# WORKSHOP CALCULATION & SCIENCE

## (NSQF)

## 2nd YEAR

### (As per Revised Syllabus July 2022)

## Information & Communication Technology System Maintenance

**Directorate General of Training**

### DIRECTORATE GENERAL OF TRAINING
### MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
### GOVERNMENTOF INDIA

## NATIONAL INSTRUCTIONAL MEDIA INSTITUTE, CHENNAI

**Workshop Calculation & Science**

**Information & Communication Technology System Maintenance - 2nd Year NSQF**

**As per Revised Syllabus July 2022**

**Developed & Published by**

# FOREWORD

The Government of India has set an ambitious target of imparting skills one out of every four Indians, to help them secure jobs as part of the National Skills Development Policy. Industrial Training Institutes (ITIs) play a vital role in this process especially in terms of providing skilled manpower. Keeping this in mind, and for providing the current industry relevant skill training to Trainees, ITI syllabus has been recently updated with the help of comprising various stakeholder's viz. Industries, Entrepreneurs, Academicians and representatives from ITIs.

The National Instructional Media Institute (NIMI), Chennai, has now come up with instructional material to suit the revised curriculum for **Workshop Calculation & Science - Information & Communication Technology System Maintenance 2nd Year** NSQF (Revised 2022) under CTS will help the trainees to get an international equivalency standard where their skill proficiency and competency will be duly recognized across the globe and this will also increase the scope of recognition of prior learning. NSQF trainees will also get the opportunities to promote life long learning and skill development. I have no doubt that with NSQF the trainers and trainees of ITIs, and all stakeholders will derive maximum benefits from these IMPs and that NIMI's effort will go a long way in improving the quality of Vocational training in the country.

The Director General of Training, Executive Director & Staff of NIMI and members of Media Development Committee deserve appreciation for their contribution in bringing out this publication.

Jai Hind

**ATUL KUMAR TIWARI,** *I.A.S.*
Secretary
Ministry of Skill Development & Entrepreneurship,
Government of India.

Novembers 2023
New Delhi - 110 001

# PREFACE

The National Instructional Media Institute(NIMI) was set up at Chennai, by the Directorate General of Training, Ministry of skill Development and Entrepreneurship,  Government of India, with the technical assistance from the Govt of the Federal Republic of Germany with the prime objective of developing and disseminating instructional Material for various trades as per prescribed syllabus and Craftsman Training Programme(CTS) under NSQF levels.

The Instructional materials are developed and produced in the form of  Instructional Media Packages (IMPs), consisting of Trade Theory, Trade Practical, Test and Assignment Book, Instructor Guide and Wall charts. The above material will enable to achieve overall improvement in the standard of training in ITIs.

A national multi-skill programme called SKILL INDIA,  was launched by the Government of India, through a Gazette Notification from the Ministry of Finance (Dept of Economic Affairs), Govt of India, dated 27th December 2013, with a view  to create opportunities, space and scope for the development of talents of Indian Youth, and to develop those sectors under Skill Development.

The emphasis is to skill the Youth in such a manner to enable them to get employment and also improve Entrepreneurship by providing training, support and guidance for all occupation that were of traditional types. The training programme would be in the lines of International level, so that youths of our Country can get employed within the  Country or Overseas employment. The **National Skill Qualification Framework (NSQF)**, anchored at the National Skill Development Agency(NSDA), is  a  Nationally Integrated Education and  competency-based framework, to organize all qualifications according to a series of **levels of Knowledge, Skill and Aptitude.**  Under NSQF the learner can acquire the Certification for Competency needed at any level through formal, non-formal or informal learning.

The **Workshop Calculation & Science -** Information & Communication Technology System Maintenance 2nd Year NSQF (Revised 2022) under CTS is one of the book developed by the core group members as per the NSQF syllabus.

The **Workshop Calculation & Science -** Information & Communication Technology System Maintenance 2nd Year NSQF (Revised 2022) under CTS as per NSQF is the outcome of the collective efforts of experts from Field Institutes of DGT, Champion ITI's for each of the Sectors, and also Media Development Committee **(MDC)** members and Staff of **NIMI.** NIMI wishes that the above material will fulfill to satisfy the long needs of the trainees and instructors and shall help the trainees for their Employability in Vocational Training.

NIMI would like to take this opportunity to convey sincere thanks to all the Members and Media Development Committee (MDC) members.

**Chennai - 600 032**                                                                   **EXECUTIVE DIRECTOR**

# ACKNOWLEDGEMENT

# INTRODUCTION

The material has been divided into independent learning units, each consisting of a summary of the topic and an assignment part. The summary explains in a clear and easily understandable fashion the essence of the mathematical and scientific principles. This must not be treated as a replacment for the instructor's explanatory information to be imparted to the trainees in the classroom, which certainly will be more elaborate. The book should enable the trainees in grasping the essentials from the elaboration made by the instructor and will help them to solve independently the assignments of the respective chapters. It will also help them to solve the various problems, they may come across on the shop floor while doing their practical exercises.

The assignments are presented through 'Graphics' to ensure communications amongst the trainees. It also assists the trainees to determine the right approach to solve the problems. The required relevent data to solve the problems are provided adjacent to the graphics either by means of symbols or by means of words. The description of the symbols indicated in the problems has its reference in the relevant summaries.

At the end of the exercise wherever necessary assignments, problems are included for further practice.

**Time allotment - 2nd Year : 24 Hrs**

Time allotment for each title of exercises has been given below. **Workshop Calculation & Science - Information & Communication Technology System Maintenance** 2nd Year NSQF Revised Syllabus 2022.

| S.No | Title | Exercise No. | Time in Hrs |
|------|-------|--------------|-------------|
| 1 | Algebra | 2.1.01 & 2.1.02 | 8 |
| 2 | Profit and Loss | 2.2.03 & 2.3.04 | 6 |
| 3 | Estimation and Costing | 2.3.05 - 2.3.18 | 10 |
| | | **Total** | **24 Hrs** |

## LEARNING / ASSESSABLE OUTCOME

On completion of this book you shall be able to

- **Demonstrate basic mathematical concept and principles to perform practical operations.**

- **Understand and explain basic science in the field of study.**

# CONTENTS

# SYLLABUS

**2nd Year**

### Workshop Calculation & Science - Information & Communication Technology System Maintenance

### Revised syllabus July 2022 under CTS

| S.no. | Syllabus | Time in Hrs |
|---|---|---|
| I | **Algebra**<br>1 Addition, Subtraction, Multiplication & Divisions<br>2 Algebra – Theory of indices, Algebraic formula, related problems | 8 |
| II | **Profit and Loss**<br>1 Simple problems on profit & loss<br>2 Simple and compound interest | 6 |
| III | **Estimation and Costing**<br>1 Simple estimation of the requirement of material etc., as applicable to the trade<br>2 Problems on estimation and costing | 10 |
| | **Total** | 24 |

## Algebra - Addition, subtraction, multiplication & division

### Introduction

Algebra is a form of mathematics in which letters may be used in place of unknown. In this mathematics numbers are also used in addition to the letters and the value of number depends upon its place. For example in $3x$ and $x^3$, the place of $x$ is different. In $3x$ =3 is multiplied with $x$, whereas in $x^3$ - 3 is an Index of $x$.

### Positive and negative numbers

Positive numbers have a + sign in front of them, and negative numbers have – sign in front of them. The same applies to letters also.

### Example   $+ x, \ - y$.

+8 or simply 8 positive number.

– 8 negative number.

### Addition and subtraction

Two positive numbers are added, by adding their absolute magnitude and prefix the plus sign.

To add two negative numbers, add their absolute magnitude and prefix the minus sign.

To add a positive and a negative number, obtain the difference of their absolute magnitudes and prefix the sign of the number having the greater magnitude.

$$+7 + 22 \ = \ +29$$
$$(-8) - 34 \ = \ -42$$
$$(-27) + 19 \ = \ -8$$
$$44 + (-18) \ = \ +26$$
$$37 + (-52) \ = \ -15$$

### Multiplication of positive and negative numbers

The product of two numbers having like signs is positive and the product of two numbers with unlike signs is negative. Note that, where both the numbers are negative, their product is positive.

**Ex.**        $-20 \text{ x } -3 \ = \ 60$
$$5 \text{ x } 8 \ = \ 40$$
$$4 \text{ x } -13 \ = \ -52$$
$$-5 \text{ x } 12 \ = \ -60$$

### Division

The number that is divided is the dividend, the number by which we are dividing is the divisor and the answer is the quotient. If the signs of the dividend and the divisor are the same then the quotient will have a + sign. If they are unlike then the quotient will have a negative sign.

$$\frac{+28}{+4} = +7$$

$$\frac{+56}{-4} = -14$$

$$\frac{-72}{+9} = -8$$

$$\frac{-96}{-6} = +16$$

> When an expression contains addition, subtraction, multiplication and division, perform the multiplication and division operations first and then do the addition and subtraction.

### Example

12 x 8 – 6 + 4 x 12 = 96 – 6 + 48 = 138

102 ÷ 6 – 6 x 2 + 3 = 17 – 12 + 3 = 8

### Parentheses and grouping symbols

(   ) Brackets

{   } Braces

7 + (6–2) = 7 + 4 = 11

6 x (8–5) = 6 x 3 = 18

### Parentheses

These are symbols that indicate that certain addition and subtraction operations should precede multiplication and division. They indicate that the operations within them should be carried out completely before the remaining operations are performed. After completing the grouping, the symbols may be removed.

In an expression where grouping symbols immediately preceded or followed by a number but with the signs of operation omitted, it is understood, that multiplication should be performed.

Grouping symbols are used when subtraction and multiplication of negative number is done.

To remove grouping symbols which are preceded by negative signs, the signs of all terms inside the grouping symbols must be changed (from plus to minus and minus to plus).

Parentheses which are preceded by a plus sign may be removed without changing the signs of the terms within the parentheses.

When one set of grouping symbols is included within another set, remove the innermost set first.

When several terms connected by + or – signs contain a common quantity, this common quantity may be placed in front of a parentheses.

8 + 6(4–1) = 8 + 6 x 3 = 26

(6+2) (9–5) = 8 x 4 = 32

Plus 4 less negative 7 is written as 4 – (–7).

1

Plus 4 times negative 7 is written as 4(–7).

$$4 - (-7) = 4 + 7 = 11$$

$$8 - (7-4) = 8 - 3 = 5$$

$$3 + (-8) = 3 - 8 = -5$$

$$7 + (4 - 19) = 7 + (-15) = 7 - 15 = -8$$

3 {40 + (7 + 5) (8–2)}

$$= 3 \{40 + 12 \times 6\}$$

$$= 3 \times 112 = 336.$$

$8x + 12$ - quantity 4 may be factored out giving the expression $8x + 12$ as $4(2x + 3)$.

The innermost set in a grouping symbols of an expression is to be simplified first.

## Algebraic symbols and simple equations

### Algebraic symbol

An unknown numerical value of a quantity is represented by a letter which is the algebraic symbol.

### Factor

A factor is any one of the numbers or letters or groups which when multiplied together give the expression. Factors of 12 are 4 and 3 or 6 and 2 or 12 and 1.

$8x + 12$ is the expression and this may be written as $4(2x + 3)$, 4 and $(2x + 3)$ are the factors.

### Algebraic terms

If an expression contains two or more parts separated by either + or –, each part is known as the term.

$y – 5x$ is the expression. y and $– 5x$ are the terms.

The sign must precede the term.

### Kinds of terms:

**1 Like terms**

a  13a, 15a, 19a, -12a, -18a

b  $5x$y, $11x$y, $-x$y, $-14x$y

c  $27m^2$, $25m^2$, $-3m^2$, $11m^2$

**2 Unlike terms**

a  3ac, - 4b, $8x$, 3yz

b  $2x$y, $y^2$, $a^2$b, $x$z, 3bc

c  $13m^2$n, $3mn^2$, $14lm^2$, $15a^2$b, 5lm

### Examples :

1  Add  7a, - 2a, a, 3a

7a + (- 2a) + (a) + 3a

7a - 2a + a + 3a

$$= 11a - 2a$$

$$= 9a$$

2  Add 25$x$y, + 2$x$y, - 6$x$y, - 3$x$y

25$x$y + 2$x$y + (- 6$x$y) + (- 3$x$y)

$$= 27x\text{y} - 9x\text{y}$$

$$= 18x\text{y}$$

3  Add 9m, + 4m, - 2

9m + 4m + (- 2)

9m + 4m - 2

$$= 13m - 2$$

### Coefficient

When an expression is formed into factors whose product is the expression, then each factor is the coefficient of the remaining factors.

$$48x = 4 \times 12 \times x$$

4  is the coefficient of $12x$ . $x$  is the coefficient of 48.

### Equation

It is a statement of equality between numbers or numbers and algebraic symbols.

$$12 = 6 \times 2, \quad 13 + 5 = 18.$$

$$2x + 9 = 5, \quad y - 7 = 4y + 5.$$

### Simple equation

Equations involving algebraic symbols to the first power are simple equations.

$$2x + 4 = 10. \quad 4x + 12 = 14.$$

### Addition

1  8a + 12b - a - 14b

$$= 8a - a + 12b - 14b$$

$$= 7a - 2b$$

2  14a + 3a + 25b + 2b + b

$$= 17a + 28b$$

3  (2a + 3b - c) + (4a - b - c) + (a - 8)

2a + 3b - c + 0

4a -   b - c + 0

 a  +   0 + 0 - 8

────────────

7a + 2b - 2c - 8

────────────

4  Add : (3$x$ + 3z) ; (5$x$ - 4y); (9y - 3z)

3$x$ + 0  + 3z

5$x$ - 4y + 0

 0 + 9y - 3z

────────────

8$x$ + 5y

────────────

## Subtraction

1. $38xy - 15xy = 23xy$

2. Subtract $3xy$ from $-4xy$

   $-4xy$

   (-) $\underline{+3xy}$

   $\underline{-7xy}$

3. Subtract $5x$ from $12x$

   $= 12x - (5x)$

   $= 12x - 5x$

   $= 7x$

4. Subtract $18x$ from $7x$

   $= 7x - (18x)$

   $= 7x - 18x$

   $= -11x$

5. Subtract $3x - 2y$ from $4y - 2x$

   $= (4y - 2x) - (3x - 2y)$

   $= 4y - 2x - 3x + 2y$

   $= 6y - 5x$

## Addition and subtraction

Quantities with algebraic symbols are added or subtracted by considering those terms involving same symbols and powers.

Example

1. $10x + 14 - 7y^2 - 11a + 2x - 4 - 3y^2 - 4a + 8$

   $= 10x + 2x - 7y^2 - 3y^2 - 11a - 4a + 14 - 4 + 8$

   $= 12x - 10y^2 - 15a + 18$

2. $2x = 10$, $2x + 6 = 10 + 6$

3. $y + 12 = 20$, $y + 12 - 8 = 20 - 8$

4. $x + 10 = 12$,

   $x + 10 - 10 = 12 - 10$

5. $3x = 6$, $2 \times 3x = 2 \times 6$, $6x = 12$

6. $5y = 20$, $\dfrac{5y}{5} = \dfrac{20}{5}$.

The same number may be added or subtracted to both members of an equation without changing its equality.

Each member of an equation may be multiplied or divided by the same number or symbol without changing its equality.

The equality of an equation is not altered when the numbers or symbols are added or subtracted from both sides. Multiplication and division by the same numbers or symbols on both sides also will not affect the equality.

## Transposition of the terms of the equations

= equals to

+ plus

− minus

x multiply

÷ divided by

## Concept of equality (Fig 1)



Fig 1
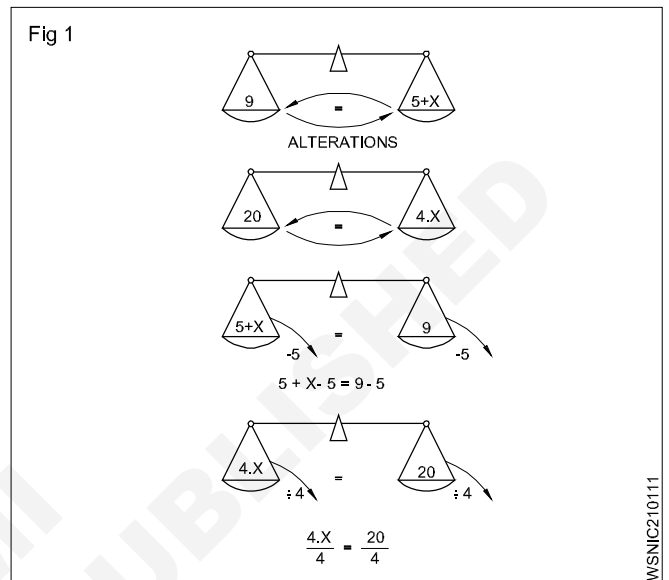
An equation can be compared to a pair of scales which always remain in equilibrium. The two sides of the equation can fully be transposed. $9 = 5 + x$ may also be written as $5 + x = 9$.

