$ = 4 : 3 = 8 : 6

B : C = $\frac{1}{3} : \frac{5}{9}$ = 3 : 5 = 6 : 10

C : D = $\frac{5}{6} : \frac{3}{4}$ = 10 : 9

$\therefore$ A : B : C : D = 8 : 6 : 10 : 9

34.(D) A × 1.2 × 0.75 = B × 1.25 × 0.8

$\Rightarrow$ A × 0.9 = B ×1

$\Rightarrow \frac{B}{A} = \frac{0.9}{1} = \frac{9}{10}$

$\therefore$ B : A = 9 : 10

35.(C) (A+B)'s 1 day work = $\frac{1}{10}$

(B + C)'s 1 day work = $\frac{1}{12}$

(C+A)'s 1 day work = $\frac{1}{15}$

So, 2(A+B+C)'s 1day work

$= \left(\frac{1}{10}+\frac{1}{12}+\frac{1}{15}\right) = \left(\frac{6+5+4}{60}\right) = \frac{15}{60} = \frac{1}{4}$

(A + B + C)'s 1 day work = $\frac{1}{4\times2} = \frac{1}{8}$

$\therefore$ C's 1 day work = $\frac{1}{8} - \frac{1}{10} = \frac{5-4}{40} = \frac{1}{40}$

$\Rightarrow$ C will finish it alone in 40 days.

36.(B) Let S = the slower speed

So, ATQ,

$S \times 4.5$ hr = $(S + 5) \times (4.5 \times 0.5)$ hr

or, $4.5\,S = 4(S + 5)$

or, $4.5\,S - 4S = 20$

or, $0.5\,S = 20$

$\Rightarrow \quad S$ = 40 km/hr

37.(C) Suppose B takes x days to do the work.

$\therefore$ A takes $\left(2\times\frac{1}{6}x\right)$ *i.e.* $\frac{x}{3}$ days to do it.

ATQ, (A + B) do whole work in 10 days.

$\Rightarrow$ (A + B)'s 1 day's work = $\frac{1}{10}$

or $\frac{1}{x} + \frac{3}{x} = \frac{1}{10}$

$\therefore \quad \frac{1+3}{x} = \frac{1}{10} \Rightarrow x$ = 40 days

Alternative Method:

Suppose B takes x days to do the work.

$\therefore$ A takes $\left(2\times\frac{1}{6}x\right)$ *i.e.* $\frac{x}{3}$ days to do it.

ATQ, (A + B) do whole work in 10 days.

$\Rightarrow \frac{x\times\frac{x}{3}}{x+\frac{x}{3}} = 10$ or, $\frac{x^2}{3x+x} = 10$

or, $x^2 - 40x = 0$

or, $x(x-40) = 0$

$\Rightarrow x = 40$ days

38.(C) C's 1 day's work

$= \frac{1}{4} - \left(\frac{1}{8}+\frac{1}{12}\right) = \frac{1}{4} - \left(\frac{3+2}{24}\right)$

$= \frac{1}{4} - \frac{5}{24} = \frac{6-5}{24} = \frac{1}{24}$

$\therefore$ A : B : C = $\frac{1}{8}:\frac{1}{12}:\frac{1}{24}$

= 3 : 2 : 1

$\therefore$ C's share = ` $\left(\frac{1}{6}\times 4500\right)$ = ` 750

39.(B) Let the amount invested by P and Q are ` $5x$ and ` $6x$ respectively

Ratio of investment of P, Q and R

$=5x\times12 : 6x\times12 : 6x\times6 = 5 : 6 : 3$

Total profit = ` 98000

= 20% of total investment

$\Rightarrow$ Total invesment = ` $\frac{98000\times100}{20}$

= ` 490000

So, R's investment = $\frac{3}{14}\times 490000$

= ` 105000

40.(B) Let 't' be time taken to arise the water level by 7cm.

Now, radius of pipe = $\frac{14}{2}$ cm = 7 cm

So, Water flow by pipe = volume of tank

$\Rightarrow \pi\times\frac{7}{100}\times\frac{7}{100}\times 5\times\frac{5}{18}\times t = 50\times44\times\frac{7}{100}$

$\Rightarrow t = \frac{100\times18\times50\times44\times7\times7}{22\times7\times7\times25}$

$\Rightarrow t = 7200$ s

$\Rightarrow t = \frac{7200}{60\times60} = 2$ h

41.(D) Work done by both the pipes in 1 minute.

