5

Percentages

INTRODUCTION

In my opinion, the chapter on Percentages forms the most important chapter (apart from Number Systems) in the syllabus of the CAT and the XLRI examination. The importance of 'percentages' is accentuated by the fact that there are a lot of questions related to the use of percentage in all chapters of commercial arithmetic (especially Profit and Loss, Ratio and Proportion, Time and Work, Time, Speed and Distance).

Besides, the calculation skills that you can develop while going through the chapter on percentages will help you in handling Data Interpretation (DI) calculations. A closer look at that topic will yield that at least 80% of the total calculations in any DI paper is constituted of calculations on additions and percentage.

BASIC DEFINITION AND UTILITY OF PERCENTAGE

Percent literally, means 'for every 100' and is derived from the French word 'cent', which is French for 100.

The basic utility of Percentage arises from the fact that it is one of the most powerful tools for comparison of numerical data and information. It is also one of the simplest tools for comparison of data.

In the context of business and economic performance, it is specifically useful for comparing data such as profits, growth rates, performance, magnitudes and so on.

Mathematical Definition of Percentage The concept of percentage mainly applies to ratios, and the percentage value of a ratio is arrived at by multiplying by 100 the decimal value of the ratio.

For example, a student scores 20 marks out of a maximum possible 30 marks. His marks can then be denoted as 20 out of 30 = (20/30) or (20/30) × 100% = 66.66%.

The process for getting this is perfectly illustrated through the unitary method:

	Marks scored		*Out of*
then,	20	$\xrightarrow{\text{out of}}$	30
	x	$\xrightarrow{\text{out of}}$	100

Then the value of $x \times 30 = 20 \times 100$

$x = (20/30) \times 100 \rightarrow$ the percentage equivalent of a ratio.

Now, let us consider a classic example of the application of percentage:

Example: Student *A* scores 20 marks in an examination out of 30 while another student *B* scores 40 marks out of 70. Who has performed better?

Solution: Just by considering the marks as 20 and 40, we do not a get clear picture of the actual performance of the two students. In order to get a clearer picture, we consider the percentage of marks.

Thus, *A* gets (20/30) × 100 = 66.66%
While *B* gets (40/70) × 100 = 57.14%

Now, it is clear that the performance of *A* is better. Consider another example:

Example: Company *A* increases its sales by 1 crore rupees while company *B* increases its sales by 10 crore rupees. Which company has grown more?

Solution: Apparently, the answer to the question seems to be company *B*. The question cannot be answered since we don't know the previous year's sales figure (although on the face of it Company *B* seems to have grown more).

If we had further information saying that company *A* had a sales turnover of ₹ 1 crore in the previous year and company *B* had a sales turnover of ₹ 100 crore in the previous year, we can compare growth rates and say that it is company *A* that has grown by 100%. Hence, company

A has a higher growth rate, even though in terms of absolute value increase of sales, company *B* has grown much more.

IMPORTANCE OF BASE/ DENOMINATOR FOR PERCENTAGE CALCULATIONS

Mathematically, the percentage value can only be calculated for ratios that, by definition, must have a denominator. Hence, one of the most critical aspects of the percentage is the denominator, which in other words is also called the base value of the percentage. No percentage calculation is possible without knowing the base to which the percentage is to be calculated.

Hence, whenever faced with the question 'What is the percentage …?' always try first to find out the answer to the question 'Percentage to what base?'

CONCEPT OF PERCENTAGE CHANGE

Whenever the value of a measured quantity changes, the change can be captured through

(a) Absolute value change or

(b) Percentage change.

Both these measurements have their own advantages and disadvantages.

Absolute value change: It is the actual change in the measured quantity. For instance, if sales in year 1 is ₹ 2500 crore and the sales in year 2 is ₹ 2600 crore, then the absolute value of the change is ₹ 100 crore.

Percentage change: It is the percentage change got by the formula

$$\text{Percentage change} = \frac{\text{Absolute value change}}{\text{Original quantity}} \times 100$$

$$= \frac{100}{2500} \times 100 = 4\%$$

As seen earlier, this often gives us a better picture of the effect of the change.

Note: The base used for the sake of percentage change calculations is always the original quantity unless otherwise stated.

Example: The population of a city grew from 20 lakh to 22 lakh. Find the

(a) percentage change

(b) percentage change based on the final value of population

Solution: (a) percentage change = (2/20) × 100 = 10%

(b) percentage change on the final value = (2/22) × 100 = 9.09%

Difference between the Percentage Point Change and the Percentage Change

The difference between the percentage point change and the percentage change is best illustrated through an example. Consider this:

The savings rate as a percentage of the GDP was 25% in the first year and 30% in the second year. Assume that there is no change in the GDP between the two years. Then:

Percentage point change in savings rate = 30%−25% = 5 percentage points.

Percentage change in savings rate = $\frac{30-25}{25} \times 100$ = 25%.

PERCENTAGE RULE FOR CALCULATING PERCENTAGE VALUES THROUGH ADDITIONS

Illustrated below is a powerful method of calculating percentages. In my opinion, the ability to calculate percentage through this method depends on your ability to handle 2 digit additions. Unless you develop the skill to add 2 digit additions in your mind, you are always likely to face problems in calculating percentage through the method illus- trated below. In fact, trying this method without being strong at 2-digit additions/subtractions (including 2 digits after decimal point) would prove to be a disadvantage in your attempt at calculating percentages fast.

This process, essentially being a commonsense process, is best illustrated through a few examples:

Example: What is the percentage value of the ratio: 53/81?

Solution: The process involves removing all the 100%, 50%, 10%, 1%, 0.1% and so forth of the denominator from the numerator.

Thus, 53/81 can be rewritten as: (40.5 + 12.5)/81 = 40.5/81 + 12.5/81 = 50% + 12.5/81

= 50% + (8.1 + 4.4)/81 = 50% + 10% + 4.4/81
= 60% + 4.4/81

At this stage you know that the answer to the question lies between 60 and 70% (Since 4.4 is less than 10% of 81)

At this stage, you know that the answer to the calculation will be in the form: 6*a*.*bcde* ….

All you need to do is find out the value of the missing digits.

In order to do this, calculate the percentage value of 4.4/81 through the normal process of multiplying the numerator by 100.

Thus the % value of $\frac{4.4}{81} = \frac{4.4 \times 100}{81} = \frac{440}{81}$

[***Note*:** Use the multiplication by 100, once you have the 10% range. This step reduces the decimal calculations.]

Thus $\frac{440}{81}$ = 5% with a remainder of 35

Our answer is now refined to 65.*bcde*. (1% Range)

Next, in order to find the next digit (first one after the decimal add a zero to the remainder;

Hence, the value of '*b*' will be the quotient of

$b \rightarrow 350/81 = 4$ Remainder 26

Answer: 65.4*cde* (0.1% Range)

$c \rightarrow 260/81 = 3$ Remainder 17

Answer: 65.43 (0.01% Range)

and so forth.

The advantages of this process are two fold:

(1) You only calculate as long as you need to in order to eliminate the options. Thus, in case there was only a single option between 60 and 70% in the above question, you could have stopped your calculations right there.

(2) This process allows you to go through with the calculations as long as you need to.

However, remember what I had advised you right at the start: Strong Addition skills are a primary requirement for using this method properly.

To illustrate another example:

What is the percentage value of the ratio $\frac{223}{72}$?

223/72 → 300 – 310% Remainder 7

700/72 → 9. Hence 309 – 310%, Remainder 52

520/72 → 7. Hence, 309.7, Remainder 16

160/72 → 2. Hence, 309.72 Remainder 16

Hence, 309.7222 (2 recurs since we enter an infinite loop of 160/72 calculations).

In my view, percentage rule (as *I* call it) is one of the best ways to calculate percentages since it gives you the flexibility to calculate the percentage value up to as many digits after decimals as you are required to and at the same time allows you to stop the moment you attain the required accuracy range.

Effect of a Percent Change in the Numerator on a Ratio's Value

The numerator has a direct relationship with the ratio, that is, if the numerator increases the ratio increases. The percentage increase in the ratio is the same as the percentage increase in the numerator, if the denominator is constant.

Thus, $\frac{22}{40}$ is exactly 10% more than $\frac{20}{40}$. (in terms of percentage change)

Percentage Change Graphic and its Applications

In mathematics there are many situations where one is required to work with percentage changes. In such situations the following thought structure (Something I call Percentage Change Graphic) is a very useful tool:

What I call Percentage Change Graphic (PCG) is best illustrated through an example:

Suppose you have to increase the number 20 by 20%. Visualise this as follows:

$$20 \xrightarrow[=+4]{20\% \uparrow} 24$$

The PCG has 6 major applications listed and explained below: PCG applied to:

1. Successive changes
2. Product change application
3. Product constancy application
4. A → B→A application
5. Denominator change to Ratio Change application
6. Use of PCG to calculate Ratio Changes

Application 1: PCG Applied to Successive Changes

This is a very common situation in most questions. Suppose you have to solve a question in which a number 30 has two successive percentage increases (20% and 10% respectively).

The situation is handled in the following way using PCG:

$$30 \xrightarrow[+6]{20\% \text{ increase}} 36 \qquad \xrightarrow[+3.6]{10\% \text{ increase}} 39.6$$

Illustration

A's salary increases by 20% and then decreases by 20%. What is the net percentage change in *A*'s salary?

Solution:

$$100 \xrightarrow[+20]{20\% \text{ inc.}} 120 \qquad \xrightarrow[-24]{20\% \text{ decrease}} 96$$

Hence, *A*'s salary has gone down by 4%

Illustration

A trader gives successive discounts of 10%, 20% and 10% respectively. The percentage of the original cost price he will recover is:

Solution:

$$100 \xrightarrow[-10]{10\% \text{ decrease}} 90 \xrightarrow[-18]{20\% \text{ decrease}} 72 \xrightarrow[-7.2]{10\% \text{ decrease}} 64.8$$

Hence the overall discount is 35.2% and the answer is 64.8%.

Illustration

A trader marks up the price of his goods by 20%, but to a particularly haggling customer he ends up giving a discount of 10% on the marked price. What is the percentage profit he makes?

Solution:

$$100 \xrightarrow[+20]{20\%\text{ increase}} 120 \xrightarrow[-12]{10\%\text{ decrease}} 108$$

Hence, the percentage profit is 8%.

Application 2: PCG applied to Product Change

Suppose you have a product of two variables say 10 × 10.

If the first variable changes to 11 and the second variable changes to 12, what will be the percentage change in the product? [Note there is a 10% increase in one part of the product and a 20% increase in the other part.]

The formula given for this situation goes as: ($a + b + ab/100$)

$$\text{Hence, Required \% change} = 10 + 20 + \frac{10 \times 20}{100}$$

(Where 10 and 20 are the respective percentage changes in the two parts of the product) (This is being taught as a shortcut at most institutes across the country currently.)

However, a much easier solution for this case can be visualised as:

$100 \xrightarrow[+20]{20\%\uparrow} 120 \xrightarrow[+12]{10\%\uparrow} 132$. Hence, the final product shows a 32% increase.

Similarly suppose 10 × 10 × 10 becomes 11 × 12 × 13

In such a case the following PCG will be used:

$$100 \xrightarrow[+30]{30\%\uparrow} 130 \xrightarrow[+26]{20\%\uparrow} 156 \xrightarrow[+15.6]{10\%\uparrow} 171.6$$

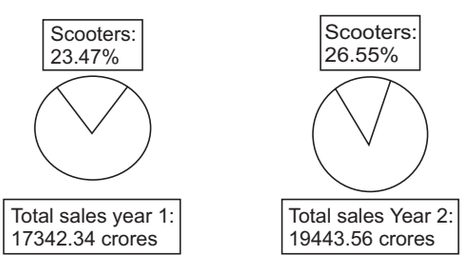
Hence, the final product sees a 71.6 percent increase (Since, the product changes from 100 to 171.6)

Note: You will get the same result irrespective of the order in which you use the respective percentage changes.

Also note that this process is very similar to the one used for calculating successive percentage change.

Application for DI:

Suppose you have two pie charts as follows:



If you are asked to calculate the percentage change in the sales revenue of scooters for the company from year one to year two, what would you do?

The formula for percentage change would give us:

$$\frac{(0.2655 \times 19443.56) - (0.2347 \times 17342.34) \times 100}{(0.2347 \times 17342.34)}$$

i.e., $\dfrac{\text{New Sales Revenue} - \text{Original Sales Revenue}}{\text{Original Sales Revenue}} \times 100$

Obviously this calculation is easier said than done.

However, the Product change application of PCG allows us to execute this calculation with a lot of ease comparatively. Consider the following solution:

Product for year one is: 0.2347×17342.34

Product for year two is: 0.2655×19443.56

These can be approximated into:

234×173 and 265×194 respectively (Note that by moving into three digits we do not end up losing any accuracy. We have elaborated this point in the chapter on Ratio and Proportions.)

The overall percentage change depends on two individual percentage changes:

234 increases to 265: A % change of 31/234 = 13.2 % approx. This calculation has to be done using the percentage rule for calculating the percentage value of the ratio

173 increases to 194 — A percentage change of approximately 12%.

Thus PCG will give the answer as follows:

$$100 \xrightarrow[+13.2]{13.2\%\uparrow} 113.2 \xrightarrow[+13.56]{12\%\uparrow} 126.76$$

Hence, 26.76 % increase in the product's value. (Note that the value on the calculator for the full calculation sans any approximations is 26.82 %, and given the fact that we have come extremely close to the answer—the method is good enough to solve the question with a reasonable degree of accuracy.)

Application 3 of PCG: Product Constancy Application (Inverse proportionality)

Suppose you have a situation wherein the price of a commodity has gone up by 25%. In case you are required to keep the total expenditure on the commodity constant, you would obviously need to cut down on the consumption. By what percentage? Well, PCG gives you the answer as follows:

$$100 \xrightarrow[\substack{+25\\ \text{Price effect}}]{25\%\uparrow} 125 \xrightarrow[\substack{-25\\ \text{Consumption Effect}}]{} 100$$

Hence, the percentage drop in consumption to offset the price increase is 20%.

I leave it to the student to discover the percentage drop required in the second part of the product if one part increases by 50 percent.

Note: Product constancy is just another name for Inverse proportionality.

Table 5.1 gives you some standard values for this kind of a situation.

Application 4 of PCG: A→B→A.

Very often we are faced with a situation where we compare two numbers say A and B. In such cases, if we are given a relationship from A to B, then the reverse relationship can be determined by using PCG in much the same way as the product constancy use shown above.

Illustration

B's salary is 25% more than A's salary. By what percent is A's salary less than B's salary?

$$100(A) \xrightarrow[+25]{25\%\uparrow} 125(B) \xrightarrow[-25]{} 100(A)$$

A drop of 25 on 125 gives a 20% drop.

Hence A's salary is 20% less than B's.

Note: The values which applied for Product Constancy also apply here. Hence Table 4.1 is useful for this situation also.

Application 5 of PCG → Effect of change in Denominator on the Value of the Ratio

The denominator has an inverse relationship with the value of a ratio.

Hence the process used for product constancy (and explained above) can be used for calculating percentage change in the denominator.

For instance, suppose you have to evaluate the difference between two ratios:

Ratio 1 : 10/20

Ratio 2 : 10/25

As is evident the denominator is increasing from 20 to 25 by 25%.

If we calculate the value of the two ratios we will get:

Ratio 1 = 0.5, Ratio 2 = 0.4.

% change between the two ratios = $\frac{0.1}{0.5} \times 100 = 20\%$ Drop

This value can be got through PCG as:

$100 \longrightarrow 125 \longrightarrow 100$ Hence, 20% drop.

Note: This is exactly the same as Product constancy and works here because the numerator is constant.

Hence, $R_1 = N/D_1$ and $R_2 = N/D_2$

i.e. $R_1 \times D_1 = N$ and $R_2 \times D_2 = N$, which is the product constancy situation.

Direct process for calculation

To find out the percentage change in the ratio due to a change in the denominator follow the following process:

In order to find the percentage change from 10/20 to 10/25, calculate the percentage change in the denominator in the reverse fashion.

i.e., The required percentage change from R_1 to R_2 will be given by calculating the percentage change in the denominators from 25 to 20 (i.e., in a reverse fashion) and not from 20 to 25.