We must always perform the same operation on both sides of the equation to keep the equilibrium. Add or subtract the same amount from both sides. $5 + x = 9$ By adding 3 on both sides, the equation becomes $5 + x + 3 = 9 + 3$ or $x + 8 = 12$.

$5 + x = 9$ Subtract 5 from both sides then $5 + x - 5 = 9 - 5$.

$x = 4$.

5 is transposed from left side to the right side by changing its sign from + to −.

$\dfrac{x}{4} = 20$. Multiply both sides by 4. Then $\dfrac{x}{4} \times 4 = 20 \times 4$.

$x = 80$,

$5x = 25$.

Divide both sides by 5 then $\dfrac{5x}{5} = \dfrac{25}{5}$

$x = 5$.

When transposing numbers or letter symbols from one side to the other side multiplication becomes division and the division becomes multiplication.

The equality of an equation remains unchanged when both sides of the equation are treated in the same way. When transposing from one side to the other side,

a plus quantity becomes minus quantity.

a minus quantity becomes a plus quantity

a multiplication becomes a division

a division becomes a multiplication.

To solve simple equations isolate the unknown quantity which is to be found on the left side of the equation.

**Example**

- Solve for x if $4x = 3(35 - x)$

  $4x = 105 - 3x$ (brackets removed)

  $4x + 3x = 105$ (By transposing $-3x$ on the right side to the left side)

  $7x = 105$

  $x = 15$ (dividing both sides by 7)

## Assignment

**Add**

1   14f - 2f + 5f - 7f + 9f

2   $3x$y + $5x$y - $2x$y + $8x$y - $4x$y

3   $17x$y - $4x$y + 13 - $x$y - 6

4   2a + a + 3a + 6a - 5b

5   8c + 5c + 3c + 2c

6   14d + 3d + 25e + 2e

7   5p + 3r - r - 2p

8   8t + 12u - t - 14u

9   $x$ - z + y + z

10   15a + 13a - 37a

11   17a - 4b - 7a + 3b

12   9c - 15e + 4c + 3e

13   13f + 40g - 16f + 7f + 2g - 17g

14   $30x$ + 45y - $17x$ - 16y

15   8a + 3c - 6b - 5c + 4a + 8b

16   27i + 17k - 5l + 12i - 31k + 19l

17   230m + 472P - 320n - 75m + 180n - 141p

18   230m + 420s + 370y + 225m - 510y - 110s

19   45b + 25c + 18b + 40c

20   14d + 3d + 25e + 2e + e + d

21   15a - (4a + 3a - 5a)

22   $5x$ + 3y - ($2x$ - 5y)

23   ($x$ + 2y + 3z) + ($4x$ - y + z)

24   ($2x$ + 5y) + ($4x$ - 8z) + (15z - 6y) + (z - $2x$)

25   ($-2x$ + 3y - 3z) + (-6y - $5x$ + z)

26   (a - 3b + 4c) + (-7c - a + 4b)

27   ($2x$ + 5y) + ($4x$ - 8z) + (15z - 2y)

**Subtract**

1   $38x$y - $25x$y

2   Subtract 2a - 3b - c from 3a - 2b + 4c

3   2a - 3(a - (a - b))

**Add and Subtract**

1   230a + 420b + 370c + 225a - 510c - 110b

2   15d - (4d + 3d - 5d)

3   $8x$ + 3z - 6y - 5z + $4x$ + 8y

**Multiplication**

1   5yz$x$ x (-5ab)

2   3ax -9b

3   2ab x -7pq

**Division**

1   $\dfrac{10a}{2a}$

2   $-3ax \div -6x$

3   $15xy \div -5$

4   $-\dfrac{8ac}{2bc}$

5   $\dfrac{-5m \; x - 6n - 7p}{-28\,mn}$

6   $\dfrac{5a + 20}{7a + 28}$

## Algebra - Theory of indices, Algebraic formula, related problems

**Calculations involving powers**

**Power : Concept**

a.a.a... upto n times is = $a^n$

a is the base, n is the exponent.

When a number, say 2 is multiplied by itself 4 times, we write it as $2^4$ (two to the power of 4) and it is equal to $2 \times 2 \times 2 \times 2 = 16$.

The exponent denotes how many times the base number is multiplied by itself.

Powers with a positive base have a positive result.

Powers with a negative base and with an exponent that is even will have a positive result.

The sign

$$(+a)^n = a^n$$
$$(-a)^{2n} = a^{2n}$$
$$(2)^2 = 2 \times 2 = 4 \text{ and}$$
$$(-2)^2 = -2 \times -2 = +4 \text{ but}$$
$$(-2)^3 = -2 \times -2 \times -2 = -8$$

**Addition and subtraction of powers**

Powers with the same base and exponents can be added or subtracted by addition or subtraction of the coefficients.

$$x.a^n + y.a^n = a^n (x + y)$$
$$x.a^n - y.a^n = a^n (x - y)$$

Ex $.4x^2 + x^2 - 3x^2 = x^2 (4 + 1 - 3) = 2x^2$.

**Multiplication**

Powers with the same bases are multiplied by involving the common base raised to the power of sum of the exponents.

$$a^m \times a^n = a^{m+n}.$$
$$2^3 \times 2^2 = 2^{3+2} = 2^5$$
$$(2 \times 2 \times 2) \times (2 \times 2) = 2 \times 2 \times 2 \times 2 \times 2 = 2^5$$
$$8 \times 4 = 32.$$

Powers with the same exponent of different base numbers are multiplied by involving the product of the base numbers raised to the common exponent.

$$a^n \times b^n = (a \times b)^n$$
$$2^2 \times 3^2 = (2 \times 3)^2$$
$$2 \times 2 \times 3 \times 3 = 6 \times 6 = 36$$

**Division**

Powers with like bases are divided by involving the base raised to the difference between the exponents.

$$\frac{a^m}{a^n} = a^{m-n}$$

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

$$\frac{2 \times 2 \times 2}{2 \times 2} = \frac{8}{4} = 2$$

Powers with the same exponents are divided by involving the quotient of the bases by the common exponent.

$$\frac{a^n}{b^n} = \left(\frac{a}{b}\right)^n$$

$$\frac{2^2}{3^2} = \left(\frac{2}{3}\right)^2 = \frac{2 \times 2}{3 \times 3} = \frac{4}{9}$$

Only like powers can be added or subtracted.

**Examples**

(The exponent 1 is usually not written.)

$$a^1 = a$$
$$2^1 = 2$$
$$2a^2 + 3a^2 = 5a^2$$

(Any number raised to the power of 0 is 1.)

$$a^0 = 1$$
$$2^0 = 1$$

A number raised to a negative power corresponds to its reciprocal with the exponent's sign changed to +.

$$a^{-n} = \frac{1}{a^n}$$

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

Powers are involved by multiplying the exponents.

$$(a^n)^m = a^{nm}$$
$$(2^2)^3 = 2^{2.3} = 2^6$$

Powers can be transposed without affecting the result.

$$\left(a^n\right)^m = \left(a^m\right)^n$$

$$(2^2)^3 = (2^3)^2$$
$$(2 \times 2) \times (2 \times 2) \times (2 \times 2) = (2 \times 2 \times 2) (2 \times 2 \times 2)$$
$$4 \times 4 \times 4 = 64$$
$$8 \times 8 = 64$$

A mixed number raised to a power is first converted into an improper fraction and then the result is evaluated.

$$\left(1\frac{3}{4}\right)^2 = \left(\frac{7}{4}\right)^2$$

$$= \frac{7}{4} \times \frac{7}{4} = \frac{49}{16}$$

## Indices

- The indices are added in multiplication

  $a^m \times a^n = a^{m+n}$.

- The indices are subtracted in division

  $$\frac{a^m}{a^n} = a^{m-n}.$$

- In case of index of an index, both the indices are multiplied mutually

  $[a^m]^n = a^{m.n}$

- A fractional index shows root of a number

  $a^{1/m} = \sqrt[m]{a}$

- In case of an index having minus sign, the sign can be changed by taking the number from numerator to denominator or vice versa

  $$a^{-m} = \frac{1}{a^m}$$

  and $\quad \dfrac{1}{a^{-m}} = a^m$

- If an index contains both the numerator and denominator then it means that the number has 'index' as well as 'root'.

  $a^{m/n} = \sqrt[n]{a^m}$

## Basic problem

### Addition

1  $5x^2y + 3xy^2 + 8x^2y + 7xy^2$

   $= 5x^2y + 8x^2y + 3xy^2 + 7xy^2$

   $= 13x^2y + 10xy^2$

2  Add $5a^3, + 12b^3, - c^3, + a^3, - 4b^3, + 3$

   $5a^3 + 12b^3 + (-c^3) + a^3 + (-4b^3) + 3$

   $= 6a^3 + 8b^3 - c^3 + 3$

### Subtract

1  Subtract $2x^2 - 3y^2$ from $3x^2 + 2y^2$

   $3x^2 + 2y^2$

   $2x^2 - 3y^2$

   _____

   $x^2 + 5y^2$

   _____

### Multiplication

1  $-4x^2 \times 8x^5 \quad = -4 \times 8x^{2+5}$

   $\underset{(-)}{} \quad \underset{(+)}{}$

   $= -32x^7$

2  $(3d^2 - 2d)\, 3d$

   $= 9d^3 - 6d^2$

3  $(5x + 3y)(5x - 3y)$

   $= (5x)^2 - (3y)^2$

   $= 5x \times 5x - 3y \times 3y$

   $= 25x^2 - 9y^2$

4  $5x^2y \times 8x^5y^3$

   $= 40x^7y^4$

5  $(2a+b)(a+2b)$

   $= 2a^2 + 4ab + ab + 2b^2$

   $= 2a^2 + 2b^2 + 5ab$

6  $8a^3b^5c^{-5} \times 3a^2b^{-5}c^5$

   $= 24a^5$

### Division

1  $\dfrac{12x^3y^2}{4x^2y} = 3xy$

2  $\dfrac{15y^{15}}{15y^5} = y^{10}$

3  $9c^5d^3 \div c^2d^2$

   $= 9c^3d$

4  $\dfrac{3a^2 \times 4a \times 5a^3}{6a^4 \times 10a}$

   $= \dfrac{60a^6}{60a^5} = a$

5  $-25a^{15} \div -5a^{-8}$

   $= \dfrac{-25a^{15}}{-5a^{-8}}$

   $= 5a^{15}a^8 = 5a^{23}$

6  $4x^2y \div 2y$

   $= \dfrac{4x^2y}{2y} = 2x^2$

7  $3x^2y^3 \div -6x^5y$

   $= \dfrac{3x^2y^3}{-6x^5y} = -\dfrac{y^2}{2x^3}$

8  $3x^3y^2 \div xy$

$$= \frac{3x^3y^2}{xy} = 3x^2y$$

9  Divide $45a^2b^2c$ by $9a^2c$

$$= \frac{45a^2b^2c}{9a^2c}$$

$$= 5b^2$$

## Algebraic Formulae

| 1 | $(a + b)^2$ | = | $a^2 + b^2 + 2ab$ |
|---|---|---|---|
| 2 | $(a - b)^2$ | = | $a^2 + b^2 - 2ab$ |
| 3 | $(a + b)^2$ | = | $(a - b)^2 + 4ab$ |
| 4 | $(a - b)^2$ | = | $(a + b)^2 - 4ab$ ; $(a + b)^2 - (a - b)^2 = 4ab$ |
| 5 | $a^2 + b^2$ | = | $(a + b)^2 - 2ab = (a - b)^2 + 2ab$ |
| 6 | $a^2 - b^2$ | = | $(a + b)(a - b)$ |
| 7 | $a^3 + b^3$ | = | $(a + b)(a^2 + b^2 - ab)$ |
| 8 | $a^3 - b^3$ | = | $(a - b)(a^2 + b^2 + ab)$ |
| 9 | $(a + b)^3$ | = | $a^3 + b^3 + 3ab(a + b)$ |
| 10 | $(a - b)^3$ | = | $a^3 - b^3 - 3ab(a - b)$ |
| 11 | $(a + b + c)^2$ | = | $a^2 + b^2 + c^2 + 2(ab + bc + ca)$ |
| 12 | $a^4 - b^4$ | = | $(a^2 + b^2)(a + b)(a - b)$ |

### Examples

1  If $x + y = 9$ and $xy = 20$

Find  i) $x^2 + y^2$    ii) $x - y$    iii) $x^2 - y^2$

iv) $x^3 + y^3$    v) $x^3 - y^3$    vi) $x$ and $y$

**i**  $(a + b)^2 = a^2 + b^2 + 2ab$

$(x + y)^2 = x^2 + y^2 + 2xy$

$(9)^2 = x^2 + y^2 + 2(20)$

$81 = x^2 + y^2 + 40$

$x^2 + y^2 = 81 - 40$

$x^2 + y^2 = 41$

**ii**  $(a - b)^2 = (a + b)^2 - 4ab$

$(x - y)^2 = (x + y)^2 - 4xy$

$= (9)^2 - 4(20)$

$= 81 - 80$

$= 1$

$x - y = \sqrt{1} = 1$

**iii**  $a^2 - b^2 = (a + b)(a - b)$

$x^2 - y^2 = (x + y)(x - y)$

$= 9 \times 1$

$x^2 - y^2 = 9$

**iv**  $a^3 + b^3 = (a + b)(a^2 + b^2 - ab)$

$x^3 + y^3 = (x + y)(x^2 + y^2 - xy)$

$= 9(41 - 20)$

$= 9 \times 21$

$x^3 + y^3 = 189$

**v**  $a^3 - b^3 = (a - b)(a^2 + b^2 + ab)$

$x^3 - y^3 = (x - y)(x^2 + y^2 + xy)$

$= 1(41 + 20)$

$= 1 \times 61$

$= 61$

$x^3 - y^3 = 61$

**vi**

$x + y = 9$

$x - y = 1$

----------------------

$2x = 10$

----------------------

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

If $x = 5$, $5 + y = 9$

$y = 9 - 5 = 4$

**$x = 5$; $y = 4$**

2  **Solve** $(x + 5)^2 - (x - 5)^2$

If $x + 5 = a$ and $x - 5 = b$

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

$(x + 5)^2 - (x - 5)^2 = [(x + 5) + (x - 5)][(x + 5) - (x - 5)]$

$= (x + 5 + x - 5)(x + 5 - x + 5)$

$= (2x)(10)$

$= 20x$

3  **If $(x - y) = 4$ and $xy = 12$, find the value of $(x^2 + y^2)$**

$(x - y)^2 = x^2 + y^2 - 2xy$

$(4)^2 = x^2 + y^2 - 2 \times 12$

$16 = x^2 + y^2 - 24$

$x^2 + y^2 - 24 = 16$

$x^2 + y^2 = 16 + 24$

$x^2 + y^2 = 40$

4  **If $x - y = 7$ and $xy = 60$ then find the value of $x^4 + y^4$**

$(x - y)^2 = x^2 + y^2 - 2xy = 7^2$

$x^2 + y^2 - 2 \times 60 = 49$

$x^2 + y^2 = 169$

$(x^2 + y^2)^2 = (169)^2$ (take square on both side)

$x^4 + y^4 + 2x^2y^2 = (169)^2$

$x^4 + y^4 + 2(xy)^2 = 28561$

$x^4 + y^4 + 2(60)^2 = 28561$

$x^4 + y^4 + 2(3600) = 28561$

$x^4 + y^4 + 7200 = 28561$

$x^4 + y^4 = 28561 - 7200$

$x^4 + y^4 = 21361$

5  $x + y = \sqrt{5}$; $x - y = \sqrt{3}$ Find the value of $8\,x\,y\,(x^2 + y^2)$

$x + y = \sqrt{5}$; $x - y = \sqrt{3}$ (take square on both sides)