$= \left(\frac{1}{30}+\frac{5}{30}\right) = \frac{6}{30} = \frac{1}{5}$ part of cistern

Hence they will fill 1 cistern in 5 minutes.

42.(A) If A covers the distance of 1km in x seconds, B covers the distance of 1 km in (x + 25)seconds.

Also, If A covers the distance of 1 km, then in the same time C cover only 725 metres.

$\Rightarrow$ If B covers the distance of 1 km in (x + 25) seconds, C covers the same distance in (x + 25 + 30) seconds,

$\Rightarrow$ If B covers 1km in (x + 25) second, then C covers 1 km in (x + 55) second.

Thus in x seconds, C covers the distance of 725m.

$\therefore \frac{x}{725}\times100 = x + 55 \Rightarrow x = 145$ seconds

$\therefore$ A covers the distance of 1km in 2 minutes 25 seonds.

43.(C) A makes one complete round of the circular track in $\frac{5}{5/2} = 2$ hours.

B in $\frac{5}{3}$ hours and C in $\frac{5}{2}$ hours,

That is after 2 hours A is at the starting point, B after $\frac{5}{3}$ hours and C after $\frac{5}{2}$ hours.

Hence the required time = LCM of 2, $\frac{5}{3}$ and $\frac{5}{2}$ hours = $\frac{\text{LCM of } 2,5,5}{\text{HCF of } 3,2} = \frac{10}{1} = 10$ hours.

44.(C) Distance is $12\times\frac{9}{2} = 54$ km

New time = 3hr.

Therefore, new speed = $\frac{54}{3} = 18$km/hr.

45.(D) Let L and S = length and speed of the train

So, L = (S – 6) kmph × 5 sec _____(i)

& L = (S – 7.5) kmph × 5.5 sec _____(ii)

From (i) and (ii)

(S – 6)kmph × 5 sec = (S – 7.5) kmph × 5.5 sec

or, 5S – 30 = 5.5S – 41.25

So, S = 22.5 kmph

So, L = 22.92 m

46.(C) Let the speed of each train be x kmph.

Their relative speed = $x + x = 2x$ kmph.

Time taken = $\frac{\text{Total length of trains}}{\text{Relative Speed}}$

$\Rightarrow \frac{12}{60\times60} = \frac{240\times\frac{1}{1000}}{2x}$

$\Rightarrow \frac{1}{300} = \frac{120}{1000x} \Rightarrow x = \frac{300\times120}{1000} = 36$

$\therefore$ The required speed = 36 kmph.

47.(A) Let the speed of the current be x kmph.

According to the question, $\frac{6}{6-x}=3$

$\Rightarrow 18-3x=6 \Rightarrow 3x=18-6$

$\Rightarrow x=\frac{12}{3}=4$ kmph.

48.(C) LCM of 2 ,6 , 3, 4 = 12

$\therefore \sqrt{2}=\sqrt[12]{2^6}=\sqrt[12]{64}$

$\sqrt[6]{3}=\sqrt[12]{3^2}=\sqrt[12]{9}$

$\sqrt[3]{4}=\sqrt[12]{4^4}=\sqrt[12]{256}$

$\sqrt[4]{5}=\sqrt[12]{5^3}=\sqrt[12]{125}$

Clearly,

$\sqrt[12]{9}<\sqrt[12]{64}<\sqrt[12]{125}<\sqrt[12]{256}$

$\therefore \sqrt[6]{3}<\sqrt{2}<\sqrt[4]{5}<\sqrt[3]{4}$

49.(B) $y=3^{x-1}+3^{-x-1}$

$=\frac{3^x}{3}+\frac{1}{3.3^x}=\frac{1}{3}\left(3^x+\frac{1}{3^x}\right)$

we know that, $3^x+\frac{1}{3^x}=2$

Thus, the least value $y=\frac{1}{3}\times 2=\frac{2}{3}$

50.(D) $\therefore x=\frac{u+v}{1-uv}$ and $y=\frac{u-v}{1+uv}$

$\therefore \frac{x+y}{1-xy}=\frac{\frac{u+v}{1-uv}+\frac{u-v}{1+uv}}{1-\frac{(u+v)}{(1-uv)}\times\frac{(u-v)}{1+uv}}$

