



# ZIAUDDIN UNIVERSITY

## EXAMINATION BOARD

### Mathematics IX- GEN Student Resource





## Topic: Profit loss and discount and profit markup (interest)

**Example 1:** A shopkeeper buys scientific calculators in bulk for Rs. 15 each. He sells them for Rs. 40 each. Calculate the profit on each calculator in rupees, and as a percentage of the cost price.

**Solution:** Given: cost price = Rs. 15, selling price = Rs. 40

Profit = selling price – cost price = Rs. 40 – 15 = Rs. 25

the profit as a percentage of the cost price:

$$\text{Profit \%} = \frac{\text{profit}}{\text{cost price}} \times 100\%$$

$$= \frac{25 \times 100}{15} \% = 166.7\%$$

**Loss:** If the selling price (S.P.) of an article is less than the cost price (C.P.), then the difference between the cost price (C.P.) and the selling price (S.P.) is called loss.

Thus, if  $S.P. < C.P.$ , then  $\text{Loss} = C.P. - S.P. \Rightarrow C.P. = S.P. + \text{Loss} \Rightarrow S.P. = C.P. - \text{Loss}$  [av\_textblock] [av\_textblock size=" av-medium-font-size=" av-small-font-size=" av-mini-font-size=" font\_color=" color=" id=" custom\_class='ed-text-block-sm-textp' av\_uid='av-2wpi6q4' admin\_preview\_bg="] **Example 2:** If the cost price of a book is Rs. 150 and selling price is 137.50, then calculate the loss and percentage loss on the book?

**Solution:** Here, cost price = Rs. 150

and selling price = Rs. 137.50

∴ Loss = Cost price – selling price

= Rs. (150 – 137.50) = Rs. 12.50

Now, Percentage Loss

$$= \frac{\text{Loss} \times 100}{\text{Cost Price}} \%$$

$$= \frac{12.50 \times 100}{150} \% = 8.33\%$$

When cost price and percentage profit are given, then selling price

$$= \text{cost price} \left( \frac{100 + \text{profit}\%}{100} \right)$$

**Example 3:** A chair was purchased for Rs. 470 and sold at a profit of 10%. Find the selling price.

**Solution:** Using the formula

$$\text{Selling price} = \text{cost price} \left( \frac{100 + \text{profit}\%}{100} \right)$$

$$= 470 \left( \frac{100 + 10}{100} \right) = 470 \times \frac{110}{100} = \text{Rs. } 517$$

When cost price and percentage loss are given, then

$$\text{Selling price} = \text{cost price} \left( \frac{100 - \text{Loss}\%}{100} \right)$$

**Example 4:** A person bought a table for Rs. 420 and sold at the loss of 15%. Find the selling price of table?

**Solution:** Selling price = cost price  $\left( \frac{100 - \text{Loss}\%}{100} \right)$

$$= \text{Rs. } 420 \left( \frac{100 - 15}{100} \right) = \frac{420 \times 85}{100}$$

$$= \text{Rs. } 357$$

When selling price and percentage profit are given, then

$$\text{Cost price} = \text{selling price} \left( \frac{100}{100 + \text{profit}\%} \right)$$

**Example 5:** A Chair was sold for Rs. 517 at a profit of 10%. Find the cost price of the chair.

**Solution:** Here, selling price = Rs. 517 and profit = 10%

$$\therefore \text{Cost price} = \text{selling price} \left( \frac{100}{100 + \text{profit}\%} \right)$$

$$= 517 \left( \frac{100}{100 + 10} \right)$$

$$= 517 \times \frac{100}{110} = \text{Rs. } 470$$

When selling price and percentage loss are given, then

$$\text{Cost price} = \text{selling price} \left( \frac{100}{100 - \text{Loss}\%} \right)$$

**Example 6:** Ram sold a watch for Rs. 376 at a loss of 6%. Find the cost price of the watch.

**Solution:**

$$\text{Cost price} = \text{selling price} \left( \frac{100}{100 - \text{Loss}\%} \right)$$

$$= \text{Rs. } 376 \times \left( \frac{100}{100 - 6} \right)$$

$$= \text{Rs. } 376 \times \frac{100}{94} = \text{Rs. } 400$$

If two items are sold each at rupees R, one at a gain of x% and other at a loss of x %, there is always an overall loss given by  $\frac{x^2}{100}$  % and the value of loss is given by

$$\frac{2x^2R}{(100^2 - x^2)}.$$

In case the cost price of both the items is the same and percentage loss and gain are equal, then net loss or profit is zero. The difference between the two cases is that the cost price in the first case is not the same, and in the second case it is the same.