$(x + y)^2 = 5$; $(x - y)^2 = 3$

Solve the equations

$(x + y)^2 = x^2 + y^2 + 2xy = 5$

$(x - y)^2 = x^2 + y^2 - 2xy = 3$

$\overline{\phantom{xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx}}$

$2\,(x^2 + y^2) = 8$

$(x^2 + y^2) = \dfrac{8}{2} = 4$

$= x^2 + y^2 + 2xy = 5$

$= x^2 + y^2 - 2xy = 3$

$(-)\quad (-)\quad (+)\qquad (-)$

$\overline{\phantom{xxxxxxxxxxxxxxxxxxxxxxxxxx}}$

$4xy = 2$

$\overline{\phantom{xxxxxxxxxxxxxxxxxxxxxxxxxx}}$

$x\mathrm{y} = \dfrac{2}{4} = \dfrac{1}{2}$

$8\,x\,y\,(x^2 + y^2) = 8 \times \dfrac{1}{2} \times 4$

$= 4 \times 4 = 16$

6  If $\left(a - \dfrac{1}{a}\right) = 6$. Find the value of $a^2 + \dfrac{1}{a^2}$

$\left(a - \dfrac{1}{a}\right) = 6$

$\left(a - \dfrac{1}{a}\right)^2 = 6^2$ (take square on both sides)

$a^2 + \left(\dfrac{1}{a}\right)^2 - 2\,(a)\left(\dfrac{1}{a}\right) = 36$

$a^2 + \dfrac{1}{a^2} - 2 = 36$

$a^2 + \dfrac{1}{a^2} = 36 + 2$

$a^2 + \dfrac{1}{a^2} = 38$

7  If $x - \dfrac{1}{x} = 2$, Find the value of $x^3 - \dfrac{1}{x^3}$

$(a - b)^3 = a^3 - b^3 - 3\,ab\,(a - b)$

$\left(x - \dfrac{1}{x}\right)^3 = x^3 - \dfrac{1}{x^3} - 3\,(x)\left(\dfrac{1}{x}\right) \cdot \left(x - \dfrac{1}{x}\right)$

$= x^3 - \dfrac{1}{x^3} - 3\left(x - \dfrac{1}{x}\right)$

$2^3 = x^3 - \dfrac{1}{x^3} - 3\left(x - \dfrac{1}{x}\right)$

$8 = x^3 - \dfrac{1}{x^3} - 3\,(2)$

$8 = x^3 - \dfrac{1}{x^3} - 6$

$8 + 6 = x^3 - \dfrac{1}{x^3}$

$14 = x^3 - \dfrac{1}{x^3}$

$x^3 - \dfrac{1}{x^3} = 14$

8  If $x - \dfrac{1}{x} = 4$, Find the value of $x^4 + \dfrac{1}{x^4}$

$x - \dfrac{1}{x} = 4$ (take square on both sides)

$\left(x - \dfrac{1}{x}\right)^2 = 4^2$  $[(a - b)^2 = a^2 + b^2 - 2ab]$

$x^2 + \dfrac{1}{x^2} - 2 \times x \times \dfrac{1}{x} = 4^2$

$$x^2 + \frac{1}{x^2} - 2 = 16$$

$$x^2 + \frac{1}{x^2} = 16 + 2$$

$$x^2 + \frac{1}{x^2} = 18$$

$$\left(x^2 - \frac{1}{x^2}\right)^2 = (18)^2 \text{ (take square on both sides)}$$

$$(x^2)^2 + \left(\frac{1}{x^2}\right)^2 + 2 \times x^2 \times \frac{1}{x^2} = 324$$

$$x^4 + \frac{1}{x^4} + 2 = 324$$

$$x^4 + \frac{1}{x^4} = 324 - 2$$

$$x^4 + \frac{1}{x^4} = 322$$

## Assignment

### Add

1  $(5x^2 - 3y^2 + z) + (-x^2 + 2y^2 - 4z)$

2  $7a^2 - 5a^2 + a^2 + 3a^2$

3  $3m^2n - 2m^2n + 4m^2n - m^2n + 7m^2n$

4  $18 + 13x^2 - 13 + 2x^2 - 15x^2$

5  $6l^2m + 3lm^2 - 2l^2m - 17lm^2 + 1$

6  $3a^2b - 2ab - 2a^2b - 3ab - 2a^2b + ab$

### Subtract

1  Subtract $2a^2 - 3b^2$ from $3a^2 + 2b^2$

2  Subtract $-2y^2 + 3xy - 5$ from $3x^2 - 4xy + 7y^2 - 5$

3  Subtract $3x - 4x^2 + 2y^2$ from $4y^2 - 2x + 8x^2$

### Add and Subtract

1  $48m^2 + 24m^2n + 12m^2 - 6m^2 - 12m^2n$

2  $3x^2y - 2xy - 2x^2y - 3xy - 2x^2y + xy$

3  $10x + 14 - 7y^2 - 11a + 2x - 4 - 3y^2 - 4a + 8$

### Multiplication

1  $7pq^2 \times 5r$

2  $(4x^2 + 3y^2) \times (-2z)$

3  $-7p \times 4q^2$

4  $p^2q^3 \times 3p^3q^2$

5  $(3b^2 - 2b)3b^2$

6  $5y \times 2y^3y^2$

7  $ab^{-1} \times ba^{-1}$

### Division

1  $4a^8 \div 2a^3$

2  $-15a^8 \div 3a^5$

3  $\dfrac{8a^4}{12a^{-7}}$

4  $\dfrac{3p^2 \times 4p \times 5p^3 \times p}{6p^4 \times 10p}$

5  $\dfrac{25m^2n}{5m^3n^2}$

# Profit and loss - Simple problems on profit & loss

## Definition of 'profit and loss statement (P&L)

A profit and loss statement (P&L) is a financial statement that summarizes the revenues, costs and expenses incurred during a specific period of time, usually a year. These records provide information about a company's ability - to generate profit by increasing revenue, reducing costs, or both. The P&L statement is also referred to as "statement of profit and loss", "income statement", "statement of operations", "statement of financial results" and "income and expenditure statement".

## Profit and loss

## Important facts

### Cost price

The price, at which an article is purchased is called its cost price, abbreviated as C.P.

### Selling price

The price at which an article is sold, is called its selling prices, abbreviated as S.P.

### Profit or gain

If S.P. is greater than C.P., the seller is said to have a profit or gain.

### Loss

If S.P. is less than C.P., the seller is said to have incurred a loss.

### Discount

The reduction given to the selling price of a product is the discount.

## Important formulae

1  Profit or Gain=(S.P)-(C.P)

2  Loss=(C.P)-(S.P)

3  Loss or gain always depends on C.P.

4  Profit/gain is always expressed in %.

$$\text{Gain\%} = \left( \frac{\text{Gain} \times 100}{\text{C.P.}} \right)$$

5  Loss percentage: (Loss %)

$$\text{Loss \%} = \left( \frac{\text{Loss} \times 100}{\text{C.P.}} \right)$$

6  Selling price: (S.P)

$$\text{SP} = \left( \frac{100 + \text{Gain\%}}{100} \times \text{C.P} \right)$$

7  Selling price: (S.P)

$$\text{SP} = \left( \frac{(100 - \text{loss\%})}{100} \times \text{C.P} \right)$$

8  Cost price: (C.P)

$$\text{C.P} = \left( \frac{100}{(100 + \text{Gain \%})} \times \text{S.P} \right)$$

9  Cost price: (C.P)

$$\text{C.P} = \left( \frac{100}{(100 - \text{Loss \%})} \times \text{S.P} \right)$$

10  If an article is sold at a gain of say 35%, then S.P.=135% of C.P.

11  If an article is sold at a loss of say, 35% then S.P=65% of C.P.

## Example

1  **A dealer bought a television set for Rs.10,000 and sold it for Rs.12,000. Find the profit made by him for 1 television set. If he had sold 5 television sets, find the total profit?**

**Solution**

| | |
|---|---|
| Selling price of the television set | = Rs.12,000 |
| Cost price of the television set | = Rs.10,000 |

S.P. > C.P., there is a profit

| | | |
|---|---|---|
| | Profit | = S.P. - C.P |
| | | = 12000-10000 |
| | Profit | = Rs.2,000 |
| Profit on 1 television set | | = Rs.2000 |
| Profit on 5 television sets | | = 2000 x 5 |
| | | **= Rs.10,000** |

2  **Sanjay bought a bicycle for Rs.5000. He sold it for Rs.600 less after two years. Find the selling price and the loss percent?**

**Solution**

| | | |
|---|---|---|
| Cost price of the bicycle | | = Rs.5000 |
| | Loss | = Rs.600 |
| | Selling price | = Cost price - loss |
| | | = 5000 - 600 |
| Selling price of the bicycle | | = Rs.4400 |
| | Loss % | = $\frac{\text{Loss}}{\text{C.P.}}$ x 100 |
| | | = $\frac{600}{5000}$ x 100 |
| **Loss** | **= 12%** | |

3  **A man bought an old bicycle for Rs.1250. he spent Rs.250 on its repairs. He then sold it for Rs.1400. Find his loss %?**

**Solution**

Cost price of the bicycle  = Rs.1250

| | |
|---|---|
| Repair Charges | = Rs.250 |
| Total cost price | = 1250+250 = Rs.1500 |
| Selling price | = Rs.1400 |

C.P > S.P, there is a loss

| | |
|---|---|
| Loss | = Cost price - Selling price |
| 1500 - 1400 = 100 | |
| Loss | = Rs.100 |

$$\text{Loss \%} = \frac{\text{Loss}}{\text{C.P.}} \times 100$$

$$= \frac{100}{1500} \times 100$$

$$= \frac{20}{3} = 6\frac{2}{3}\% \text{ (or) } 6.67\%$$

**Loss = 6.67%**

---

**Profit percentage or loss percentage is always calculated on the cost price of the article.**

---

**4  A fruit seller bought 8 boxes of grapes at Rs.150 each. One box was damaged. He sold the remaining boxes at Rs.190 each. Find the profit percent?**

**Solution**

| | |
|---|---|
| Cost price of 1 box of grapes | = Rs.150 |
| Cost price of 8 boxes of grapes | = 150 x 8 |
| | = Rs.1200 |
| Number of boxes damaged | = 1 |
| Number of boxes sold | = 8 - 1 = 7 |
| Selling price of 1 box of grapes | = Rs.190 |
| Selling price of 7 boxes of grapes | = 190 x 7 |
| | = Rs.1330 |

S.P.>C.P, there is a profit

| | |
|---|---|
| Profit = Selling price - Cost price | |
| | = 1330-1200 |
| | = 130 |
| Profit | = Rs.130 |

$$\text{Percentage of profit} = \frac{\text{Profit}}{\text{C.P}} \times 100$$

$$= \frac{130}{1200} \times 100$$

$$= 10.83$$

**Profit = 10.83%**

**5  Ram, the shopkeeper bought a pen for Rs.50 and then sold it at a loss of Rs.5. Find his selling price.**

**Solution**

| | |
|---|---|
| Cost price of the pen | = Rs.50 |
| Loss | = Rs.5 |
| S.P. = C.P. - Loss | |
| | = 50 - 5 = 45 |

**Selling price of the pen = Rs.45**

**6  Find the initial amount if 12% of the total amount it is ₹ 1080**

Let the initial amount be '$x$'

Given: 12% of the total amount = Rs.1080

$$\frac{12}{100} \times x = 1080$$

$$x = \frac{1080 \times 100}{12}$$

$$= ₹ 9000$$

∴ **The initial amount = Rs.9000**

**Applications of profit and loss**

In this section, we learn to solve problems on applications of profit and loss.

**i  Illustration of the formula for S.P.**

Consider the following situation

Rajesh buys a pen for Rs.80 and sells it to his friend.

If he wants to make a profit of 5%, can you say the price for which he would have sold?

(Rajesh bought the pen for Rs.80 which is the cost price (C.P.). When he sold, he makes a profit of 5% which is calculated on the C.P.)

$$\therefore \text{Profit} = 5\% \text{ of C.P.} = \frac{5}{100} \times 80 = \text{Rs.4}$$

Since there is a profit, S.P > C.P.

$$\text{S.P.} = \text{C.P.} + \text{Profit}$$

$$= 80 + 4 = \text{Rs.84}$$

∴ **The price for which Rajesh would have sold = Rs.84**

**The same problem can be done using the formula.**

$$\text{Selling price (S.P)} = \frac{(100 + \text{Profit \%})}{100} \times \text{C.P}$$

$$= \frac{(100 + 5)}{100} \times 80$$

$$= \frac{105}{100} \times 80 = \text{Rs. 84}$$

**ii  Illustration of the formula for C.P**

Consider the following situation

Suppose a shopkeeper sells a wrist watch for Rs. 540 making a profit of 5%, then what would have been the cost of the watch?

(The shopkeeper had sold the watch at a profit of 5% on the C.P. Since C.P. is not known, let us take it as Rs. 100)

Profit of 5% is made on the C.P.

$$\therefore \text{ Profit } = 5\% \text{ of C.P.}$$

$$= \frac{5}{100} \times 100 = \text{Rs. } 5$$

We know S.P. = C.P + Profit

$$= 100 + 5$$

$$= \text{Rs. } 105$$

Here, if S.P. is Rs.105, then C.P. is Rs. 100

When S.P. of the watch is Rs. 540, C.P $= \dfrac{540 \times 100}{105}$

$$= \text{Rs. } 514.29$$

$\therefore$ The watch would have cost Rs. 514.29 for the shopkeeper.

The above problem can also be solved by using the formula method.

$$\text{C.P.} = \left(\frac{100}{100 + \text{Profit \%}}\right) \times \text{S.P}$$

$$= \left(\frac{100}{100 + 5} \times 540\right)$$

$$= \frac{100}{105} \times 540 = \text{Rs. } 514.29$$

We now summarize the formulae to calculate S.P. and C.P. as follows.

| 1  When there is a profit | 1  When there is a loss |
|---|---|
| $\text{C.P} = \left(\dfrac{100}{100 + \text{Profit\%}}\right) \times \text{S.P.}$ | $\text{C.P} = \left(\dfrac{100}{100 - \text{Loss\%}}\right) \times \text{S.P.}$ |
| 2  When there is a profit | 2  When there is a loss |
| $\text{S.P} = \left(\dfrac{100 + \text{Profit\%}}{100}\right) \times \text{C.P.}$ | $\text{S.P} = \left(\dfrac{100 - \text{Loss\%}}{100}\right) \times \text{C.P.}$ |

**Example**

**1  Hameed buys a colour T.V. set for Rs. 15,200 and sells it at a loss of 20%. What is the selling price of the T.V. set?**

**Solution**

**Method - I**

Loss is 20% of the C.P.

$$\frac{20}{100} \times 15200 = \text{Rs. } 3040$$

$$\text{S.P} = \text{C.P - Loss}$$

$$15200 - 3040 = \text{Rs.} 12160$$

**Method - II**

$$\text{C.P} = \text{Rs } 15,200$$

$$\text{Loss} = 20\%$$

$$\text{S.P} = \frac{100 - \text{Loss\%}}{100} \times \text{C.P.}$$

$$= \frac{100 - 20}{100} \times 15200$$

$$= \frac{80}{100} \times 15200$$

$$= \text{Rs. } 12,160$$

**2  A scooty is sold for Rs. 13600 and fetches a loss of 15%. Find the cost price of the scooty.**

**Method - I**

Loss of 15% means,

If C.P. is Rs. 100, Loss = Rs. 15

Therefore, S.P. would be

$$(100-15) = \text{Rs. } 85$$

If S.P. is Rs. 85, C.P. is Rs. 100

When S.P is Rs. 13600 then

$$\text{C.P} = \frac{100 \times 13600}{85} = \text{Rs. } 16000$$

**Method - II**

$$\text{Loss} = 15\%$$

$$\text{S.P.} = \text{Rs. } 13600$$

$$\text{C.P.} = \left(\frac{100}{100 - \text{Loss\%}}\right) \times \text{S.P}$$

$$= \frac{100}{100-15} \times 13600$$

$$= \frac{100}{85} \times 13600$$

$$= Rs. \ 16000$$

Hence the cost price of the scotty is Rs. 16000

## Discount

Discount is the reduction in value on the marked price or list price of the article.

