CMA STUDENTS' E-BULLETIN FOUNDATION

VOL: 2 NO: 5

MAY, 2017 ISSUE
(Syllabus 2016)

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Behind every successful business decision, there is always a CMA

Message from the President

Dear Students,
Greetings,

"There is no end to education. It is not that you read a book, pass an examination, and finish with education. The whole of life, from the moment you are born to the moment you die, is a process of learning"- Jiddu Krishnamurti

June term of examination is approaching. I am sure that all of you are very busy now as you are gearing up to appear for and to deliver your best in the examination. To prepare yourself you need the guidance in the righteous direction and through these E-bulletins all the eminent teachers are putting their tips and guiding you how to read the subjects properly and deliver professionally. I must pay my sincere thanks to all the contributors of this e-bulletin, who despite their busy schedules, have given their suggestions to make you successful. I believe that teachers who love teaching teach children to love learning.

A man without education is like a building without foundation. I am delighted to know that you have enjoyed reading the previous E-bulletin and reciprocated favourably. I firmly believe that Intelligence plus character – is the goal of true education. In this connection I want to refer a great saying by our Noble Laureate Rabindranath Tagore that ***"The highest education is that which does not merely give us information but makes our life in harmony with all existence"***.

I am happy to note that Directorate of Studies is reciprocating to meet up your demands and their team is working for your development and success. Your performance will make all of us happy if you come out with flying colours and be a nation building partner.
I want to put an end by quoting Malcolm Forbes that ***"Education's purpose is to replace an empty mind with an open one".***

Be dedicated, determined and disciplined; success is yours.

CMA Manas Kumar Thakur
President
The Institute of Cost Accountants of India

Be a CMA, be a Proud Indian

VOL:2, No.:5
MAY, 2017 ISSUE

Message from the Chairman

"A good education is the greatest gift you can give yourself and anyone else"- Mahtab Narshimhan

Dear Students,

I know that the hard work you have done for your examination which is approaching soon. That's very important in your life. The belief, work, efforts you have done to get the success will definitely complete.

All of you should begin to develop a degree of individual responsibility or autonomy in your study as well as possess the ability to collaborate with other available resources; for example availing the support services offered by the Directorate of Studies. In my message in the April issue, I had asked you to follow the Mock Test Papers (MTP) and practice in line of it. Hope, you have following that meticulously and preparing yourself for the successful attempt of your examination. The answers of the questions asked in the MTPs will be uploaded in the mid of May by the Directorate of Studies. Please compare those answers with the already solved problems of yours.

Understanding your qualification is important and the stated guidelines in each subject outline how CMA qualifications fit within the National Qualifications Framework and support professional learning. CMAs should be able to display competence in the application of knowledge in the performance of a range of work activities, some of which may be routine and predictable with some being complex or non-routine.

As desired by the industry and the economy, successful completion of the CMA Course enables students to make an entry to the industry with updated knowledge and requisite skills. We do hope that your learning will help you to take the challenge on your own stride.

My best wishes with you,

CMA Pappa Rao Sunkara,
Chairman,
Training & Education Facilities (T& EF) Committee

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Behind every successful business decision, there is always a CMA

KNOWLEDGE UPDATE

In this section of e-bulletin we shall have a series of discussion on each of these chapters to provide a meaningful assistance to the students in preparing themselves for the examination at the short end and equip them with sufficient knowledge to deal with real life complications at the long end.

STUDENTS' E-bulletin Foundation

2

VOL:2, No.:5
MAY, 2017 ISSUE

PAPER: 1, PART- I

FUNDAMENTALS OF ECONOMICS & MANAGEMENT (FEM) - ECONOMICS

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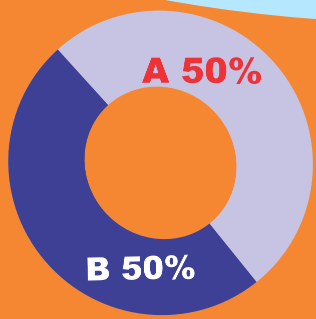
Your Preparation Quick Takes

Syllabus Structure

A Fundamentals of Economics **50%**
B Fundamentals of Management **50%**



Behind every successful business decision, there is always a CMA

Learning Objectives:

In this issue, you will learn about law of Variable Proportion, It refers to the input - output relation when output is increased by varying the quantity of one input, keeping the quantities of other factor fixed.
This law has played a vital role and occupies important place in modern economic theory. This law has been supported by the empirical evidence in the real word. In Costing Analysis, we have to understand this concept.

Short Run- Application of the Law of Variable Proportion

Introduction:-

The short run does not refer to a specific duration of time but rather is unique to the firm, industry or economic variable being studied. The **short run** is a period of time in which **at least one input** used for production **is variable** and at **least one input** is **fixed.**

The long run is a period of time in which all inputs used for production are **variable.** The long run is the conceptual time period in which there are **no fixed factors of production**.

The main difference between long run and short run is that there are **no fixed factors in the long run;** there are **both fixed and variable factors** in the **short run** .

The difference between short run and long run depends on the particular production activity. For some producers, the short run lasts a few days. For others, the short run can last for decades.

Short Run Production Behavior
In short run there are three basic results-

First, production might increase at a increasing rate. - This occurs if **each additional unit** of a variable input added to a fixed input causes **incremental production to increase.** For example, the one additional worker contributes 10 units of output to production, the next additional worker contributes another 11 units, and the subsequent additional worker contributes 12 units. With increasing marginal returns, each worker contributes more to production that the previous worker.

Second, production might increase at a decreasing rate.- This occurs if **each additional unit** of a variable input added to a fixed input causes **incremental production to decrease.** For example, the one additional worker contributes 10 units of output to production, the next additional worker contributes another 9 units, and the subsequent additional worker contributes only 8 units. With decreasing marginal returns, each worker contributes less to production that the previous worker.

Third, production might actually decrease - This results if the addition of a variable input added to a fixed input actually causes the total production to decline. For example, if 10 workers produce a total of 100 units of output, and 11 workers produce a total of 98 units, then the eleventh worker is said to have negative marginal returns.

These three alternatives are technically termed ***increasing marginal returns, decreasing marginal returns, and negative marginal returns.***

Three Production Stages

Short-run production exhibits three distinct stages reflected by the shapes and slopes of the three product curves--total product, marginal product, and average product.

- **Stage I:** The first stage is increasing marginal returns and is characterized by the increasingly steeper positive slope of the total product curve.

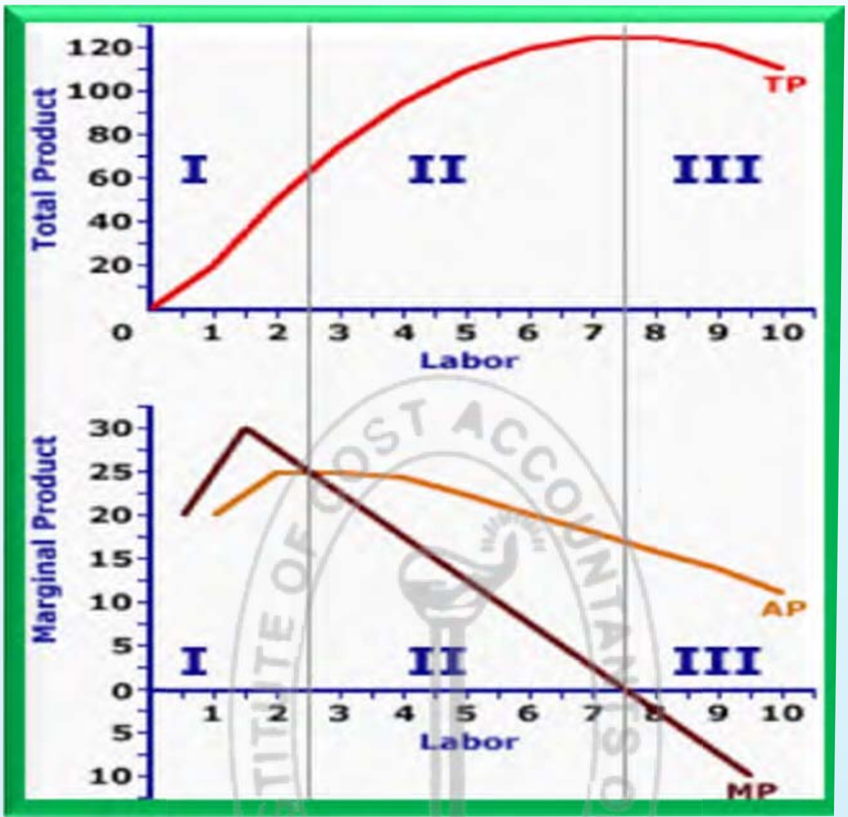
  In this stage Total Product, Average product and Marginal Product are increasing. At the end of 1st Stage Marginal Product starts to decline.