Table 5.1 Product Constancy Table, Inverse Proportionality Table, A → B → A table, Ratio Change to Denominator table

Product XY is Constant	*X increases (%)*	*Y Decreases (%)*
A→B→A	*A → B % increase*	*B → A% decrease*
X is inversely proportional to Y	*X increases (%)*	*Y decreases (%)*
Ratio change effect of Denominator change	*Denominator increases (%)*	*(Ratio decreases(%)*
Denominator change effect of Ratio change	*Ratio increases (%)*	*As Denominator decreases (%)*
Standard Value 1	9.09	8.33
Standard Value 2	10	9.09
Standard Value 3	11.11	10
Standard Value 4	12.5	11.11
Standard Value 5	14.28	12.5
Standard Value 6	16.66	14.28
Standard Value 7	20	16.66
Standard Value 8	25	20
Standard Value 9	33.33	25
Standard Value 10	50	33.33
Standard Value 11	60	37.5
Standard Value 12	66.66	40
Standard Value 13	75	42.85
Standard Value 14	100	50

Application 6: Use of PCG to Calculate Ratio Changes:

Under normal situations, you will be faced with ratios where both numerator and denominator change. The process to handle and calculate such changes is also quite convenient if you go through PCG.

Illustration

Calculate the percentage change between the Ratios.

Ratio 1 = 10/20 Ratio 2 = 15/25

The answer in this case is 0.5 → 0.6 (20% increase). However, in most cases calculating the values of the ratio will not be easy. The following PCG process can be used to get the answer:

When 10/20 changes to 15/25, the change occurs primarily due to two reasons:

(A) Change in the numerator (Numerator effect)

(B) Change in the denominator (Denominator effect)

By segregating the two effects and calculating the effect due to each separately, we can get the answer easily as follows:

Numerator Effect The numerator effect on the value of the ratio is the same as the change in the numerator.

Hence, to calculate the numerator effect, just calculate the percentage change in the numerator:

In this case the numerator is clearly changing from 10 to 15 (i.e., a 50% increase.) This signifies that the numerator effect is also 50%.

Denominator Effect As we have just seen above, the effect of a percentage change in the denominator on the value of the ratio is seen by calculating the denominator's percentage change in the reverse order.

In this case, the denominator is changing from 20 to 25. Hence the denominator effect will be seen by going reverse from 25 to 20, i.e., 20% drop.

With these two values, the overall percentage change in the Ratio is seen by:

$$100 \xrightarrow[\substack{+50\\ \text{Numerator Effect}}]{50\%\uparrow} 150 \xrightarrow[\substack{-30\\ \text{Denominator Effect}}]{20\%\downarrow} 120$$

This means that the ratio has increased by 20%.

I leave it to the student to practice such calculations with more complicated values for the ratios.

Implications for Data Interpretation

Percentage is perhaps one of the most critical links between QA and Data Interpretation.

In the chapter theory mentioned above, the Percentage Rule for Percentage Calculations and the PCG applied to product change and ratio change are the most critical.

As already shown, the use of PCG to calculate the percentage change in a product (as exhibited through the pie chart example above) as well as the use of PCG to calculate ratio changes are two extremely useful applications of the concepts of percentages into DI.

Applying Percentages for the special case of comparing two ratios to find the larger one.

Suppose you have two ratios to compare. Say $R_1 = N_1/D_1$ and $R_2 = N_2/D_2$

The first step is to find the ten percent ranges for each of these ratios. In case, they belong to different ranges of 10% (say R1 lies between 50 and 60 while R2 lies between 70 and 80), it becomes pretty simple to say which one will be higher.

In case, both of these values for percentage of the ratios belong to the same ten percent range, then we can use the following process

Step 1: Calculate the percentage change in the numerator

Step 2: Calculate the percentage change in the denominator.

There could be four cases in this situation, when we move from Ratio_1 to Ratio_2:

Case 1: **Numerator is increasing while denominator is decreasing** → obviously the net effect of the two changes will be an increase in the ratio. Hence, R_2 will be greater.

Case 2: **Numerator is decreasing while denominator is increasing** → obviously the net effect of the two changes will be a decrease in the ratio. Hence, R_1 will be greater.

It is only in the following cases that we need to look at the respective changes in the Numerator and denominator.

Case 3: Numerator and denominator are both increasing Calculate the percentage value of the respective increases. If the numerator is increasing more than the denominator the ratio will go up. On the other hand, if the denominator is increasing more than the numerator, Ratio_2 will be smaller than Ratio_1. (Note: Compare in percentage values)

Case 4: **Numerator and denominator are both decreasing** → Calculate the percentage value of the respective decreases. If the numerator is decreasing more than the denominator the ratio will go down. On the other hand, if the denominator is decreasing more than the numerator, Ratio_2 will be greater than Ratio_1.

FRACTION TO PERCENTAGE CONVERSION TABLE

The following percentage values appear repeatedly over the entire area where questions can be framed on the topic of percentage. Further, it would be of great help to you if you are able to recognise these values separately from values that do not appear in the Table 5.2.

Some Utilisations of the Table

- The values that appear in the table are all percentage values. These can be converted into decimals by just shifting the decimal point by two places to the left. Thus, 83.33% = 0.8333 in decimal value.
- A second learning from this table is in the process of division by any of the numbers such as 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 15, 16, 24 and so on, students normally face problems in calculating the decimal values of these divisions. However, if one gets used to the decimal values that appear in the Table 5.2, calculation of decimals in divisions will become very simple. For instance, when an integer is divided by 7, the decimal values can only be .14, .28, .42, .57, .71, .85 or .00. (There are approximate values)
- This also means that the difference between two ratios like $\frac{x}{6} - \frac{x}{7}$ can be integral if and only if x is divisible by both 6 and 7.

  This principle is very useful as an advanced short cut for option based solution of some questions. I leave it to the student to discover applications of this principle.

Calculation of Multiplication by Numbers like 1.21, 0.83 and so on

In my opinion, the calculation of multiplication of any number by a number of the form $0.xy$ or of the form $1.ab$

Table 5.2 Percentage Conversion Table

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
1	100											
2	50	100										
3	33.33	66.66	100									
4	25	50	75	100								
5	20	40	60	80	100							
6	16.66	33.33	50	66.66	83.33	100						
7	14.28	28.57	42.85	57.14	71.42	85.71	100					
8	12.5	25	37.5	50	62.5	75	87.5	100				
9	11.11	22.22	33.33	44.44	55.55	66.66	77.77	88.88	100			
10	10	20	30	40	50	60	70	80	90	100		
11	9.09	18.18	27.27	36.36	45.45	54.54	63.63	72.72	81.81	90.09	100	
12	8.33	16.66	25	33.33	41.66	50	58.33	66.66	75	83.33	91.66	100
15	6.66	13.33	20	26.66	33.33	40						
16	6.25	12.5	18.75	25								
20	5	10	15	20	25							
24	4.166	8.33	12.5	16.66	20.83	25						
25	4	8	12	16	20	24	28	32	26	40		
30	3.33	6.66	10	13.33	16.66	20						
40	2.5	5	7.5	10	12.5	15	17.5	20				
60	1.66	3.33	5	6.66	8.33	10						

Formula for any cell = Column value × 100/Row value

should be viewed as a subtraction/addition situation and not as a multiplication situation. This can be explained as follows.

Example: Calculate 1.23×473.

Solution: If we try to calculate this by multiplying, we will end up going through a very time taking process, which will yield the final value at the end but nothing before that (i.e. you will have no clue about the answer's range till you reach the end of the calculation).

Instead, one should view this multiplication as an addition of 23% to the original number. This means, the answer can be got by adding 23% of the number to itself.

Thus $473 \times 1.23 = 473 + 23\%$ of $473 = 473 + 94.6 + 3\%$ of $473 = 567.6 + 14.19 = 581.79$.

(The percentage rule can be used to calculate the addition and get the answer.)

The similar process can be utilised for the calculation of multiplication by a number such as 0.87
(Answer can be got by subtracting 13% of the number from itself and this calculation can again be done by percentage rule.)

Hence, the student is advised to become thorough with the percentage rules. Percentage calculation and additions of 2 and 3 digit numbers.

Space for Notes

WORKED-OUT PROBLEMS

Problem 5.1 *A* sells his goods 30% cheaper than *B* and 30% dearer than *C*. By what percentage is the cost of *C*'s goods cheaper than *B*'s goods.

Solution There are two alternative processes for solving this question:

1. Assume the price of *C*'s goods as *p*.: Then *A*'s goods are at 1.3 p and *B*'s goods are such that *A*'s goods are 30% cheaper than *B*'s goods, i.e., *A*'s goods are priced at 70% of *B*'s goods.

$$\text{Hence, } 1.3\,p \rightarrow 70$$
$$B\text{'s price} \rightarrow 100$$
$$B\text{'s price} = 130\,p/70 = 1.8571\,p$$

Then, the percentage by which *C*'s price is cheaper than *B*'s price =

$$(1.8571\,p - p) \times 100/(1.8571\,p) = 600/13 = \mathbf{46.15\%}$$

Learning task for student Could you answer the question: Why did we assume *C*'s price as a variable *p* and then work out the problem on its basis. What would happen if we assumed *B*'s price as *p* or if we assumed *A*'s price as *p*?

2. Instead of assuming the price of one of the three as p, assume the price as 100.

Let *B* = 100. Then *A* = 70, which is 30% more than *C*. Hence *C* = 23.07% less than *A* (from Table 4.1) = approx. 53.84. Hence answer is 46.15% approximately.

(This calculation can be done mentally if you are able to work through the calculations by the use of percentage rule. The students are advised to try to assume the value of 100 for each of the variables *A*, *B* and *C* and see what happens to the calculations involved in the problem. Since the value of 100 is assumed for a variable to minimise the requirements of calculations to solve the problems, we should ensure that the variable assumed as 100 should have the maximum calculations associated with it.)

Note: In fact this question and the ones that follow contain some of the most basic operations in the chapter of percentages. The questions at the first level of difficulty would appear in examinations like CET Maharashtra, Bank P.O., MAT, NMAT, CLAT, NLS and most other aptitude exams. Hence, if you are able to do the operations illustrated here mentally, you would be able to solve LOD 1 questions easily and gain a significant time advantage over your competitors.

However, for the serious CAT aspirant, the logic used for LOD I questions would normally be used as a part of the entire logic. You would be able to see this in the questions of the second and the third level of difficulties in the exercises later in the chapter. Hence, developing the process for solving questions of the LOD 1 level mentally would help you gain an improved speed for the CAT level questions.

Also remember that since percentages are the basis for most of the commercial mathematics as well as for calcula-tion and the Data Interpretation section, developing skills for calculation and problem solving illustrated here would go a long way towards helping you clear aptitude exams.

Problem 5.2 The length and the breadth of a rectangle are changed by +20% and by –10%, respectively. What is the percentage change in the area of the rectangle.

Solution The area of a rectangle is given by: length × breadth. If we represent these by:

Area = $L \times B = LB \rightarrow$ then we will get the changed area as

$$\text{Area}_{(\text{NEW})} = 1.2\,L \times 0.9\,B = 1.08\,LB$$

Hence, the change in area is 8% increase.

Note: You can solve (and in fact, finish the problem) during your first reading by using percentage change graphic as follows:

$100 \xrightarrow{+20\%} 120 \xrightarrow{-10\%} 108$. Hence, the percentage change is **8%**.

Problem 5.3 Due to a 25% price hike in the price of rice, a person is able to purchase 20 kg less of rice for ₹ 400. Find the initial price.

Solution Since price is rising by 25%, consumption has to decrease by 20%. But there is an actual reduction in the consumption by 20 kg. Thus, 20% decrease in consumption is equal to a 20 kg drop in consumption.

Hence, original consumption is: 100 kg of rice.

Money spent being ₹ 400, the original price of rice is ₹ 4 per kg.

(There, you see the benefit of internalising the product constancy table! It is left to the student to analyse why and how the product constancy table applies here.)

Problem 5.4 *A*'s salary is 20% lower than *B*'s salary, which is 15% lower than *C*'s salary. By how much percent is *C*'s salary more than *A*'s salary?

Solution The equation approach here would be

$$A = 0.8\,B$$
$$B = 0.85\,C$$

Then $A = 0.8 \times 0.85\,C$

$A = 0.68\ C$ (Use percentage change graphic to calculate the value of 0.68)

Thus, A's salary is 68 % of C's salary.

If A's salary is 68, B's salary is 100.

Using percentage change graphic

$$68 \xrightarrow[+32]{(3200/68)\%} 100$$

Students are advised to refrain from using equations to solve questions of this nature. In fact, you can adopt the following process, which can be used while you are reading the problem, to get the result faster.

Assume one of the values as 100. (Remember, selection of the right variable that has to take the value of 100 may make a major difference to your solving time and effort required. The thumb rule for selecting the variable whose value is to be taken as 100 is based on three principal considerations:

Select as 100, the variable

1. With the maximum number of percentage calculations associated with it.
2. Select as 100 the variable with the most difficult calculation associated with it.
3. Select as 100 the variable at the start of the problem solving chain.

The student will have to develop his own judgment in applying these principles in specific cases.

Here I would take C as 100, getting B as 85 and A as 68.

Hence, the answer is $(32 \times 100/68)$.

Problem 5.5 The cost of manufacture of an article is made up of four components A, B, C and D which have a ratio of 3 : 4 : 5 : 6 respectively. If there are respective changes in the cost of +10%, –20%, –30% and +40%, then what would be the percentage change in the cost.

Solution Assume the cost components to be valued at 30, 40, 50 and 60 as you read the question. Then we can get changed costs by effecting the appropriate changes in each of the four components.

Thus we get the new cost as 33, 32, 35 and 84 respectively.

The original total cost was 180 the new one is 184. The percent change is 4/180 = 2.22%.

Problem 5.6 Harsh receives an inheritance of a certain amount from his grandfather. Of this he loses 32.5% in his effort to produce a film. From the balance, a taxi driver stole the sum of ₹ 1,00,000 that he used to keep in his pocket. Of the rest, he donated 20% to a charity. Further he purchases a flat in Ganga Apartment for ₹ 7.5 lakh. He then realises that he is left with only ₹ 2.5 lakh cash of his inheritance. What was the value of his inheritance?

Solution These sort of problems should either be solved through the reverse process or through options.

Reverse process for this problem He is left with ₹ 2.5 lakh after spending ₹ 7.5 lakh on the apartment.

Therefore, before the apartment purchase he has ₹ 10 lakh. But this is after the 20% reduction in his net value due to his donation to charity. Hence, he must have given ₹ 2.5 lakh to charity (20% decrease corresponds to a 25% increase). As such, he had 12.5 lakh before the charity. Further, he must have had ₹ 13.5 lakh before the taxi driver stole the sum. From 13.5 lakh you can reach the answer by trial and error trying whole number values. You will get that if he had 20 lakh and lost 32.5% of it he would be left with the required 13.5 lakh.

Hence, the answer is ₹ 20 lakh.

This process can be done mentally by: 2.5 + 7.5 = 10 lakh → +25% → 12.5 lakh → + 1 lakh → 13.5 lakh.

From this point move by trial and error. You should try to find the value of the inheritance, which on reduction by 32.5%, would leave 13.5 lakh. A little experience with numbers leaves you with ₹ 20 lakh as the answer. This process should be started as soon as you finish reading the first time.

Through options Suppose the options were:

(a) 25 lakh (b) 22.5 lakh

(c) 20 lakh (d) 18 lakh

Start with any of the middle options. Then keep performing the mathematical operation in the order given in the problem. The final value that he is left with should be ₹ 2.5 lakh. The option that gives this, will be the answer. If the final value yielded is higher than ₹ 2.5 lakh in this case, start with a value lower than the option checked. In case it is the opposite, start with the option higher than the one used.

As a thumb rule, start with the most convenient option—the middle one. This would lead us to start with ₹ 20 lakh here.

However, if we had started with ₹ 25 lakh the following would have occurred.

25 lakh –32.5% → 16.875 lakh –1 lakh → 15.875 lakh –20% – 7.5 lakh, should equal 2.5 lakh → (Prior to doing this calculation, you should see that there is no way the answer will yield a nice whole number like 2.5 lakh. Hence, you can abandon the process here and move to the next option)

Trying with 20 lakh, 20 –32.5% → 13.5 lakh –1ac. → 12.5 lakh –20% → 10 lakh – 7.5 lakh = **2.5 lakh** → Required answer.