$=\frac{4(1+uv)+v(1+uv)+u(1-uv)-v(1-uv)}{(1-u^2v^2)-(u^2-v^2)}$

$=\frac{u(2)+v(2uv)}{1-u^2v^2-u^2+v^2}$

$=\frac{2u(1+v^2)}{(1-u^2)(1+v^2)}=\frac{2u}{1-u^2}$

51. (C) $x+\frac{1}{x}=-2$ _____(i)

$\therefore \left(x-\frac{1}{x}\right)^2=\left(x+\frac{1}{x}\right)^2-4$

$=(-2)^2-4=0$

$\Rightarrow x-\frac{1}{x}=0$ _____(ii)

Sovling equations (i) and (ii), we have

$\therefore x=-1$

$\therefore x^{2n+1}+\frac{1}{x^{2n+1}}$

$=(-1)^{2n+1}+\frac{1}{(-1)^{2n+1}}=-1+\frac{1}{(-1)}=-2$

52. (A) The external dimensions of the box are:
Length = 20cm , Breadth = 12cm
Height = 10cm
External volume of the box = 20 × 12 × 10
= 2400cm³.
Thickness of the wood = 1cm
So, Internal length, breadth and height = (20 – 2),(12 – 2) &(10 – 2) = 18, 10 & 8 cms
$\therefore$ Internal volume = 18 × 10 × 8 = 1440cm³.
$\therefore$ Volume of the wood
= (2400 - 1440) cm³ = 960cm³.

53.(B)Side of the square paper sheet = $\sqrt{784}=28$cm

So, radius of each circle = $\frac{28}{4}=7$cm.

Now, Circumference of each circular plate = $2\pi r$

$=2\times\frac{22}{7}\times 7=44$ cm

54. (B) $\frac{a+b}{a-b}=\sqrt{\frac{a^2+b^2+2ab}{a^2+b^2-2ab}}$

$=\sqrt{\frac{117+108}{117-108}}=\sqrt{\frac{225}{9}}$

$=\frac{15}{3}=5$

55.(A) $4ab(a^2+b^2)=2\times ab\times 2(a^2+b^2)$

$=2\times\left\{\frac{(a+b)^2-(a-b)^2}{4}\right\}\times\left\{(a+b)^2+(a-b)^2\right\}$

$=2\times\frac{\sqrt{3}^2-\sqrt{2}^2}{4}\times\left(\sqrt{3}^2+\sqrt{2}^2\right)$

$=2\times\frac{1}{4}\times 5=\frac{5}{2}$

56.(B) $\left(x+\frac{1}{x}\right)^2=x^2+\frac{1}{x^2}+2$

$=7+2=9\Rightarrow x+\frac{1}{x}=3$

$\therefore \left(x+\frac{1}{x}\right)^3=3^3$

$\Rightarrow x^3+\frac{1}{x^3}+3\left(x+\frac{1}{x}\right)=27$

$\Rightarrow x^3+\frac{1}{x^3}+3\times 3=27$

$\Rightarrow x^3+\frac{1}{x^3}=27-9=18$

57.(A) $\frac{P\sin\theta-q\cos\theta}{P\sin\theta+q\cos\theta}=\frac{P\tan\theta-q}{P\tan\theta+q}$

$=\frac{P\frac{P}{q}-q}{P\frac{P}{q}+q}=\frac{P^2-q^2}{p^2+q^2}$

58.(B) $\sin\theta = \frac{3}{4}$

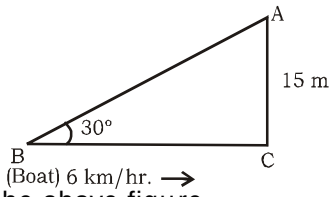
Then, $\sqrt{\frac{\operatorname{cosec}^2\theta - \cot^2\theta}{\sec^2\theta - 1}}$

$= \sqrt{\frac{\frac{1}{\sin^2\theta} - \frac{\cos^2\theta}{\sin^2\theta}}{\frac{1}{\cos^2\theta} - 1}} = \sqrt{\frac{\frac{1-\cos^2\theta}{\sin^2\theta}}{\frac{1-\cos^2\theta}{\cos^2\theta}}}$

$= \sqrt{\frac{\sin^2\theta}{\sin^2\theta} \times \frac{\cos^2\theta}{\sin^2\theta}} = \sqrt{\frac{\cos^2\theta}{\sin^2\theta}}$