**Example 7:** Ram sells two Mobile phones for Rs. 1000 each, one at a profit of 10% and other at a loss of 10%. Find his gain or loss percentage.

**Solution:** Using the formula,

$$\text{Loss \%} = \left(\frac{x^2}{100}\right)\% = \left(\frac{10 \times 10}{100}\right)\% = 1\%$$

A dishonest shopkeeper claims to sell goods at cost price, but uses a lighter weight, then his Gain %

$$= \left[ \frac{100 \times \text{excess}}{(\text{original value} - \text{excess})} \right]$$

**Example 8:** A shopkeeper sells rice to a customer, using false weights and gains 100/8 % on his cost. What weight has he substituted for a kilogram?

**Solution:** Using the formula,

$$\text{Gain \%} = \left[ \frac{100 \times \text{excess}}{(\text{original value} - \text{excess})} \right]$$

$$\Rightarrow \frac{100}{8} = \left[ \frac{100 \times \text{excess}}{(1 - \text{excess})} \right]$$

From here, Excess = 0.111.. Kg, which is 111.11 grams

Weight used by shopkeeper = 1000 - 111.11 = 888.89 grams

### Formulas to Remember

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

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

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

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

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

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

## Goods passing through successive hands

When there are two successive profits of  $a\%$  and  $b\%$ , then the resultant profit per cent is given by

$$\left(a + b + \frac{ab}{100}\right)\%$$

When there is a profit of  $a\%$  and loss by  $b\%$  in a transaction, then the resultant profit

or loss per cent is given by  $\left(a - b - \frac{ab}{100}\right)\%$

according to the +ve or -ve sign respectively.

When cost price and selling price are reduced by the same amount ( $A$ ) and profit increases then cost price (C.P.)

$$= \frac{[\text{Initial profit \%} + \text{Increase in profit \%}] \times A}{\text{Increase in profit \%}}$$

**Example 9:** A table is sold at a profit of 20%. If the cost price and selling price are Rs. 200 less, the profit would be 8% more. Find the cost price.

**Solution:** By direct method,

$$\text{C.P.} = \text{Rs.} \frac{(20+8) \times 200}{8}$$

$$= \text{Rs. } 28 \times 25 = \text{Rs. } 700.$$

If cost price of  $x$  articles is equal to the selling price of  $y$  articles, then profit/loss percentage

$$= \frac{x-y}{y} \times 100\%$$

according to +ve or -ve sign respectively.



**Example 10:** If the C.P. of 15 tables be equal to the S.P. of 20 tables, find the loss per cent.

**Solution:** By direct method,

$$\text{Profit/Loss \%} = \frac{-5}{20} \times 100$$

= -25% loss, since it is -ve.

## Discount

The reduction made on the 'marked price' of an article is called the discount. When no discount is given, 'selling price' is the same as 'marked price'.

Discount = Marked price  $\times$  Rate of discount.

S.P. = M.P. - Discount.

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

**Example 11:** How much % must be added to the cost price of goods so that a profit of 20% must be made after throwing off a discount of 10% from the marked price?

**Solution:** (c) Let C.P. = Rs. 100, then S.P. = Rs. 120

Also, Let marked price be Rs. x. Then, 90% of x = 120

$$\Rightarrow x = \frac{120 \times 100}{90} = 133\frac{1}{3}$$

$\therefore$  M.P. should be Rs.  $133\frac{1}{3}$

or M.P. =  $33\frac{1}{3}\%$  above C.P.