The market price of a product is Rs.550

Amount paid by pooja to the shop keeper is Rs. 440

| | | |
|---|---|---|
| Discount | = Rs. 550 - Rs. 440 | |
| | = Rs. 110 | |
| | = Marked price - Selling price | |

Hence we conclude the following

| | |
|---|---|
| Discount | = Marked price - Selling price |
| Selling price | = Marked price - Discount |
| Marked price | = Selling price + Discount |

### Example

**1  A bicycle marked at Rs. 1500 is sold for Rs. 1350. What is the percentage of discount?**

Marked price = Rs. 1500

Selling price  = Rs. 1350

Amount of discount = Marked price - Selling price

$$= 1500 - 1350$$

$$= Rs. \ 150$$

Discount for Rs. 1500 = Rs. 150

Discount for Rs. 100 $= \dfrac{150}{1500} \times 100$

Percentage of discount  = 10%

**2  The list price of a Frock is Rs.220.  A discount of 20% on sales is announced.  What is the amount of discount on it and its selling price?**

Amount of discount $= \dfrac{Discount}{100\%} \times M.P.$

Amount of discount $= \dfrac{20}{100} \times 220 = Rs. \ 44$

Selling price of the frock = Marked price - Discount

$$220 - 44 = Rs. \ 176$$

**3  An almirah is sold at Rs. 5225 after allowing a discount of 5%.  Find its marked price.**

## Solution

### Method - I

The discount is given in percentage

Hence, the M.P. is taken as Rs. 100

Rate of discount     = 5%

Amount of discount   $= \dfrac{5}{100} \times 100$

Selling price        = M.P - Discount

$$= 100 - 5 = Rs. \ 95$$

If S.P. is Rs. 95, then M.P. is Rs.100

When S.P. is Rs. 5225

$$M.P. \ = \frac{100}{95} \times 5225$$

M.P of the almirah   = Rs. 5500

### Method - II

| | |
|---|---|
| S.P | = Rs. 5225 |
| Discount | = 5% |
| M.P | = ? |

$$M.P = \left( \frac{100}{100 - Discount\%} \right) \times S.P.$$

$$= \left( \frac{100}{100 - 5} \right) \times 5225$$

$$= Rs. \ 5500$$

**4  A shopkeeper allows a discount of 10% to his customers and still gains 20%.  Find the marked price of an article which costs Rs.450 to the shopkeeper.**

## Solution

### Method - I

Let M.P be Rs. 100

| | |
|---|---|
| Discount | = 10% of M.P |

$$= \frac{10}{100} \text{ of } M.P = \frac{10}{100} \times 100$$

$$= Rs. \ 10$$

| | |
|---|---|
| S.P | = M.P - Discount |
| | = 100 - 10 |
| | = Rs. 90 |
| Gain | = 20% of C.P. |

$$= \frac{20}{100} \times 450 = Rs. \ 90$$

| | |
|---|---|
| S.P | = C.P + Gain |
| | = 450 + 90 = Rs. 540 |

If S.P. is Rs. 90, then M.P is Rs. 100

$$M.P. = \frac{540 \times 100}{90} = Rs. 600$$

The M.P. of an article = Rs. 600

### Method - II

Discount = 10%,  Gain = 20%

C.P. = Rs. 450 , M.P. = ?

$$M.P = \frac{100 + Gain\%}{100 - Discount\%} \times C.P$$

$$= \frac{(100 + 20)}{(100 - 10)} \times 450$$

$$= \frac{120}{90} \times 450$$

$$= Rs. 600$$

**5  A dealer allows a discount of 10% and still gains 10%.  What is the cost price of the book which is marked at Rs. 220?**

**Solution**

**Method - I**

M.P = Rs.220

Discount = 10% of M.P

$$= \frac{10}{100} \times 220$$

$$= Rs. 22$$

S.P = M.P - Discount

= 220 - 22

= Rs. 198

Let, C.P. be Rs. 100

Gain = 10% of C.P.

$$= \frac{10}{100} \times 100$$

$$= Rs. 10$$

S.P. = C.P + Gain

= 100 + 10

= Rs. 110

If S.P. is Rs. 110, then C.P is Rs. 100

When S.P. is Rs. 198,

$$= \frac{198 \times 100}{110}$$

$$= Rs. 180$$

### Method - II

Discount = 10%

Gain = 10%

M.P. = Rs. 220

$$C.P. = \frac{100 - Discount\%}{100 + Gain\%} \times M.P$$

$$= \frac{100 - 10}{100 + 10} \times 220$$

$$= \frac{90}{110} \times 220$$

= Rs. 180

**6  A trader buys an article for Rs. 1200 and marks it 30% above the C.P.  He then sells it after allowing a discount of 20%.  Find the S.P. and profit percent.**

**Solution**

Let C.P. of the article be Rs. 100

M.P. =30% above C.P. = Rs. 130

If C.P is Rs. 100, then M.P. is Rs. 130

When C.P. is Rs. 1200,

$$M.P. = \frac{1200 \times 130}{100} = Rs. 1560$$

$$Discount = 20\% \text{ of } 1560 = \frac{20}{100} \times 1560$$

$$Discount = 20\% \text{ of } 1560 = \frac{20}{100} \times 1560$$

$$= Rs. 312$$

S.P = M.P. - Discount

= 1560 - 312

= Rs. 1248

Profit = S.P - C.P

= 1248 - 1200

= Rs. 48

$$Profit \% = \frac{Profit}{C.P.} \times 100$$

$$= \frac{48}{1200} \times 100$$

$$= 4\%$$

**Summary**

Percent means per hundred. A fraction with its denominator 100 is called a percent.

**In case of profit, we have Profit = S.P - C.P.**

$$\text{Profit \%} = \frac{\text{Profit}}{\text{C.P.}} \times 100$$

$$\text{S.P} = \left(\frac{100 + \text{Profit\%}}{100}\right) \times \text{C.P.}$$

$$\text{C.P} = \left(\frac{100}{100 + \text{Profit\%}}\right) \times \text{S.P.}$$

$$\text{M.P.} = \frac{100}{100 - \text{Discount \%}} \times \text{S.P}$$

$$\text{S.P.} = \frac{100 - \text{Discount \%}}{100} \times \text{M.P}$$

$$\text{C.P.} = \frac{100 - \text{Discount \%}}{100 + \text{Profit \%}} \times \text{M.P}$$

$$\text{M.P.} = \frac{100 + \text{Profit \%}}{100 - \text{Discount \%}} \times \text{C.P}$$

$$\text{Discount percent} = \frac{\text{Discount}}{\text{M.P.}} \times 100$$

Discount is the reduction given on the Marked price.

Selling price is the price payable after reducing the discount from the marked price.

Discount = M.P. - S.P.

**In case of loss, we have Loss = C.P - S.P.**

$$\text{Loss \%} = \frac{\text{Loss}}{\text{C.P.}} \times 100$$

$$\text{S.P} = \left(\frac{100 - \text{Loss\%}}{100}\right) \times \text{C.P.}$$

$$\text{C.P} = \left(\frac{100}{100 - \text{Loss\%}}\right) \times \text{S.P.}$$

# Assignment

1  Find the cost price if the product is sold at Rs. 572 with a profit of Rs. 72.

2  Find the C.P if the product is sold at Rs.1973 with a profit of Rs. 273

3  Find the selling price if the cost price is Rs. 7282 with a profit of Rs. 208

4  Find out the S.P. if the C.P. is Rs. 9684 with a loss of Rs. 684

5  Find out the profit percentage if the C.P is Rs. 320 and S.P is Rs. 384.

6  Find out the profit amount if the C.P. and S.P. are Rs. 2500 and Rs. 2700 respectively.

7  Calculate the percentage of loss if the C.P. and S.P are Rs. 40 and Rs. 38 respectively.

8  A computer table bought at Rs. 1150 with Rs. 50 as a transport charge. Calculate the S.P. if the profit is of 5%

9  By selling a table for Rs. 1320 with a gain of 10%. Find the C.P.

10 The C.P. of 16 bolts is equal to the S.P. of 12 bolts. Find the gain percent.

# Profit and loss - Simple and compound interest

**Interest**

When we borrow (or lent) money we pay (or receive) some additional amount in addition to the original amount. This additional amount that we receive is termed as Interest. It is denoted as 'I'. Money can be borrowed//lent deposited in banks to get Interest. The amount borrowed//lent is called the principal. (P)

The principal added to the Interest is called the Amount(A).

Amount = Principal + Interest

A = P + I

Interest depends on principal and duration of time. But it also depends on one more factor called the rate of interest. Rate of interest is the amount calculated annually for ₹100. (ie) if rate of interest is 10% per annum, then interest is ₹10 for ₹100 for 1 year.

So,

Interest depends on

Amount deposited or borrowed/lent - Principal - P

Period of time - mostly expressed in years - n

Rate of interest - r

This interest is termed as Simple interest.

When the interest is paid on the principal only, it is called simple interest.

**Calculation of interest**

If 'r' is the rate of interest, Principal is 100,

The interest for 1 year = $100 \times 1 \times \dfrac{r}{100}$

for 2 years = $100 \times 2 \times \dfrac{r}{100}$

for 3 years = $100 \times 3 \times \dfrac{r}{100}$

for n years = $100 \times n \times \dfrac{r}{100}$

So,

$I = \dfrac{Pnr}{100}$

$A = P + I$

$A = P + \dfrac{Pnr}{100}$

$A = P\left(1 + \dfrac{nr}{100}\right)$

Interest = Amount - Principal

The other formulae derived from

$I = \dfrac{Pnr}{100}$

$r = \dfrac{100\,I}{Pn}$

$n = \dfrac{100\,I}{Pr}$

$P = \dfrac{100\,I}{rn}$

'n' is always calculated in years. When 'n' is given in months or days, convert it into years.

**Example :**

12 Months = 1 year

6 Months $= \dfrac{6}{12}$ year $= \dfrac{1}{2}$ year

3 Months $= \dfrac{3}{12}$ year $= \dfrac{1}{4}$ year

146 days $= \dfrac{146}{365}$ year $= \dfrac{2}{5}$ year

**Example**

1  **Vimal invested ₹ 3000 for 1 year at 7% per annum. Find the simple interest and the amount received by him at the end of one year.**

**Solution**

| | |
|---|---|
| Principal (P) | = ₹ 3,000 |
| Number of years (n) | = 1 |
| Rate of interest (r) | = 7% |
| Interest(I) | $= \dfrac{Pnr}{100}$ |
| | $= \dfrac{3000 \times 1 \times 7}{100}$ |
| I | = 210 |
| Amount(A) | = P + I |
| | = 3000 + 210 |

**Amount received by him (A) = ₹ 3,210**

2  **Ramani invested ₹ 5000 for 2 years at 11% per annum. Find the simple interest and the amount received by him at the end of 2 years.**

**Solution**

| | |
|---|---|
| Principal (P) | = ₹ 5,000 |
| Number of years (n) | = 2 yrs |
| Rate of interest (r) | = 11% |
| Interest(I) | $= \dfrac{Pnr}{100}$ |

$$= \frac{5000 \times 2 \times 11}{100}$$

$$= 1100$$

$$I = ₹ 1100$$

Amount(A) = P + I

= 5000 + 1100

**Amount received by him (A) = ₹ 6,100**

**3 Find the simple interest and the amount due on ₹ 7,500 at 8% per annum for 1 year 6 months.**

**Solution**

Principal (P) = ₹ 7,500

Number of years (n) = 1 yr. 6 months

$$= 1\frac{6}{12} \text{ yrs}$$

$$= 1\frac{1}{2} \text{ yrs} = \frac{3}{2} \text{ yrs.}$$

r = 8%

Interest(I) $$= \frac{Pnr}{100}$$

$$= \frac{7500 \times \frac{3}{2} \times 8}{100}$$

$$= \frac{7500 \times 3 \times 8}{2 \times 100}$$

$$= 900$$

$$I = ₹ 900$$

Amount = P + I

= 7500 + 900

**Amount due on = ₹ 8,400**

**Interest = ₹ 900, Amount = ₹ 8,400**

**Alternative method**

Principal (P) = ₹ 7,500

Number of years (n) $$= \frac{3}{2} \text{ yrs}$$

Rate of interest (r) = 8%

$$A = P\left(1 + \frac{nr}{100}\right)$$

$$= 7500\left(1 + \frac{\frac{3}{2} \times 8}{100}\right)$$

$$= 7500\left(1 + \frac{3 \times 8}{2 \times 100}\right)$$

$$= 7500\left(\frac{28}{25}\right)$$

$$= 300 \times 28$$

$$= 8400$$

$$A = ₹ 8400$$

Interest (I) = A - P

= 8400 - 7500

**Interest(I) = ₹ 900, Amount = ₹ 8,400**

**4 Find the simple interest and the amount due on ₹ 6,750 for 219 days at 10% per annum.**

**Solution**

Principal (P) = ₹ 6,750

Number of years (n) = 219 days

$$= \frac{219}{365} \text{ year} = \frac{3}{5} \text{ year}$$

r = 10%

$$I = \frac{Pnr}{100}$$

$$= \frac{6750 \times 3 \times 10}{5 \times 100}$$

$$= 405$$

$$I = ₹ 405$$

Amount = P + I

= 6750 + 405

Amount due on = ₹ 7,155

**Interest(I) = ₹ 405, Amount = ₹ 7,155**

**5 Ravi borrowed ₹ 4000 on 7th june 2006 and returned it on 19th August 2006. Find the amount he paid, if the interest is calculated at 5% per annum.**

**Solution**

Principal (P) = ₹ 4,000

r = 5%

Number of days, June = 24(30 - 6)

July = 31

August = 18

Total number of days = 73

n = 73 days

$$= \frac{73}{365} \text{ year}$$

$$= \frac{1}{5} \text{ year}$$

Amount 
$$= P\left(1+\frac{nr}{100}\right)$$

$$= 4000\left(1+\frac{1 \times 5}{5 \times 100}\right)$$

$$= 4000\left(1+\frac{1}{100}\right)$$

$$= 4000\left(\frac{101}{100}\right)$$

$$= 4,040$$

**Amount = ₹ 4,040**

**6  Find the rate percent per annum when a principal of ₹ 7,000 earns a S.I. of ₹ 1,680 in 16 months.**

**Solution**

Principal (P) $= ₹ 7,000$

$n = 16 \text{ months}$

$$= \frac{16}{12} \text{ yr} = \frac{4}{3} \text{ yr}$$

$I = ₹ 1,680$

$r = ?$

$$r = \frac{100\,I}{Pn}$$

$$= \frac{100 \times 1680}{7000 \times \frac{4}{3}}$$

$$= \frac{100 \times 1680 \times 3}{7000 \times 4}$$

$$= 18$$

**Rate of interest  (r) = 18%**

**7  Vijayan invested ₹10,000 at the rate of 5% simple interest per annum. He received ₹ 11,000 after some years. Find the number of years.**

**Solution**

$A = ₹ 11,000$

$P = ₹ 10,000$

$r = 5\%$

$I = A - P$

$= 11,000 - 10,000$

$= 1,000$

$I = ₹ 1,000$

$$n = \frac{100\,I}{Pr}$$

$$= \frac{100 \times 1000}{10000 \times 5}$$

Number of years $= 2 \text{ years.}$

**Alternative method**

$$A = P\left(1+\frac{nr}{100}\right)$$

$$11000 = 10000\left(1+\frac{n \times 5}{100}\right)$$

$$\frac{11}{10} = \frac{20+n}{20}$$

$$\frac{11}{10} \times 20 = 20 + n$$

$$22 = 20 + n$$

$$22 - 20 = n$$

**Number of years = 2**

**8  A sum of money triples itself at 8% per annum over a certain time. Find the number of years.**

**Solution**

Let principal $= ₹ P$

Amount $= \text{triple the principal}$

$= ₹ 3P$

Let, $P = 100$

$3P = 3 \times 100$

$r = 8\%$

$n = ?$

$I = A - P$

$= 300 - 100$

$I = ₹ 200$

$$n = \frac{100\,I}{Pr} = \frac{100 \times 200}{100 \times 8}$$

$$n = \frac{200}{8} = 25$$

**Number of years = 25**

**9  A certain sum of amounts to ₹ 10,080 in 5 years at 8%. Find the principal.**

**Solution**

$A = ₹ 10,080$

$n = 5 \text{ years}$

$r = 8\%$

$P = ?$

$$\text{Amount (A)} = P\left(1+\frac{nr}{100}\right)$$

$$₹ 10080 = P\left(1+\frac{5 \times 8}{100}\right)$$

$$₹\,10080 = P\left(1 + \frac{5 \times 8}{100}\right)$$

$$₹\,10080 = P\left(\frac{7}{5}\right)$$

$$₹\,10080 \times \frac{5}{7} = P$$

$$7{,}200 = P$$

**Principal = ₹ 7,200**

**10 A certain sum of amounts to ₹ 7,920 in 4 years and ₹ 8,880 in 6 years respectively. Find the principal and rate percent.**

**Solution**

| Amount at the end of 6 years | = Principal + interest for 6 years |
|---|---|
| | = $P + I_6 = 8880$ |
| Amount at the end of 4 years | = Principal + interest for 4 years |
| | = $P + I_4 = 7920$ |
| $I_2$ | = 8880 - 7920 |
| | = 960 |
| Interest at the end of 2 years | = ₹ 960 |
| Interest at the end of 1$^{st}$ years | = $\dfrac{960}{2}$ |
| | = 480 |
| Interest at the end of 4 years | = 480 × 4 |
| | = 1,920 |
| $P + I_4$ | = 7920 |
| $P + 1920$ | = 7920 |
| $P$ | = 7920 - 1920 |
| $P$ | = 6,000 |
| Principal | = ₹ 6,000 |
| $r$ | = $\dfrac{100 I}{Pn}$ |
| | = $\dfrac{100 \times 1920}{6000 \times 4}$ |

**Rate of interest (r) = 8%**

**Compound Interest**

Rajesh borrowed ₹ 50,000 from a bank for a fixed time period of 2 years. at the rate of 4% per annum.