$= \sqrt{\frac{1-\sin^2\theta}{\sin^2\theta}} = \sqrt{\frac{1-\frac{9}{16}}{\left(\frac{3}{4}\right)^2}} = \frac{\sqrt{7}}{4} \times \frac{4}{3} = \frac{\sqrt{7}}{3}$

59.(A)



In the above figure

AC → bridge and B → boat & $\angle ABC = 30^\circ$

& BC → distance between boat and bridge

Now, $\tan 30^\circ = \frac{AC}{BC}$

or, $\frac{1}{\sqrt{3}} = \frac{15}{BC}$

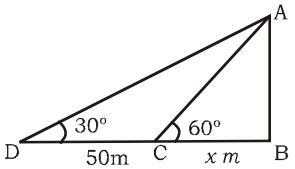
$\Rightarrow$ BC = 15 $\sqrt{3}$ metre.

So, Time taken by boat to cover the above

distance = $\frac{\text{Distance}}{\text{speed}} = \frac{15\sqrt{3}\text{ m}}{6\text{ km/hr}}$

$= \frac{15\sqrt{3}\text{m}}{6 \times \frac{5}{18}\text{m/sec.}} = 15.59\text{sec.}$

60.(A)



In the above figure

AB → the tower and DC = 50m

Let CB = x m

Now, $\tan 30^\circ = \frac{AB}{(50+x)}$ or, $\frac{1}{\sqrt{3}} = \frac{AB}{(50+x)}$

or, $\sqrt{3}(AB) = (50 + x) \Rightarrow x = \sqrt{3}(AB) - 50$ ____(i)

also, $\tan 60^\circ = \frac{AB}{x} \Rightarrow \sqrt{3} = \frac{AB}{x}$

$\Rightarrow$ AB = $\sqrt{3}\,x$

or, AB = $\sqrt{3}\{\sqrt{3}(AB) - 50\}$ From (i)

or, AB = 3AB - 50 $\sqrt{3}$

$\Rightarrow$ 2AB = 50 $\sqrt{3}$

$\Rightarrow$ AB = 25 $\sqrt{3}$ metre.

61.(A) $\sin^4\theta - \cos^4\theta$

$= (\sin^2\theta) - (\cos^2\theta)^2$

$= (\sin^2\theta + \cos^2\theta)^2 (\sin^2\theta - \cos^2\theta)^2$

$= (\sin^2\theta - \cos^2\theta)^2$

Hence (i) is not a correct statement.

62.(D) Let RQ be the height of building,

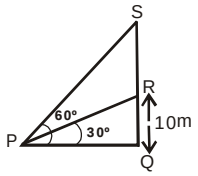
i.e RQ = 10cm, S be the position of helicopter.

Then

In Δ PQR,

$\frac{RQ}{PQ} = \tan 30^\circ$

$\therefore$ PQ = $\frac{RQ}{\tan 30^\circ} = 10\sqrt{3}$



$\therefore$ In Δ SPQ, $\tan 60^\circ = \frac{SQ}{PQ}$

$\Rightarrow \frac{SQ}{PQ} = \sqrt{3} \Rightarrow SQ = PQ \times \sqrt{3}$

$= 10\sqrt{3} \times \sqrt{3} = 30\text{m}$

63.(A) $\therefore$ a = 6, b = 11, c = 15

$\therefore s = \frac{a+b+c}{2} = \frac{6+11+15}{2} = 16$

$\Delta = \sqrt{s(s-a)(s-b)(s-c)}$

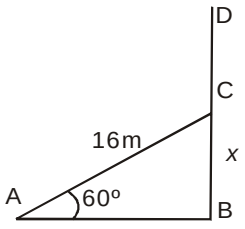
$= \sqrt{16 \times 10 \times 5 \times 1}$

$= \sqrt{800} = 20\sqrt{2}$

$r = \frac{\Delta}{s} = \frac{20\sqrt{2}}{16} = \frac{5\sqrt{2}}{4}$ cm

64.(D) Here, BD = wall

Also, BC = CD = $\frac{BD}{2} = x$ (let)