- **Stage II:** The second stage is decreasing marginal returns and is reflected in the positive but flattening slope of the total product curve.

  In this stage Total product goes on increasing but it increases with diminishing rate. At the end of this stage Total product is maximum.

- **Stage III:** The third and last stage is negative marginal returns illustrated by the negative value of marginal product and the negative slope of the total product curve. Average product is positive, but the marginal product curve has a negative slope.

In order to understand these three stages it is better to graphically illustrate the production behavior in short run.



This Law is known as Law of Variable Proportion which exhibits the relationship between inputs and outputs in the short run

Causes of law of variable proportion

Increasing returns to a variable factor occur initially because of the more effective and fuller use of the fixed factor becomes possible as more units of the variable factor are employed to work with it.

Once the point is reached at which the amount of the variable factor is sufficient to ensure the efficient utilisation of the fixed factor, then further increases in the variable factor will cause marginal and average products of a variable factor to decline because the fixed factor then becomes inadequate relative to the quantity of the variable factor.

As the amount of a variable factor continues to be increased to a fixed quantity of the other factor, a stage is reached when the total product declines and the marginal product of the variable factor becomes negative.

This phenomenon of negative marginal returns to the variable factor in stage 3 is due to the fact that the number of the variable factor becomes too excessive relative to the fixed factor so that they obstruct each other with the result that the total output falls instead of rising.

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PAPER: 1, PART- II

FUNDAMENTALS OF ECONOMICS & MANAGEMENT (FEM) - MANAGEMENT

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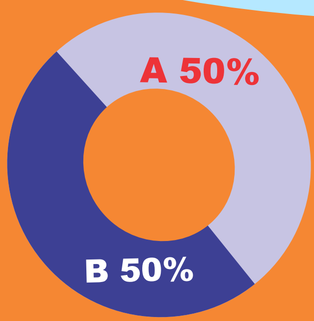
Your Preparation Quick Takes

Syllabus Structure

A Fundamentals of Economics **50%**
B Fundamentals of Management **50%**



Behind every successful business decision, there is always a CMA

Learning Objectives:

- Students will demonstrate their knowledge of business and management principles
- Students will reveal effective written and oral communication
- Students will exhibit an awareness of the global environment in which businesses operate
- Students will display the ability to recognize when change is needed, adapt to change as it occurs, and lead change

MANAGEMENT

We do hope that you are enjoying your tips given on the topics in the monthly issues of the E-bulletin on this particular subject. If you have gone through on a regular basis, you may find that almost all the areas are covered and you may feel comfortable before the examination. Chapter wise and topic wise coverage will certainly help you to do better in your examination.

In this issue, we are discussing about **'Management Concepts'**.

'Concept of Power', 'Concept of Authority' & 'Concept of Responsibility' have been discussed here for your better understanding.
The term **'power'** is often considered as synonymous to **'authority'**. Really speaking, there is a difference between the two terms. Power refers to the ability or capacity to influence the behaviour or attitudes of other individuals. Authority is derived from position whereas power may be derived from many sources like technical competence, seniority etc. a manager's power may be measured in terms of his ability to –

(a) Give rewards,
(b) Punish individuals,
(c) Withdraw rewards, etc.

Thus, Power is a broader concept than authority.
Now, the often used in the management is **'Delegation of Authority'**. So, what do we mean by this? Delegation of authority is "the process a manager follows in dividing the work assigned to him so that he performs that part which only he, because of his unique organisational placement, can perform effectively and so that he can get others to help with what remains."

We should understand the terms 'Centralization '& 'Decentralisation' of Authority. Centralisation and decentralisation are opposite terms. They refer to the location of decision- making authority in an organisation. They refer to the location of decision- making authority in an organisation. **Centralisation** implies the concentration of authority at the top level of the organisation while **decentralisation** means dispersal of authority throughout the organisation. Centralisation and decentralisation are relative terms because every organisation structure contains both the features. There cannot be complete centralisation or decentralisation in practice.

Distinction between Delegation and Decentralisation

Decentralisalion is much more than delegation. Delegation means transfer of authority from one individual to another. But decentralisation implies diffusion of authority throughout the organisation.

The main points of distinction between delegation and decentralisation are presented as follows:

1. Delegation is the process of devolution of authority whereas decentralisation is the end result which is achieved when delegation is systematically repeated up to the lowest level.
2. Delegation can take place from one individual (superior) to another (subordinate) and -be a complete process. But decentralisation is completed only when the fullest possible delegation is made at all levels of organisation.
3. In delegation control rests entirely with the superior. But in decentralisation the top management exercises only overall control and delegates the authority for day today control to the departmental managers.
4. Delegation is a must for management as subordinates must be given sufficient authority to perform their duties. But decentralisation is optional in the sense that top management may or may not disperse authority.
5. Delegation is a technique of management used to get things done through others. However, decentralisation is both a philosophy of management and a technique.

Coming to the **'Concept of Responsibility'** which according to Koontz and O'Donnell is, "Responsibility may be defined as the obligation of a subordinate, to whom duty has been assigned to perform the duty."
Management can use various techniques to define responsibilities so as to actively involve members of an organization in its coordination effort. Two such techniques are:

(1) **responsibility charting**, and
(2) **role negotiation**.

Moreover, new organizational positions may be created and line and staff conflict resolved by enhancing the degree of coordination.

1. **Responsibility Charting** – A responsibility chart is a nice way of summarizing the relationship between tasks and actors (performers). The chart lists activities that are complicated or the decisions that must be made and the individuals who are responsible for each of them. On the vertical axis we show the tasks and on the horizontal axis we show the actors.

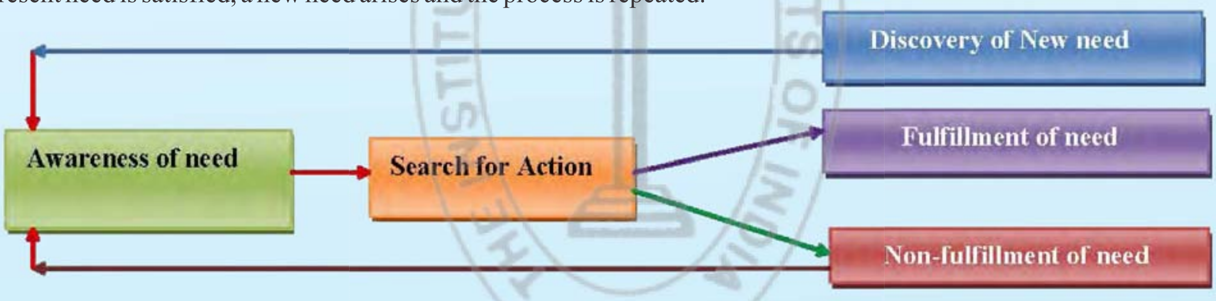
The following four roles are important:

- ✯ The individual is responsible for the activity (decision).
- ✯ The individual must approve the activity or decision.
- ✯ The individual must be consulted before completing the activity or making the decision.
- ✯ The individual has to be informed about the activity or the decision.

2. **Role Negotiation** – Role negotiation is an important technique that can supplement the use of responsibility charting. If used properly, it can lead to clear definitions of tasks and the responsibilities associated with them.

The basic promise of the technique is that nobody gets anything without promising something in exchange. Organizational members meet at periodic intervals to list rededication of tasks so that coordination can be maximized. The primary objective of this approach is to identify the independent clusters of tasks completed by the organization. The second objective is to match the personal needs and work preference of individuals with the tasks that must be completed.

An important term in management is **'Motivation'**. The term 'motivation' has been derived from the word 'motive'. Motive means the urge to do something. Motivation may be defined as the process of inducing or inspiring people to take the desired course of action.
The process of motivation begins with the awareness of a need. Feeling of an unsatisfied need causes tension. A person takes some action to satisfy his need. If the action succeeds to satisfy the need, the person feels motivated. In case the action fails, the person takes a different action. When the present need is satisfied, a new need arises and the process is repeated.



Pictorial Presentation of the Process of Motivation & How it takes place

Motivation is one of the most crucial factors that determine the efficiency and effectiveness of an individual in organisation. All organisational facilities will remain useless unless people are motivated to utilise these facilities in a productive manner. Motivation is an integral part of management process and every manager must motivate his subordinates to create in them the will to work.