LEVEL OF DIFFICULTY (I)

1. If we express 12(4/15)% as a fraction, then it is equal to
   (a) 46/375 (b) 46/125
   (c) 23/250 (d) None of these.
2. What is 10% of 20% of 25% of 100?
   (a) 0.5 (b) 0.75
   (c) 0.25 (d) 1.0
3. Which of the following is the largest number?
   (a) 40% of 400 (b) 5% of 800
   (c) 1000% of 4 (d) 200% of 9
4. If 30% of a number is 300, then 50% of that number is:
   (a) 400 (b) 125
   (c) 150 (d) 500
5. If 25% of x = 30% of y, then find the value of x if y = 5000.
   (a) 2000 (b) 3000
   (c) 4000 (d) 6000
6. 30% of a% of b is 25% of b% of c. Which of the following is c?
   (a) 1.5a (b) 0.667a
   (c) 0.5a (d) 1.20a
7. 20% of a number when subtracted from 108, gives the number itself. Find the number.
   (a) 50 (b) 80
   (c) 70 (d) 90
8. When 40% of a number A is added to another number B, B becomes 125% of its previous value. Then which of the following is true regarding the values of A and B?
   (a) $A > B$
   (b) $B > A$
   (c) $B = A$
   (d) Either (a) or (b) can be true depending upon the values of A and B
9. Two students appeared at an examination. One of them secured 10 marks more than the other and his marks was 60% of the sum of their marks. The marks obtained by the better student are:
10. Two numbers A and B are such that the sum of 5% of A and 10% of B is 1/2 of the sum of 20% of A and 10% of B. Find the ratio of A:B?
11. Mr. Ram is worried about the balance of his monthly budget. The price of petrol has increased by 50%. By what percent should he reduce the consumption of petrol so that he is able to balance his budget?
    (a) 33.33 (b) 28.56
    (c) 25 (d) 14.28
12. In Question 11, if Mr. Ram wanted to limit the increase in his expenditure to 20% on his basic expenditure on petrol then what should be the corresponding decrease in consumption?
    (a) 33.33 (b) 12.50
    (c) 25 (d) 20
13. Ashok sells his goods 50% dearer than Shankar and 20% dearer than Bishnu. How much percentage is Bishnu's goods dearer than Shankar's?
    (a) 33.33% (b) 25%
    (c) 66.66% (d) 40%
14. In an election between 2 candidates, Chaman gets 80% of the total valid votes. If the total votes were 12000, what is the number of valid votes that the other candidate Dhande gets if 15% of the total votes were declared invalid?
    (a) 1645 (b) 1545
    (c) 1675 (d) 2040
15. In a physical measurement, by mistake Shyam gave his height as 25% more than normal. In the interview panel, he clarified that his height was 5 feet 5 inches. Find the percentage correction made by the candidate from his stated height to his actual height.
    (a) 20 (b) 28.56
    (c) 25 (d) 16.66
16. Raunak generally wears his father's coat. Unfortunately, his cousin Vikas told him one day that he was wearing a coat of length more than his height by 15%. If the length of Raunak's father's coat is 345 cm then find the actual length (in cm) of his coat.
    (a) 110 (b) 345
    (c) 300 (d) 105
17. A number is mistakenly divided by 2 instead of being multiplied by 2. Find the percentage change in the result due to this mistake.
    (a) 100% (b) 125%
    (c) 200% (d) 75%
18. Sachin wanted to subtract 10 from a number. Unfortunately, he added 10 instead of subtracting. Find the percentage change in the result.
    (a) 300% (b) 66.66%
    (c) 50% (d) Cannot be determined
19. In a mixture of 100 litres of milk and water, 25% of the mixture is milk. How much water should be added to the mixture so that milk becomes 20% of the mixture?
    (a) 25 litres (b) 15 litres
    (c) 20 litres (d) 24 litres

20. A landowner increased the length and the breadth of a rectangular plot by 20% and 30% respectively. Find the percentage change in the cost of the plot assuming land prices are uniform throughout his plot.
(a) 23% (b) 52%
(c) 56% (d) None of these

21. The height of a triangle is increased by 30%. What can be the maximum percentage increase in length of the base so that the increase in area is restricted to a maximum of 90%?
(a) 33.33% (b) 20.67%
(c) 46.15% (d) 25.34%

22. The length, breadth and height of a room in the shape of a cuboid are increased by 10%, 20% and 50%, respectively. Find the percentage change in the volume of the cuboid.
(a) 47.20% (b) 55.33%
(c) 48% (d) 98%

23. The salary of Ajay is 10% more than that of Vivek. Find by what percentage is the salary of Vivek less than that of Ajay?
(a) 16.12% (b) 13.07%
(c) 11.23% (d) 9.09%

24. The price of salt is reduced by 50% but, inspite of the decrease, Aayush ends up increasing his expenditure on salt by 50%. What is the percentage change in his monthly consumption of sugar?
(a) +60% (b) –100%
(c) +25% (d) 200%

25. The price of wheat falls by 20%. How much wheat can be bought now with the money that was sufficient to buy 100 kg of rice previously?
(a) 105 kg (b) 115 kg
(c) 125 kg (d) 130 kg

26. At an election, the candidate who got 60% of the votes cast won by 200 votes. Find the total number of voters on the voting list if 66.67% people cast their vote and there were no invalid votes.
(a) 3000 (b) 2400
(c) 1800 (d) 1500

27. The population of a town is 5,00,000. The rate of increase is 20% per annum. Find the population at the start of the third year.
(a) 6,20,000 (b) 7,20,000
(c) 8,30,000 (d) None of these.

28. The population of the city of Gotham is 50,000 at this moment. It increases by 20% in the first year. However, in the second year, due to immigration, the population drops by 10%. Find the population at the end of the third year if in the third year the population increases by 30%.
(a) 82,340 (b) 70,200
(c) 62,540 (d) 52,340

29. Shyam invests ₹ 40,000 in some shares in the ratio 1 : 4 : 5 which pay dividends of 10%, 15% and 25% (on his investment) for that year respectively. Find his dividend income.
(a) 5900 (b) 2000
(c) 8800 (d) 7800

30. In an examination, Madan obtained 20% more than Sahir but 40% less than Ravi. If the marks obtained by Sahir is 80, find the percentage marks obtained by Ravi if the full marks is 200.
(a) 80% (b) 70%
(c) 78.33% (d) 71.11%

31. In a class, 20% of the students were absent for an exam. 10% failed by 10 marks and 20% just passed because of grace marks of 5. Find the average score of the class if the remaining students scored an average of 50 marks and the pass marks are 30 (counting the final scores of the candidates).
(a) 41.25 (b) 37
(c) 38 (d) 33

32. Sharad spends 20% of his monthly income on his household expenditure, 30% of the rest on food, 10% of the rest on clothes and saves the rest. On counting, he comes to know that he has finally saved ₹10080. Find his monthly income (in ₹).
(a) 10000 (b) 15000
(c) 20000 (d) 12000

33. Harish and Bhuvan have salaries that jointly amount to ₹ 10,000 per month. They spend the same amount monthly and then it is found that the ratio of their savings is 6: 1. Which of the following can be Harish's salary?
(a) ₹ 6000 (b) ₹ 5000
(c) ₹ 4000 (d) ₹ 3000

34. The population of a town is 6000. If the number of males increases by 10% and the number of females increases by 20%, then the population becomes 6800. Find the population of females in the town.
(a) 2500 (b) 3000
(c) 2000 (d) 3500

35. Raju sells his goods 20% cheaper than Bharat and 20% dearer than Charan. How much percentage Charan's goods cheaper/dearer than Bharat's?
(a) 33.33% cheaper (b) 50% dearer
(c) 42.85% dearer (d) None of these

36. In an election contested by two parties, Party SJP secured 12 percentage points of the total votes more than Party SJD. If party SJD got 132,000 votes and there are no invalid votes, by how many votes did it lose the election?
(a) 18,000 (b) 25,000
(c) 24,000 (d) 36,000

37. During winters, an athlete can run 'x' metres on one bottle of energy drink. But in the summer, he can only run 0.2 x metres on one bottle of energy drink. How many bottles of energy drink are required to run 1000 metres during summer?
(a) 1000/x (b) 5000/x
(c) 2000/x (d) 4500/x

38. Vinay's salary is 75% more than Ashok's. Vinay got a raise of 40% on his salary while Ashok got a raise of 25% on his salary. By what percent is Vinay's salary more than Ashok's?
(a) 96% (b) 51.1%
(c) 90% (d) 52.1%

39. On a morning prayer all the students of a school stand in three rows, the first row has 20% more students than the second row and the third row contains 20% less students than the second row. If the total number of students in all the rows is 300, then find the number of students in the first row.
(a) 120 (b) 125
(c) 100 (d) None of these.

40. An ore contains 20% of an alloy that has 50% copper. Other than this, in the remaining 80% of the ore, there is no copper. How many kilograms of the ore are needed to obtain 10 kg of pure copper?
(a) 100 kg (b) 125 kg
(c) 80 kg (d) 75 kg

41. Last year, the Australian Football team played 80 football matches out of which they managed to win only 20%. This year, so far it has played some matches, which has made it mandatory for it to win 80% of the remaining matches to maintain its existing winning percentage. Find the number of matches played by Australia so far this year.
(a) 30 (b) 25
(c) 28 (d) Insufficient Information

42. The population of a village is 4,00,000. Increase rate per annum is 20%. Find the population at the starting of the 4^{th}year.
(a) 691400 (b) 591200
(c) 691200 (d) None of these

43. In a conference, out of 200 men, 100 women, 400 children present inside the building premises, 10% of the men, 20% of the women and 30% of the children were Indians. Find the percentage of people who were not Indian.
(a) 73% (b) 77%
(c) 79% (d) 83%

44. A table and a chair are priced at ₹3000 and ₹1000 respectively. If the price of the table and that of the chair is increased by 10% and 20% respectively, then the price of 10 tables and 20 chairs is:
(a) 52,000 (b) 57,000
(c) 54,000 (d) None of these

45. Out of the total production of Aluminum from Bauxite, an ore of Aluminum, 30% of the ore gets wasted, and out of the remaining ore, only 30% is pure Aluminum. If the pure Aluminum obtained in a year from a mine of Bauxite was 42,000 kg, then the quantity of Bauxite mined from that mine in the year is
(a) 3,00,000 kg (b) 2,00,000 kg
(c) 2,50,000 kg (d) None of these

46. Ramesh buys a house for ₹ 2,00,000. The annual repair cost comes to 6.0% of the price of purchase. Besides, he has to pay an annual tax of ₹ 12000. At what monthly rent must he rent out the house to get a return of 20% on his net investment (in ₹) of the first year?
(a) ₹ 3867.67 (b) ₹ 3733.33
(c) ₹ 3000 (d) ₹ 3212.50

47. Recently, while shopping in Meena Market in Lucknow, I came across two new trousers selling at a discount. I decided to buy one of them for my little boy Sherry. The shopkeeper offered me the first trouser for ₹ 42 and said that it usually sold for 8/7 of that price. He then offered me the other trouser for ₹ 36 and said that it usually sold for 7/6th of that price. Of the two trousers which one do you think is a better bargain and what is the percentage discount on it?
(a) first trouser, 12.5% (b) second trouser, 14.28%
(c) Both are same (d) None of these

48. 4/5 th of the voters in Kanpur promised to vote for Modi and the rest promised to vote for Advani. Of these voters, 10% of the voters who had promised to vote for Modi, did not vote on the election day, while 20% of the voters who had promised to vote for Advani did not vote on the election day. What is the total number of votes polled if Modi got 216000 votes?
(a) 200000 (b) 300000
(c) 264000 (d) 100000

49. In an examination, 80% students passed in Physics, 70% in Chemistry while 15% failed in both the subjects. If 3250 students passed in both the subjects. Find the total number of students who appeared in the examination.
(a) 7500 (b) 8,000
(c) 3000 (d) 5,000

50. Sudhir spends 25% of his salary on house rent, 20% of the rest he spends on his children's education and 10% of the total salary he spends on clothes. After his expenditure, he is left with ₹ 20,000. What is Sudhir's salary?
(a) ₹ 40,000 (b) ₹ 20,000
(c) ₹ 25,000 (d) ₹ 35,000

51. The entrance ticket at the Imagica in Mumbai is worth ₹ 1000. When the price of the ticket was lowered, the sale of tickets increased by 25% while the collections recorded a decrease of 20%. Find the deduction in the ticket price.
    (a) ₹ 240 (b) ₹ 360
    (c) ₹ 105 (d) ₹ 120
52. Raman's monthly salary is A rupees. Of this, he spends X rupees. The next month he has an increase of C% in his salary and D% in his expenditure. The new amount saved is:
    (a) $A(1 + C/100) – X(1 + D/100)$
    (b) $(A/100)\,(C – (D)\,X\,(1 + D/100)$
    (c) $X(C – (D)/100$
    (d) $X(C + D)/100$
53. In the year 2010, the luxury bike industry had two bike manufacturers—Splendor and Passion with market shares of 30% and 70%, respectively. In 2011, the overall market for the product increased by 20% and a new player Yamaha also entered the market and captured 10% of the market share. If we know that the market share of Splendor increased to 40% in the second year, the share of Passion in that year was:
54. Ranjan buys goods worth ₹ 10,000. He gets a rebate of 20% on it. After getting the rebate, he pays sales tax @ 10%. Find the amount he will have to pay for the goods.
55. A number is mistakenly divided by 5 instead of being multiplied by 5. What is the percentage error in the result?
56. The salary of Anuj is 20% lower than Bhuwan's salary and the salary of Chauhan is 56.25% greater than Anuj's salary. By how much percent the salary of Bhuwan is less than the salary of Chauhan.
    (a) 20% (b) 25%
    (c) 40% (d) 15%
57. The length and breadth of a rectangle are changed by +20% and −50%. What is the percentage change in area of rectangle?
58. I recently got a promotion accompanied by 23% hike in salary but due to recession my company reduced my salary by 32%. What was the net change in my salary?
59. A number when reversed becomes 45% greater than the original. By how much percentage is the units place digit greater than the tens' place digit?
60. A batsman scored 100 runs which included 4 boundaries and 6 sixes. What percent of his total score did he make by running between the wickets?

Space for Rough Work

LEVEL OF DIFFICULTY (II)

1. Due to a 25% hike in the price of rice per kilogram, a person is able to purchase 5 kg less for ₹200. Find the increased price of rice per kilogram.
   (a) ₹ 5 (b) ₹ 6
   (c) ₹ 10 (d) ₹ 4
2. A fraction is such that if the double of the numerator and the triple of the denominator is changed by +10% and –30% respectively then we get 33% of 16/21. Find the fraction.
   (a) $\frac{4}{25}$ (b) $\frac{8}{11}$
   (c) $\frac{3}{25}$ (d) None of these
3. After receiving two successive hikes, Karun's salary became equal to 15/8 times of his initial salary. By how much percent was the salary raised the first time if the second raise was twice as high (in percent) as the first?
   (a) 15% (b) 20%
   (c) 25% (d) 30%
4. After three successive equal percentage rise in the salary the sum of 1000 rupees turned into 1331 rupees. Find the percentage rise in the salary.
   (a) 10% (b) 22%
   (c) 66% (d) 82%
5. Sudhir, a very clever businessman, started off a business with very little capital. In the first year, he earned a profit of 50% and donated 50% of the total capital (initial capital + profit) to a charitable organisation. The same course was followed in the 2nd and 3rd years also. If at the end of three years, he is left with ₹ 33,750, then find the amount donated by him at the end of the 2nd year.
   (a) ₹ 90,000 (b) ₹ 25,000
   (c) ₹ 45,000 (d) ₹ 40,000
6. In an examination, 48% students failed in Physics and 32% students in Chemistry, 20% students failed in both the subjects. If the number of students who passed the examination was 880 (by passing both the subjects), how many students appeared in the examination if the examination consisted only of these two subjects?
   (a) 2000 (b) 2200
   (c) 2500 (d) 1800
7. A machine depreciates in value each year at the rate of 10% of its previous value. However, every second year there is some maintenance work so that in that particular year, depreciation is only 5% of its previous value. If at the end of the fourth year, the value of the machine stands at ₹ 1,46,205, then find the value of machine at the start of the first year.
   (a) ₹ 1,90,000 (b) ₹ 2,00,000
   (c) ₹ 1,95,000 (d) ₹ 2,10,000
8. Kaku's project report consists of 25 pages each of 60 lines with 75 characters on each line. In case the number of lines is reduced to 55 but the number of characters is increased to 90 per lines, what is the percentage change in the number of pages. (Assume the number of pages to be a whole number.)
   (a) +10% (b) +5%
   (c) –8% (d) –10%
9. The price of soap is collectively decided by five factors: raw materials, research, labour, advertisements and transportation. Assume that the functional relationship is
   Price of soap = (k' × Raw material costs × Research costs × Labour costs × Advertising cost × Transportation cost).
   If there are respective changes of 20%, 20%, –20%, 25% and 10% in the five factors, then find the percentage change in the price of soap.
   (a) +58.40% (b) 54.40%
   (c) 48.50% (d) 56%
10. The ratio of Jim's salary for October to his salary for November was 9: 8 and the ratio of the salary for November to that for December was 3: 4. The worker got 40 rupees more for December than for October and received a bonus constituting 40 per cent of the salary for three months. Find the bonus. (Assume that the number of workdays is the same in every month.)
11. Praveen goes to a shop to buy a sofa set costing ₹ 13,080. The rate of sales tax is 10%. She tells the shopkeeper to reduce the price of the sofa set to such an extent that she has to pay ₹13080 inclusive of sales tax. Find the percentage reduction needed in the price of the sofa set to just satisfy her requirement.
   (a) 8.33% (b) 9.09%
   (c) 9% (d) 8.5%
12. The price of a certain product was raised by 20% in India. The consumption of the same article was increased from 400 tons to 440 tons. By how much percent will the expenditure on the article rise in the Indian economy?
   (a) 32% (b) 25%
   (c) 27% (d) 26%