Now, $\sin 60^\circ = \frac{BC}{AC}$

$\Rightarrow \quad \frac{\sqrt{3}}{2} = \frac{x}{16}$

$\Rightarrow x = 8\sqrt{3} = 13.856$

$\therefore$ Height of the wall

$= 2 \times 13.856 = 27.712$m

65.(A) $\sin\theta + \cos\theta = 1$

On squaring both sides, we get

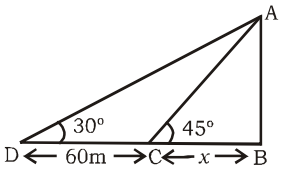
$\sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = 1$

$1 + 2\sin\theta\cos\theta = 1$

$\Rightarrow 2\sin\theta\cos\theta = 0$

$\Rightarrow \sin\theta\cos\theta = 0$

66.(B)



Let, AB $\rightarrow$ the pole

BC $\rightarrow$ length of initial shadow = x m

BD $\rightarrow$ length of new shadow = $(60 + x)$m

now, $\tan 45^\circ = \frac{AB}{x} \Rightarrow 1 = \frac{AB}{x}$

$\Rightarrow AB = x$ _____(i)

also, $\tan 30^\circ = \frac{AB}{(60+x)}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{AB}{(60+x)}$

or, $\sqrt{3}\,AB = 60 + x$

or, $\sqrt{3}\,AB = 60 + AB$ _____from (i)

$\Rightarrow \sqrt{3}\,AB - AB = 60$

or, $(\sqrt{3}-1)AB = 60$

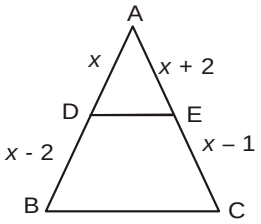
$\Rightarrow AB = \frac{60}{(\sqrt{3}-1)}$

$= \frac{60}{(\sqrt{3}-1)} \times \frac{(\sqrt{3}+1)}{(\sqrt{3}+1)}$

$= \frac{60(\sqrt{3}+1)}{\sqrt{3}^2 - 1^2} = \frac{60(\sqrt{3}+1)}{3-1} = 30(\sqrt{3}+1)$ m

67.(D) As DE $\parallel$ BC, so by basic proportionality theorem.

$\frac{AD}{DB} = \frac{AE}{EC}$



$\Rightarrow \frac{x}{x-2} = \frac{x+2}{x-1}$

$\Rightarrow x(x-1) = (x+2)(x-2)$

$\Rightarrow x^2 - x = x^2 - 4$

$\Rightarrow x = 4$

68.(C) As BC $\parallel$ AD and the diagonals of a trapezium divide each other portionally.

So, $\frac{AO}{OC} = \frac{BO}{OD}$

$\Rightarrow \frac{3x-1}{5x-3} = \frac{2x+1}{6x-5}$

$\Rightarrow (3x-1)(6x-1)$

$\Rightarrow (5x-3)(2x+1)$

$\Rightarrow 18x^2 - 15 - 6x + 5$

$\Rightarrow 10x^2 + 5x - 6x - 3$

$\Rightarrow 8x^2 - 20x + 8 = 0$

$\Rightarrow 4x^2 - 10x + 4 = 0$

$\Rightarrow 4x^2 - 8x - 2x + 4 = 0$

$\Rightarrow 4x(x-2) - 2(x-2) = 0$

$\Rightarrow (4x-2)(x-2) = 0$

$\Rightarrow x = \frac{1}{2}$ or $x = 2$

But as $x = \frac{1}{2}$ will make OC negative.

$\therefore \quad x = 2$

69.(C) as AE is an exterior angle bisector

Let CE = x, BE = BC + EC = $12 + x$

$\Rightarrow \frac{12+x}{x} = \frac{10}{6}$

$\Rightarrow (12 + x)\,6 = 10x$

$\Rightarrow 72 + 6x = 10x$

$\Rightarrow 4x = 72$

$\Rightarrow x = 18$cm

70.(A) Here $\angle CAB = \angle BCD$ (angles in alternate segments)

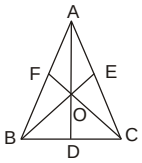
and $\angle DAB = \angle CDB$ (angles in alternate segments)

$\angle CAD = \angle CAB + \angle DAB = \angle BCD + \angle CDB$

$\Rightarrow \angle CAD + \angle CBD = \angle BCD + \angle CDB + \angle CBD$

$= 180^\circ$

71. (C)