Theories of Motivation

There are several theories of motivation. Some are called content theories and others are called process theories. These theories can be summed up as under:

1. Maslow's need hierarchy theory
2. Herzberg's two-factory theory
3. Theory X and Theory Y by McGregor
4. Alderfer's ERG (Existence, Relatedness and Growth) theory
5. Achievement motivation model by McClelland
6. J. Stacy Adam's Equity Theory
7. Victor Vroom's Expectancy Theory

Only the theories of Mc Gregor have been discussed here. Prof. Douglas McGregor has developed a theory of motivation on the basis of hypotheses relating to human behaviour. According to McGregor, the function of motivating people involves certain assumptions about human nature. There are two alternative sets of assumptions which **McGregor has described as Theory X and Theory Y**.

Theory X is a conventional or traditional approach to motivation. External control is considered appropriate for dealing with unreliable, irresponsible and immature people. According to McGregor, an organisation built upon Theory 'X' notions will be one in which there is close supervision and control of subordinates and high centralization of authority. Leadership in such an organisation will tend to be autocratic, and workers will have very little (if any) say in decisions affecting them.

Theory Y represents a modern and dynamic nature of human beings. It is based on assumptions which are nearer to reality. An organisation designed on the basis of Theory Y is characterised by decentralisation of authority, job enrichment, participative leadership and two-way communication system. The focus is on self-control and responsible jobs.

Comparison between Theory X and Theory Y:

	Theory-X	Theory-Y
1	Inherent dislike for work.	Work is natural like rest or play.
2	Unambition and prefer to be directed by others.	Ambition and capable of directing their others own behaviour.
3	Avoid responsibility.	Accept and seek responsibility under proper conditions.
4	Lack creativity and resist change.	Creativity widely spread.
5	Focus on lower level (Physiological and safety).	Both lower level and higher order needs need to motivate workers like social; esteem and self-actualisation are sources of motivation.
6	External control and close supervision required to achieve organisational objectives.	Self-direction and self-control.
7	Centralisation of authority and autocrat leadership.	Decentralisation and participation in leadership decision-making. Democratic leadership.
8	People lack self-motivation.	People are self-motivated.

Despite its significance, **McGregor's theory has been criticised** for various reasons.

- First, it tends to over-generalise and over-simplify people as being one way or the other. People cannot be put into two extreme patterns or stereotypes.
- Secondly, McGregor's theory squeezes all managerial styles and philosophies into two extremes of conduct which is devoid of reality.
- Thirdly, McGregor suggests tacitly that job itself is the key to motivation. But all persons do not look for motivation in the job and not all work can be made intrinsically challenging and rewarding.
- Lastly, some managers may have Theory Y assumptions about human nature, but they may find it necessary to behave in a very directive and controlling manner with some people in the short run to help them grow up in a developmental sense until they are truly Y people.

Keep Calm, Study Hard & Become Successful

VOL:2, No.:5
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PAPER: 2

FUNDAMENTALS OF ACCOUNTING (FOA)

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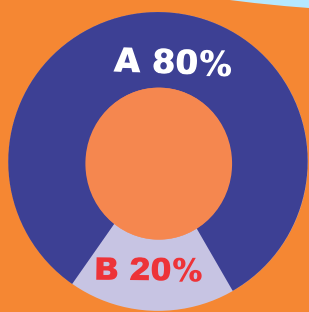
Your Preparation Quick Takes

Syllabus Structure

A Fundamentals of Financial Accounting **80%**

B Fundamental of Accounting **20%**



Learning Objectives:
In order to internalize the concepts of subjects like accountancy one has to have an understanding of the learning objectives of the chapters. Try to go through the Statement of Objects and Reasons issued for every topics as it would give you a background to your study.

In past issues we have discussed various topics from section A relating to Financial Accounting. Now we will concentrate on a very interesting topic from section B relating to Management accounting. Before we proceed let us have an idea about the management accounting. In simple terms it's a branch of accounting where post mortem analysis is done after the financial accounting is over. It helps the authority (management) to make decisions. How marginal costing helps in decision making is also there in the syllabus which we will discuss in the next issue. Here we will confine ourselves to the basic concepts of marginal costing.

Marginal costing is a technique of analyzing cost into fixed and variable and to see its impact over cost , volume and profit. It is popularly also known as cost, volume and profit analysis. (CVP Analysis). In fact marginal cost is the variable cost only. Some experts like to call fixed cost as irrelevant cost in the sense that it does not take part in the decision making. By nature it remains fixed and does not vary with the change in production. In that sense it is irrelevant only. However on the other hand marginal cost is the additional cost for producing one more unit. Therefore by nature it is variable and takes vital part in decision making. For example, in a corporate meeting a seminar hall is rented for Rs. 5000 for an evening. Hall rent will not change whether 200 or 500 people attend the programme. However, the cost of tea or food packets will increase or decrease depending on the number of attendance and hence cost of tea is a variable expense and to be handled very carefully.

With this basic idea let us see the following format to deal better with these ideas:

			Rs.
Sales			xxx
Less : variable cost			xxx
	Contribution		xxx
Less : fixed cost		xxx	
	Profit		xxx

In fact the above statement is based on the basic philosophy of business SALES – COST = PROFIT. Only thing we did is to segregate cost into fixed and variable and introduced a new concept CONTRIBUTION. See how this simple format helps us to develop

various formulae under marginal costing.

1. Sales – variable cost = contribution
2. Fixed cost + profit = contribution
3. C/S RATIO OR P/V RATIO = contribution/ sales x 100
4. Variable cost ratio = 1- P/V Ratio.
5. Break even sales = fixed cost / p/v ratio (in rupees) and FC/ Contribution per unit (in units)
6. Margin of safety = actual sales – break even sales or profit / p/v ratio

Note: if information for more than one year is available we calculate the p/v ratio as
Change is profit/ change in sales x100.

Two important items needs some explanation before we move to solving sums. They are break even point and margin of safety. Firstly, BEP is such a level of sales where the firm neither attains profit nor incurs loss. Any firm will always like to stay above this level. The more it is above such level the more it is safe from any kind of business fluctuations. That is why margin of safety is calculated as actual sales – break even sales.

Illustrations :

1. When fixed expenses are Rs.16000 and break even point is Rs. 40000 find out

a. P/V ratio
b. Profit when sales are Rs. 80000 and

c. New BEP if selling price is reduced by 20 % (june 2016)

2. What will be the selling price if average P/V ratio is 40 % and estimated marginal cost is Rs. 75 (june 2016)

3. Margin of safety in marginal costing means - (june 2016)

4. Ascertain PV Ratio

	Jan 2016	feb 2016
Sales	400000	600000
Profit	140000	200000

5. Calculate BES , FC and sales to earn a profit of Rs. 300000
Sales Rs. 900000, MOS 40% and PV Ratio 2/3

1. A. Given break even point is Rs.40000.
Therefore , fixed cost / p/v ratio = 40000
16000/p/v ratio = 40000
p/v ratio = 16000/40000
p/v ratio = 40 %

B.

Sales	80000
Less VC (60 %)	48000
Contribution	32000
Less FC	16000
Profit	16000

C. If selling price is reduced by 20 %, new P/v ratio will be changed.
New selling price will be Rs. 80000-20% of 80000= 64000.
New contribution will be Rs.64000- 48000 = Rs. 16000

Therefore, new p/v ratio will be 16000/64000x100 = 25 %.

Now new break even sales will be FC/ New pv ratio = 16000/25% = 64000/-

2. What will be the selling price if average P/V ratio is 40 % and estimated marginal cost is Rs. 75
If p v ratio is 40 %, VC ratio will be 60 % (i.e. 1-pv ratio) which means sales will be Rs.100 when VC is Rs. 60. Given VC is Rs. 75.
Therefore sales price will be : 75/60x100 = Rs.125/-

3. Margin of safety in marginal costing means –
Actual sales – break even sales.

4. Ascertain PV Ratio

	Jan 2016	Feb 2016
Sales	400000	600000
Profit	140000	200000

Since information for more than one year is available we have to apply the following formula

Change in profit/ change in sales x 100

(200000-140000) / (600000-400000)x100 = 30 %

5. Calculate BES , FC and sales to earn a profit of Rs. 300000

Sales Rs. 900000, MOS 40% and PV Ratio 2/3

MOS = 40% i.e 40/100x900000= Rs. 360000

Therefore Break Even sales = 900000-360000 = Rs. 540000

Again BEP = FC/ PV ratio

Or, 540000=FC/ 2/3

Or, FC = 540000x2/3= 360000

We know FC + Profit = Contribution

Or, 360000+300000 = contribution

Or, contribution = 660000.