13. In the university examination last year, Samanyu scored 65% in English and 82% in History. What is the minimum percent he should score in Sociology, which is out of 50 marks (if English and History were for 100 marks each), if he aims at getting 78% overall?
(a) 94% (b) 92%
(c) 98% (d) 96%

14. King Dashratha, at his eleventh hour, called his three queens and distributed his gold in the following way: He gave 50% of his wealth to his first wife, 50% of the rest to his second wife and again 50% of the rest to his third wife. If their combined share is worth 1,30,900 kilograms of gold, find the quantity of gold King Dashratha was having initially?
(a) 1,50,000 kg (b) 1,49,600 kg
(c) 1,51,600 kg (d) 1,52,600 kg

15. The population of Swansea increases with a uniform rate of 8% per annum, but due to immigration, there is a further increase of population by 1% (however, this 1% increase in population is to be calculated on the population after the 8% increase and not on the previous years population). Find what will be the percentage increase in population after 2 years.
(a) 18.984 (b) 18.081
(c) 18.24 (d) 17.91

16. 10% of Mexico's population migrated to South Asia, 10% of the remaining migrated to America and 10% of the rest migrated to Australia. If the female population, which was left in Mexico, remained only 3,64,500, find the population of Mexico City before the migration and its effects if it is given that before the migration the female population was half the male population and this ratio did not change after the migration?
(a) 10,00,000 (b) 12,00,000
(c) 15,00,000 (d) 16,00,000

17. Malti has ₹M with her and her friend Chinki has ₹C with her. Malti spends 12% of her money and Chinki also spends the same amount as Malti did. What percentage of her money did Chinki spend?
(a) $\frac{18M}{C}$ (b) $\frac{18C}{M}$
(c) $\frac{12M}{C}$ (d) $\frac{12C}{M}$

18. In a village consisting of p persons, x% can read and write. Of the males alone y%, and of the females alone z% can read and write. Find the number of males in the village in terms of p, x, y and z if $z < y$.
(a) $\frac{[p(x-z)]}{[y+x-z]}$ (b) $\frac{[p(x-z)]}{[y+x-2z]}$
(c) $\frac{[p(x-z)]}{[x-z]}$ (d) $\frac{[p(x-z)]}{[y-z]}$

19. According to a recent survey report issued by the Commerce Ministry, Government of India, 30% of the total FDI goes to Gujarat and 20% of this goes to rural areas. If the FDI in Gujarat, which goes to urban areas, is \$72 m, then find the size of FDI in rural Andhra Pradesh, which attracts 50% of the FDI that comes to Andhra Pradesh, which accounts for 20% of the total FDI?
(a) \$30 m (b) \$9 m
(c) \$60 m (d) \$40 m

20. If in the previous question, the growth in the size of FDI for the next year with respect to the previous year is 20%, then find the share of urban Maharashtra next year if 12% of the total FDI going to Maharashtra went to urban areas (provided Maharashtra attracted only 10% of the total share for both years).
(a) \$36 m (b) \$4.32 m
(c) \$3 m (d) \$5 m

21. The cost of food accounted for 25% of the income of a particular family. If the income gets raised by 20%, then what should be the percentage point decrease in the food expenditure as a percentage of the total income to keep the food expenditure unchanged between the two years?
(a) 3.5 (b) 8.33
(c) 4.16 (d) 5

22. If the length, breadth and height of a cube are decreased, decreased and increased by 5%, 5% and 20%, respectively, then what will be the impact on the surface area of the cube (in percentage terms)?
(a) 7.25% (b) 5%
(c) 8.33% (d) 6.0833%

23. *Aman*'s salary is first increased by 25% and then decreased by 20%. The result is the same as *Baman*'s salary increased by 20% and then reduced by 25%. Find the ratio of *Baman*'s initial salary to that of *Aman*'s initial salary.
(a) 4 : 3 (b) 11 : 10
(c) 10 : 9 (d) 12 : 11

24. The minimum quantity of Kerosene in liters (in whole number) that should be mixed in a mixture of 60 liters in which the initial ratio of Kerosene to water is 1:4, so that the resulting mixture has 15% Kerosene is
(a) 3 (b) 4
(c) 5 (d) This is not possible

25. A person saves 5% of his income. Two years later, his income shoots up by 20% but his savings remain the same. Find the hike in his expenditure.
(a) 25.95% (b) 24.07%
(c) 21.05%. (d) 15.5%

26. P is 50% more than Q, R is 2/3 of P and S is 60% more than R. Now, each of P, Q, R and S is increased by 10%. Find what per cent of Q is S(after the increase)?

(a) 150% (b) 160%
(c) 175% (d) 176%

27. *Alok* and *B*imal have, between them, ₹ 12000. *Alok* spends 12% of his money while *Bimal* spends 20% of his money. They are then left with a sum that constitutes 85% of the whole sum. Find what amount is left with *Alok*.
(a) ₹ 7500 (b) ₹ 8000
(c) ₹ 7000 (d) ₹ 6600

28. In order to maximise his gain, a theatre owner decides to reduce the price of tickets by 20% and as a result of this, the sales of tickets increase by 40%. If, as a result of these changes, he is able to increase his weekly collection by 1,68,000, find by what value did the gross collection increase per day.
(a) 14,000 (b) 18,000
(c) 24,000 (d) 20,000

29. In a town consisting of three localities *A*, *B* and *C*, the population of the three localities *A*, *B* and *C* are in the ratio 9:8:3. In locality *A*, 80% of the people are literate, in locality *B,* 30% of the people are illiterate. If 90% people in locality *C* are literate, find the percentage literacy in that town.
(a) 61.5% (b) 78%
(c) 75% (d) None of these

30. To pass an examination, 30% marks are essential. *A* obtains 20% marks less than the pass marks and *B* obtains 50% marks less than *A*. What percent less than the sum of *A*'s and *B*'s marks should *C* obtain to pass the exam?
(a) 40% (b) 41(3/17)%
(c) 28% (d) None of these

Directions for Questions 31 to 33: Read the following passage and answer the questions.

In a recent youth fete organised by Mindworkzz, the entry tickets were sold out according to the following scheme:

Tickets bought in one lot	6	12	18
Percentage discount	10%	20%	25%

Original price per ticket: ₹40

This offer could have been availed only when tickets were bought in a fixed lot according to the scheme and any additional ticket was available at its original price.

31. If a person has to buy 25 tickets, then what will be the minimum price per ticket?
(a) Equal to ₹32 (b) ₹32.32
(c) ₹31.84 (d) Cannot be determined.

32. In the above question, what will be the approximate possible maximum price per ticket (if discounts have been availed for 24 tickets)?
(a) ₹30 (b) ₹32
(c) ₹36 (d) ₹36.16

33. On the last day of the fete, with the objective of maximising participation, the number of tickets sold in a lot was halved with the same discount offer. Mr. *X* is in a fix regarding the number of tickets he can buy with ₹ 532. The maximum number of tickets he can purchase with this money is
(a) 14 (b) 15
(c) 16 (d) 17

34. 800 people were supposed to vote on a resolution, but 1/3rd of the people who had decided to vote for the motion were abducted. However, the opponents of the motion, through some means managed to increase their strength by 100%. The motion was then rejected by a majority, which was 50% of that by which it would have been passed if none of these changes would have occurred. How many people finally voted for the motion and against the motion?
(a) 200 (for), 400 (against)
(b) 100 (for) and 200 (against)
(c) 150 (for), 300 (against)
(d) 200 (for) and 300 (against)

35. At IIM Bangalore, 60% of the students are boys and the rest are girls. Further 15% of the boys and 7.5% of the girls are getting a fee waiver. If the number of those getting a fee waiver is 90, find the total number of students getting 50% concession if it is given that 50% of those not getting a fee waiver are eligible to get half fee concession?

36. A watch gains by 2% per hour when the temperature is in the range of 40°C–50°C and it loses at the same rate when the temperature is in the range of 20°C–30°C. However, the watch owner is fortunate since it runs on time in all other temperature ranges. On a sunny day, the temperature started soaring up from 8 a.m. in the morning at the uniform rate of 2°C per hour and sometime during the afternoon it started coming down at the same rate. Find what time will it be by the watch at 7 pm, if at 8 am the temperature was 32°C and at 4 pm, it was 40°C.
(a) 6 : 55 p.m. (b) 6 : 55 : 12 p.m.
(c) 6 : 55 : 24 p.m. (d) None of these

37. There were '*a*' 10 ₹ Notes and '*b*' 100 ₹ Notes. If there had been '*a*' ₹ 100 notes and '*b*' ₹ 10 notes the amount would have been 200% more.
Find the minimum possible value of *a* If $1 \le b \le 20$

38. In a garment shop there are four types of shirts namely *w*, *x*, *y*, *z*. There are 20% more shirts of type 'x' than type '*w'*. 20% less shirts of type '*x*' than type '*y'* and there are 30% more shirts of type '*z'* than type 'x'. If there are 156 shirts of type '*z'*, then find the total number of shirts.

39. Of the adult population in Nagpur, 45% of men and 25% of women are married. What percentage of the total population of adults is married (assume that no man marries more than one woman and vice versa)?

40. The weight of a bucket increases by 33.33% when filled with water to 50% of its capacity. Which of

these may be 50% of the weight of the bucket when it is filled with water (assume the weight of bucket and its capacity in kg to be integers)?
(a) 7 kg (b) 6 kg
(c) 5 kg (d) 8 kg

41. Pakistan scored a total of x runs in 20 overs. India tied the scores in 10% less overs. If India's average run-rate had been 50% higher the scores would have been tied 5 overs earlier. Find how many runs were scored by Pakistan.
(a) 60 (b) 20
(c) 80 (d) Cannot be determined

42. Ashish, a salesman is appointed on the basic salary of ₹ 1200 per month and the condition that for every sales of ₹ 10,000 above ₹ 10,000, he will get 50% of basic salary and 10% of the sales as a reward. This incentive scheme does not operate for the first ₹10000 of sales. What should be the value of sales if he wants to earn ₹7600 in a particular month?
(a) ₹ 60,000 (b) ₹ 50,000
(c) ₹ 40,000 (d) None of these

43. In the previous question, which of the following income cannot be achieved in a month?
(a) ₹6000
(b) ₹ 9000
(c) Both a and b
(d) Any income can be achieved

44. An organization gives its' sales staff incentives based on the value of their sales. In a particular year, despite a 5 percentage point increment on the commission from 20%, the total commission for a sales organization remained unaltered. Find the change in the volume of the sales.
(a) –10% (b) –16%
(c) –25% (d) –20%

45. In a Local election at Kanpur, the total turnout was 80% out of which 16% of the total voters on the voting list were declared invalid. Find which of the following can be the percentage votes got by the winner of the election if the candidate who came second got 20% of the total voters on the voting list. (There were only three contestants, only one winner and the total number of voters on the voters list was 20000.)
(a) 44.8% (b) 46.6%
(c) 48% (d) None of these

46. The hourly wages of Rahim are increased by 10%, whereas the weekly working hours are reduced by 10%. Find the percentage change in the weekly wages if she was getting ₹ 1000 per week for 50 hours previously.
(a) 1% (b) 4%
(c) 2% (d) None of these

47. Two numbers A and B are 20% and 28% less than a third number C. Find by what percentage is the number B less than the number A.
(a) 8% (b) 12%
(c) 10% (d) 9%

48. Price of a commodity is first increased by x% and then decreased by x%. If the new price is K/100, find the original price.
(a) $(x - 100)100/K$ (b) $(x^2 - 100^2)100/K$
(c) $(100 - x)100/K$ (d) $100K/(100^2 - x^2)$

49. The salary of Sahir is increased by ₹ 4800 and the rate of tax is decreased by 2% from 12% to 10%. The effect is such that he is now paying the same tax as before. If in both the cases, the standard tax deduction is fixed at 20% of the total income, find the increased salary?
(a) ₹ 32,800 (b) ₹ 36,800
(c) ₹ 28,000 (d) None of these

50. Seema goes to a shop to buy a radio costing ₹ 2568. The rate of sales tax is 7% and the final value is rounded off to the next higher integer. She tells the shopkeeper to reduce the price of the radio so that she has to pay ₹2568 inclusive of sales tax. Find the reduction needed in the price of the radio.
(a) ₹ 180 (b) ₹ 210
(c) ₹ 168 (d) None of these

Questions 51 and 52: Study the following table and answer the questions that follow.

Beverages	*% of Vitamin*	*% of Minerals*	*% of Micronutrients*	*Cost per 250 gram (In ₹)*
7up	12	18	30	8
Dew	15	20	10	10
Sprite	20	10	40	7

51. Which of the following beverages contains the maximum amount of vitamins?
(a) 7up worth ₹ 16
(b) Dew worth ₹ 15
(c) Sprite worth ₹ 8
(d) All the three worth ₹ 12.5 (125 grams of each)

52. Which of these is the cheapest?
(a) 200 grams of 7up + 200 grams of Dew
(b) 300 grams of Dew +100 grams of 7up
(c) 100 grams of Dew + 100 grams of 7up + 100 grams of Sprite
(d) 300 grams of Dew +100 grams of Sprite

Directions for questions 53 to 54: Three great gamblers Ajay, Biru, Chetan were playing a game of Teen-Patti (3 card flush). At the beginning of the game Ajay and Biru together had as much money as Chetan had and Ajay and Chetan together had 100% more money than Biru. At the end of the game Ajay and Biru together had 100% more

money than Chetan. Also, Ajay and Chetan together had 200% more money than Biru. If at the end of the game Biru had ₹1500 then answer the following questions.

53. How many persons have suffered a loss?
54. The percentage change of money for Ajay is:

Directions for questions 55 to 57: Mindworkzz has two offices, one in Delhi and the other in Lucknow. This year the number of employees in the Lucknow office remained the same as the previous year but the ratio of male to female employees has changed. In the Delhi office, this year the number of employees grew by 25% to 2500. Last year the ratio of male to female employees in the Delhi office was 3:1. The number of female employees in the Delhi office grew by 20% from the last year to this. The number of male employees in the Lucknow office last year equals the number of female employees in Delhi this year. The total number of employees in both the company offices grew to 3500 this year. The number of female employees in Lucknow grew up by 25% from last year to this year. Based on this information, answer the following questions.

55. What is the number of females in the Delhi office this year?
56. The percentage growth of the number of men from last year to this year in the Delhi office is
57. The difference between number of male employees and number of female employees in Lucknow and Delhi office together this year.
58. A company has 'n' employees in 2011. In 2012, 20% of the employees left the company while no one was hired. In 2013 and 2014, the number of employees again grew by 50% and 15% respectively. In 2015 the company fired 280 employees and at the end of 2015 the percentage increase in the number of employees from 2011 was found to be 10%. Find the number of employees at the end of the year 2015:
    (a) 1200 (b) 1300
    (c) 1100 (d) None of these.

Directions for Questions 59 to 60: The Food and Beverage unit of Pepsi-co India produces 1,00,000 chips packets per annum. If each packet is being sold at ₹10 and the cost of raw material is ₹ 1 per packet, the cost of manufacturing and labour is ₹ 2 per packet. The maintenance and marketing cost is ₹ 1 per packet. 10% taxes are being paid on selling price of the packet. Based on this information, answer the following questions.

59. What is the percentage profit of the company at the end of the year?
    (a) 25% (b) 50%
    (c) 33% (d) None of these.
60. If government increased taxes from 10% to 20% and cost of raw material also increased by 100%, then the percentage increase in selling price per packet of chips to maintain the same profit would be.