Rajesh has to pay for the first year.

$$\text{Simple interest} = \frac{P \times n \times r}{100}$$

$$= \frac{50000 \times 1 \times 4}{100} = ₹\,2{,}000$$

Suppose he fails to pay the simple interest ₹ 2,000 at the end of first year, then the interest ₹ 2,000 is added to the old principal ₹ 50,000 and now the sum = P + I = ₹ 52,000 becomes the new principal for the second year for which the interest is calculated.

Now in the second year he will have to pay an interest of

$$\text{Simple interest} = \frac{P \times n \times r}{100}$$

$$= \frac{52000 \times 1 \times 4}{100} = ₹\,2{,}080$$

Therefore Rajesh will have to pay more interest for the second year.

This way of calculating interest is called compound Interest.

If the interest is paid on the principal as well as on the accrued interest, it is called compound interest.

Generally in banks, insurance companies, post offices and in other companies which lend money and accept deposits, compound interest is followed to find the interest.

**Example**

**Ram deposited ₹ 8,000 with a finance company for 3 years at an interest of 15% per annum. What is the compound interest that Ram gets after 3 years?**

**Solution**

**Step 1 :**

| Principal for the first year | = ₹ 8,000 |
|---|---|
| Interest for the first year | = $\dfrac{P \times n \times r}{100}$ |
| | = $\dfrac{80000 \times 1 \times 15}{100}$ |
| | = ₹ 1,200 |
| Amount at the end of first year | = P + I |
| | = 8,000 + 1,200 |
| | = ₹ 9,200 |

**Step 2 :**

| Principal for the 2$^{nd}$ year | = ₹ 9,200 |
|---|---|
| Interest for the 2$^{nd}$ year | = $\dfrac{P \times n \times r}{100}$ |
| | = $\dfrac{9200 \times 1 \times 15}{100}$ |
| | = ₹ 1,380 |

Amount at the end of 2ⁿᵈ year $= P + I$

$= 9,200 + 1,380$

$= ₹\ 10,580$

**Step 3 :**

Principal for the 3ʳᵈ year $= ₹\ 10,580$

Interest for the 3ʳᵈ year $= \dfrac{P \times n \times r}{100}$

$= \dfrac{10580 \times 1 \times 15}{100}$

$= ₹\ 1,587$

Amount at the end of 3ʳᵈ year $= P + I$

$= 10,580 + 1,587$

$= ₹\ 12,167$

Hence, the compound interest that Ram gets after 3 years is

$A - P = 12,167 - 8,000 = ₹\ 4,167$

**Deduction of formula for compound interest**

The above method which we have used for the calculation of compound interest is quite lengthy and cumbersome, especially when the period of time very large. Hence we shall obtain a formula for the computation of amount and compound interest.

**Example**

**If the principal is P, Rate of interest per annum is r% and the period of time or the number of years is n, then we deduce the compound interest formula as follows:**

Step 1:

Principal for the first year $= P$

Interest for the first year $= \dfrac{P \times n \times r}{100}$

$= \dfrac{P \times 1 \times r}{100} = \dfrac{Pr}{100}$

Amount at the end of first year $= P + I$

$= P + \dfrac{Pr}{100}$

$= P\left(1 + \dfrac{r}{100}\right)$

**Step 2 :**

Principal for the 2ⁿᵈ year $= P\left(1 + \dfrac{r}{100}\right)$

Interest for the 2ⁿᵈ year $= P\left(1 + \dfrac{r}{100}\right) \times \dfrac{1 \times r}{100}$

(using the Simple Interest formula)

$= P\left(1 + \dfrac{r}{100}\right) \times \dfrac{r}{100}$

Amount at the end of 2ⁿᵈ year $= P + I$

$= P\left(1 + \dfrac{r}{100}\right) + P\left(1 + \dfrac{r}{100}\right) \times \dfrac{r}{100}$

$= P\left(1 + \dfrac{r}{100}\right)\left(1 + \dfrac{r}{100}\right)$

$= P\left(1 + \dfrac{r}{100}\right)^2$

**Step 3 :**

Principal for the 3ʳᵈ year $= P\left(1 + \dfrac{r}{100}\right)^2$

Interest for the 3ʳᵈ year $= P\left(1 + \dfrac{r}{100}\right)^2 \times \dfrac{1 \times r}{100}$

(using the Simple interest formula)

$= P\left(1 + \dfrac{r}{100}\right)^2 \times \dfrac{r}{100}$

Amount at the end of 3ʳᵈ year $= P + I$

$= P\left(1 + \dfrac{r}{100}\right)^2 + P\left(1 + \dfrac{r}{100}\right)^2 \times \dfrac{r}{100}$

$= P\left(1 + \dfrac{r}{100}\right)^2\left(1 + \dfrac{r}{100}\right)$

$= P\left(1 + \dfrac{r}{100}\right)^3$

Similarly, Amount at the end of nᵗʰ year is

$A = P\left(1 + \dfrac{r}{100}\right)^n$ and C.I. at the end of 'n' years is given by

Compound Interest (C.I) $= A - P$

(ie.) Compound Interest (C.I) $= P\left(1 + \dfrac{r}{100}\right)^n - P$

**To compute compound interest**

## Case 1 : Compounded Annually

When the interest is added to the principal at the end of each year, we say that the interest is compounded annually.

Here,

$$A = P\left(1+\frac{r}{100}\right)^n \text{ and C.I } = A - P$$

## Case 2 : Compounded half-yearly (semi-annually)

When the interest is compounded half-yearly, there are two conversion periods in a year each after 6 months. In such situations, the half-yearly rate will be half of the annual rate, that is ().

In this case,

$$A = P\left(1+\frac{1}{2}\left(\frac{r}{100}\right)\right)^{2n} \text{ and C.I } = A - P$$

## Case 3 : Compounded quarterly

When the interest is compounded quarterly, there are four conversion periods in a year and the quarterly rate will be one-fourth of the annual rate, that is ().

In this case,

$$A = P\left(1+\frac{1}{4}\left(\frac{r}{100}\right)\right)^{4n} \text{ and C.I } = A - P$$

## Case 4 : Compounded when time being fraction of a year

### When interest is compounded annually but time being a fraction.

In this case, when interest is compounded annually but time being a fraction of a year, say $5\frac{1}{4}$ years, then amount A is given by

$$A = P\left(1+\frac{r}{100}\right)^5\left[1+\frac{1}{4}\left(\frac{r}{100}\right)\right] \text{ and C.I } = A - P$$

for 5 years            for $\frac{1}{4}$ years

## Example

**Find the C.I. on ₹ 15,625 at 8% p.a. for 3 years compounded annually.**

### Solution

We know,

$$\text{Amount after 3 years} = P\left(1+\frac{r}{100}\right)^3$$

$$= 15625\left(1+\frac{8}{100}\right)^3$$

$$= 15625\left(1+\frac{2}{25}\right)^3$$

$$= 15625\left(\frac{27}{25}\right)$$

$$= 15625 \times \frac{27}{25} \times \frac{27}{25} \times \frac{27}{25}$$

$$= ₹ 19,683$$

Now, compound interest = A - P

$$= 19,683 - 15,625$$

$$= ₹ 4,058$$

**To find the C.I. when the interest is compounded annually or half-yearly.**

Let us see what happens to ₹100 over a period of one year if an interest is compounded annually or half-yearly.

| S. No. | Annually | Half yearly |
|---|---|---|
| 1 | P = ₹ 100 at 10% per annum compounded annually. | P = ₹ 100 at 10% per annum compounded half-yearly. |
| 2 | The time period taken is 1 year. | The time period is 6 months or 1/2 year. |
| 3 | $I = \frac{100 \times 10 \times 1}{100} = ₹ 10$ | $I = \frac{100 \times 10 \times \frac{1}{2}}{100} = ₹ 5$ |
| 4 | A = 100 + 10 = ₹ 110 | A = 100 + 5 = ₹ 105 <br> For the next 6 months, P = ₹ 105 <br> So, $I = \frac{105 \times 10 \times \frac{1}{2}}{100} = ₹ 5.25$ and <br> A = 105 + 5.25 = ₹ 110.25 |
| 5 | A = ₹ 110 | A = ₹ 110.25 |

Thus, if interest is compounded half-yearly, we compute the interest two times and rate is taken as half of the annual rate.

**Example**

**1  Find the compound interest on ₹ 1000 at the rate of 10% per annum for 18 months when interest is compounded half-yearly.**

**Solution**

Here, P = ₹ 1000, r = 10% per annum.

and n = 18 months = $\dfrac{18}{12}$ years = $\dfrac{3}{2}$ years = $1\frac{1}{2}$ years

∴ Amount after 18 months $= P\left[1+\dfrac{1}{2}\left(\dfrac{r}{100}\right)\right]^{2n}$

$= 1000\left[1+\dfrac{1}{2}\left(\dfrac{10}{100}\right)\right]^{2\times\frac{3}{2}}$

$= 1000\left[1+\dfrac{10}{200}\right]^{3}$

$= 1000\left(\dfrac{21}{20}\right)^{3}$

$= 1000 \times \dfrac{21}{20} \times \dfrac{21}{20} \times \dfrac{21}{20}$

$= ₹ 1157.625$

$= ₹ 1157.63$

C.I $= A - P$

$= 1157.63 - 1000$

**Compound Interest   = ₹ 157.63**

**2  Find the compound interest on ₹ 20,000 at 15% per annum for $2\frac{1}{3}$ years.**

**Solution**

Here, P = ₹ 20,000, r = 15% per annum. and n = $2\frac{1}{3}$ years.

Amount after $2\frac{1}{3}$ years A $= P\left(1+\dfrac{r}{100}\right)^{2}\left(1+\dfrac{1}{3}\left(\dfrac{r}{100}\right)\right)$

$= 20000\left(1+\dfrac{15}{100}\right)^{2}\left(1+\dfrac{1}{3}\left(\dfrac{15}{100}\right)\right)$

$= 20000\left(1+\dfrac{3}{20}\right)^{2}\left(1+\dfrac{1}{20}\right)$

$= 20000\left(\dfrac{23}{20}\right)^{2}\left(\dfrac{21}{20}\right)$

$= 20000 \times \dfrac{23}{20} \times \dfrac{23}{20} \times \dfrac{21}{20}$

$= ₹ 27,772.50$

C.I $= A - P$

$= 27,772.50 - 20,000$

**Compound Interest= ₹ 7,772.50**

**Inverse problems on compound interest**

We have already learnt the formula, A $= P\left(1+\dfrac{r}{100}\right)^{n}$

Where four variable A, P, r and n are involved. Out of these four variables, if any three variables are known, then we can calculate the fourth variable.

**Example**

**1  At what rate per annum will ₹ 640 amount to ₹ 774.40 in 2 years, interest being compounded annually?**

**Solution**

Given : P = ₹ 640,  A = ₹ 774.40, n = 2 years , r = ?

We know,

$A = P\left(1+\dfrac{r}{100}\right)^{n}$

$774.40 = 640\left(1+\dfrac{r}{100}\right)^{2}$

$\dfrac{774.40}{640} = \left(1+\dfrac{r}{100}\right)^{2}$

$\dfrac{77440}{64000} = \left(1+\dfrac{r}{100}\right)^{2}$

$\dfrac{121}{100} = \left(1+\dfrac{r}{100}\right)^{2}$

$\left(\dfrac{11}{10}\right)^{2} = \left(1+\dfrac{r}{100}\right)^{2}$

(∴ Remove square root on both side)

$\dfrac{11}{10} = \dfrac{100+r}{100}$

$\dfrac{11}{10} \times 100 = 100 + r$

$110 = 100 + r$

$r = 110 - 100$

$r = 10\%$

**Rate r = 10% per annum**

**2** **In how much time will a sum of ₹ 1600 amount to ₹ 1852.20 at 5% per annum compound interest.**

**Solution**

Given : P = ₹1600,  A = ₹ 1852.20, r = 5% per annum, n = ?

We know,

$$A = P\left(1+\frac{r}{100}\right)^n$$

$$1852.20 = 1600\left(1+\frac{5}{100}\right)^n$$

$$\frac{1852.20}{1600} = \left(\frac{105}{100}\right)^n$$

$$\frac{185220}{160000} = \left(\frac{21}{20}\right)^n$$

$$\frac{9261}{8000} = \left(\frac{21}{20}\right)^n$$

$$\left(\frac{21}{20}\right)^3 = \left(\frac{21}{20}\right)^n$$

$$\therefore n = 3 \text{ years}$$

**3** **Find the principal that will yield a compound interest of ₹ 1632 in 2 years at 4% rate of interest per annum.**

**Solution**

Given : C.I = ₹ 1632, n = 2 years, r = 4% p.a

$$P = ?$$

We know,

Amount - Principal = Compound interest

$$A - P = C.I$$

$$- P = C.I - A$$

$$+ P = A - C.I$$

$$P = P\left(1+\frac{r}{100}\right)^n - C.I$$

$$= P\left(1+\frac{4}{100}\right)^2 - 1632$$

$$= P \times \frac{104}{100} \times \frac{104}{100} - 1632$$

$$P = 1.0816P - 1632$$

$$1P - 1.0816P = -1632$$

$$-0.0816P = -1632$$

$$0.0816P = 1632$$

$$P = \frac{1632}{0.0816}$$

$$= 20,000$$

**Principal = ₹ 20,000**

**Difference between simple interest and compound interest**

When P is the Principal, n = 2 years and r is the rate of interest.

Difference between C.I and S.I for 2 years = $P\left(\frac{r}{100}\right)^2$

**Example**

**Find the difference between simple interest and compund interest for a sum of ₹ 8,000 lent at 10% p.a. in 2 years.**

**Solution**

Here, P = ₹ 8000, n = 2 years, r = 10% p.a.

Difference between compound interest and simple interest

for 2 years $= P\left(\frac{r}{100}\right)^2$

$$= 8000\left(\frac{10}{100}\right)^2$$

$$= 8000\left(\frac{1}{10}\right)^2$$

$$= 8000 \times \frac{1}{10} \times \frac{1}{10}$$

$$= ₹ 80$$

# Assignment A

1   If principal = Rs. 5000, Interest = Rs. 500.  Find the amount.

2   If principal = Rs. 12500, Amount= Rs. 17500.  Find the Interest.

3   If the amount is Rs. 25000, its interest is 6000, calcaulate its principal.

4   If principal = Rs. 8450, Interest is 750.  Calculate the amount.

5   If principal = Rs. 12000, Amount= Rs. 15600.  Find the Interest.

# Assignment B

**Convert the following**

1  6 Months = _____ year.

2  10 Months = _____ year.

3  259 days into week.

4  22 weeks into days.

5  170 days into year.

6  292 days into year.

7  The month of July and August = ____ days

8  2 year 6 months = ____ years

9  15 years = ____ months

10  144 Months = _____ years.

# Assignment C

1  Ramani invested Rs. 1000 for 2 years at 10% per annum. Find the simple interest.

2  Find the S.I. and the amount on ₹ 5,000 at 10% per annum for 5 years.

3  Find the S.I. and the amount on ₹ 1,200 at 12½% per annum for 3 years.

4  Kamesh invested ₹ 10,000 in a bank that pays an interest of 10% per annum. He withdraws the amount after 2 years and 3 months. Find the interest, he receives.

5  Find the amount when ₹ 2,500 is invested for 146 days at 13% per annum.

6  Find the S.I. and the amount on ₹ 12,000 from May 21" 1999 to August 2nd 1999 at 9% per annum.

7  Shanthi deposited ₹ 6,000 in a bank and received 7500 at the end of 5 years. Find the rate of interest.

8  Find the principal that earns ₹ 250 as S.I. in 2½ years at 10% per annum.

9  In how many years will a sum of ₹ 5,000 amount to ₹ 5,800 at the rate of 8% per annum.

10  A sum of money doubles itself in 10 years. Find the rate of interest.

11  A sum of money doubles itself in 12½ per annum over a certain period of time. Find the number of years.

12  A certain sum of money amounts to ₹ 6,372 in 3 years at 6%. Find the principal.

13  A certain sum of money amounts to ₹ 6,500 in 3 years and ₹ 5,750 in 1½ years respectively. Find the principal and the rate percent.