Let ABC be an equilateral triangle of side x cm.
also, Let OD = $\sqrt{3}$ cm,
OE = $2\sqrt{3}$ cm and OF = $5\sqrt{3}$ cm,
From the figure,
ar Δ BOC + ar Δ AOC + ar Δ AOB = ar Δ ABC

or, $\frac{1}{2}\times x\times\sqrt{3}+\frac{1}{2}\times x\times 2\sqrt{3}+\frac{1}{2}\times x\times 5\sqrt{3}=\frac{\sqrt{3}}{4}x^2$

or, $2\sqrt{3}+4\sqrt{3}+10\sqrt{3}=\sqrt{3}x$
or, $x = 2 + 4 + 10 = 16$
$\therefore$ Perimeter of the triangle = $3x = 3\times16 = 48$cm

72.(C) As. AB = AC
$\Rightarrow \angle ACB = \angle ABC = 50^\circ$
$\therefore$ BAC = $180^\circ - (50 + 50) = 80^\circ$
$\therefore$ $\angle BDC = \angle BAC = 80^\circ$ (angles in the same segment)

73.(A) $\angle CBF = \angle CDA$
$\Rightarrow \angle CDA = 130^\circ$
$\angle CDA + x = 180^\circ$ (linear pair)
$\Rightarrow x = 180^\circ - 130^\circ$
$\Rightarrow x = 50^\circ$

74.(D)Base and height of triangle are 16 and 9cm respectively.

Area of triangle = $\frac{1}{2}\times16\times9 = 72$cm

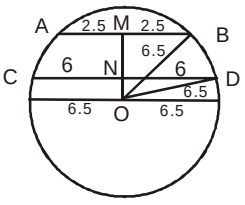
$\therefore$ Area of equilateral triangle = $\frac{\sqrt{3}}{2}\times72$

$= 36\sqrt{3}$ cm^2

$\Rightarrow \frac{\sqrt{3}}{4}a^2 = 36\sqrt{3}$

$\Rightarrow$ a = 12 cm

75.(C) AB = 5cm & CD = 12cm



Required distance; MN = MO - NO

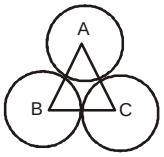
$=\sqrt{\{(OB)^2-(MB)^2\}}-\sqrt{\{(OD)^2-(ND)^2\}}$

$=\sqrt{\{(6.5)^2-(2.5)^2\}}-\sqrt{\{(6.5)^2-6^2\}}$

$=\sqrt{(42.25-6.25)}-\sqrt{(42.25-36)}$

$=\sqrt{36}-\sqrt{6.25}$ = 6 - 2.5 = 3.5cm

76. (B)



Radius of each circle = 3.5cm
From the figure.
Δ ABC will be an equilateral triangle of side 7cm each.
Now, the required area
= Area of Δ ABC $-$ 3 × (Area of a sector of angle 60° in a circle of radius 3.5cm)

$=\frac{\sqrt{3}}{4}\times(7)-3$

$\left[\frac{60}{360}\times\frac{22}{7}\times(3.5)^2\right]cm^2$

$=\left[\frac{49\sqrt{3}}{4}-19.25\right]cm^2$

$=(21.217-19.25)cm^2$
$=1.967\ cm^2$

77.(A) Since , x_1, x_2, x_3 and y_1, y_2, y_3 are in G.P. whose common ratio is r.
$\therefore$ $x_2 = x_1r$, $x_3 = x_1r^2$ and $y_2 = y_1r$, $y_3 = y_1r^2$
Slope of

PQ = $\frac{y_2-y_1}{x_2-x_1}=\frac{y_1r-y_1}{x_1r-x_1}=\frac{y_1}{x_1}$

Slope of

PR = $\frac{y_3-y_1}{x_3-x_1}=\frac{y_1r^2-y_1}{x_1r^2-x_1}=\frac{y_1}{x_1}$ $\therefore$

slope of PQ = slope of PR
$\Rightarrow$ P, Q, R are collinear.

78.(C) Let y = mx be the equation of tangent (s) from the origin to the circle $(x-7)^2+(y+1)^2 = 5^2$, there r = d

$\Rightarrow \frac{7m-(-1)}{\sqrt{m^2+1}} = \pm5$

$\Rightarrow$ Let m_1 and m_2 be the slopes of the tangents.

Since, m_1, m_2 = product of the roots $= -\frac{12}{12} = -1$

$\therefore$ The angle between two tangents is $\frac{\pi}{2}$.