Space for Rough Work

LEVEL OF DIFFICULTY (III)

1. The price of raw materials has gone up by 15%, labour cost has also increased from 25% of the cost of raw material to 30% of the cost of raw material. By how much percentage should there be a reduction in the usage of raw materials so as to keep the cost same?
   (a) 17% (b) 24%
   (c) 28% (d) 25%
2. Mr. *A* is a computer programmer. He is assigned three jobs for which time allotted is in the ratio of 5 : 4 : 2 (jobs are needed to be done individually). But due to some technical snag, 10% of the time allotted for each job gets wasted. Thereafter, owing to the lack of interest, he invests only 40%, 30% and 20% of the hours of what was actually allotted to do the three jobs individually. Find how much percentage of the total time allotted is the time invested by *A*.
   (a) 38.33% (b) 39.4545%
   (c) 32.72% (d) 36.66%
3. In the Mock CAT paper at Mindworkzz, questions were asked in five sections. Out of the total students, 5% candidates cleared the cut-off in all the sections and 5% cleared none. Of the rest, 25% cleared only one section and 20% cleared four sections. If 24.5% of the entire candidates cleared two sections and 300 candidates cleared three sections, find out how many candidates appeared at the Mock CAT at Mindworkzz?
   (a) 1000 (b) 1200
   (c) 1500 (d) 2000
4. There are three galleries in a coal mine. On the first day, two galleries are operative and after some time, the third gallery is made operative. With this, the output of the mine became half as large again. What is the capacity of the second gallery as a percentage of the first, if it is given that a four-month output of the first and the third galleries was the same as the annual output of the second gallery?
   (a) 70% (b) 64%
   (c) 60% (d) 65%
5. 10% of salty sea water contained in a flask was poured out into a beaker. After this, a part of the water contained in the beaker was vapourised by heating and due to this, the percentage of salt in the beaker increased *M* times. If it is known that after the content of the beaker was poured into the flask, the percentage of salt in the flask increased by *x*%. Find the original quantity of sea water in the flask.
   (a) $\frac{9M+1\%}{M-1}$ (b) $\frac{(9M+1)x\%}{M-1}$
   (c) $\frac{9M-1x\%}{M+1}$ (d) $\frac{9M+x\%}{M+1}$
6. In an election of 3 candidates *A*, *B* and *C, A* gets 50% more votes than *B*. *A* also beats *C* by 1,80,00 votes. If it is known that *B* gets 5 percentage point more votes than *C*, find the number of voters on the voting list (given 90% of the voters on the voting list voted and no votes were illegal)
   (a) 72,000 (b) 81,000
   (c) 90,000 (d) 1,00,000
7. A clock is set right at 12 noon on Monday. It loses 1/2% on the correct time in the first week but gains 1/4% on the true time during the second week. The time shown on Monday after two weeks will be
   (a) 12 : 25 : 12 (b) 11 : 34 : 48
   (c) 12 : 50 : 24 (d) 12 : 24 : 16
8. The petrol prices shot up by 7% as a result of the hike in the price of crudes. The price of petrol before the hike was ₹ 28 per litre. Vawal travels 2400 kilometres every month and his car gives a mileage of 18 kilometres to a litre. Find the increase in the expenditure that Vawal has to incur due to the increase in the price of petrol (to the nearest rupee)?
   (a) ₹ 270 (b) ₹ 262
   (c) ₹ 276 (d) ₹ 272
9. For Question 8, by how many kilometres should Vawal reduce his travel if he wants to maintain his expenditure at the previous level (prior to the price increase)?
   (a) 157 km (b) 137 km
   (c) 168 km (d) 180 km
10. In Question 8, if Vawal wants to limit the increase in expenditure to ₹ 200, what strategy should he adopt with respect to his travel?
    (a) Reduce travel to 2350 kilometres
    (b) Reduce travel to 2340 kilometres
    (c) Reduce travel to 2360 kilometres
    (d) None of these
11. A shopkeeper announces a discount scheme as follows: for every purchase of ₹ 3000 to ₹ 6000, the customer gets a 15% discount or a ticket that entitles him to get a 7% discount on a further purchase of goods costing more than ₹ 6000. The customer, how-

ever, would have the option of reselling his right to the shopkeeper at 4% of his initial purchase value (as per the right refers to the 7% discount ticket). In an enthusiastic response to the scheme, 10 people purchase goods worth ₹ 4000 each. Find the maximum. Possible revenue for the shopkeeper.

(a) ₹ 38,400 (b) ₹ 38,000
(c) ₹ 39,400 (d) ₹ 39,000

12. For question 11, find the maximum possible discount that the shopkeeper would have to offer to the customer.

(a) ₹ 1600 (b) ₹ 2000
(c) ₹ 6000 (d) ₹ 4000

Directions for Questions 13 to 16: Read the following and answer the questions that follow.

Two friends Shayam and Kailash own two versions of a car. Shayam owns the diesel version of the car, while Kailash owns the petrol version.

Kailash's car gives an average that is 20% higher than Shayam's (in terms of litres per kilometre). It is known that petrol costs 60% of its price higher than diesel.

13. The ratio of the cost per kilometre of Kailash's car to Shayam's car is

(a) 3 : 1 (b) 1 : 3
(c) 1.92 : 1 (d) 2 : 1

14. If Shayam's car gives an average of 20 km per litre, then the difference in the cost of travel per kilometre between the two cars is

(a) ₹ 4.3 (b) ₹ 3.5
(c) ₹ 2.5 (d) Cannot be determined

15. For Question 14, the ratio of the cost per kilometre of Shayam's travel to Kailash's travel is

(a) 3 : 1 (b) 1 : 3
(c) 1 : 1.92 (d) 2 : 1

16. If diesel costs ₹ 12.5 per litre, then the difference in the cost of travel per kilometre between Kailash's and Shayam's is (assume an average of 20 km per litre for Shayam's car and also assume that petrol is 50% of its own price higher than diesel)

(a) ₹ 1.75 (b) ₹ 0.875
(c) ₹ 1.25 (d) ₹ 1.125

Directions for Questions 17 to 23: Read the following and answer the questions that follow.

In the island of Hoola Boola Moola, the inhabitants have a strange process of calculating their average incomes and expenditures. According to an old legend prevalent on that island, the average monthly income had to be calculated on the basis of 14 months in a calendar year while the average monthly expenditure was to be calculated on the basis of 9 months per year. This would lead to people having an underestimation of their savings since there would be an underestimation of the income and an overestimation of the expenditure per month.

17. Mr. Boogle Woogle comes back from the USSR and convinces his community comprising 273 families to start calculating the average income and the average expenditure on the basis of 12 months per calendars year. Now if it is known that the average estimated income in his community is (according to the old system) 87 moolahs per month, then what will be the percentage change in the savings of the community of Mr. Boogle Woogle (assume that there is no other change)?

(a) 12.33% (b) 22.22%
(c) 31.31% (d) Cannot be determined

18. For Question 17, if it is known that the average estimated monthly expenditure is 19 moolahs per month for the island of Hoola Boola Moola, then what will be the percentage change in the estimated savings of the community?

(a) 32.42% (b) 38.05%
(c) 25.23% (d) Cannot be determined

19. For Question 18, if it is known that the average estimated monthly expenditure was 22 moolahs per month for the community of Boogle Woogle (having 273 families), then what will be the percentage change in the estimated savings of the community?

(a) 30.77% (b) 28.18%
(c) 25.23% (d) 25.73%

20. For Question 19, what will be the percentage change in the estimated average income of the community (calculated on the basis of the new estimated average)?

(a) 14.28% increase (b) 14.28% decrease
(c) 16.66% increase (d) 16.66% decrease

21. If the finance minister of the island Mr. Bhola Ram declares that henceforth the average monthly income has to be estimated on the basis of 12 months per year while the average monthly expenditure is to be estimated on the basis of 11 months to the year, what will happen to the savings in the economy of Hoola Boola Moola?

(a) Increase (b) Decrease
(c) Remain constant (d) Either (b) or (c)

22. For Question 21, what will be the percentage change in savings?

(a) 3.1% (b) 1.52%
(c) 2.5% (d) Cannot be determined

23. For Question 22, what will be the percentage change in the estimated monthly expenditure?

(a) 22.22% decrease (b) 22.22% increase
(c) 18.18% decrease (d) 18.18% increase

24. Abhimanyu Banerjee has 72% vision in his left eye and 68% vision in his right eye. On corrective therapy, he starts wearing contact lenses, which augment his vision by 15% in the left eye and 11% in the right eye. Find out the percentage of normal vision that he possesses after corrective therapy. (Assume that a person's eyesight is a multiplicative construct of the eyesight's of his left and right eyes)
    (a) 52.5% (b) 62.5%
    (c) 72.5% (d) 68.6%
25. A shopkeeper gives 3 consecutive discounts of 10%, 15% and 15% after which he sells his goods at a percentage profit of 30.05% on the C.P. Find the value of the percentage profit that the shopkeeper would have earned if he had given discounts of 10% and 15% only.
    (a) 53% (b) 62.5%
    (c) 72.5% (d) 68.6%
26. If the third discount in Question 25 was ₹ 2,29,50, then find the original marked price of the item.
    (a) ₹ 1,00,000 (b) ₹ 1,25,000
    (c) ₹ 2,00,000 (d) ₹ 2,50,000
27. Krishna Iyer, a motorist uses 24% of his fuel in covering the first 20% of his total journey (in city driving conditions). If he knows that he has to cover another 25% of his total journey in city driving conditions, what should be the minimum percentage increase in the fuel efficiency for non-city driving over the city driving fuel efficiency, so that he is just able to cover his entire journey without having to refuel? (Approximately)
    (a) 39.2% (b) 43.5%
    (c) 45.6% (d) 41.2%

Directions for Questions 28 to 30: Read the following and answer the questions that follow the BSNL announced a cut in the STD rates on 27 December 2011. The new rates and slabs are given in the table below and are to be implemented from 14 January 2012.

Slab Details

Distance	*Rates (₹/min)*			
	Peak Rates		*Off Peak*	
	Old	*New*	*Old*	*New*
50–200	4.8	2.4	1.2	1.2
200–500	11.6	4.8	3.0	2.4
500–1000	17.56	9.00	4.5	4.5
1000+	17.56	9.00	6.0	4.5

28. The maximum percentage reduction in costs will be experienced for calls over which of the following distances?
    (a) 50–200 (b) 500–1000
    (c) 1000+ (d) 200–500
29. The percentage difference in the cost of a set of telephone calls made on the 13th and 14th January having durations of 4 minutes over a distance of 350 km, 3 minutes for a distance of 700 km and 3 minutes for a distance of 1050 km is (if all the three calls are made in peak times)
    (a) 51.2% (b) 51.76%
    (c) 59.8 % (d) cannot be determined
30. If one of the three calls in Question 29 were made in an off peak time on both days, then the percentage reduction in the total cost of the calls between 13th and 14th January will
    (a) definitely reduce
    (b) definitely increase
    (c) will depend on which particular call was made in an off peak time
    (d) cannot be determined

Directions for Questions 31 to 35: Read the following caselet and answer the questions that follow.

The circulation of the *Deccan Emerald* newspaper is 3,73,000 copies, while its closest competitors are *The Times of Hindustan* and *India's Times,* which sell 2,47,000 and 20% more than that respectively (rounded off to the higher thousand). All the newspapers cost ₹ 2 each. The hawker's commissions offered by the three papers are 20%, 25% and 30%, respectively (these commissions are calculated on the sale price of the newspaper). Also, it is known that newspapers earn primarily through sales and advertising.

31. Taking the base as the net revenue of *Deccan Emerald*, the percentage difference of the net revenue (revenues — commission disbursed to hawkers) between *Deccan Emerald* and *India's Times* is
    (a) 24.62% (b) 30.32%
    (c) 26.28% (d) None of these
32. The ratio of the percentage difference in the total net revenue between *Deccan Emerald* and *India's Times* to the percentage difference in the total revenue between *Deccan Emerald* and *India's Times* is
    (a) 1.488 (b) 0.3727
    (c) 0.6720 (d) Cannot be determined
33. If the cost of printing the newspaper is ₹ 8, 7.5 and 7, respectively per day for *Deccan Emerald*, *Times of Hindustan* and *India's Times* respectively and on any day the available advertising space in the *Deccan Emerald* newspaper is 800 cc (column centimetres) and the advertising rate for *Deccan Emerald* is ₹ 3000 per cc then the percentage of the advertising space that must be utilised to ensure the full recovery of the day's cost for *Deccan Emerald* is

(a) 95.83% (b) 99.46%
(c) 97.28% (d) Cannot be determined

34. Based on the data in the previous question and the additional information that the space availability in *India's Times* is 1000 cc and that in the *Times of Hindustan* is 1100 cc, find the percentage point difference in the percentage of advertising space to be utilised in *India's Times* and that which must be utilised in *Times of Hindustan* so that both newspapers just break even.
(a) 4.5 (b) 5.2
(c) 10 (d) Cannot be determined

35. For the data in Questions 33 and 34 if it is known that the advertising rate in *Times of Hindustan* is ₹ 1800 per cc and that in the *India's Times* is ₹ 2100 per cc, then what is the percentage point difference in the percentage of advertising space to be utilised by *Times of Hindustan* and *India's Times* so that both of them are just able to break even?
(a) 4.18 (b) 5.6
(c) 4.09 (d) Cannot be determined

36. On a train journey, there are 5 kinds of tickets AC I, AC II, AC III, 3-tier, and general. The relationship between the rates of the tickets for the Eurail is:
AC II is 20% higher than AC III and AC I is 70% of AC III's value higher than the AC II ticket's value. The 3-tier ticket is 25% of the AC I's ticket cost and the general ticket is 1/3 the price of the AC II ticket. The AC II ticket costs 780 euros between London and Paris. The difference in the rates of 3 tier and general ticket is
(a) 41.25 euros (b) 55.8 euros
(c) 48.75 euros (d) 52.75 euros

37. For the above question, the total cost of one ticket of each class will be
(a) 3233.75 (b) 3533.75
(c) 4233.75 (d) 3733.75

Directions for Questions 38 to 40: Read the following and answer the questions that follow.

A Eurailexpress train has 2 AC I bogeys having 24 berths each, 3 AC II bogeys having 45 berths each, 2 AC III bogeys having 64 berths each and 12 3-tier bogeys having 64 berths each. There are no general bogeys in the train. If 200 euros is the cost of an AC 3-tier berth from London to Glasgow, answer the following questions:

38. The value of the maximum revenues possible from the Eurailexpress between Glasgow to London and back is
(a) 3,15,600 (b) 2,44,800
(c) 2,98,400 (d) 2,96,760

39. For a Eurailexpress journey from London to Glasgow, 80% of the train was uniformly booked across classes. What percentage of the total revenues came out of the sales of 3-tier tickets?
(a) 44.23% (b) 52.18%
(c) 39.23% (d) 48.9%

40. If bookings for the above question was 40% in AC I, 70% in AC II, 60% in AC III and 55% in 3-tier, then what will happen to the percentage contribution of 3-tier to the total revenues on the train journey?
(a) Decrease (b) Increase
(c) Remain constant (d) Cannot be determined

41. A 14.4 kg gas cylinder runs for 104 hours when the smaller burner on the gas stove is fully opened while it runs for 80 hours when the larger burner on the gas stove is fully opened. Which of these values are the closest to the percentage difference in the usage of gas per hour, between the smaller and the larger burner?
(a) 26.23% (b) 30%
(c) 32.23% (d) 23.07%

42. For Question 41, assume that the rate of gas dispersal is directly proportional to the degree of opening of the aperture of the gas. If we are given that the smaller burner is open to 60% of its maximum and the larger burner is open to 50% of its maximum, the percentage decrease in the percentage difference between the smaller burner and the larger burner (in terms of hours per kg) is
(a) 72.22% (b) 73.33%
(c) 66.66% (d) None of these

43. Hursh Sarma has a salary of ₹10,800 per month. In the first month of the year, he spends 40% of his income on food, 50% on clothing and saves 11.11% of what he has spent. In the next two months, he saves 9.09% of what he has spent (spending 38.33% of his income on food). In the fourth month, he gets an increment of 11.11% on his salary and spends every single paise on celebrating his raise. But from the fifth month onwards good sense prevails on him and he saves 12.5%, 15%, 20%, 10%, 8.33%, 12.5%, 15% and 20% on his new income per month. The ratio between the sum of the savings for the two months having the highest savings to the sum of the savings for the two months having the lowest savings is
(a) 2.6666 (b) 5.3333
(c) 8 (d) None of these

44. In an economy, the rate of savings has a relation to the investment in industry for that year and the following three years. The relation is such that a percentage point change in investment in industry for that year has a relation to the total production output in the next 4 years. A 2 percentage point increase in the savings rate in a year, increases the

investment in the industry of the economy by 1%. Further, the rate of investment also goes up by 0.5% in the next year, by 0.25% in the second year and again by 0.25% in the third year. Also assume that the investment in an economy is only dependent on the patterns of savings in the previous 3 years in the economy. Also, the percentage change in the investment in a particular year is got by adding the effect of the previous three years savings pattern.

In fiscal 2008–09, the rate of savings in the Indian economy is 25% while that in the Pakistani economy, is 20%. This has remained constant since 2003. In 2009–10 the savings rate in the Indian economy suddenly rises by 5 percentage points to 30% while that in the Pakistani economy rises by 2 percentage points to 22%. It is further known that the value of the investment in the industry in the 2 countries was 2 million dollars and 1.8 million dollars respectively (for the previous year). The percentage difference between the investment in the Pakistani economy to the investment in the Indian economy in 2010–11 will be (if it is known that there is no change in the savings rate in 2010–11):

(a) 13.6% (b) 15.12%
(c) 11.18% (d) 12.2%

Directions for Questions 45 to 48: In an economy the rate of savings has a relation to the investment in industry for that year and for the following three years and the investment in industry for that year has a relation to the total production output in the next 4 years.