14  Find the S.I. and the amount on ₹ 3,600 at 15% per annum for 3 years and 9 months.

15  Find the principal that earns ₹ 2,080 as S.I. in 3¼ years at 16% p.a.

# Assignment D

1  Find the amount and compound interest in the following cases:

| SI. No. | Principal in Rs. | Rate % per annum | Time in years |
|---------|------------------|------------------|---------------|
| a | 1000 | 5% | 3 |
| b | 4000 | 10% | 2 |
| c | 18000 | 10% | 2½ |

2  Sankari borrowed Rs. 8,000 from Alex for 2 years at 12½% per annum. What interest did sankari pay to Alex if the interest is compounded annually.

3  Find the compound interest on Rs. 24000 compounded semi annually (half yearly) for 1½ years at the rate of 10% per annum.

4  Find the amount that Divakar would receive if he invests Rs. 8192 for 18 months at 12½% per annum, the interest being compounded half-yearly.

5  Anbu took a loan of Rs.80,000 from a bank for 1½ years at 10% per annum. What interest did Anbu pay to bank if the interest is compounded annually.

6  Find the amount that Manimegalai would receive if she invests Rs. 80,000 for 18 months at 10% per annum, the interest being compounded half-yearly.

7  Find the compound interest on Rs. 15625 for 9 months at 16% per annum compounded quarterly.

8  Raju took a loan of Rs. 80,000 from a bank. If the rate of interest is 10% p.a. Find the difference in amounts he would be paying after 1½ years if the interest compounded annually is Rs. 92400, compounded half yearly is Rs. 92610.

9  Guna borrowed Rs. 26400 from a bank to buy a scooter at the rate of 15% p.a. compounded yearly. What amount will he pay at the end of 2 years to clear the loan.

10 Find the difference between simple interest and compound interest on ₹ 2400 at 2 years at 5% per annum compounded annually.

11 Find the difference between simple interest and compound interest on ₹ 6400 for 2 years at 6¼% p.a. compounded annually.

# Assignment E

**I MCQ (Multiple Choise Questions)**

1 Reduction from original selling price is called _____

   A loss           B list price

   C profit          D marked price

2 A man buys an article for Rs. 27.50 and sells it for Rs. 28.60. Find his gain percent

   A 1%            B 2%

   C 3%            D 4%

3 A TV is purchased at Rs.5000 and sold at Rs. 4000, find the lost percent.

   A 10%          B 20%

   C 25%          D 28%

4 A person incurs a loss of 5% be selling a watch for Rs. 1140. At what price should the watch be sold to earn 5% profit.

   A Rs. 1200      B Rs. 1230

   C Rs. 1260      D Rs. 1290

5 A book was sold for Rs. 27.50 with a profit of 10%. If it were sold for Rs.25.75, What would have been percentage of profit and loss?

   A 2% profit     B 3% profit

   C 2% loss      D 3% loss

6 Alfred buys an old scooter for Rs. 4700 and spends Rs. 800 on its repairs. If he sells the scooter for Rs. 5800 his gain percent is _____

   A 6.19%       B 6.17%

   C 5.4545%     D 3.5111%

7 If the cost price is 25% of selling price. Then what is the profit percent?

   A 150%        B 200%

   C 300%        D 350%

8 The cost price of 20 articles is the same as the selling price of $x$ articles. If the profit is 25%, find out the value of $x$.

   A 13            B 14

   C 15            D 16

9 A man buys an item at Rs. 1200 and sells it all the loss of 20 percent. Then what is the selling price of that item.

   A 660           B 760

   C 860           D 960

10 A plot is sold for Rs. 18,700 with a loss of 15%. At what price it should be sold to get profit of 15%.

   A Rs. 25300     B Rs. 22300

   C Rs. 24300     D Rs. 21300

11 A man gains 20% by selling an article for a certain price. If he sells it at double the price, the percentage of profit will be

   A 130%        B 140%

   C 150%        D 160%

12 If the cost price of 12 pens is equal to the selling price of 8 pens, the gain percent is?

   A 12%         B 30%

   C 50%         D 60%

13 Ryan buys a clock for Rs. 75 and sells it for Rs. 100. His gain percent is _____

   A 25%        B $33\frac{1}{3}$%

   C 20%        D $37\frac{1}{2}$%

14 A bat is bought for Rs. 120 and sold for Rs. 105, the loss percent is _____

   A $15\frac{1}{3}$%     B $14\frac{1}{5}$%

   C 15%       D $16\frac{2}{3}$%

15 A man bought apples at the rate of 8 for Rs.34 and sold them at the rate of 12 for Rs. 57. How many apples should be sold to earn a net profit of Rs. 45?

   A 90           B 100

   C 135         D 150

16 A tradesman sold an article at a loss of 20%. Had he sold it for Rs. 100 more , he should have gained 5%. The cost price of the article was _____

   A Rs. 360       B Rs. 400

   C Rs. 425       D Rs. 450

17 At what percentage above the cost price must an article be marked so as to gain 33% after allowing a customer a discount of 5%?

   A 35%        B 38%

   C 40%        D 42%

18 A shopkeeper earns a profit of 12% on selling a book at 10% discount on the printed price. The ratio of the cost price and the printed price of the book is

   A 45:56       B 45:51

   C 47:56       D 47:51

19 By selling a bicycle for Rs. 2,850 a shopkeeper gains 14%. If the profit is reduced to 8%, then the selling price will be

A  Rs. 2600        B  Rs. 2700

C  Rs. 2800        D  Rs. 3000

20 A person sold a horse at a gain of 15%. Head he bought it for 25% less and sold it for Rs. 600 less, he would have made a profit of 32%. The cost price of the horse was:

A  Rs. 3750        B  Rs. 3250

C  Rs. 2750        D  Rs. 2250

21 If a man were to sell his chair for Rs. 720, he would lose 25%. To gain 25% he should sell it for:

A  Rs. 1200        B  Rs. 1000

C  Rs. 960         D  Rs. 900

22 If harsh sold a match ticket for Rs. 340 at a profit of 25%, at what price did he purchase the ticket?

A  280             B  255

C  300             D  272

23 Eleven bags are bought for Rs. 1000 and sold at 10 for Rs. 1100. What is the gain or loss in percentage?

A  10%             B  21%

C  25%             D  20%

24 A man buys an article for Rs. 27.50 and sells it for rs. 28.60. Find its gain percent?

A  1%              B  2%

C  3%              D  4%

## II MCQ

1  Find the simple interest on Rs. 5200 for 2 years at 6% per annum.

A  Rs. 450         B  Rs. 524

C  Rs. 600         D  Rs. 624

2  Rs. 1200 is lent out at 5% per annum simple interest for 3 years. Find the amount after 3 years

A  Rs. 1380        B  Rs. 1290

C  Rs. 1470        D  Rs. 1200

3  Interest obtained on a sum of Rs. 5000 for 3 years is Rs. 1500. Find the rate percent.

A  Rs. 8%          B  Rs. 9%

C  Rs. 10%         D  Rs. 11%

4  Rs. 2100 is lent at compound interest of 5% per annum for 2 years. Find the amount after two years.

A  Rs. 2300        B  Rs. 2315.25

C  Rs. 2310        D  Rs. 2320

5  Find the difference between the simple interest and the compound interest at 5% per annum for 2 years on principal of Rs. 2000?

A  Rs. 5           B  Rs. 10.5

C  Rs. 4.5         D  Rs. 5.5

6  A bank offers 5% compound interest calculated on half yearly basis. A customer deposits Rs. 1600 each on 1st January and 1st july of a year. At the end of the year, the amount he would have gained by way of interest is:

A  Rs. 120         B  Rs. 121

C  Rs. 122         D  Rs. 123

7  There is 60% increase in an amount in 6 years at simple interest. What will be the compound interest of Rs. 12,000 after 3 years at the same rate?

A  Rs. 2160        B  Rs. 3120

C  Rs. 3972        D  Rs. 6240

8  What is the difference between the compound interest on Rs. 5000 for $1\frac{1}{2}$ years at 4% per annum compounded yearly and half-yearly?

A  Rs. 2.04        B  Rs. 3.06

C  Rs. 4.80        D  Rs. 8.30

9  The compound interest on Rs. 30,000 at 7% per annum is Rs. 4347. Their period (in years) is

A  Rs.2            B  Rs.$2\frac{1}{2}$

C  Rs.3            D  Rs.4

10 What will be the compound interest on a sum of Rs. 25000 after 3 years at the rate of 12 p.c.p.a?

A  Rs. 9000.30     B  Rs. 9720

C  Rs. 10123.20    D  Rs. 10483.20

11 At what rate of compound interest per annum will a sum of Rs. 1200 become Rs. 1348.32 in 2 years?

A  6%              B  6.5%

C  7%              D  7.5%

12 Albert invested an amount of Rs. 8000 in a fixed deposit scheme for 2 years at compound interest rate 5 P.C.P.A. How much amount will Albert get on maturity of the fixed deposit?

A  Rs. 8600        B  Rs. 8620

C  Rs. 8820        D  Rs. 8940

## Estimation and Costing - Simple estimation of the requirement of material etc., as applicable to the trade - Scanner installation

### Introduction

Estimation is the method of calculating the various quantities and the expenditure to be incurred on a particular job or process.

Estimate is the method used to measure or quantify the different quantities and the expected expenditure to be incurred on a particular work or project.

We know that the estimation is a long procedure, and it is totally depends upon the projects,

In case the funds available are less than the estimated cost the work is done in part or by reducing it or specifications are altered,

The following essential details are required for preparing an estimate.

Drawings like plan, elevation and sections of important parts.

Detailed specifications about workmanship & properties of materials, etc.

Standard schedule of rates of the current year.

Estimating is the process of preparing an approximation of quantities which is a value used as input data and it is derived from the best information available.

An estimate that turns out to be incorrect will be an overestimate if the estimate exceeded the actual result, and an underestimate if the estimate fell short of the actual result.

A cost estimate contains approximate cost of a product process or operation. The cost estimate has a single total value and it is inclusive of identifiable component values.

### Purpose of Estimating and Costing

1 Estimates provide a rough idea of the cost of the job and therefore its feasibility can be calculated, i.e. whether or not the project would be included in the funds available.

2 Estimate gives an idea of the time needed to complete the work.

3 Estimates are required to invite tenders and quotations and to arrange the contracts.

4 Estimates are also required to control expenditure during the execution of the work.

5 Estimates decide whether or not proposed plan matches the funds available.

### Estimation Methods

Estimate involves the following operations

- Preparing detailed Estimate.
- Calculating the rate of each unit of work.
- Preparing abstract of estimate.

**Estimation** is the process of calculating or evaluating a quantity by estimation, that is, without reference to specific measurements. Estimating is a fundamental process in all engineering.

This is usually done before purchase or construction begins or during preliminary planning stages. Estimating is usually more accurate, but there are a few limitations - namely that if your estimate relies on labour costs, you'll need to know how many man-hours will take to complete the project.

Estimates are developed from observations and knowledge of past experience. The accuracy of an estimate often depends on the level of detail available and the amount of time for which data are available for analysis.

**Costing** is the process of estimating the cost of a project before it's completed. It can be done with an itemized list, or through estimation using a construction cost calculator.

Costing includes three steps: estimating, bidding, and finalizing. It helps predict how much money will be required to construct the project.

A "costing" typically refers to how much it will cost someone to produce a single unit.
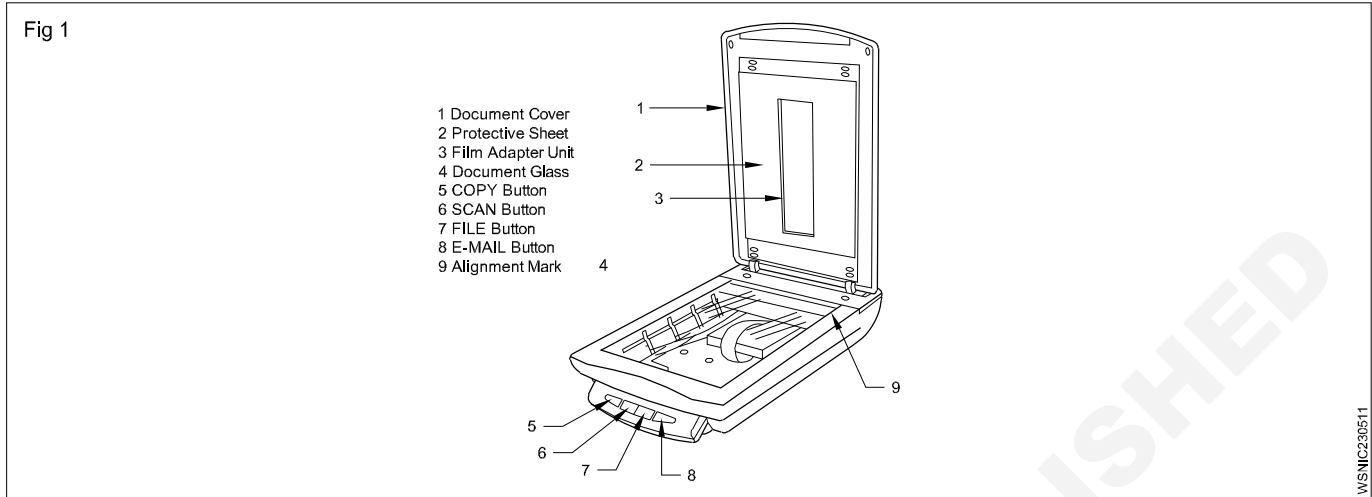
### There are two types of costings

**Independent costing -** this is the cost of direct material and labour costs. This type of costing only takes into account the cost of a single-phase, so it's not representative of the overall project cost.

**Cumulative Costing -** this type of costing looks at the total cost for all phases of work, but it can be difficult to ensure that estimates are accurate.

## Scanner installation (Fig 1)

### Tools/Instruments - Service persons owns

- Philips head Screw driver          - 1 No.
- Scanner driver Software CD/DVD       - 1 No.
- Interface Cable                    - 1 No.



Fig 1

1 Document Cover
2 Protective Sheet
3 Film Adapter Unit
4 Document Glass
5 COPY Button
6 SCAN Button
7 FILE Button
8 E-MAIL Button
9 Alignment Mark

1       Examine the scanner for any lock switch. A lock switch is provided by the manufacturer to prevent damage to the scanning unit during transport. Lock switch may be in the side or bottom of the scanner.

2       Unlock the lock switch by pushing it toward the "unlock" mark to use the scanner.

3       Connect the scanner to the PC.

4       Turn ON the scanner and see whether the scanner lamp is turning on and the scanner gets initialized.

5       The scanner driver software gets automatically installed in the system. If prompted for a driver install the software driver from the installation disk provided by the manufacturer.

6       Test the installation by scanning a test document.

**HP Scanner price   =   Rs.58,000**

## Estimation and Costing - Simple estimation of the requirement of material etc., as applicable to the trade - Laser printer - replacing mechanical parts

**Laser printer - replacing mechanical parts. (Fig 1)**

**Tools/Instruments - Service persons owns**

- Phillips screwdriver with magnetic tip   - 1 No.
- Small flat-blade screwdriver   - 1 No.
- Needle-nose pliers   - 1 No.

- Tweezers   - 1 No.
- Multimeter   - 1 No.
- Cleaning Brush   - 1 No.
- ESD mat   - 1 No.



Fig 1
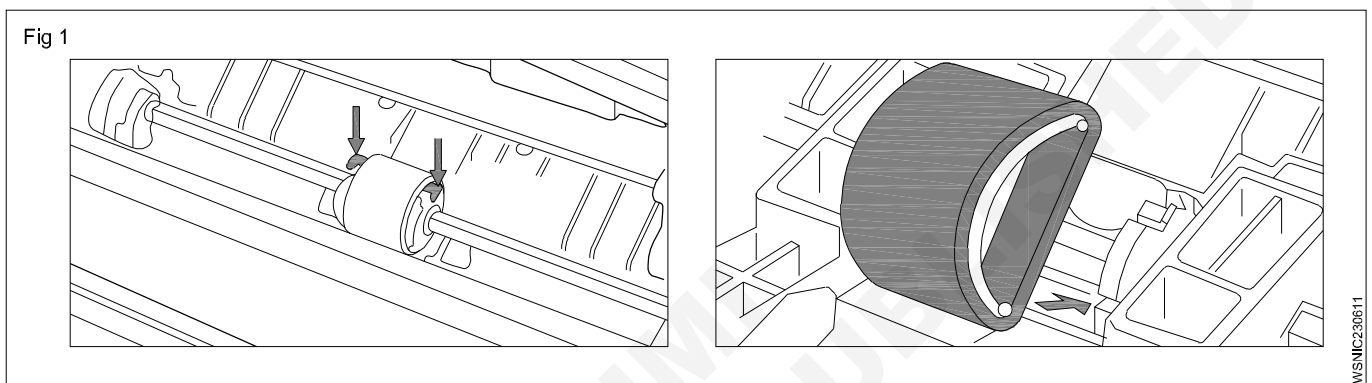
1   Turn off the printer and remove the power chord.