Again PV ratio is 2/3

Therefore , sales required to earn a profit of Rs. 300000 will be 660000/2/3 = Rs. 990000/-

Keep solving these kind of problems and put stress on the basics and the formula as discussed above.
With best wishes

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PAPER: 3

FUNDAMENTALS OF LAWS AND ETHICS (FLE)

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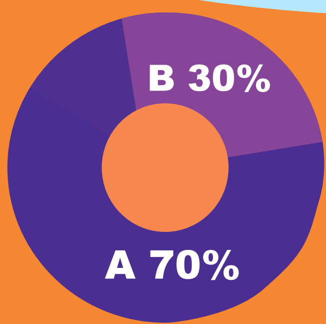
Your Preparation Quick Takes

Syllabus Structure

A Fundamentals of Commercial Laws **70%**

B Fundamentals of Ethics **30%**



Behind every successful business decision, there is always a CMA

Learning Objectives:

- Read the Study Material minutely.
- For details or if you don't understand Study Material or the section is important to identify the topic, then refer to Bare Act, otherwise reference to Bare Act is not necessary. For Company Law, book by Avtar Singh is recommended. For other laws Institute Study Material is sufficient.
- The words used in any of the texts as mentioned above should be understood by immediate reference to the Dictionary.
- The main points coming out in any of the provisions should be either underlined or written in separate copy which has to be repeated again and again.
- Theoretical knowledge should be adequate and clear before solving practical problems.
- Don't write wrong English. It changes the meaning and therefore answer may be wrong even when the student's conception is clear. Also don't make spelling mistakes.

INDIAN CONTRACT ACT

'Intention to create legal relationships' forms the basic ingredient of a valid contract. It is viewed as the intention of the parties to enter into a legally binding agreement. Since it measures the readiness of the parties to accept the legal sequences and consequences to enter into a legally binding agreement, 'intention to create a legal relation' is one of the most necessary elements of a valid contract.

So if there is no intention to create a legal relation then the contract is not legally enforceable or in other words can be assumed as not legal. In a famous case Jones v/s Vernon's Pools Ltd (1938), the agreement clearly contained a clause that "it shall not give rise to any legal relationship, or be legally enforceable, but binding in honor only". It was held that since the contract did not give rise to legal relations and therefore was not a contract. Hence absence of legal relation makes a contract void.

Hence it can also be said that an agreement of purely social or domestic nature is not a contract bcoz it is assumes that such an agreement generally does not intend to create any legal relation. In a famous case, Balfour v/s Balfour (1919), the husband promised to pay a certain sum to his wife every month while he was abroad. As he failed the promised amount the wife sued him for the recovery of the same. It was held that as it was a social agreement and the parties did not intend to create a legal relation the wife could not recover the promised amount from her husband.

So in the absence to legal intention the contracting parties would not be able to sue each other which can make the parties hard to enquire legal interference and call for justice. As mentioned generally in a social or domestic relation there is a presumption to be legally binding. However there are exceptions and even in the case of agreements of social or domestic nature there may be intention of the parties to create legal relation. Whether or not such an agreement is intended to create a legal relation or have legal consequences will depend upon the facts of respective cases. Generally in commercial and /or business contracts the law will presume that the contracting parties intended to have a legal binding unless otherwise explicitly expresses in the contract, as already mention in the above case law. Similarly in domestic or social types of contracts the presumption in general is that they do not give rise to legal consequences unless and contrary evidence is submitted. In those cases where evidence is shown that the intention of the contracting parties of the domestic contract was to create legal obligations then the presumption is rebuttable.

In a case Parker v/s Clark (1960), An aged couple (C and his wife) made a promise through correspondence to their niece and her husband (Mr. and Mrs. P) that C would leave them a portion of his estate in his will, if Mr. and Mrs. P sell their cottage and start living with the aged couple and share their household expenses. Mr. and Mrs. P did the same but after some time due to certain differences the aged couple repudiated the agreement by requiring them to stay somewhere else. The young couple filed a suit for the breach of promise. It was held by the court that though the promise was of domestic nature yet there was an intention to create a legal relation and the young couple could recover the damages.

Tips to answer –

✓ ***Answers in examination should be concise and in own language as far as practicable.***

✓ ***Try to supplement answers with relevant sections and case laws where ever required.***

Best of luck students for your examination!

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PAPER: 4

FUNDAMENTALS OF BUSINESS MATHEMATICS AND STATISTICS (FBMS)

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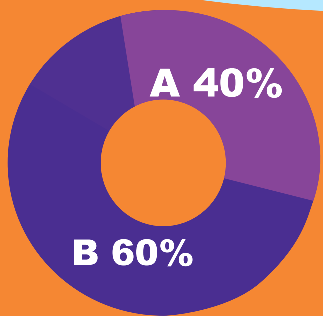
Your Preparation Quick Takes

Syllabus Structure

A Fundamentals of Business Mathematics **40%**
B Fundamentals of Business Statistic **60%**



Behind every successful business decision, there is always a CMA

Learning Objectives:
- appreciate the usefulness, power and beauty of mathematics
- enjoy mathematics and develop patience and persistence when solving problems
- understand and be able to use the language, symbols and notation of mathematics
- develop mathematical curiosity and use inductive and deductive reasoning when solving problems
- become confident in using mathematics to analyse and solve problems both in professional and in real-life situations

GEOMETRIC PROGRESSION

1.1 INTRODUCTION:

If we go through the following sequences

1, 3, 9, 27, 81, 243, ……………………….(1)

$\frac{1}{4}, -\frac{1}{8}, \frac{1}{16}, -\frac{1}{32}, \frac{1}{64}$ ……………………… (2)

The significance that we can understand is as follows:

(i) Any term of the sequences divided either by its, preceding term or by its succeeding term remains constant.

(ii) Any term of the sequences can be obtained by multiplying its, preceding term by a constant number or by dividing its succeeding term by the same constant number to be obtained as per (i)

Hence both the series: 1 + 3 + 9 + 27 + 81 + 243 + ………

And $\frac{1}{4} - \frac{1}{8} + \frac{1}{16} - \frac{1}{32} + \frac{1}{64}$ ……… Possessing such Significances are termed as Geometric Progression and the constant number as Common Ratio.

DEFINITION

If in the series $\sum_{n=1}^{n} T_n$, $\frac{T_n}{T_{n-1}}$ remains constant for all natural number n, then the series is called Geometric Progression, abbreviated by G. P. and the ratio of T_n and T_{n-1} is known as Common Ratio of the **Geometric Progression:**

Therefore if a is the first term of a G. P. and r is the common ratio of the G. P., then the G. P. will be as $a + ar + ar^2 + ar^3 +$ ……………

1.2 TO FIND THE n^{th} TERM (tn) OF A G. P. :

Let $a + ar + ar^2 + ar^3 +$ …………… is a G. P. whose first term is a and the common ratio is r.

Here the first term $(t_1) = a \quad = ar^{1-1}$

The second term $(t_2) = ar \quad = ar^{2-1}$

The third term $(t_3) = ar^2 \quad = ar^{3-1}$

…………………………………………………………

…………………………………………………………

…………………………………………………………

The n^{th} term $(t_n) = ar^{n-1}$

Therefore the n^{th} term of the G. P. $= t_n = ar^{n-1}$

Example: (i) Find the 8^{th} term of the Series

$\sqrt{3} + \frac{1}{\sqrt{3}} + \frac{1}{3\sqrt{3}} + ...$

Solution:

Here the first term (a) $= \sqrt{3}$

and the Common Ratio (r) $= \frac{\frac{1}{\sqrt{3}}}{\sqrt{3}} = \frac{1}{\sqrt{3}} \times \frac{1}{\sqrt{3}} = \frac{1}{3}$

Hence the 8^{th} term $(t_8) = ar^{n-1} = ar^7$

$= \sqrt{3}.\left(\frac{1}{3}\right)^7 = \frac{\sqrt{3}}{3.3^6} = \frac{1}{\sqrt{3}.3^6}$

$= \frac{1}{729\sqrt{3}}$

(ii) Find a G. P. whose 3^{rd} term and the 6^{th} term are 1 and – 1/8 respectively. Find its 11^{th} term.

Solution: Let the first term of the G. P. is a and the Common Ratio is r.

$\therefore$ According to the problem, $t_3 = ar^2 = 1$ ....(1)

and $t_6 = ar^5 = -\frac{1}{8}$ ....(2)

Now dividing (2) by (1) yields $= r^3 = -\frac{1}{8}$ Again from (1)

$\rightarrow r^3 = \left(-\frac{1}{2}\right)^3$ $\quad ar^2 = 1$

$\rightarrow r = -½$ $\quad \rightarrow a.(-½)^2 = 1$

$\rightarrow a. ¼ = 1$

$\rightarrow a = 4$

Hence the 11^{th} term $= t^{11} = ar^{10}$

$= 4. (-1/2)^{10}$

$= 1/256$

Note: (i) The number of terms (n) is always > 0 and the common ratio (r) $\neq 0$ or 1

(ii) If the first term (a) and the common ratio (r) are known, then any term of the G. P. and the complete G. P. are known

1.3 PROPERTIES OF THE G. P.

(i) If each term of a G. P. is multiplied by or divided by the same numbers, then the series thus obtained will be a G. P.