79.(D) Let the length and breadth of rectangle be x and y m. respectively.
According to the question, $2(x + y) = 160$

$\Rightarrow x + y = \frac{160}{2} = 80$ _____(i)

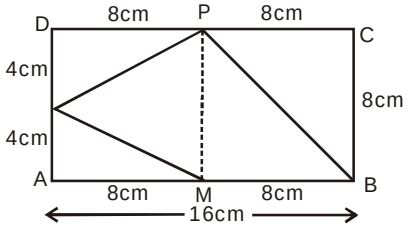
Perimeter of square = 160m

$\therefore$ Side of square = $\frac{160}{4} = 40$m

Now,
Area of rectangle = xy
Area of square = $40 \times 40 = 160m^2$
Then,
$1600 - xy = 100$
$\Rightarrow xy = 1600 \Rightarrow 100 = 1500$ _____(ii)
Now,
$(x-y)^2 = (x+y)^2 - 4xy$
$= (80)^2 - 4 \times 1500$
$= 6400 - 6000 = 400$
$\Rightarrow x - y = \sqrt{400} = 20$ _____(iii)
From equations (i) and (iii), $2x = 100$
$\Rightarrow x = \frac{100}{2} = 50m.$

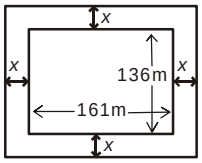
80.(A) Volume of original shpere $\frac{4}{3}\pi (6)^3 = 288cm^3$
Let the radii of small spheres be $3x$, $4x$ and $5x$ cm respectively
$\Rightarrow \frac{4}{3}\pi\left[(3x)^3 + (4x)^3 + (5x)^3\right] = 228\pi$
$\Rightarrow \frac{4}{3}\pi \times 216x^3 = 228\pi$
$\Rightarrow x^3 = \frac{288\pi \times 3}{4\pi \times 216} = 1 \Rightarrow x = 1$
$\therefore$ Required radius = $3 \times 1 = 3$ cm.

81.(C)



Area of quadrilateral BMNP
= Area of Δ MNP + Area of Δ MPB
$= \left(\frac{1}{2} \times 8 \times 8\right) + \left(\frac{1}{2} \times 8 \times 8\right) = 32 + 32 = 64\ m^2$

82.(C) Let the breadth of the path = x m
$\therefore$ Area of path
$= (161 + 2x)(136 + 2x) - 161 \times 136$



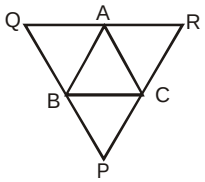
$= 161 \times 136 + 4x^2 + 322x + 272x - 161 \times 136$
$= 4x^2 + 594x$
But according to question area of path = 1204 sq m
$\Rightarrow 4x^2 + 594x = 1204$
$\Rightarrow 2x^2 + 297x - 602 = 0$
$\Rightarrow x(2x + 301) - 2(2x + 301) = 0$
$\Rightarrow (x - 2)(2x + 301) = 0$
$\Rightarrow x = 2 \left(\because x \neq -\frac{301}{2}\right)$
Hence, width of path = 2m

83.(D) Let length of rectangle = x
and breadth of rectangle = y
$(x + 2)(y - 2) = xy + 20$
$\Rightarrow xy + 2y - 2x - 4 = xy + 20$
$\Rightarrow 2y - 2x = 24$
$\Rightarrow y - x = 12$ _____(i)
Also, $(x - 2)(y - 1) = xy - 37$
$\Rightarrow xy - x - 2y + 2 = xy - 37$
$\Rightarrow 2y + x = 39$ _____(ii)
On solving Eqs. (i) and (ii),
we get $x = 5$ and $y = 17$
Hence, area of rectangle = xy
$= 5 \times 17 = 85$sq m

84.(B) Let the length of the smaller line segment = x cm.
$\therefore$ The length of larger line segment = $(x + 2)$cm
According to the question.
$(x + 2)^2 - x^2 = 32$
$\Rightarrow x^2 + 4x + 4 - x^2 = 32$
$\Rightarrow 4x = 32 - 4 = 28$
$\Rightarrow x = \frac{28}{4} = 7$
$\therefore$ The required length = $x + 2 = 7 + 2 = 9$cm.

85.(A) The volume of iron used
$= \pi r_{ext}^2 h - \pi r_{int}^2 h = \pi h (r_{ext}^2 - r_{int}^2)$
$= \frac{22}{7} \times 20 (8^2 - 6^2)$
$= \frac{22}{7} \times 20 \times 28 = 1760$cu. cm.