2   Open the print-cartridge door on the top of the printer and remove the toner cartridge in the printer.

3   Locate the pickup roller.

4   Gently release the small, white tabs on each side of the pickup roller by pushing them away from the roller, and then rotate the pickup roller towards the front.

5   Gently pull the pickup roller up and out.

6   Position the new pickup roller in the slot of the previous pickup roller.

7   Rotate the top of the new pickup roller into position until the white tabs on each side of the roller snap and roller into place.

8   Using a Phillips screwdriver unscrew the two screws that hold the separation pad in place.

9   Remove the separation pad.

10   Insert the new separation pad, and screw it in place.

**Cost of the Pickup roller  = Rs.1800**

# Estimation and Costing - Simple estimation of the requirement of material etc., as applicable to the trade - Removing and installing transfer-roller assembly

**Removing and installing transfer-roller assembly. (Fig 1)**

**Tools/Instruments - Service persons owns**

| | |
|---|---|
| • Phillips screwdriver with magnetic tip | - 1 No. |
| • Small flat-blade screwdriver | - 1 No. |
| • Needle-nose pliers | - 1 No. |
| • Tweezers | - 1 No. |
| • Multimeter | - 1 No. |
| • Cleaning Brush | - 1 No. |
| • ESD mat | - 1 No. |



Fig 1
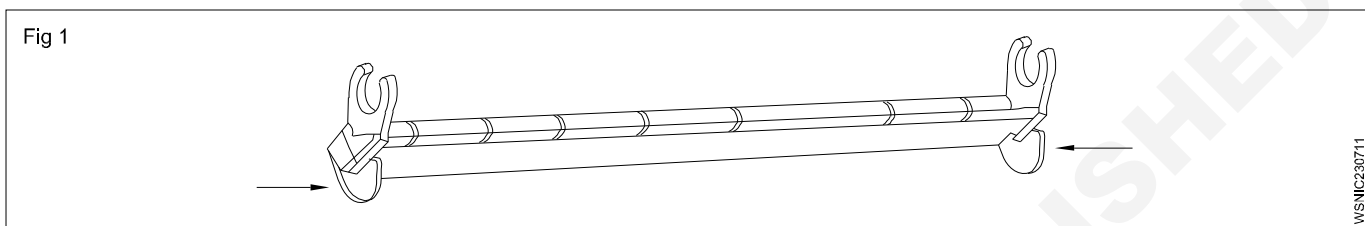
1   Open the print-cartridge door, and then release the two tabs on the paper guide and rotate it up.

2   Note: Do not touch the black-sponge portion of the transfer roller. Skin oils and finger prints can cause print-quality problems.

3   Grasp the right end of the paper guide and pull the clamp off the right bearing. Slide the paper guide slightly to the right, and the left clamp will slide off the left bearing.

4   Use needle-nose pliers or your fingers to squeeze the two small tabs on the transfer roller.

5   Angle the transfer roller up while holding on to the gear on the right side. Slide the roller towards rightside of the printer. Lift both the transfer roller and the transfer-roller guide out of the printer.

6   A small grounding spring is under the right transfer-roller bearing.

7   When reinstalling the transfer roller, position this spring correctly under the right bearing.

8   Install the new transfer roller as you removed the transfer roller.

9   Reinstall the paper guide by gently pressing the two ends of the guide onto the transfer-roller bearings until the clamps snap into place.

10  Rotate the paper guide down until the tabs on both ends engage.

**Cost of new transfer-roller  =  Rs.2000**

## Estimation and Costing - Simple estimation of the requirement of material etc., as applicable to the trade - Replace laptop battery

**Replace laptop battery. (Fig 1)**



Fig 1
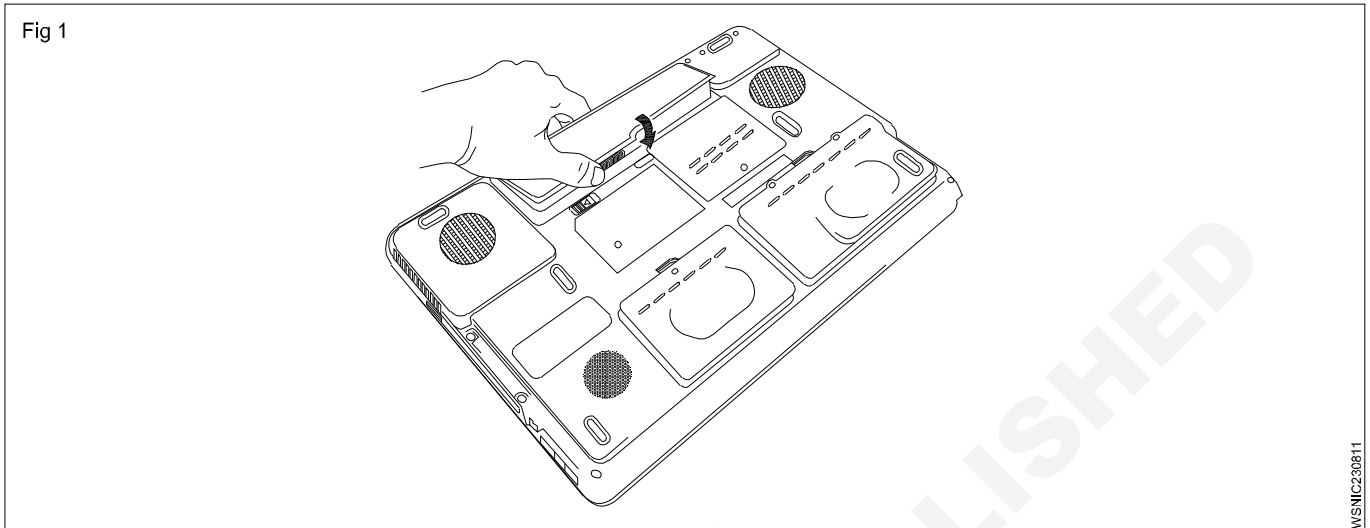
1   Turn off your laptop and disconnect the AC adapter.

2   Turn the laptop over so the bottom is facing up.

3   Locate the battery latch on the bottom of the computer. The image shows some of the more common battery latches found on laptops.

4   There are also some older laptops (IBM laptops) that require the latch to be pulled out and then pushed towards the battery.

5   Refer the laptop documentation or check the manufacturer's website for steps on how to remove the battery or if servicing is required to remove the battery.

6   Release the latch or other attachment devices that hold your battery in place.

7   Slide the latch switch to the opposite side and hold it in that position until the battery is released from its compartment or storage bay.

8   Take the replacement battery out of the box.

9   Slide it into the notch or bay.

10   Close the safety latch to lock it into place.

11   Reconnect the AC adapter and give the battery a full charge.

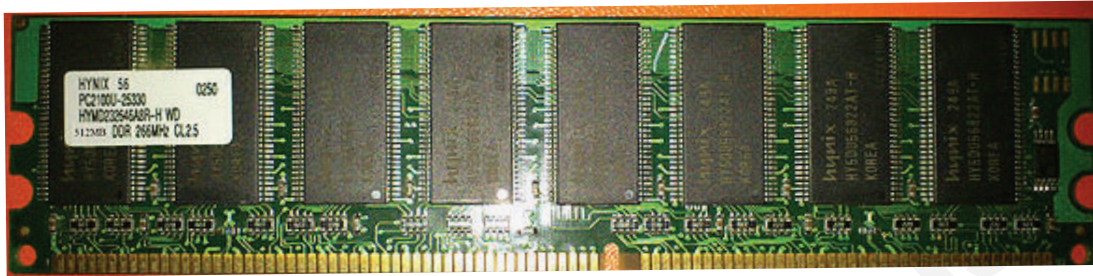**Estimation and cost of replace battery   =   Rs.3400**

## Estimation and Costing - Simple estimation of the requirement of material etc., as applicable to the trade - Upgrading a memory (RAM) and graphic card

**Upgrading a memory (RAM) and graphic card. (Fig 1)**

**Tools/Instruments - Service persons owns**

- PIV based system or above       - 1 No.

- Tools Kit(To open the Computer case etc.,) - as reqd.



Fig 1

1     Get a new memory stick, then turn off the computer and the power supply and unplug your computer.

2     Open the side cover of a computer by removing the screws in the back. (though some computers have a latch which is pushed).

3     Locate the memory cards that are already in your computer. They are usually long and thin, and rectangular in shape.

4     Push the two white tabs down to release the current memory and pull out the RAM Chip.

5     Line up the new chip and push it into place. Make sure it is in the whole way. A clicking sound can usually be heard when the memory is secured.

6     Turn your computer on.

7     Right-click on the "My Computer" icon and select Properties from the pop-up menu to verify that the computer recognizes the RAM which was installed.

Cost of RAM 32 GB    = Rs.6575

Cost of Graphic card    = Rs.1000

**Total cost    = Rs.7575**

# Estimation and Costing - Simple estimation of the requirement of material etc., as applicable to the trade - Printer cable testing and rectifying

**Printer cable testing and rectifying. (Fig 1)**

**Tools/Instruments - Service persons owns**

- Philips head screw driver     - 1 No.
- Multimeter                    - 1 No.
- Centronics printer cable      - 1 No.
- USB printer cable             - 1 No.
- Cable tester                  - 1 No.



Fig 1
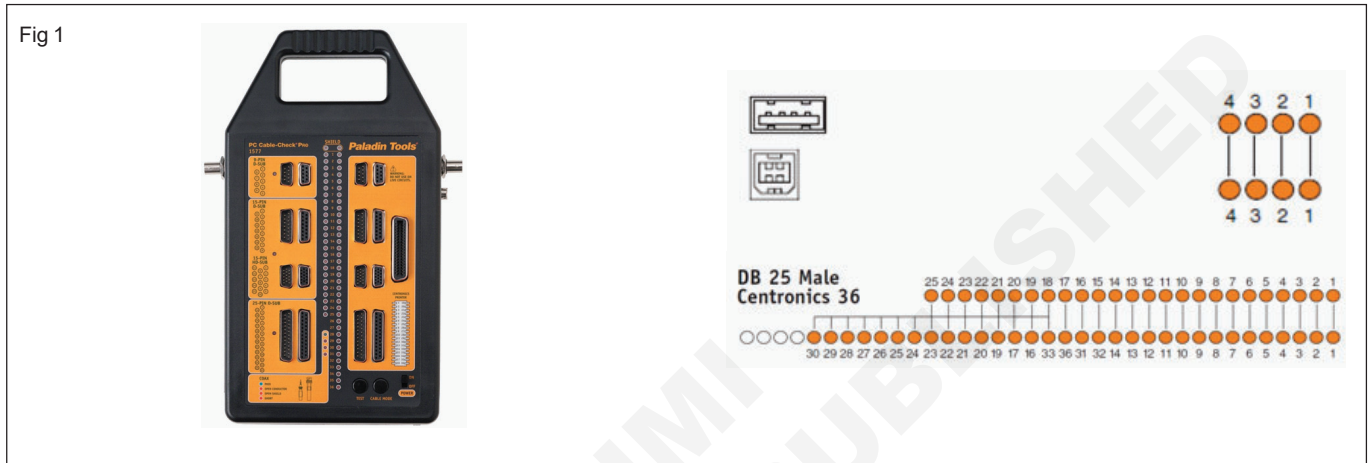
1    Connect the printer to the computer using the appropriate printer cable.

2    Check the cable by printing a test page from the printer properties page.

3    If the test page appears correctly then the printer cable is good.

4    If the test page is not printed then check the printer cable for any visual defects such as burns, wear and tear, cuts or damaged connectors.

5    Remove the suspected cable from the printer and system and check the continuity of the cable using Multimeter in continuity testing mode.

6    Connect the cable to be tested to a cable tester by connecting the cable to the corresponding connectors on the left- and right-hand sides of the tester.

7    Press the CABLE MODE button repeatedly until the red LED indicate the proper connector that size is selected.

8    To begin testing, press the TEST button and hold it for 5 seconds to begin automatic cycling. If the cable is not good the LEDs will not glow.

9    To be replaced the cable because cable is faulty.

10   For USB cable turn off the printer, remove the cable from the system.

11   Uninstall the printer driver by navigating to Control panel → Printers → Select the printers → Uninstall.

12   Re-connect the USB to the system.

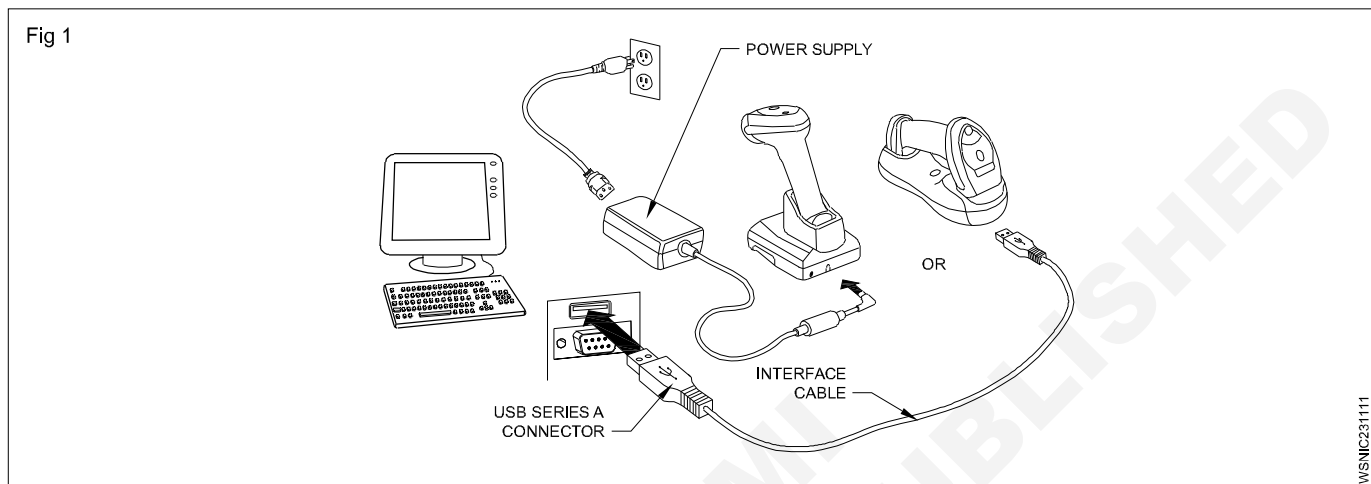13   If the system automatically detect the device connected then the cable is OK.

**Cable cost  =  Rs.200**

## Estimation and Costing - Simple estimation of the requirement of material etc., as applicable to the trade - Installing a typical bar code scanner

**Installing a typical bar code scanner. (Fig 1)**

**Tools/Instruments - Service persons owns**

• ISO-Propyl alcohol                      - as reqd.



Fig 1

1   Identify the different parts in the given Barcode scanner.

2   Locate the power connection jack and the interface jack in the cradle.

3   Insert the interface cable into the cradle's host port.

4   Connect the other end of the interface cable to the PC.

5   Connect the power supply to the cradle's power port.

6   Connect the appropriate cable to the power supply and AC power source.

7   Check the battery in the image scanner and replace it, if necessary.

8   Fully charge the linear imager scanner battery before using the linear imager scanner for the first time.

9   To charge the linear imager scanner battery, place the linear imager scanner in the cradle, ensuring that the metal contacts on the bottom of the linear imager scanner touch the contacts on the cradle.