Example: Let a, ar, ar^2,........., ar^{n-1} is a G. P.

If each term of the G. P. is multiplied by m, then the series that obtained is i. e., is am, arm, ar^2m, ,......................................., ar^{n-1} m

i.e., am $(am)^r$ (am) r^2, ..., $(am)^{r\ n-1}$

which is also a G. P., whose first term is arm and the common ratio is r.

Again let each term of the G. P. is divided by m, then the series thus obtained is

$\frac{a}{m}, \frac{ar}{m}, \frac{ar^2}{m}, \frac{ar^3}{m}, ..., \frac{ar^{n-1}}{m}$

i. e., $\frac{a}{m}, \left(\frac{a}{m}\right)r. \left(\frac{a}{m}\right)^{r2}, \left(\frac{a}{m}\right)^{r3}, ...\left(\frac{a}{m}\right)r^{n-1}$, which is also a G. P. whose first term (a/m) and the common ratio is r,

(ii) The reciprocal of the terms of a G. P. also form a G. P.

Example: Let a, ar, ar^2, ar^3, ……….. ar^{n-1} is a G. P.
Then the reciprocals of the terms of the G. P. are

$$\frac{1}{a}, \frac{1}{ar}, \frac{1}{ar^2}, \frac{1}{ar^3} \cdots\cdots \frac{1}{ar^{n-1}}$$

i.e., $\frac{1}{a}, \left(\frac{1}{a}\right)\frac{1}{r}, \left(\frac{1}{a}\right)\frac{1}{r^2}, \frac{1}{r^3}, \cdots\cdots \left(\frac{1}{a}\right)\frac{1}{r^{n-1}}$

This is also a G. P., whose first term is 1/a and the common ratio is 1/r.

(iii) If each term of a G. p. is raised to the same power, then the series thus obtained is also a G. P.

Example: Let a, ar, ar^2, ……….. ar^{n-1} is a G. P. and also let each term of the G. P. is raised to the power p. Then the series so formed is a^p, $(ar)^p$, (ar^2) p, …………., $(ar^{n-1})^p$

i.e. a^p, $(a^p)\, r^p$, $(a^p)\,(r^p)^2$, ………, $(a^p) . (r^p)^{n-1}$

Which is a G. P. whose first term is a^p, and the common ratio is r^p.

1.4 TO FIND THE SUN OF n TERMS OF A G. P.

Let the G. P. is $a + ar + ar^2 + \ldots + ar^{n-2} + ar^{n-1}$ and Sx denotes the sum to n terms of the G. P

Hence $S_n = a + ar + ar^2 + \ldots + ar^{n-2} + ar^{n-1}$ ………………..(1)

Now multiplying both sides of (1) by r, we have r, Sn = $ar + ar^2 + ar^3 + \ldots + ar^{n-1} + ar^n$ …………..(2)

Here (2) – (1) yields

$r\,S_n - S_n = ar^n - a$

$\rightarrow (r-1)\,S_n = a\,(r^{n-1})$

$\rightarrow S_n = \frac{a(r^{n-1})}{r-1}$ when r > 1 ……………………………………..(3)

Again, (1) – (2) yields $S_n - r\,S_n = a - a - ar^n$

$\rightarrow S_n(1-r) = a(1-r^n)$

$\rightarrow S_n = \frac{a(1-r^n)}{1-r}$ when r < 1….. ……………..(4)

If l is the last term of the G. P., then $L = ar^{n-1}$ Therefore from (3),

$$S_n = \frac{a(r^{n-1})}{r-1} = \frac{ar^n - a}{r-1}$$

$$= \frac{ar^{n-1}.\,r - a}{r-1}$$

$$= \frac{Lr - a}{r-1}$$

$[\because l = ar^{n-1}]$

$\therefore S_n = \frac{lr - a}{r-1}$ when r > 1

Again from (4), $S_n = \frac{a(1-r^n)}{r-1} = \frac{a - ar^n}{r-1} = \frac{a - ar^{n-1}, r}{r-1} = \frac{a - lr}{r-1}$

Hence $S_n = \frac{a - lr}{r-1}$ when r < 1

Example: Find the Sum to n terms of the series $1\frac{1}{2} + 2\frac{1}{4} + 3\frac{3}{8} + \ldots\ldots$

SOLUTION:

The given series is $1\frac{1}{2}+2\frac{1}{4}+3\frac{3}{8}+$ .... upto n terms

Here the first term (a) = $1\frac{1}{2} = \frac{3}{2}$

and the common ratio (r)

$= 2\frac{1}{4} - \div 1\frac{1}{2} = \frac{9}{4} \div \frac{3}{2}$

$= \frac{9}{4} \times \frac{2}{3} = \frac{3}{2} (> 1)$

Hence $S_n = 1\frac{1}{2}+2\frac{1}{4}+3\frac{3}{8}+$ .... upto n terms

$= \frac{3}{2}[\left(\frac{3}{2}\right)^n - 1] \qquad \left[\because S_n \frac{a(r^{n-1})}{r-1}\right]$

$= \frac{3}{2} - 1$

$= \frac{\frac{3}{2}\left[\left(\frac{3}{2}\right)^n - 1\right]}{\frac{1}{2}} = 3\left[\left(\frac{3}{2}\right)^n - 1\right]$

1.5 RFPRESENTATION OF TERMS IN G. P.

Some-times for solving the problems of G. P. it is convenient to represent the terms in G. P. as follows:

(i) If three numbers are in G. P., they are to be represented as $\frac{a}{r}, a, ar$

(ii) If four numbers are in G. P., then $\frac{a}{r^3}, \frac{a}{r}, ar, ar^3$

(iii) If five numbers are in G. P., then $\frac{a}{r^2}, \frac{a}{r}, a, ar, ar^2$

(iv) If six numbers are in G. P., then $\frac{a}{r^5}, \frac{a}{r^3}, \frac{a}{r}, ar, ar^3, ar^5$

(v) If Seven numbers are in G. P., then $\frac{a}{r^6}, \frac{a}{r^4}, \frac{a}{r^2}, a, ar^2, ar^4, ar^6$

EXAMPLE:

Find three numbers in G. P., such that their sum is 35 and their product is 1000.

Solution: Let the three numbers in G. P. are $\frac{a}{r}, a, ar$

$\therefore$ According to the problem $\frac{a}{r} + a + ar = 35$ ....(*i*)

and $\frac{a}{r} \times a \times ar = 1000$

$\rightarrow a^3 = 1000 = (10)^3$

$\rightarrow a = 10$

From (i)

$\frac{10}{r} + 10 + 10r = 35 \quad [\because a = 10]$

$\Rightarrow 2\ \cancel{10}\left(\frac{1}{r} + 1 + r\right) = \cancel{35}\ 7$

$$\Rightarrow 2\left(\frac{1}{r}+1+r\right)=7$$

$$\Rightarrow 2\left(\frac{1+r+r^2}{r}\right)=7$$

$$\Rightarrow 2r^2+2r+2-7r=0$$

$$\Rightarrow 2r^2-5+2=0$$

$$\Rightarrow 2r^2-4r-r+2=0$$

$$\rightarrow 2r(r-2)-1(r-2)=0$$

$$\rightarrow (r-2)(2r-1)=0$$

$$\therefore r=2 \text{ or } ½$$

When r = 2, the three numbers in G. P. are 10/2, 10, 20 i. e. 5, 10, 20
When r = 1/2, the three numbers in G. P. will be in the reverse order i. e., 20, 10, 5.
Hence the required three numbers are 5, 10, 20

1.6. GEOMETRIC MEAN

If three quantifies form a G. P., then the middle term is called Geometric Mean (in brief G. M.) between the other two. If the quantities are more than three, then the quantities lying in between the first and the last are known as Geometric Means. For example if a, G_1, G_2, G_3, ... G_n b are in G. P, then the quantities G_1, G_2, G_3, ... G_n are the Geometric Means between a and b.

Let the three numbers a, x, b form a G. P. Then the number x is the G. M. Here we have $\frac{a}{x}=\frac{x}{b}$ *i. e.*, $x^2=ab \Rightarrow x=\sqrt{ab}$. Hence the G. M. between a & b is $\sqrt{ab}$.