45. For Question 44, if there is no additional change in the savings rate until 2011–12, then the percentage difference in the value of the investment in India to the investment in Pakistan in 2011–12 (as a percentage of the investment in India) is
    (a) 11.28% (b) 14.18%
    (c) 14.02% (d) None of these
46. If the change in production is directly related to the change in investment in the previous year, and if the data of the savings rate change for the previous 2 questions are to be assumed true, then for which year did the difference between the production in the Indian economy and the production in the Pakistani economy show the maximum percentage change?
    (a) 2010–11 (b) 2011–12
    (c) 2012–13 (d) Cannot be determined
47. For Question 44, it is known that the percentage change in investment in a year leads to a corresponding equal percentage increase in the manufacturing production in the next year. Further, if the growth rate of manufacturing production is 27% of the GDP growth rate of the country, then what is the GDP growth rate of India in 2010–11?
    (a) 8.52% (b) 7.28%
    (c) 9.26% (d) None of these
48. The Euro was ushered in on the Ist January 2002 and the old currencies of the European economies were exchanged into Euros. In France, 4 Francs were exchanged for 1 Euro while in Germany 5 Deutsche Marks were exchanged for 1 Euro and in Italy 3 Liras were exchanged for 1 Euro. The exchange rate for Moolahs, the official currency of Hoola Boola Moola, was set at 185 Moolahs per Euro. Dr. Krishna Iyer, an NRI doctor based in Europe, had a practice across each of these three countries and he sends back money orders to his native island of Hoola Boola Moola. The existing exchange rate of Moolahs with the above-mentioned currencies was 51 moolahs per Franc, 36 Moolahs per Deutsche Mark and 70 moolahs per Lira. If Dr. Iyer has this information, then what should he do with his currency holdings in these three currencies on the 31st December 2001 so that he maximises his moolah value on the Ist of January 2002. (Assume no arbitrage possibilities between the three currencies)
    (a) Change to Francs
    (b) Change to Deutsche Marks
    (c) Change to Liras
    (d) Remain indifferent
49. For the above questions, the exchange rates for the three currencies with respect to a dollar was: 2$ per Lira, 1.5$ per Franc and 1.4 dollar per Deutshce Mark. If Dr. Iyer has 100 liras, 100 Deutsche Marks and 100 Francs on 31st December 2001, the maximum percentage change he can achieve in his net holding in terms of dollars due to the arbitrage created by the Euro conversion could be
    (a) 17.23% (b) 7.33%
    (c) 11.2% (d) Cannot be determined
50. For Question 48, which one of the following will allow the calculation of all possibilities of percentage change in terms of moolah value of Dr. Iyer's portfolio? (That is possible through currency conversions.)
    (a) Dr. Iyer's money holding in all three currencies
    (b) Dr. Iyer's monthly earnings in all three currencies
    (c) The inter-currency conversion rates between Liras, Deutsche Mark and Francs
    (d) Both (a) and (c)

ANSWER KEY

Level of Difficulty (I)

1. (a)	2. (a)	3. (a)	4. (d)
5. (d)	6. (d)	7. (d)	8. (d)
9. 30	10. 1: 1	11. (a)	12. (d)
13. (b)	14. (d)	15. (a)	16. (c)
17. (d)	18. (d)	19. (a)	20. (c)
21. (c)	22. (d)	23. (d)	24. (d)
25. (c)	26. (d)	27. (b)	28. (b)
29. (d)	30. (a)	31. (a)	32. (c)
33. (a)	34. (c)	35. (a)	36. (d)
37. (b)	38. (a)	39. (a)	40. (a)
41. (d)	42. (c)	43. (b)	44. (b)
45. (b)	46. (b)	47. (b)	48. (c)
49. (d)	50. (a)	51. (b)	52. (a)
53. 50%	54. 8800	55. 96%	56. (a)
57. –40%	58. –16.36%	59. 57.89%	60. 48%

Level of Difficulty (II)

1. (c)	2. (b)	3. (c)	4. (a)
5. (c)	6. (b)	7. (b)	8. (c)
9. (a)	10. 265.6	11. (b)	12. (a)
13. (d)	14. (b)	15. (a)	16. (c)
17. (c)	18. (d)	19. (a)	20. (b)
21. (c)	22. (d)	23. (c)	24. (d)
25. (c)	26. (b)	27. (d)	28. (c)
29. (d)	30. (d)	31. (c)	32. (d)
33. (c)	34. (a)	35. 330	36. (d)
37. 29	38. 526	39. 32.14	40. (c)
41. (d)	42. (b)	43. (b)	44. (d)
45. (d)	46. (a)	47. (c)	48. (d)
49. (d)	50. (a)	51. (a)	52. (c)
53. 2	54. 150	55. 600	
56. 26.67%	57. 1300	58. (c)	59. (b)
60. 25%			

Level of Difficulty (III)

1. (a)	2. (c)	3. (b)	4. (c)
5. (b)	6. (d)	7. (a)	8. (b)
9. (a)	10. (d)	11. (a)	12. (c)
13. (a)	14. (d)	15. (a)	16. (b)
17. (d)	18. (d)	19. (a)	20. (c)
21. (a)	22. (d)	23. (c)	24. (b)
25. (a)	26. (c)	27. (b)	28. (d)
29. (b)	30. (a)	31. (b)	32. (a)
33. (b)	34. (c)	35. (b)	36. (c)
37. (a)	38. (c)	39. (a)	40. (a)
41. (b)	42. (a)	43. (b)	44. (a)
45. (c)	46. (d)	47. (c)	48. (b)
49. (d)	50. (d)		

Hints

Level of Difficulty (III)

1. Assume initial raw material price to be 100. This means that the initial labour cost is 25. Hence the net cost is 125. Now, since there is a 15% increment in raw material cost and the labour cost has gone up to 30% of the raw material cost, it is clear that the new total expenditure is 115*1.3 = 149.5. Reduce the cost to 125 by reducing the usage of raw materials used.
2. Assume that 50, 40 and 20 hours are available. There is no need to use 10% waste of time in this question.
4. Half as large again means 1.5 times (or an addition of 50%).
5. Assume values for M and x and solve through options.
6. $A = 1.5\ B$, $A - C = 180000$ and $B = 1.05\ C$. Solve to get A, B and C. Also, $A + B + C = 90\%$ of total voters on voting list. This will give you the answer. Ideally solve this question through options.
7. Clock loses 0.5% of 168 hours in the first week and gains 0.25% of 168 hours in the second week. Hence, net loss is 0.25% of 168 hours.
8. Vawal uses 133.33 litres of petrol every month, while the price of petrol has gone up by ₹ 1.96. Hence, the increase in expenditure = 133.33 * 1.96 = ₹ 261 approximately.
11. Maximum revenue for the shopkeeper will occur when the minimum discount offer is used by the customer. This level is 4%.
12. This is the case of maximum discounts.

Hints for Questions 13–16

	Diesel Shyam	Petrol Kailash
Average (in litre per km)	x	$1.2x$
Cost of Fuel (in ₹/litre)	$0.4\ p$	p

13. Average in litre per kilometre multiplied by the Cost of fuel in ₹/litre will give the required cost per kilometre.
14. Shyam's car gives 20 km/litre means 0.05 litres per kilometre then Kailash's car gives 0.06 litre/km. However, since we do not know the price of petrol or diesel we cannot find out the difference in the cost of travel.
15. This question is the opposite of question 13.
16. Cost of petrol is ₹ 25 per litre. Cost per kilometre for Shyam = 12.5×0.05

    Also, cost per kilometre for Kailash = 25×0.06

Hints for Questions 17–23

Estimated average savings

$$= \frac{\text{Annual Income}}{14} - \frac{\text{Annual Expenditure}}{9}$$

17. The value will depend on the values of annual expenditure which is not available.
18. Average estimated monthly expenditure is given for the island of Hoola Boola Moola and not for Mr. Boogle Woogle's community.
19. Original estimated savings = 87 – 22 = 65 Moolahs.
    New estimated savings = 1218/12 – 198/12 = 85.
24. $0.72 \times 1.15 \times 0.68 \times 1.11$.
25. Solve through options: A 15% reduction on the correct answer will give a profit of 30.05%.
    Option (a) is correct.
26. The last discount being 22,950, it means that the value prior to this 15% discount must have been 1,53,000 checking with options:

    $200{,}000 \xrightarrow{15\%\downarrow} 17{,}000 \xrightarrow{10\%\downarrow} 1{,}53{,}000.$

    Hence option (c) is correct.
27. For 45% of the journey in city driving conditions, 54% of the fuel is consumed.
    Hence, for the remaining 55% journey, 46% fuel is left.
    Required increase in fuel efficiency

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

28. The maximum percentage reduction in peak rates is for the 200 – 500 category.
29. $$\frac{(4\times11.6+3\times17.56+3\times17.56)-(4\times4.8+3\times9+3\times9)}{4\times11.6+3\times17.56+3\times17.56}$$
33. Loss to be made up everyday = 373000(8 – 1.60)
    $= 6.4 \times 373000$.
    No. of cc required to be sold = $\frac{373000 \times 6.4}{3000}$
34. Advertising rates have not been mentioned. Hence, we cannot solve the question.

36–40. The ticket cost are:
    AC III → 100 (assume), AC – II → 120,
    AC I → 190, 3 Tier → 47.5, General → 40.
    Also, AC – II = 780 Euros for a London – Paris journey
36. $(47.5 - 40) \times 6.5 = 48.75$
37. $(100 + 120 + 190 + 47.5 + 40) \times 6.5$.
38. Maximum revenues on a return journey means 100% bookings both ways.
39. $$\frac{\text{Revenues from 3-Tier}}{\text{Total Revenues}} \times 100$$
41. $$\frac{\frac{14.4}{80} - \frac{14.4}{104}}{\frac{14.4}{104}} = \frac{104-80}{80} = 30\%$$
42. Original percentage difference = 30%
    At 60% aperture opening the smaller gas will last $\frac{104}{0.6} = 173.33$ hours.
    Similarly, the larger gas will last $\frac{80}{0.5} = 160$ hours.
    Thus, the smaller gas lasts $\frac{173.33-160}{173.33} \times 100 =$ 8.33% more than the larger gas.
    Then, required answer = $\frac{30-8.33}{30} \times 100 = 72.22\%$
44. The 5% point increase in savings rate will account for a 2.5% increase in investment in 2005–06 and a further 1.25% increase in investment in 2006–07.
    Thus, Indian investment is 2006–07 = 2 million × 1.025 × 1.0125 similarly, calculate for Pakistan.
45. Use the same process as for the previous question.
46. Cannot be determined since we do not know the initial values of the production output.
47. Since there is a 2.5% increase in investment in 2005–06, there will be a 2.5% increase in manufacturing production is 2006–07.
    Then, GDP growth rate = $\frac{2.5}{0.27} = 9.26\%$.

Solutions and Shortcuts

Level of Difficulty (I)

1. 12(4/15)% = 184/15%. As a fraction, the value = 184/(15 × 100) = 46/375
2. 10% of 20% of 25% of 100 = $\frac{10}{100} \times \frac{20}{100} \times \frac{25}{100} \times 100 = 0.50$
3. It can be clearly seen that 40% of 400 = 160 is the highest number.
4. $0.30N = 300 = > 1000$. Thus, $0.50 \times 1000 = 500$.
5. 25% of x = 30% of 5000 or $0.25x = 1500 = 6000$
6. $(30/100) \times (a/100) \times (b) = (25/100) \times (b/100) \times (c)$
   $= 30a = 25c$, $c = 1.2a$
7. Check the options. If you check with Option d = 90, you get → 108 – 20% of 90 = 108 – 18 = 90. This matches the given requirement and hence Option (d) is the correct answer.
8. B + 40% of A = 125% of B
   40% of A = 25% of B.
   i.e. $0.4A = 0.25B$
   $A/B = 5/8$
   Apparently it seems that B is bigger, but if you consider A and B to be negative the opposite would be true.
   Hence, option (d) is correct.
9. Let their marks be $(x + 10)$ and x.
   Then $\frac{x+10}{2x+10} \times 100 = 60$

$x = 20$

Hence $(x + 10) = 30$.

10. $0.05A + 0.1B = \frac{1}{2}(0.2A + 0.1B)$

$0.05A = 0.05B$

$A : B = 1 : 1$

11. The following PCG will give the answer:

$$100 \xrightarrow{50\%} 150 \xrightarrow{33.33\%} 100$$

Hence, the percentage reduction required is 33.33% (50/150).

12. 100 ------ → 150 ------- →120.

The reduction from 150 to 120 is 20% and hence, it means that he needs to reduce his consumption by 20%.

13. $\underset{(100)}{\text{Shankar}} \xrightarrow{50\% \text{ more}} \underset{(150)}{\text{Ashok}} \xleftarrow{20\% \text{ more}} \underset{(125)}{\text{Bishnu}}$

Required percentage = $\frac{25}{100} \times 100 = 25\%$

14. Total votes = 12000. Valid votes = 85% of 12000 = 10200. Chaman gets 80% of 10200 votes = 8160 votes and Dhande would get 10200 – 8160 = 2040 Votes.

15. If Shyam has inadvertently increased his height by 25% the correction he would need to make to go back to his original height would be to reduce the stated height by 20%.

16. Let Raunak's height be H. Then, $H \times 1.15 = 345$, $H = 345/1.15 = 300$.

17. Let the number be *100*. Then, 200 should be the correct outcome. But instead the value got is 50. Change in value = 200 – 50 = 150. The percentage change in the value = 150 × 100/200 = 75%. Alternately, you could think of this as the number being 'x' and the required result being 2x and the derived result being 0.5x. Hence, the percentage change in the result is 1.5x × 100/2x. Clearly, the value would be 75%. (Note: In this case, the percentage change in the answer does not depend on the value of 'x').

18. The percentage difference would be given by thinking of the percentage change between two numbers: $(x – 10)$ to $(x + 10)$ ['What he wanted to get' to 'what he got by mistake'].

The value of the percentage difference in this case depends on the value of x. Hence, this cannot be answered. Option (d) is correct.

19. From the first statement we get that out of 100 litres of the mixture, 25 litres must be milk. Since, we are adding water to this and keeping the milk constant, it is quite evident that 25 litres of milk should correspond to 20% of the total mixture. Thus, the amount in the total mixture must be 125, which means we need to add 25 litres of water to make 100 litres of the mixture.

20. Let the area of the land is 100 square units. On increasing the length of the land by 20% the area will get increased by 20%. Similarly on increasing the breadth by 30% the area would get increased by 30%. The answer can be thought on the following percentage change graphic (PCG):

$$100 \xrightarrow[\substack{+20\\ \text{Effect of length}\\ \text{increase}}]{20\% \text{ increases}} 120 \xrightarrow[\substack{+36\\ \text{Effect of breadth}\\ \text{increase}}]{30\% \text{ increases}} 156$$

Hence, the required answer is 56%

21. The area of a triangle depends on the product: base × height.

Since, the height increases by 30% and the area has to increase by 90% overall, the following PCG will give the answer. Let 100 be the original area.

$$100 \xrightarrow[\substack{+30\\ \text{Effect of increase}\\ \text{in base}}]{30\% \text{ increase}} 130 \xrightarrow[\text{Effect of increase in height}]{} 190$$

The required answer will be $\frac{60}{130} \times 100 = 46.15\%$

22. The volume goes up by:

$$100 \xrightarrow[\substack{+10\\ \text{Effect of increase}\\ \text{in length}}]{} 110 \xrightarrow[\substack{+22\\ \text{Effect of increase}\\ \text{in breadth}}]{}$$

$$132 \xrightarrow[\substack{+66\\ \text{Effect of increase}\\ \text{in height}}]{} 198$$

Hence, 98%.

23. Let the salary of Vivek and Ajay be ₹ 100 and ₹ 110 respectively.

Required percentage = $\frac{110 - 100}{110} \times 100 = 9.09\%$

24. $100 \xrightarrow[\text{Effect of price}]{50\% \text{ drop}} 50 \xrightarrow[+100 \text{ Effect of consumption}]{} 150$

We have assumed initial expenditure to be 100, in the above figure. Then the final expenditure is 150. The percentage change in consumption can be seen to be $\frac{150 - 50}{50} \times 100 = 200\%$

25. If the price of wheat has fallen by 20% the quantity would be increased by 25% (if we keep the expenditure constant.)

This means that 100 kgs would increase by 25% to 125 kgs.

26. The winning candidate gets 60% of the votes cast and the losing candidate gets 40% of the votes cast. Thus, the gap between the two is 20% of the votes cast = 200 votes. Thus, the votes cast = 1000. Since, this is 66.67% of the number of voters on the voting list, the number of people on the voting list = 1500.