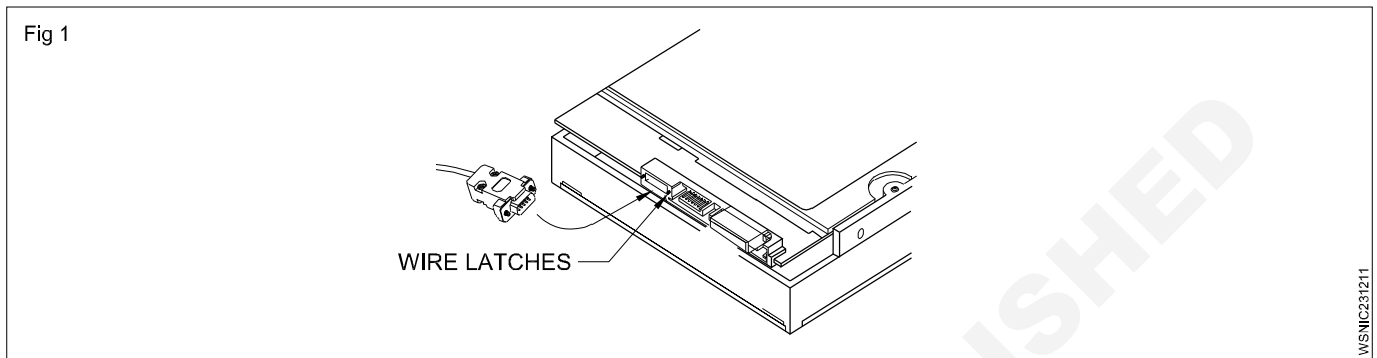10  Turn on the scanner and ensure that the scanner projects a red illumination.

**Cost of Installing a typical bar code scanner = Rs.22,000**

# Estimation and Costing - Problems on estimation and costing - Printer installation

**Printer Installation (Fig 1)**

**Tools/Instruments - Service persons owns**

- Printer Installation Disk          - 1 No.
- Printer cable                      - 1 No.



Fig 1

WIRE LATCHES

1    Locate the ports and sockets in the printer.

2    Identify the type of printer cable needed for connecting the printer to the PC.

3    Make sure both the Printer and Computer are turned off. Connect the parallel or USB cable to the printer and press the wire latches into place to secure the cable connector if present.

4    Connect the other end of the cable to the PC.

5    Plug the power chord in to the AC inlet socket located at the back of the printer and the other end to the properly grounded electrical socket.

6    Turn on the computer and the printer.

   **Printer software installation**

7    Insert the printer installation software disk in the DVD drive.

8    Use the Add printer wizard from the control Panel.

9    Select "Add a Local Printer".

10   Choose the printer port and click on next.

11   Click on have disk.

12   Browse and select the setup information file *.inf from the installation disk and click on OK.

13   Select the printer from the printers displayed in the screen.

14   Type the printer name.

15   The printer gets installed. Share the Printer if needed by selecting the sharing option.

16   Print a test page and complete the installation by clicking on "Print a Test Page".

17   Click on finish to complete the installation.

| | | | |
|---|---|---|---|
| 1 | Cost of Printer | = | Rs.6500 |
| 2 | Cost of Install the printer software | = | Rs. 500 |
| 3 | Installation charge | = | Rs. 500 |
| | **Total cost** | **=** | **Rs.7500** |

# Estimation and Costing - Problems on estimation and costing - Refilling and servicing of toner cartridges

**Refilling and servicing of toner cartridges. (Fig 1)**

**Tools/Instruments - Service persons owns**

- Used toner cartridge       - 1 No.
- Hand pump       - 1 No.
- Face mask       - 1 No.
- Suitable toner (100 gms or 200 gms)   - as reqd.
- Philips head screw driver       - 1 No.
- Tweezers       - 1 No.
- Cleaning brush       - 1 No.
- Plastic bag for disposing waste toner   - as reqd.

- Gloves       - 1 No.
- Nose plier       - 1 No.
- OPC drum       - 1 No.
- PCR roller       - 1 No.
- Magnetic roller       - 1 No.
- Doctor blade       - 1 No.
- Wiper blade       - 1 No.
- Iso propyl alchohol       - 1 No.



Fig 1
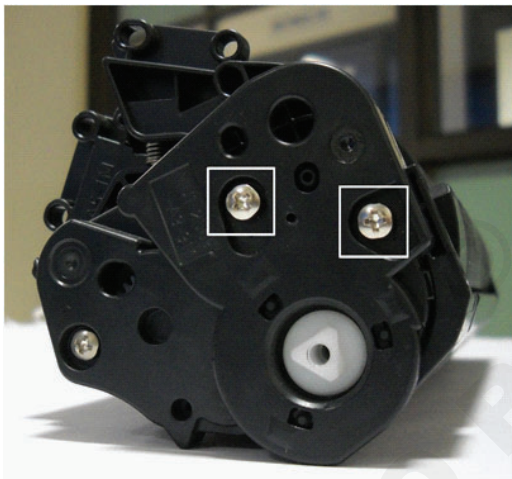
**Disassembling and identifying toner cartridge parts**

1   Wear protective mask and gloves to avoid inhaling fine toner particles.

2   Hold the toner cartridge with handle facing up and remove the screws fastening the side end cap or Drum cap at the right hand side of the Toner Cartridge. Store the screws in a safe place.

3   Locate the pins locking the two compartments of the cartridge together, by lifting the drum shutter.

4   Inline to the located pins drill a hole in the front side both on left and right side of the toner cartridge so as to push the pin outside.

5   Push the pins outside using a modified spring hook or bent tweezer.

6   Separate the two halves of the toner cartridge.

7   Remove the OPC drum without touching the photoconductive coating by hand, place it in a storage bag and store it in a safe place.

8   Remove the PCR roller from the cartridge using needle nose pliers.

9   Open the shutter and lift it from the shutter cradle.

10  Lift out wiper blade and clean with a soft damp cotton cloth moistened with water. Pour the waste Toner in a polythene bag, fasten it and dispose it safely. Clean the waste compartment using compressed air.

11  Carefully lift out the magnetic roller and clean using compressed air. Store it in a safe place.

12  Remove the two screws and the plastic protectors holding the doctor blade in place.

13  Lift out the doctor blade and clean using a soft damp cotton cloth moistened with water.

14  Clean the toner hopper with compressed air.

|   |   |   |
|---|---|---|
| 1 | Toner refilling cost | = Rs.  500 |
| 2 | Toner cartridge reset chip change | = Rs.  800 |
| 3 | Service charge | = Rs.  500 |
|   | **Total cost** | **= Rs.1800** |

# Estimation and Costing - Problems on estimation and costing - Inkjet printer - cartridge refilling

**Inkjet printer - cartridge refilling. (Fig 1)**

**Tools/Instruments - Service persons owns**

| | | | | |
|---|---|---|---|---|
| • Philips head Screw driver | - 1 No. | | • Interface Cable | - 1 No. |
| • Distilled water | - as reqd. | | • Hand gloves | - 1 set |
| • Iso propyl alcohol | - 100 ml | | • Scotch Tape | - as reqd, |
| • Cotton swab | - as reqd. | | • Cartridge refilling kit | - 1 set. |
| • Suction Tube | - as reqd. | | | |



Fig 1

### Refilling an Inkjet printer cartridge

1   Remove the empty cartridge from your printer.

2   Place the cartridge over a folded tissue paper with the head facing down.

3   Locate the fill holes on the top of the cartridge by feeling with the finger across the sticker label on top of the cartridge.

4   Identify the colour of the fill hole by inserting a slender toothpick into the holes of the fill hole one by one. The tooth pick gets coloured corresponding to the colour inside the cartridge compartment.

5   Note : Refilling the wrong colour in the fill hole will contaminate the cartridge and make it useless.

6   Take the syringe provided in the refill kit. Take the right colour and amount of ink in the syringe.

7   Insert the needle of the syringe deeply into the correct hole penetrating the foam down into the bottom of the cartridge.

8   Do not to push air bubbles into the cartridge foam while refilling. An air pocket will keep the ink from reaching the print head causing the cartridge not to print.

9   Slowly and gently add the ink. Make sure that the cartridge is not over-filled.

10  Stop filling as soon as a bit of ink oozes out of the head. Immediately suck a little ink back out of the ink cartridge, before removing the needle completely.

11  Blot the cartridge head contacts on the tissue paper, a spot of the filled ink leaks out onto the tissue paper.

12  Repeat the above steps for the remaining colours.

13  Cover the fill holes with the removed sticker or with a small piece of clear scotch tape. Make sure that no ink is leaking out of the top fill holes.

14  After refilling all the three colours, carefully blot the cartridge print head on a folded piece of tissue paper. Repeat the process several times until it stops oozing out. Do not wipe rub the cartridge head.

15  A well refilled cartridge when blotted with a tissue paper will show an even stripe of three colors showing up on the tissue paper.

16  If the blot is either faded or has missing colours, then blot on wet paper tissue and again on dry, to get the ink flowing.

17  Replace the cartridge to the printer when satisfied.

18  Do not install a leaky cartridge in to the printer.

19  Check the refilled cartridge by printing a printer test page.

20  Print multiple pages to get a satisfactory result.

21  Get the work checked by your instructor.

| 1 | Cost of Ink jet refill for 3 colours | = | Rs.1750 |
|---|---|---|---|
| 2 | Service charge | = | Rs. 500 |
| | **Total cost** | **=** | **Rs.2250** |

# Estimation and Costing - Problems on estimation and costing - Upgrading motherboard and CPU

**Upgrading motherboard and CPU. (Fig 1)**

**Tools/Instruments - Service persons owns**

- PIV based system or above     - 1 No.
- Thermal grease     - as reqd.

- Internet connection
- Tools Kit (To open the Computer case etc.,)     -as reqd.



Fig 1
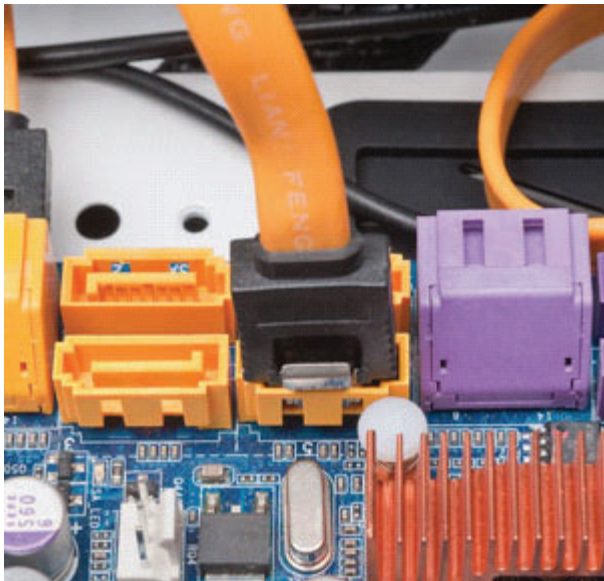
Prior to removing the old board, disconnect all wiring, including the serial ATA connector..

Don't forget to remove the old ATX I/O shield, and install the new one in its place

### Upgrading a Motherboard

1  Prior to disassembling the system, back up the contents of hard drive.

2  Determine which parts need to be removed. may have to take out the power supply unit (PSU) or hard drives to make motherboard removal easier. If have to remove the PSU, take care to disconnect all power cables first. The ATX12V (a small four- or eight-pin connector) is easy to overlook.

3  Take out all cards, the CPU fan, and all memory. If not upgrading the CPU, can leave it in the socket for the moment.

4  Disconnect all wiring. Double check: Did really disconnect all wiring?

5  Remove all the screws holding the motherboard in place. Usually, a number 2 Phillips screwdriver will fit the screws. Place the old board in an antistatic bag.

6  Check to confirm that all of the mounting nuts are firmly screwed into the case. Sometimes, these nuts will come out or become loose when removing the motherboard screws.

7  Remove the ATX I/O shield, and store it with the old motherboard.

| | | | |
|---|---|---|---|
| 1 | Cost of Upgrade Motherboard | = | Rs. 5000 |
| 2 | Cost of Upgrade CPU | = | Rs. 1000 |
| 3 | Service charge | = | Rs.  500 |
| | **Total cost** | = | **Rs. 6500** |

# Estimation and Costing - Problems on estimation and costing - Cleaning inkjet cartridges with inbuilt printer head

**Cleaning inkjet cartridges with inbuilt printer head. (Fig 1)**

**Tools/Instruments - Service persons owns**

- Distilled water      - as reqd.
- Iso propyl alcohol      - 100 ml
- Cotton swab      - as reqd.

- Suction Tube      - as reqd.
- Interface Cable      - 1 No.
- Hand gloves      - 1 set



Fig 1

1. Press the power button to turn on the printer, and then raise the printer cover. The cradle moves to the center of the printer.

2. Disconnect the power cord from the back of the printer.

3. Remove the print cartridges and place them on a piece of paper with the nozzle plate facing up.

4. Lightly moisten a cotton swab with distilled water and squeeze any excess water from the swab.

5. Wipe the face and edges of the print cartridge with the cotton swab.

6. Inspect the face and edges of the print cartridge for fibers.

7. Wipe the underside of the print cartridge cradle walls with clean, moistened cotton swabs. Repeat the process until no ink residue or dust appears on a clean swab.

8. Clean the electrical contacts inside the carriage of the printer with a dry cotton swab.

9. Insert the print cartridges in the printer, and then close the printer cover.

10. Connect the power cord to the back of the printer.

11. Print a test page.

12. Repeat the cleaning procedure if ink streaks continue to appear on printed pages.

13. Open the printer toolbox.

14. Click clean the print cartridges.

15. Click clean, and then follow the onscreen instructions.

16. Print a test page.
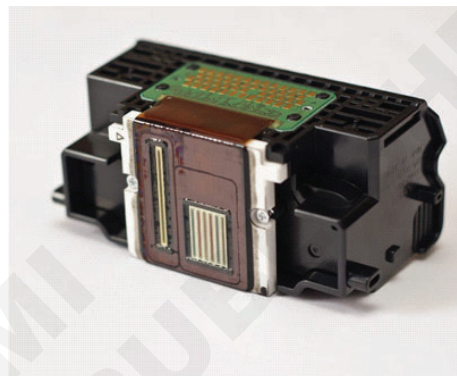
**Cleaning charge = Rs. 500**

# Estimation and Costing - Problems on estimation and costing - Cleaning Inkjet printer head

**Cleaning inkjet printer head. (Fig 1)**

**Tools/Instruments - Service persons owns**

- Distilled water      - as reqd.
- Iso propyl alcohol      - 100 ml
- Cotton swab      - as reqd.

- Suction Tube      - as reqd.
- Interface Cable      - 1 No.
- Hand gloves      - 1 set



Fig 1

1. Press the Power button to turn on the printer, and then raise the printer cover. The cradle moves to the center of the printer.

2. Remove the print cartridges so that the printer head is visible.

3. Remove the head by releasing pulling up the lever.

4. The head looks like.

5. Place the head to be cleaned in a plate filled with distilled water just enough to soak the head tip. The water dissolves the ink dried up in the head.

6. Using a suction tube try sucking the water in to the nozzle from the inside of the head

7. Blot the soaked head with a dry tissue paper and allow it to dry.

8. Inspect the cleaned and dried head for any dirt or dried up ink visually.

9. Install back the head and the cartridges.

10. Print a test page.

**Cleaning ink jet printer head charge = Rs. 500**

## Estimation and Costing - Problems on estimation and costing - Configuration of bar code scanner

**Configuration of bar code scanner. (Fig 1)**

**Tools/Instruments - Service persons owns**

- ISO-Propyl alcohol          - 100 ml



Fig 1

Do Not Transmit UPC-A Check Digit (00h)

*Transmit UPC-E Check Digit (01h)

1    Install the scanner software Tool that came along with the Barcode scanner in the PC.

2    Connect the scanner cradle to the PC.

3    Check for communication between the scanner and the PC.

4    Refer to the user manual and locate the Barcodes for configuring the scanner.

5    Scanning one bar code sets the parameter value.

6    For example, to transmit bar code data without the UPC-A check digit, simply scan the Do Not Transmit UPC-A Check Digit bar code.

7    Transmit UPC-A Check Digit bar code.

8    The Barcode scanner issues a fast warble beep and the LED turns green, signifying a successful parameter entry.

9    To correct an error during a scanning sequence, just re-scan the correct parameter.

10   To change the default values, scan the appropriate bar codes in the manual. These new values replace the standard default values in memory. To recall the default parameter values, scan the Default Parameters.

11   Read the manual and with the help of the Instructor, identify the different indications, beep signals and what they are meant for.

12   Turn on the scanner and ensure that the scanner projects a red illumination which allows positioning the bar code within its field of view.

13   Aim the scanner at the bar code.

14   Press the trigger.

15   Upon successful decode, the Barcode scanner beeps and the LED displays a single green flash.

16   When reading high density bar codes, attempt to read them slightly further away from the scanner.

17   If the Scanner window is dirty then clean the scanner window with a dampened cloth of 70% Iso-propyl alcohol.

**Total cost**

| | | | |
|---|---|---|---|
| 1 | Installation of bar code scanner | = | Rs. 22,000 |
| 2 | Install the scanner software | = | Rs.  5,000 |
| 3 | Service charge | = | Rs.    500 |
| | **Total cost** | **=** | **Rs. 27,500** |