Example: Find the G. M, between 5, 20

Solution: Let G be the G. M. between b, and 20

$$\therefore \frac{5}{G}=\frac{G}{20}$$

$$\Rightarrow G^2=100$$

$$\Rightarrow G=\sqrt{100}=10$$

Hence the required G. M. = 10

1.7. INSERTION OF GEOMETRIC MEAN:

Let G_1, G_2, G_3, ... G_n be the n Geometric Mean which are to be inserted between two given numbers a and b. Hence a, G_1, G_2, G_3, ... G_n, b are in G. P. Also Let r is the common ratio of this G. P. The total number of terms of the G. P. is (n + 2). So $t_{n+2}=b$

$$\Rightarrow ar^{n+2-1}=b$$

$$\Rightarrow r^{n+1}=\frac{b}{a}$$

$$\Rightarrow r=\left(\frac{b}{a}\right)\frac{1}{n+1}=\sqrt[n+1]{\frac{b}{a}}$$

Therefore $G_1=ar=a\left(\frac{b}{a}\right)^{\frac{1}{n+1}}$

$$G_2=ar^2=a\left(\frac{b}{a}\right)^{\frac{2}{n+1}} \quad [\because r^2=\left\{\left(\frac{b}{a}\right)^{\frac{1}{n+1}}\right\}^2=\left(\frac{b}{a}\right)^{\frac{2}{n+1}} \text{ Similarly } r^3, r^4......r^n]$$

$$G_3 = ar^3 \quad = a\left(\frac{b}{a}\right)^{\frac{3}{n+1}}$$

……………………………………………..

………………………………………………

$$G_n = ar^3 \quad = a\left(\frac{b}{a}\right)^{\frac{3}{n+1}}$$

Now the G. P. can be written as follows:

$$a,\ a\left(\frac{b}{a}\right)^{\frac{1}{n+1}}, a\left(\frac{b}{a}\right)^{\frac{2}{n+1}}, a\left(\frac{b}{a}\right)^{\frac{3}{n+1}}, \ldots\ldots\ldots\ldots, a\left(\frac{b}{a}\right)^{\frac{n}{n+1}}, b$$

NOTE: (i) There is an easiest alternative method for insertion of any number of Geometric Means between two numbers . Let n Geometric Means are to be inserted between two numbers a and b. Hence the G. P. contains (n + 2) terms. If L denotes the last term of the G. P., then L = (n + 2) th term = t_{n+2}

i.e., L = ar $^{n+2-1}$ = ar $^{n+1}$ [r is the common ratio of the G. P.]

$$\Rightarrow r^{n+1} \quad = \frac{l}{a}$$

$$\Rightarrow r = \left(\frac{l}{a}\right)^{\frac{1}{n+1}} \quad = \quad \sqrt[n+1]{\frac{l}{a}}$$

∴ If G_1 be the first G. M., then $G_1 = ar = a\left(\frac{l}{a}\right)^{\frac{1}{n+1}}$

Similarly if G_2 be the second G. M., then $G_2 = ar^2 = a\left(\frac{l}{a}\right)^{\frac{2}{n+1}}$ and so on.

(ii) The product of n Geometric mean is $G_1, G_2, G_3 \ldots\ldots\ldots\ldots G_n$

$$= \left[a\left(\frac{b}{a}\right)^{\frac{1}{n+1}}\right] \cdot \left[a.\left(\frac{b}{a}\right)^{\frac{2}{n+1}}\right] \cdot \left[a.\left(\frac{b}{a}\right)^{\frac{3}{n+1}}\right] \ldots\ldots\ldots \left[a.\left(\frac{b}{a}\right)^{\frac{n}{n+1}}\right]$$

$$= a^n.\left(\frac{b}{a}\right)^{\frac{1}{n+1}} \cdot \left(\frac{b}{a}\right)^{\frac{2}{n+1}} \cdot \left(\frac{b}{a}\right)^{\frac{3}{n+1}} \ldots\ldots\ldots \left(\frac{b}{a}\right)^{\frac{n}{n+1}}$$

$$= a^n.\left(\frac{b}{a}\right)^{\frac{1}{n+1}+\frac{2}{n+1}+\frac{3}{n+1}+\ \ldots\ldots\ldots\ +\frac{n}{n+1}}$$

$$= a^n\left(\frac{b}{a}\right)^{\frac{1}{n+1}\left[1+2+3+\ldots\ldots\ldots+n\right]}$$

$$= a^n\left(\frac{b}{a}\right)^{\frac{1}{n+1}\cdot\frac{n(n+1)}{2}} \qquad \left[\because 1+2+3+\ldots\ldots+n = \frac{n(n+1)}{2}\right.$$

= The sum of n natural numbers]

$$= a^n\left(\frac{b}{a}\right)^{\frac{n}{2}} \quad = a^n.\frac{b^{\frac{n}{2}}}{a^{\frac{n}{2}}} \qquad = a^{\frac{n}{2}}\, b^{\frac{n}{2}} \quad = (ab)^{\frac{n}{2}} = \sqrt{ab}$$

Example: Insert seven Geometric Means between two numbers 3 and 768.,

Solution: Since there are seven Geometric Means between two numbers 3 and 768, the total numbers of terms is 9. Here the first term (a) and the last term (L) are 3 and 768 respectively. If r is the common ratio of the G. P., then

$$r = \left(\frac{768}{3}\right)^{\frac{1}{7+1}} \quad \left[\because r = \left(\frac{l}{a}\right)^{\frac{1}{n+1}}\right]$$

$$= (256)^{\frac{1}{8}} \quad = (2^8)^{\frac{1}{8}}$$

$$= 2^{\frac{8}{8}} \quad = 2$$

$\therefore$ The first Geometric Mean = 3 × 2 = 6

Similarly the other Six Geometric Means are respectively

6 × 2 = 12, 12 × 2 = 24, 24 × 2 = 48, 48 × 2 = 96
96 × 2 = 192, 192 × 2 = 384

(iii) To prove A. M. ≥ G. M.

PROOF: Let a and b are two quantities.

Then A. M = $\frac{a+b}{2}$. and G. M = $\sqrt{ab}$

It is Known that $(\sqrt{a} - \sqrt{b})^2 \geq 0$

i.e., $a + b - 2\sqrt{ab} \geq 0$

$\rightarrow a + b \geq 2\sqrt{ab}$

$\rightarrow \frac{a+b}{2} \geq \sqrt{ab}$

$\rightarrow$ A. M. ≥ G. M.

Hence the Proof

1.8 : INFINITE GEOMETRIC SERIES:

The Geometric Series $\sum_{n=1}^{\infty} ar^{n-1}$ i.e, $a + ar + ar^2 + ar^3 + \ldots\ldots ar^n + \ldots\ldots\ldots$ to ∞ will be called an infinite Geometric Series. In this case we observe that the number of terms of the Series is infinite. Hence an infinite Geometric Series can be defined as here-under: A Geometric Series is said to be an infinite Geometric Series if the number of terms of the Series is in infinite:

1.9 : TO FIND THE SUM OF AN INFINITE GEOMETRIC SERIES: -

Let us consider the partial sum

$S_n = a + ar + ar^2 + \ldots\ldots + ar^{n-1}$

$$= \frac{a(r^{n-1})}{r-1} \quad when\ r > 1$$

$$= \frac{a(1-r^n)}{1-r} \quad when\ r < 1$$

Case I : When r > 1

If is Known that

$$S_n = \frac{a(r^{n-1})}{r-1}$$

$$= \frac{ar^n}{r-1} - \frac{a}{r-1} \quad \ldots\ldots\ldots\ldots(i)$$

If n becomes infinitely large i. e. $n \to \infty$, it appears from (i) that $\frac{ar^n}{r-1} \Rightarrow \infty$ and the result of

$\left[\frac{ar^n}{r-1} - \frac{a}{r-1}\right]$ Ultimately $\to \infty$ [The symbol $\to$ is to be read as TENDS TO]

Hence we have when $n \to \infty$, the sum of the series $\sum_{n=1}^{\infty} ar^{n-1} \Rightarrow \infty$ i. e., the sum of infinite Geometric Series is ∞. If can be concluded that where $r > 1$, the infinite Geometric Series diverges to ∞ and consequently the series is a divergent.

Case II : When $-1 < r < 1$

Here

$$Sn = \frac{a(1-r^n)}{1-r}$$

$$= \frac{a}{1-r} - \frac{ar^n}{1-r} \quad ....(2)$$

Now if $n \to \infty$, it is observed in (2) That $\frac{ar^n}{1-r} \Rightarrow 0$ and the result of

$\left[\frac{a}{1-r} - \frac{ar^n}{1-r}\right]$ becomes $\frac{a}{1+r}$

Therefore we get when $n \to \infty$, the sum at the series $\sum_{n=1}^{\infty} ar^{n-1} \Rightarrow \frac{a}{1-r}$ i. e., the sum of the infinite Geometric Series is $\frac{a}{1-r}$. Now it is to be concluded that the series converges to $\frac{a}{1-r}$ and consequently the series is convergent.