27. $500000 \xrightarrow{20\% \text{ increase}} 600000 \xrightarrow{20\% \text{ increase}} 720000$

28. $50,000 \xrightarrow{20\% \text{ increase}} 60,000 \xrightarrow{10\% \text{ decrease}} 54,000 \xrightarrow{30\% \text{ increase}} 70,200$

29. His investments are 4000, 16,000 and 20,000 respectively. His dividends are: 400, 2400 and 5000, which means that his total dividend = ₹7800.

30. Sahir obtained 80 marks, hence Madan obtained = 80 × 1.2 = 96. Ravi = 96/0.6 = 160. 160 out of 200 means a percentage of 80%.

31. 10% students got a final score of 20. 20% students got a final score of 30 (inclusive of grace marks.) 50 % students got a final score of 50.
Hence, average score of the class (Note: For the class average, we would not take into account the students who were absent)
$$= \frac{10 \times 20 + 20 \times 30 + 50 \times 50}{80} = 41.25$$

32. If his income is 100, his household expenditure is 20, expenditure on food is 24, on clothes it is 5.6. Thus he saves: 100 – 20 – 24 – 5.6 = 50.4% of his income. Since, this is given to us as 10080, the total income would be: $\frac{100}{50.4} \times 10080 = 20000$

33. The only logic for this question is that Harish's salary would be more than Bhuvan's salary. Thus, only option (a) is possible for Harish's salary.

34. By using options, you can easily see that option (c) satisfies.
2000 females and 4000 males.
Increase = 2000 × 0.2 + 4000 × 0.1 = 800

35. If we take Raju as 100, we will get Bharat as 125 and Charan as 83.33. This means Charan's goods are priced at 2/3rd Bharat's and hence he sells his goods 33.33% cheaper than Bharat.

36. Let the percentage of the total votes secured by Party SJP be x% Then the percentage of total votes secured by Party SJD = $(x - 12)$% As there are only two parties contesting in the election, the sum total of the votes secured by the two parties should total up to 100%, i.e., $x + x - 12 = 100 \rightarrow 2x - 12 = 100$ or $2x = 112$ or $x = 56\%$. If Party SJP got 56% of the votes, then Party SJD got (56 – 12) = 44% of the total votes. 44% of the total votes = 132,000, i.e.,
$$\frac{44}{100} \times T = 132,000$$
$$T = \frac{132,000}{44} \times 100 = 300,000$$
The margin by which Party SJD lost the election = 12% of the total votes = 12% of 300,000 = 36,000.

37. 1 Bottle = $0.2x$ metres
? Bottles = 1000 metres
Using unitary method, we get the number of bottles = $1000/0.2x = 5000/x$ Bottles.

38. If Ashok's salary = 100, then Vinay's salary = 175. Ashok's new salary = 125, Vinay's new salary = 175 × 1.4 = 245. Percentage difference between Vinay's salary and Ashok's salary now = 120 × 100/125 = 96%.

39. Let the second row has 100 students. Then, the first row would contain 120 students and the third row would contain 80 students. The total number of students would be 100 + 120 + 80 = 300. But this number is given as 300. Thus, the first row would contain 120 students.

40. Since the only copper contained in the ore is 50% of 20%, the net copper percentage would be 10%. Thus, 10 kg should be 10% of the ore = 10/0.1 = 100 kg.

41. The data is insufficient since the number of matches to be played by Australia this year is not given. (You cannot assume that they will play 80 matches.)

42. Start of the 4th year, means end of the third year too. The following PCG diagram gives us the answer:
$400000 \xrightarrow{20\% \text{ increase}} 480000 \xrightarrow{20\% \text{ increase}} 576000 \xrightarrow{20\% \text{ increase}} 691200$

43. Total people present = 200 + 100 + 400 = 700.
Indians = 0.1 × 200 + 0.2 × 100 + 0.3 × 400 = 160 = 22.85% of the population. Thus, 77.15 % or 77% of the people were not Indians.

44. Price of a table after increase 10% = 3000+ 300 = 3300. Price of a chair after 20% increase = 1000+ 20% of 1000 = 1200. Cost of 10 tables and 20 chairs = 10 × 3300 + 20 × 1200 = ₹57000.

45. (100 × 0.7 × 0.3)% = 42,000 kg
21% = 42,000 kg. Thus, the total quantity of hematite mined = 2,00,000 kg.

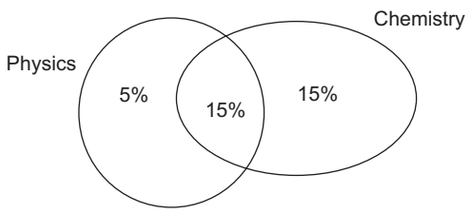
46. The total cost for a year = 2,00,000 + 6% of 2,00,000 + 12000 = 2,00,000 + 24000 = 2,24,000
To get a return of 20% he must earn: 2,24,000 × 0.20 = 44,800 in twelve months.
Hence, the monthly rent should be 44800/12 = 3733.33.

47. The sales price of the first trousers is $\frac{8}{7} \times 42 =$ ₹48.
Hence, I am being offered a discount of ₹ 6 on a price of ₹ 48 → a 12.5% discount.
The sales price of the second trousers is 7/6 × 36 = ₹ 42.
Hence, I am being offered a discount of ₹ 6 on ₹ 42 → a 14.28% discount. Hence, the second trouser is a better bargain.

48. 72% must have voted for Modi and 16% for Advani. Since, Modi got 216000 votes, 72% = 216000.1%

= 3000. Hence, total number of votes 88 × 3000 = 264000.

49. The following Venn diagram would solve this problem:
20% failed in Physics, 30% failed in Chemistry and 15% failed in both.



We can clearly see from the above figure that 35% of the people failed in at least one subject or 65% passed in both subjects. Since this value is given as 3250, we get that the total number of students who appeared for the exam is 5,000.

50. Out of 100, he spends 25 on house rent, 15 on children's education and 10 on clothes. Thus, he is left with 100 – 25 – 15 – 10 = 50% of his income. Since, he is left with ₹ 20000, his income must be ₹40000.

51. $100 \xrightarrow[\text{Effect of increases in sales of tickets}]{\text{25\% increase}} 125 \xrightarrow[\text{Effect of reduction in ticket price}]{} 80$

From the PCG figure, we get that the deduction in the ticket price = $\frac{125-80}{125}\times 100 = \frac{45}{125}\times 100 = 36\%$

Thus there is a drop of 36% of 1000 = ₹ 360

52. A C % increase in income means the new income is A (1 + C/100) while a D% increase in expenditure means that the new expenditure would be X(1 + D/100). Thus, the new savings = A(1 + C/100) – X(1 + D/100)
53. In 2001, YAHAMA = 10%, Spendor = 40% and hence Passion = 50%
54. Rebate = 20% of 10,000 = 2000;
Sales tax = 10% of (10000 – 2000) = 800;
Amount to be paid = 8000 + 800 = 8800.
55. The actual number should be 5x but it is x/5. So the percentage error $\frac{5x-\frac{x}{5}}{5x} \times 100 = 96\%$
56. Let the salary of Bhuwan = ₹ 100
Salary of Anuj = ₹ 80
Salary of Chauhan = $\frac{80\times 156.25}{100} = 125$
So the required percentage = $\frac{125-100}{125} \times 100 =$ 20%
57. $100 \xrightarrow[\text{Effect of increase in length}]{\text{20\% increase}} 120 \xrightarrow[\text{Effect of decrease in breadth}]{\text{50\% decrease}} 60$

From the PCG we can make out that there must have been a 40% decrease.

58. $100 \xrightarrow[\text{Effect of increase}]{\text{23\% increase}} 123 \xrightarrow[\text{Effect of decrease}]{\text{32\% decrease}} 83.64$

16.36% decrease or –16.36%.

59. Let the units place digit be x and the tens place digit be y. In that case the number is (10y + x). The reversed number is (10x + y). According to the question, we know that:
(10x + y) = 1.45(10y + x)
x = 1.5789y
This means that x is 57.89% greater than y.
60. Number of runs made by running
= 100 – (4 ×4 + 6 × 6)
= 100 – (52)
= 48
Required percentage = 48%.

Level of Difficulty (II)

1. The expenditure is constant. Thus, the drop of 5 kg, in what he can buy, is equivalent to 20% of the original consumption. Hence, the original consumption should be 25 kg and the new consumption should be 20 kg. The increased price of rice would be 200/20 = ₹ 10.
Income of the salesman = 1200 + (1600x)
2. Solve using options. 8/11 fits the requirement.
3. The total raise of salary is 87.5% (That is what 15/8 means here).
Using the options and PCG, you get option (c) as the correct answer. You will see the following PCG if you try with 25% being the first raise.

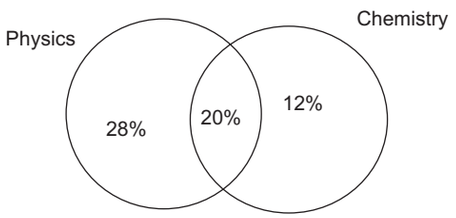
$100 \xrightarrow[+25]{\text{25\% increase}} 125 \xrightarrow[+62.5]{\text{50\% increase}} 187.5$

4. Solve through trial and error using the options. 10% (option a) is the only value that fits the situation.
5. You can make the following table to see the flow of his capital:

Year	*Capital at the beginning*	*Capital after profit*	*Capital after donation*
1	100	150	75
2	75	112.5	56.25
3	56.25	84.375	42.1875

Since, this value is given to us as: 33750, we get 42.1875% = 33750 → 1% = 800. Hence, donation at the end of the 2nd year = 56.25 × 800 = 45000.

6. The following figure shows the percentage of failures:



From the figure it is clear that 60% of the people have failed in at least one subject, which means that 40% of the students would have passed in both subjects. This value is given as 880 people. Hence, there would be 880/0.4 = 2200 students who would appear in the examination.

7. Solve using options. Checking for option (b), gives us:
   200000 → 180000 → 171000 → 153900 → 146205 (by consecutively decreasing 200000 by 10% and 5% alternately)
8. Total characters in her report = 25 × 60 × 75.
   Let the new number of pages be n.
   Then:
   $$n \times 55 \times 90 = 25 \times 60 \times 75$$
   $$n = 22.72$$
   This means that her report would require 23 pages. A drop of 8% in terms of the pages.
9. The following percentage change thinking would give us the value of the percentage increase as 58.4%
   $$100 \xrightarrow{+20\%} 120 \xrightarrow{+20\%} 144 \xrightarrow{-20\%}$$
   $$115.2 \xrightarrow{+25\%} 144 \xrightarrow{+10\%} 158.4$$
10. October: November: December = 9:8:10.666 since, he got ₹40 more in December than October, we can conclude that 1.666 = 40 → 1 = 24.
    Thus, total Bonus for the three months is:
    $$0.4 \times 27.666 \times 24 = 265.6$$
11. 10% increase is offset by 9.09% decrease. Hence, option (b) is correct.
12. The expenditure increase can be calculated using PCG as:
    $$100 \xrightarrow{+20\%} 120 \xrightarrow{+20\%} 132$$
    A 32% increase.
13. Samanyu's scores in each area is 65 and 82 respectively out of 100 each. Since, the exam is of a total of 250 marks (100 + 100 + 50) he needs a total of 195 marks in order to get his target of 78% overall. Thus, he should score 195 − 65 − 82 = 195 − 147 = 48 marks in Sociology, which would mean 96%.
14. The total wealth given would be 50% + 25% (which is got by 50% of the remaining 50%) + 12.5% (which is got by 50% of the remaining 25%). Thus, the total wealth given by him would be equivalent to 87.5% of the total. Since, this is equal to 130900 kilograms of gold, the total gold would be:
    $$130900 \times 8/7 = 149600.$$
15. Population at the start = 100.
    Population after 2 years = 100 × 1.08 × 1.01 × 1.08 × 1.01 = 118.984
    Thus, the required percentage increase = 18.984%
16. After the migrations, 72.9% of the people would remain in the country. This would comprise females and males in the ratio of 1:2 (as given) and hence, the women's population left would be 1/3rd of 72.9% = 24.3% which is given as being equal to 364500. Thus, the total population would be
    $$364500 \times 100/24.3 = 1500000$$
17. Chinki would have spent 12% of Malti.
    Thus, her percentage of expenditure would be 0.12 M × 100/C = 12 M/C
18. Option (d) is correct and can be verified experimentally by using values for x, y, z and p.
19. 24% of the total goes to urban Gujarat = \$72 m
    1% = \$ 3 million.
    The required value for Rural AP
    = 50% of 20% = 10%
    Hence, required answer = \$ 30 mn
20. In the previous question, the total FDI was \$ 300 mn.
    A growth of 20% this year means a total FDI of \$360 mn.
    The required answer is 12% of 10% of 360 mn
    = 1.2% of 360 = \$4.32 mn.
21. The income goes to 120. Food expenditure has to be maintained at 25. (i.e. 20.833%)
    Hence, percentage point drop from 25 to 20.833 is 4.16%
22. Assume the initial surface area as 100 on each side. A total of 6 such surfaces would give a total surface area of 600. Two surface areas would be impacted by the combined effect of length and breadth, two would be affected by length and height and two would be affected by breadth and height. Thus, the respective surface areas would be (90.25 twice, 114 twice and 114 twice) Thus, new surface area = 180.5 + 456 = 636.5. A percentage increase of 6.0833%. Option (d) is correct.
23. Option (c) fits the situation as if the ratio is 10:9, the value of Baman's salary would first go up from 10 to 12 and then come down from 12 to 9 (after a 25% decrease). On the other hand, the value of Aman's salary would go up from 9 to 11.25 and then come back to 9 (Note that a 25% increase followed by a 20% decrease gets one back to the starting value.)
24. Initial quantity of Kerosene and water = 12 and 48 litres respectively. Since, this is already containing

20% Kerosene, adding more Kerosene to the mixture cannot make the mixture reach 15% Kerosene. Hence, it is not possible.

25. On 100 he saves ₹ 5. On 120 he still saves 5. Thus, his expenditure goes up from 95 to 115- a percentage increase of 20 on 95 = 21.05%.
26. $Q = 100$, $P = 150$, $R = 100$, $S = 160$. S is 160% of Q. Note that this does not change if all the values are incremented by the same percentage value.
27. Think about this problem through alligation. Since, A*lok* spends 12% of his money and *Bimal* spends 20% of his money and together they spend 15% of their money- we can conclude that the ratio of the money Alok had to the money Bimal had would be 5:3. Hence, Total money with *Alok* = 5/8 of 12000 = 5 × 12000/8 = 7500.
    Money spent by *Alok* = 12% of 7500 = 900.
    Money left with *Alok* = 7500 – 900 = 6600.
28. The weekly change is equal to ₹ 1,68,000.
    Hence, the daily collection will go up by 1,68,000/7 = 24,000.
29. The total population of the town can be taken as 9 + 8 + 3 = 20.
    The number of literates would be:
    80% of 9 + 70% of 8 + 90% of 3 = 7.2 + 5.6 + 2.7 = 15.5
    15.5 out of 20 represents a 77.5% literacy rate.
30. Let the exam be of 100 marks. *A* obtains 24 marks while *B* obtains 12 marks (50% less than *A*). The sum of *A* and *B*'s marks are 24+ 12 = 36. To pass *C* can obtain 6 marks less than 36. This is a percentage of 16.67%. Thus, option (d) is correct.
31. The minimum price occurs at:
    $18 \times 30 + 6 \times 36 + 1 \times 40$
    Hence, the average price = 796/25 = 31.84
32. For the maximum price, discounts should be availed only at the minimum rate of discount. Thus, if one buys 4 lots of six tickets each at a discount of 10%, the condition required would be fulfilled. The total cost of 25 tickets = $36 \times 24 + 40 \times 1 = 904$
    Required average price per ticket = 904/25 = 36.16.
33. If the ticket lots are halved, the maximum discount will be available for 9 tickets (25%). A maximum number of 16 tickets can be bought in ₹532 as: 9 tickets for ₹30 each, 6 tickets for ₹32 each and 1 ticket for ₹40 would use up ₹502 of the amount available. The remaining ₹30 cannot be used to purchase another ticket since the price of the ticket is greater than that.
34. Solve using options.
    Checking for option (a) will go as: According to this option 400 people have voted against the motion. Hence, originally 200 people must have favoured the motion. (Since, there is a 100% increase in the opponents)
    This means that 200 people who were for the motion initially went against it.
    This leaves us with 400 people who were for the motion initially (after the abduction.)
    1/3rd of the original having been abducted, they should amount to half what is left.
    This means that 600 (for) and 200 (against) were the original distribution of 800.
    This option fits perfectly (given all the constraints) and hence is the correct answer.
35. The thought process would go like:
    If we assume 100 students
    Total : 60 boys and 40 girls.
    Fee waiver : 9 boys and 3 girls.
    This means that a total of 12 people are getting a fee waiver. (But this figure is given as 90.)
    Hence, 1 corresponds to 7.5.
    Now, number of students not getting a fee waiver = 51 boys and 37 girls
    Students getting a 50% concession = 25.5 boys and 18.5 girls (i.e. a total of 44.)
    Hence, the required answer = 44 × 7.5 = 330.
36. At 12 noon, the watch would show the correct time (since till then the temperature range was below 40°C). The watch would gain 2% every hour between 12 and 4. An hour having 3600 seconds, it would gain 72 seconds in each of these hours. Thus, at 7 pm it would be 72 × 4 = 288 seconds ahead. The time exhibited would be 7: 04: 48.
37. $3 \times (10a + 100b) = 100a + 10b$
    $290b = 70a \rightarrow a = 29b/7$
    a will be an integer when $b = 7 \rightarrow a = 29$.
38. According to the last statement
    $1.3x = z = 156 \rightarrow x = 120$.
    $1.2w = x = 120 \rightarrow w = 100$
    $0.8y = x = 120 \rightarrow y = 150$.
    Therefore total number of shirts = 156 + 120 + 100 + 150 = 526
39. 1 man is married to 1 woman.
    Hence, 45% of men = 25% of women.
    i.e. $0.45\ M = 0.25\ W$
    Hence $\frac{0.45}{0.25} = \frac{M}{W}$
    Women to men ratio of 9:5
    Using alligation, the required answer is 32.14
40. The required weight of the bucket to the water when full is 3:2. (Note: This is the interpretation of the first statement of the question – 'The weight of a bucket increases by 33.33% when filled with water to 50% of its capacity.')