86.(C)



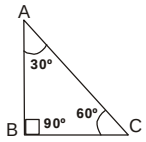
AQ ∥ CB, and AC ∥ QB
$\therefore$ AQBC, is a parapllelogram
$\Rightarrow$ BC = AQ
Again , AR ∥ BC and AB ∥ RC
$\therefore$ ARCB, is a parallelogram.
$\Rightarrow$ BC = AR $\Rightarrow$ AQ = AR
$\Rightarrow AQ = AR = \frac{1}{2}QR$
$\Rightarrow BC = \frac{1}{2}OR$

Similarly, $AB = \frac{1}{2}PR$ and $AC = \frac{1}{2}PQ$

$\therefore$ Required ratio

$= (PQ + QR + RP) : (AB + BC + CA) = 2 : 1$

87.(A)



In ΔABC

$\sin 60^\circ = \frac{AB}{AC}$

$\Rightarrow \frac{1}{2} = \frac{AB}{AC}$

$\Rightarrow AB = \frac{1}{2}AC = \frac{1}{2} \times 10 = 5cm$

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

$= \sqrt{10^2 - 5^2}$

$= \sqrt{100 - 25} = \sqrt{75} - 5\sqrt{3}$ cm

$\therefore$ Area of ΔABC

$= \frac{1}{2} \times AB \times BC$

$= \frac{1}{2} \times 5 \times 5\sqrt{3} = \frac{25\sqrt{3}}{2}$ cm^2

88.(B) Volume of ice compartment $= 8 \times 5 \times 4$

$= 160cm^3$

volume of one ice cube $= (2)^3 = 8cm^3$

So, Required number of cubes $= \frac{160}{8} = 20$

89.(C) Let radius and height of cone are $3x$ and $4x$ respectively.

$\Rightarrow$ Volume of cone

$= \frac{1}{3}\pi(3x)^2 \times 4x = 96\pi$

or, $x^3 = \frac{96 \times 3}{9 \times 4} = 8 \Rightarrow x = 2$

$\Rightarrow$ Radius & heigth of cone = 6 cm & 8 cm

So, slant height of cone $= \sqrt{8^2 + 6^2} = \sqrt{64 + 36}$

$= \sqrt{100} = 10cm$

90.(B) Area of four walls of a room $= 2(6 + 5) \times 4 = 88m^2$

So, required length of paper $= \frac{88m^2}{0.5m} = 176m$

91.(D) Possible combinations $\rightarrow$ (3 ladies & 2 men) or, (4 ladies & 1man) or (5 ladies & no man)

So, Required number of ways

$= {}^5C_3 \times {}^8C_2 + {}^5C_4 \times {}^8C_1 + {}^5C_5 \times {}^8C_0$

$= 280 + 40 + 1 = 321$

92.(D) Required difference $= \frac{18000}{360^\circ}(160^\circ - 150^\circ)$

$= \frac{18000}{360^\circ} \times 10^\circ = 500$

93.(D) Can't be determined

94.(D) Can't be determined

95.(B) No. of category C workers in Retail sector

$= \frac{80^\circ}{360^\circ} \times$ No. workers in Retail sector $= 1840$

$\Rightarrow$ No. of workers in Retail sector $= \frac{1840 \times 360}{80}$

$= 8280$

So, No. of workers in Insurance sector $= 8280 \times \frac{3}{5} = 4968$

$\Rightarrow$ No. of category A workers in Insurance sector $= \frac{160}{360} \times 4968 = 2208$

96.(C) Increase in expenditure $= (300 - 150)$

$= ₹ 150$ thousand

So, % increase $= \frac{150}{150} \times 100\% = 100\%$

97.(C) The required %

$= \frac{1050}{10500} \times 100\% = 10\%$

98.(B) Expenditure on House Rent is same.

99.(C) The sequence of total expenditure (in thousand rupees) in consecutive years is-

1500 $\xrightarrow{+200}$ 1700 $\xrightarrow{+300}$ 2000 $\xrightarrow{+400}$ 2400 $\xrightarrow{+500}$ 2900

So, The likely expenditure in 2010

$= (2900+600)$ thousand

$= 3500$ thousand

$= ₹ 3500000$

100.(D) It is clear from the table that the required item is food.