NOTE: (i) If $r = 1$, Then

$$S_n = a + ar + ar^2 + \ldots\ldots\ldots + ar^{n-1}$$
$$= a + a + a + \ldots\ldots\ldots + a \qquad [\because r = 1]$$
$$= na \; [\therefore \text{Number of Terms} = n]$$

Now it appears that when $n \to \infty$, $S_n = na \to \infty$ $S_n = na \to \infty$,

i.e. $\sum_{n=1}^{\infty} ar^{n-1} = \infty$ When $r = 1$

i.e., The infinite Geometric series divergent When $r = 1$

(ii) If $r = -1$, then

$$S_n = a + ar + ar^2 + \ldots\ldots\ldots + ar^{n-1}$$
$$= a - a + a - a + \ldots\ldots\ldots + a(-1)^{n-1} \qquad [\because r = -1]$$
$$= a \text{ or } 0 \text{ according as n is Odd or even}$$

This implies that when $n \to \infty$, $S_n \to a$ or o according as n is odd or even, When $r = -1$

i.e., The series $\sum_{n=1}^{\infty} ar^{n-1} = a$

or o according as n is odd or even, When $r = -1$

i.e., The infinite Geometric Series oscillates between a and o and as such this Series is an oscillates between a and o and as such this series is an oscillatory infinite Geometric Series.

(iii) It is to be marked that (i) $S_n = \sum_{n=1}^{n} ar^{n-1} = \frac{a(r^n - 1)}{r-1}$

When r > 1 or $Sn = \frac{a(1-r^n)}{1-r}$

When r < 1 is the partial Sum of the infinite Geometric series

$S_n \sum_{n=1}^{\infty} ar^{n-1}$

and ,

(ii) $S_n \sum_{n=1}^{\infty} ar^{n-1} = \frac{a}{1-r}$ is the limiting value.

The sum of the infinite Geometric series is nothing but this Limiting value if of course the Limiting value exists.

Example: Find the sum to infinity of the following series

$$1+\frac{1}{2}+\frac{1}{2^2}+\frac{1}{2^3}+ \ldots\ldots\ldots\ldots + \frac{1}{2^{n-1}} + \ldots\ldots\ldots$$

SOLUTION: It is Infinite Geometric Series whose first term (a) = 1 and the common ratio (r) = ½ < 1

$\therefore$ S_n = The partial sum of the given infinite series.

$$= 1+\frac{1}{2}+\frac{1}{2^2}+\frac{1}{2^3}+ \ldots\ldots\ldots\ldots + \frac{1}{2^{n-1}} + \ldots\ldots\ldots$$

$$= \frac{1\left[1-\left(\frac{1}{2}\right)^n\right]}{1-\frac{1}{2}}$$

$$= \frac{1-\left(\frac{1}{2}\right)^n}{\frac{1}{2}} = 2\left[1-\frac{1}{2^n}\right]$$

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

Now when the value of n increases, the value of $\frac{1}{2^{n-1}}$ decreases and ultimately When $n \to \infty$, $\frac{1}{2^{n-1}} \to 0$

$\therefore$ From (i) $S_n \to 2$ When $n \to \infty$

i.e, $1+\frac{1}{2}+\frac{1}{2^2}+\frac{1}{2^3}+ \ldots\ldots\ldots\ldots + \frac{1}{2^{n-1}} + \ldots\ldots\ldots$ to $\infty = 2$

1.10. SUMMARISATION:

First term a, common ratio r, No. of terms n

1. n^{th} term = $t_n = ar^{n-1}$
2. S_n = Sum of n terms = $\frac{a(r^n-1)}{r-1)}$, When r > 1

   $= \frac{a(1-r^n)}{1-r}$ When r < 1

3. Geometric Mean (G. M.) between two numbers a and b G. M. = √ab.
4. n Geometric Mean between a and b

$$\left(\frac{b}{a}\right)^{\frac{1}{n+1}}, \left(\frac{b}{a}\right)^{\frac{2}{n+1}}, \left(\frac{b}{a}\right)^{\frac{3}{n+1}}, \ldots\ldots\ldots\ldots\ldots \left(\frac{b}{a}\right)^{\frac{n}{n+1}}$$

5. Product of n Geometric Means is $(ab)^{\frac{n}{2}}$

6. A. M. $\rightarrow$ G. M.

7. S_n When $n \rightarrow \infty$ is (i) ∞ when $r \geq 1$ (ii) $\frac{a}{1-r}$ When $-1 < r < 1$

   (iii) a or o according as n is odd or even When r = -1

1.11 ILLUSTRATIVE EXAMPLES:

1. Find the sum to a terms of the series 0.3 + 0.33 + 0.333 + …………………

Solution: The Given series is 0.3 + 0.33 + 0.333 + …………… to n terms

= 3 [0.1 + 0.11 + 0.111 + ………….. to n terms]

= 3/9 [0.9 + 0.99 + 0.999 + ……. to n terms]

= 1/3 [(1- 0.1) + (1 – 0.01) + (1 – 0.001) + ……….. to n terms]

= 1/3 [(1 + 1 + 1 + ……….. to n terms) – (0.1 + 0.01 + 0.001 + …….. to n terms)]

$$= \frac{1}{3}\left[n - \frac{0.1\left[1-(0.1)^n\right]}{1-0.1}\right]$$

$$= \frac{1}{3}\left[n - \frac{1}{9}\left\{1-(0.1)^n\right\}\right]$$

2. Find the least value of n for which the sum $1 + 3 + 3^2 + \ldots\ldots$ to n terms is greater than 7000.

SOLUTION: Here S_n = Sum to terms

$$1 + 3 + 3^2 + \ldots\ldots + 3^{n-1} = \frac{1.\left(3^n - 1\right)}{3-1} \quad [\because r > 1]$$

$$= \frac{3^n - 1}{2}$$

Now S_n i. e. Sum to n terms will be greater than 7000 if $\frac{3^n - 1}{2} > 7000$

i.e., if $3^n - 1 > 14000$

i.e., if $3^n > 14001$

i.e., if n log 3 > log 14001

i.e., if $n > \frac{\log 14001}{\log^3} = \frac{4.1461}{0.4771}$ [From Log – Table]

i.e., if n > 8.69

Therefore the least value of n is 9

3. If S be the sum P the product and R the sum of the reciprocals of n terms in G. P., prove that $P^2R^n = S^n$

SOLUTION: Let the n terms in G. P. are a, ar, ar^2, ..., ar^{n-1}

$\therefore$ S = The sum = $\frac{a(1-r^n)}{1-r}$ [supposing r < 1]

P = The product = a. ar. ar^2.......... ar^{n-1}

$= a^n . r^{1+2+3+ \ldots + n-1}$

$= a^n \; r^{\frac{(n-1).n}{2}}$

R = The Sum of the reciprocals

$= \frac{1}{a} + \frac{1}{ar} + \frac{1}{ar^2} + \ldots\ldots + \frac{1}{ar^{n-1}}$

$= \frac{\frac{1}{a}\left[\left(\frac{1}{r}\right)^n - 1\right]}{\frac{1}{r} - 1}$ [$\because$ r < 1 $\therefore \frac{1}{r} > 1$]

$= \frac{\frac{1}{a}\left[\frac{1}{r^n} - 1\right]}{\frac{1-r}{r}}$

$= \frac{r}{a} \frac{(1-r^n)}{(1-r)\,r^n}$

$= \frac{1-r^n}{ar^{n-1}(1-r)}$

$\therefore \frac{S}{R} = \frac{a(1-r^n)}{1-r} . \frac{ar^{n-1}(1-r)}{1-r^n} = a^2 r^{n-1}$

$\Rightarrow \left(\frac{S}{R}\right)^n = \left(a^2 r^{n-1}\right)^n = a^{2n} . r^{n(n-1)} = P^2$

$\Rightarrow \frac{S^n}{R^n} = P^2$

$\Rightarrow P^2 . R^n = S^n$ Proved

4. Three integers form an increasing G. P. if the third term is decreased by 16, we get an A. P. If then the second term is decreased by 2, we again get a G. P. Find the three numbers.