If both the weights (bucket and water) are integers, then the total weight must be a multiple of 5.

Only option (c) shows this characteristic.

41. We do not have sufficient information to solve the question.
42. For every ₹10000 increase in sales, his income would increment by 600+1000 = ₹1600.

    If x is the number of ₹10000 sales he achieves over the initial ₹10000, we would have:

    $$1200 + 1600\,x = 7600$$

    We get $x = 4$.

    This means that the sales value must be ₹50000.
43. A sales value of ₹ 9000 cannot be achieved, since his basic salary is 1200 and his increments are only in quantum of 1600 for every 10000 rupees of sales. 9000 would not be a term of the arithmetic progression 1200, 2800, 4400, 6000, 7600, 9200…. Hence, option (b) is the correct answer.
44. This question is based on a product constancy situation. A 25% increment in the commission (How?? Note: When the commission goes up by 5 percentage points from 20 to 25, there is a 25% increment in the commission) would get offset by a 20% drop in the volume of the transaction. Option (d) is correct.
45. Out of a total of 100% votes; 80% voted. 16% were invalid and 20% went to the second placed candidate. This means that the maximum the winner can get is 44%. Options a, b and c are greater them 44% and hence cannot be correct. Hence, none of these.
46. Let the old wage = 1000 ₹ per week for 50 hours. The wages per hour would increase by 10% and the number of hours would decrease by 10%. Using PCG you can see that there would be a 1% decrease in the weekly wages.
47. If $C = 100$, $A = 80$ and $B = 72$.

    Thus, B is less then A by 10%
48. Assume values of x% = 10% and the original price as 100, then the final price = $K/100 = 99 \rightarrow K = 9900$.

    (Note: After an increase of 10% followed by a decrease of 10% a price of 100 would become 99).

    Put these values of x, and K in the options. The option that gives a value of 100 for the original price should be the correct answer.

    Option (d) is correct.
49. The correct answer should satisfy the following condition: If 'x' is the increased salary

    $$x \times 0.8 \times 0.1 = (x - 4800) \times 0.8 \times 0.12.$$

    None of the first 3 options satisfies this.

    In fact, solving for x we get $x = 28800$.

    Option (d) is correct.
50. A sales tax of 7% on a price of 2568 would amount to a tax amount of 179.76. Since, the price is rounded off to the next higher integer, the tax would be rounded off to ₹180. This would also be the amount of discount (or reduction in price) that Seema is asking for.
51. 7up worth ₹ 16 would be containing 60 grams of vitamins would contain the maximum vitamin amongst the three.
52. Option (a) would cost: 6.4 + 8 = 14.8

    Option (b) would cost: 12 + 3.2 = 15.2

    Option (c) would cost: 4 + 3.2 + 2.8 = 10

    Option (d) would cost: 12 + 2.8 = 14.8

    Option (c) is the cheapest.

Solutions to questions 53 and 54: Let initially Ajay, Biru. Chetan had A, B *and*C rupees, respectively.

$$A + B = C \quad (1)$$

$$A + C = 2B \quad (2)$$

By solving equation (1) and (2) we get

$$A : B = 1 : 2,\ B{:}C = 2{:}3$$

$$A : B : C = 1 : 2 : 3$$

At the end of the game If they have a, b and c rupees respectively then:

$$a + b = 2c \quad (3)$$

$$a + c = 3b \quad (4)$$

By solving equation (3), (4) we get

$$a : b = 5 : 3,\ b : c = 3 : 4$$

$$a : b : c = 5 : 3 : 4$$

$b = 1500$. So $a = 2500$ and $c = 2000$. So, $a + b + c = 6000$.

Since the total amount of money at the start and at the end is equal we can say that: $A + B + C = 6000$. With a ratio of 1:2:3, the respective values of A, B and C would be $A = 1000$, $B = 2000$, $C = 3000$.

53. Chetan and Biru had suffered a loss. So two people had suffered a loss.
54. Percentage change in money of Ajay = 150% (since the value for A has gone from 1000 to 2500).

    Solution 55 to 57: You will get the following table by using the information in the question

	DELHI OFFICE			**LUCKNOW OFFICE**		
	MALES	FEMALES	TOTAL	MALES	FEMALES	TOTAL
LAST YEAR	1500	500	2000	600	400	1000
THIS YEAR	1900	600	2500	500	500	1000

Logic for the table:

Statement: In the Delhi office, this year the number of employees grew by 25% to 2500 → last years total employees in Delhi = 2000 and this years total number of employees in Delhi is 2500.

Statements: Last year the ratio of male to female employees in the Delhi office was 3:1. The number of female employees in the Delhi office grew by 20% from the last year to this. → Delhi Male employees last year = 1500; Delhi female employees last year = 500; Delhi Female employees this year = 600. Hence, Delhi male employees this year = 2500 – 600 = 1900.

Statement: The total number of employees in both the company offices grew to 3500 this year and this year the number of employees in the Lucknow office remained the same as the previous year → Lucknow total employees in each of the two years is equal to 1000 each.

Consequently, we can complete the number of employees (male and female) for Lucknow for both the years.

The answers are:

55. 600

56. % of growth = $\frac{1900-1500}{1500} \times 100 = 26.67\%$

57. Required difference = (1900 + 500) – (600 + 500) = 1300

58. As per the question →

$$\left(1-\frac{20}{100}\right)\left(1+\frac{50}{100}\right)\left(1+\frac{15}{100}\right)n - 280 = 1.1n$$

$n \times 0.8 \times 1.5 \times 1.15 - 1.1\ n = 280$

$n = 1000$

$1.1n = 1100$

59. Per packet cost = $1 + 2 + 1 + 10 \times \frac{10}{100} = ₹\ 5$

Per packet profit = 10 – 5 = ₹ 5

% profit per packet = $\frac{5}{10} \times 100 = 50\%$

This will be the percentage profit of the company at the end of the year.

60. New cost per packet = $\left[1+\frac{100}{100}\right] + 2 + 1 + x\left(\frac{20}{100}\right)$

$= 5 + 0.2\ x$

(where x is the new selling price)

$x - (5 + 0.2x) = 5$ (Note: The profit needs to be maintained at ₹ 5 per packet, in order to maintain the same profit)

$0.8x = 10$ or $x = 12.5$.

Required percentage increase in selling price = $\frac{2.5}{10} \times 100 = 25\%$

Level of Difficulty (III)

1. Let the initial price of raw materials be 100. The new cost of the same raw material would be 115.

   The initial cost of labour would be 25 and the new cost would be 30% of 115 = 34.5

   The total cost initially would be ₹125.

   The total cost for the same usage of raw material would now be: 115 + 34.5 = 149.5

   This cost has to be reduced to 125. The percentage reduction will be given by 24.5/149.5 = 17 % approx.

2. Let the initial times allotted be: 50, 40 and 20 hours. Then, the time used in each activity is

   20, 12 and 4 hours. Thus, 36 hours out of 110 are used in all.

   Hence, the answer is 36/110 = 32.72 %

3. The following structure would follow:

   Passed all: 5%

   Passed 4: 20% of 90% =18%

   Passed 1: 25% of 90% = 22.5%

   Passed 2: 24.5%

   Passed None: 5%

   Passed 3: Rest (100 – 5 – 18 – 22.5 – 24.5 – 5 = 25%)

   But it is given that 300 people passed 3. Hence, 25% = 300.

   Hence, 1200 students must have appeared in the test.

4. The third gallery making the capacity 'half as large again' means: an increase of 50%.

   Further, it is given that : 4(first + third) = 12 (second)

   In order to get to the correct answer, try to fit in the options into this situation.

   (Note here that the question is asking you to find the capacity of the second gallery as a percentage of the first.)

   If we assume option (a) as correct – 70% the following solution follows:

   If second is 70, then first is 100 and first + second is 170. Then third will be 85 (50% of first + second).

   Then the equation:

   $4 \times (100 + 85)$ should be equal to 12×70

   But this is not true.

   Through trial and error, you can see that the third option fits correctly.

   $4 \times (100 + 80) = 12 \times 60$.

   Hence, it is the correct answer.

5. Let the initial percentage of salt be 10% in 100 litres of sea water in the flask.

   10% of this is poured out (i.e.,10 litres are poured out) and the water heated so as to increase the percentage of salt in the beaker 5 times (we have assumed M as 5 here.)

   This means that there will be 30% salt in the beaker. Since, the salt concentration is increased by only

evaporating water, the amount of salt remains the same.

Initially the salt was 10% of 10 litres (= worth 1 litre). Hence, the water must have been worth 9 litres.

Now, since this amount of salt becomes worth 50% of the total solution, the amount of water left after evaporation would have been 1 litre and the total would be 2 litres.

When the 2 litres are mixed back again: The new concentration of salt in sea water would go up. In this specific case by alligation we would get the following alligation situation:

Mix 90 litres of 10% salted sea water with 2 litres of 50% salted sea water.

The result using alligation will be: [10 + 40/46] % concentration of salted sea water. The value of the increase percentage will be 400/46. (this will be the value of x)

Now, try to use the given options in order to match the fact that originally the flask contained 100 litres of sea water.

Use $M = 5$, $x = 400/46$,

Only option (b) matches the situation.

$$\frac{(9 \times 5 + 1)\,400/46}{(5 - 1)} = 100$$

6. The only values that fit this situation are C 25%, B 30%, and A 45%. These are the percentage of votes polled. (*Note*: these values can be got either through trial and error or through solving $c + c + 5 + 1.5$ $(c + 5) = 100\%$

   Then, 20% is 18000 (the difference between A & C.)

   Hence, 90000 people must have voted and 100000 people must have been on the voter's list.

7. The net time lost over two weeks would be 0.25% of a week's time (since in the first week the clock loses 1/2% and in the second week the clock gains 1/4% on the true time.)

   A week contains 168 hours. Hence, the clock loses 0.42 hours.i.e. 25.2 minutes or 25 minutes 12 seconds. Hence, the correct time would be 12:25:12.

8. Traveling for 2400 kms at 18 kmph, Vawal will use 133.33 litres of petrol every month. The increase in expenditure for Vawal will be $133.33 \times 0.7 \times 28 =$ ₹ 262 (approx).

9. The required answer will be given by: $(7/107) \times 2400 = 157$ km

10. The original expenditure is 28* 133.333 = ₹ 3733.333

    The new expenditure will be given by $28 \times 1.07 \times n/18$ where n = the no. of kilometres to travel.

    Since the new expenditure should increase by ₹ 200, its value has to be equal to ₹ 3933.333

    This gives us $n = 2363.15$

    Hence, the answer is e.

11. The shopkeeper would get the maximum revenue when everybody opts for a 4% resale of the right. In such a case, the revenue for the shopkeeper from each customer would be: 96% of 4000 = 4000 – 160 = 3840. hence, total revenue is 38400.

12. Similarly, the highest discount would be if everybody opts for the 15% discount. In such a case, the total discount would be: $600 \times 10 = 6000$.

13-16. Detailed solutions for 13–16 are given in the hints of LOD III.

17–23. The average income estimated would be: Annual Income/14 (Underestimated savings).

The average monthly expenditure would be: Annual expenditure/9 (Overestimated expenditure)

17–19 are explained in the hints of LOD III.

20. $x/14 = 87$. Hence, annual income = 1218.

    New income = 1218/12 = 101.5

    Change in estimated income due to the change in process of average calculation = 14.5/87 → 16.66% increase.

21. Estimated monthly income would go up, while the estimated monthly expenditure would go down. Hence, Savings (estimated) would increase.

22. Cannot be determined since the percentage change would depend on the actual values which are not available for this question.

23. The estimated monthly expenditure would change from: $x/9$ to $x/11$. Hence, percentage drop in the ratio will be 2/11 → 18.18%

24 to 29 are explained in the hints to LOD III.

31-34. The following table will give a clearer picture of the situation:

Newspaper	*Circulation (in 000)*	*Revenues*	*Commission*	*Net Revenues*
Deccan Emerald	373	746	20%	596.8
Times of Hindustan	247	494	25%	395.2
India's Times	297	594	30%	415.8

31. Reduction of $\frac{181 * 100}{596.8} = 30.32\%$

32. The percentage difference between the revenues is: $(746–594) \times 100/746 = 20.37$

    Hence, the required value is 30.32/20.37 = 1.488

33. The day's cost of printing 373000 copies of Deccan Emerald is: $373000 \times 8 = 2984000$

    Out of this, the paper recovers 596800. The remaining cost to be recovered would be: 2387200.

    At ₹ 3000 per cc, 795.733 cc will have to be booked on any given day in order to obtain the cost. This represents 99.46% of the total value.

35. Times of Hindustan:
Total cost = 2,47,000 × 7.5 = 18,52,500
Net revenues from newspaper sales is 3,95,200
Cost to be covered through advertising = 18,52,500 – 3,95,200 = 14,57,300.
At an ad rate of ₹1800 per cc, they would have to sell 809.61 cc i.e.73.6%
Similar calculations for India's Times will give 79.2%.
Hence, the percentage point difference = 5.6

36. If Ac 3rd costs 100, Ac 2nd would cost 120 and AC 1st would cost 190. 3 Tier ticket would cost : 47.5 and general ticket would cost 40.

$$\text{AC } 2^{nd} \rightarrow 780 = 120$$

Then the difference between 3 Tier and general ticket would be: 7.5 × 780 = 48.75

37. Total cost → 100 + 120 + 190 + 47.5 + 40 = 497.5
This gives (497.5/120) × 780 = 3233.75.

43. Hursh Sarma's savings:

Month	Salary	Savings
1	10800	1080
2	10800	900
3	10800	900
4	10800	0
5	12000	1500
6	12000	1800
7	12000	2400
8	12000	1200
9	12000	1000
10	12000	1500
11	12000	1800
12	12000	2400

Required Ratio = 4800/900 = 5.333

48. Assume he has 1200 francs, 1200 DM and 1200 Liras. If he converts everything to francs, the result will be:
1200 DM will convert to 240 Euros which will convert to 960 francs. But 51 Moolas = 1 Franc. Thus the value of 1200 DM in terms of Moolas goes up from 1200 × 36 = 43200 to 960 × 51 = 48960. This increase in value has occurred only because of the change of currency. Hence, he should convert all his DM into Francs. However, before concluding on this you also will need to consider the effect of Liras.
It is evident that 1200 DM will yield 240 Euros, which would yield 720 Liras (since 1 euro is 3 lira), which in turn would yield 720 × 70 = 5040 Moolas.
Thus, it is evident that by converting DM into Liras the increase in value is higher than that achieved by converting DM into Francs.
Similarly, converting Francs to Liras also increases the value of the Francs.
1200 × 51 becomes equivalent to 900 × 70.
Note: The thought process goes like this: 1200 Francs = 300 Euros (since 1 euro = 4 francs). Further 300 Euros equals 900 liras which equal 900 × 70 Moolas.

49. Cannot be determined since the conversion from dollar to Euro is not given, neither is the inter currency exchange rate between Lira, Francs and DMs.

50. Obviously, both a and c are required in order to answer this question.