SOLUTION: Let the three integers are a, ar, ar^2,

Where r > 1

$\therefore$ According to the problem a + (ar^2 – 16) = 2ar ....(1)

and a + (ar^2 – 16) = $(ar – 2)^2$..........(2)

From (i), a + ar^2 – 2ar = 16

$\rightarrow$ a (1 + r^2 – 2r) = 16

$\rightarrow$ a $(r – 1)^2$ = 16

$\rightarrow a = \frac{16}{(r-1)^2}$ ....(3)

Again from (2)

$a^2r^2 - 16a = a^2r^2 - 4ar + 4$

$\Rightarrow 4ar - 16a = 4$

$\Rightarrow ar - 4a = 1$

$\Rightarrow a(r - 4) = 1$

$\Rightarrow \frac{16}{(r-1)^2}(r-4) = 1 \quad [\because a = \frac{16}{(r-1)^2}]$

$\Rightarrow 16r - 64 = r^2 - 2r + 1$

$\Rightarrow r^2 - 18r + 65 = 0$

$\Rightarrow (r-13)(r-5) = 0$

$\therefore r = 13$ or 5

Now if r = 13, then a = 1/9 which is a fraction, But according to problem a is an integer

So, $r \neq 13$ $\therefore r = 5$

Therefore from (3), we have a = 1

Hence the three integers are 1, 5 and 25

5. If $x = 1 + a + a^2 + \ldots\ldots\infty$
   $y = 1 + b + b^2 + \ldots\ldots\infty$

Prove that $1 + ab + a^2b^2 + \ldots\ldots\infty = \frac{xy}{x+y-1}$

When \ a\ and \b\ are less than 1

Solution: Here $x = 1 + a + a^2 + \ldots\ldots\infty$

$= \frac{1}{1-a}$ [$\because$ The first term is 1 and the common ratio is a where \a\ < 1

Similarly $y = 1 + b + b^2 \ldots\ldots\infty$

$= \frac{1}{1-b}$ [$\because$ The first term is 1 and the common ratio is b] where \b\ < 1

Now L. H. S. = $1 + ab + a^2b^2 + \ldots\ldots\infty$

$= \frac{1}{1-ab}$

$$R.H.S = \frac{xy}{x+y-1} = \frac{\frac{1}{1-a}\cdot\frac{1}{1-b}}{\frac{1}{1-a}+\frac{1}{1-b}-1}$$

$$= \frac{\frac{1}{1-a}\cdot\frac{1}{1-b}}{\frac{1-b+1-a-(1-a)(1-b)}{(1-a)(1-b)}}$$

$$\frac{\frac{1}{1-a}\cdot\frac{1}{1-b}}{\frac{1-\cancel{b}+\cancel{1}-a-\cancel{1}+\cancel{b}+\cancel{a}-ab}{(1-a)(1-b)}} = \frac{1}{1-ab}$$

Hence L. H. S. = R. H. S. Proved

6. If a, b, c, d are the G. P. then show that $(b-c)^2 + (c-a)^2 + (d-b)^2 = (a-d)^2$

SOLUTION: If r is the common ratio of the G.P. then a = a, b = ar, c = br = ar. r = ar^2

and $d = cr = ar^2 . r = ar^3$

Now L. H. S. $= (b - c)^2 + (c - a)^2 + (d - b)^2$

$= (ar - ar^2)^2 + (ar^2 - a)^2 + (ar^3 - ar)^2$

$= a^2r^2 + a^2r^4 - 2a^2r^3 + a^2r^4 + a^2 - 2a^2r^2 + a^2r^6 + a^2r^2 - 2a^2r^4$

$= a^2 - 2a^2r^3 + a^2r^6$

$= a^2 (1 - 2r^3 + r^6)$

$= a^2 (1 - r^3)^3$

$= (a - ar^3)^2$

$= (a - d)^2$

= R.H.S.

7. If n be an odd positive integer, show that the product of n terms of a G. P. will be equal to the n th power of the middle term.

SOLUTION:

Let a is the first term and r is the common ratio of the G. P. Then the n number of terms of the G. P. be a, ar, ar^2, ……., ar^{n-1}

∴ The product of the n terms of the G. P.

$= a \times ar \times ar^2 \times …….. \times ar^{n-1}$

$= a^n . r\ 1+2+3+…….. + (n-1)$

$= a^n r \frac{(n-1)(n-1+1)}{2}$ [∵ The sum to n natural numbers $= \frac{n(n+1)}{2}$]

$= a^n r \frac{n(n-1)}{2}$............(i)

As n is an odd positive number, there will be one middle term for n terms and this middle term is the $\left(\frac{n+1}{2}\right)^{th}$ term

∴ Middle term $= \left(\frac{n+1}{2}\right)^{th}$ term $= ar\ \frac{n+1}{2} - 1\ = ar \frac{n-1}{2}$

Again the n^{th} power of the middle term $= \left(ar \frac{n-1}{2}\right)^n$

$= a^n\ r\ \frac{n(n-1)}{2}$...........(2)

Hence from (1) and (2) we get

The product of n terms of a G. P. = The n^{th} power of the Middle term.

SUBMISSIONS

Dear Students,

We are very much delighted to receive responses from all of you; for whom our effort is!
We have noted your queries and your requests will definitely be carried out. Further, requesting you to go through the current edition of the bulletin. All the areas will be covered gradually. Expecting your responses further to serve you better as we believe that there is no end of excellence! One of the mails received is acknowledged below.

Absolutely great learning from the e-bulletin provided by all of you!! Concepts became very clear after solving e- bulletin! The kind of questions contained by this bulletin is can be solved by the students acquainted with basic knowledge!! I hope that this service of providing bulletin to the students is great, it must continued in future!! Thanks

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Updation of E-Mail Address/Mobile:

Students are advised to update their E-Mail id and Mobile Numbers timely so that important communications are not missed as the same are sent through bulk mail/SMS nowadays. Student may update their E-Mail id/ Mobile Number instantly after logging into their account at www.icmai.in at request option.

Please put your opinions so that we can make your e-bulletin everything that you want it to be.

Send your Feedback to:
e-mail: studies.ebulletin@icmai.in
website: http://www.icmai.in

PRACTICAL ADVICE

ABOUT YOUR STUDIES - FOUNDATION COURSE

Practical support, information and advice to help you get the most out of your studies.

1. ASSESS YOURSELF
2. APPEAR FOR EXAMINATION
3. SOLVE EXERCISES GIVEN IN STUDY NOTES
4. READ STUDY NOTES & MTPs
5. READ THE TIPS

Examination TIME TABLE

THE INSTITUTE OF COST ACCOUNTANTS OF INDIA

(Statutory body under an Act of Parliament)

Day & Date	Foundation Course Examination Syllabus-2012 Time 2.00 p.m. to 5.00 p.m.	Foundation Course Examination Syllabus-2016 Time 2.00 p.m. to 5.00 p.m.
11th June, 2017 Sunday	Fundamentals of Economics & Management (FEM)	Fundamentals of Economics & Management (FEM)
12th June, 2017 Monday	Fundamentals of Accounting (FOA)	Fundamentals of Accounting (FOA)
13th June, 2017 Tuesday	Fundamentals of Laws & Ethics (FLE)	Fundamentals of Law & Ethics (FLE)
14th June, 2017 Wednesday	Fundamentals of Business Mathematics & Statistics (FBMS)	Fundamentals of Business Mathematics & Statistics (FBMS)

Message from the Directorate of Studies

Dear Students,

"Success is the sum of small efforts, repeated day in and day out." ~ Robert Collier

For the last couple of months we are trying to help in your studies by the publication of this soft version of bulletin. With the responses received from you we are really pleased and your enjoyment in reading has helped us to proceed further.

Students wishing to progress should definitely review the range of services provided by the Directorate of Studies. Information on appropriate services offered can be obtained from our website. Students' under the New Syllabus-2016 is going to appear their examination for the first time. In each subject, you have to figure out what's important and keep the main points. We do hope that 'Tips' given in papers will help them to swim across this national level professional examination and they will reach to their target.

The journey of a thousand miles starts with a single step. We are not telling you it is going to be easy —what we want to tell you it's going to be worth it. We believe that- 'Luck is for the Lazy; Success is definitely for those who work hard'. You only fail when you stop trying.

Essentials to follow:

- Stay positive,
- Work hard,
- Examine the questions carefully,
- Eliminate wrong answers,
- Use the allotted time fruitfully,
- See the positive possibilities,
- Be confident,
- Don't let the stress of your exams to restrict you,
- Be relaxed and calm down.

Students at this level study highly developed and complex levels of knowledge enabling the development of in-depth and original responses to complicated and unpredictable problems and situations. A qualification at this level is appropriate for people working as knowledge based professionals or in professional management positions. We believe that Students at this level of study should display a mastery of high level knowledge and skills and have professional based skills.

Nothing can stop you from doing your best; nothing can pull you down – as long as you start studying hard and stop fooling around. You have done it before and you can do it now. Exams don't test your knowledge as much as they test your state of mind; rather exams are your opportunity at proving your worth to everyone around you. Grab it and do your best, don't let it pass through. Follow your heart but take your brain with you.

"Make the most of yourself, for that is all there is for you." ~ Ralph Waldo Emerson

Believe in yourself and be successful...........................

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THE INSTITUTE OF COST ACCOUNTANTS OF INDIA

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