Buy x get y free i.e., if x + y articles are sold at cost price of x articles, then the percentage discount

$$= \frac{y}{x+y} \times 100.$$

## Successive Discounts

In successive discounts, first discount is subtracted from the marked price to get net price after the first discount. Taking this price as the new marked price, the second discount is calculated and it is subtracted from it to get net price after the second discount. Continuing in this manner, we finally obtain the net selling price.

In case of successive discounts  $a\%$  and  $b\%$ , the effective discount is:

$$\left(a + b - \frac{ab}{100}\right)\%$$

**Example 12:** Find the single discount equivalent to successive discounts of 15% and 20%.

**Solution:** By direct formula,

Single discount

$$= \left(a + b - \frac{ab}{100}\right)\%$$

$$= \left(15 + 20 - \frac{15 \times 20}{100}\right)\%$$

$$= 32\%$$

If the list price of an item is given and discounts  $d_1$  and  $d_2$  are given successively on it

then, Final price = list price  $\left(1 - \frac{d_1}{100}\right) \left(1 - \frac{d_2}{100}\right)$

**Example 13:** An article is listed at Rs. 65. A customer bought this article for Rs. 56.16 and got two successive discounts of which the first one is 10%. The other rate of discount of this scheme that was allowed by the shopkeeper was :

1. 3%
2. 4%
3. 6%
4. 2%

**Solution:** (2): Price of the article after first discount =  $65 - 6.5 = \text{Rs. } 58.5$

Therefore, the second discount

$$= \frac{58.5 - 56.16}{58.5} \times 100 = 4\%$$

### **Profit and Loss: Concept of Discounts and Marked Price Explained**

In the first part of Profit and Loss series, we learnt the basic definitions and the meaning of Cost Price, Selling Price, Marked price etc. Let us revise the definition of Marked Price. As we saw earlier, traders are in the habit of marking their articles at a certain price above their costs. Then the discounts they offer are on this marked price, thereby they actually make sure that have already factored in the profit they want.

Cost Price is amount at which shopkeeper buys item

Marked Price is the price is printed on the item

Selling Price is at which item is sold to customer

Discounts are offered on the marked price and the selling price is determined by the discount offered on the marked price. For the process of simplification, let us assume:

C = Cost price

S = Selling price

M = Market price

D% = Discount

G% = Gain

Now,

Discount = D% of marked price, M

Discount = Marked Price – Selling Price

Marked Price – Amount of Discount = Selling Price

$M(1-D\%) = \text{Selling Price}$

Also, Selling Price = Cost Price + Gain

Thus,

$M(1-D\%) = C(1 + G\%)$

Or in other words

Marked Price (1 – Discount%) = Cost Price (1 + Gain%)

**Example-1:** Natasha offers her customers a discount of 10% on her beauty products and she still makes a profit of 20%. What is the actual cost to her of that beauty product marked Rs. 400?

**Solution:**

Marked price = Rs. 400

Discount = 10%

Profit = 20%

Therefore, the Selling Price = 90% of 400

Therefore  $400 \times 90/100 = \text{Rs. } 360$

Selling price = Rs. 360

Profit = 20%

Cost price =  $100/120 \times 360 = \text{Rs. } 300$

### **Profit and Loss: Concept of successive discounts**

If successive discounts of  $x\%$  and  $y\%$  are allowed on the marked price  $M$  of the discount, then, after discount the customer finally ends up paying:

Selling Price =  $(1-x\%)(1-y\%) \times$  Marked Price

If you look at the above formula closely, you would see that the multiplication is nothing else but a percentage equivalent of two successive percentage change on a number.

**Example-2:** Pankaj offers a 10% discounts on his goods and he offers a further discount of 5% on the reduced price to those customers who pay cash. What does a customer have to pay in cash for a cricket bat of Rs. 200?

#### **Solution:**

Price of the cricket bat = Rs. 200

After Discount of 10% Marked price would be Rs. 180

Since he is purchasing the bat by cash, so a discount of 5% is applicable again on the reduced marked price. Thus, the final selling price the cricket bat would be of Rs. 171

### **Profit and Loss: Basic Question types**

#### **Type-1: Comparing quantities of goods and prices**

In these types of questions, CP of a fixed number of goods are compared with the SP of another field number of goods. Let us see through an example:

**Example-3:** The cost price of 30 articles is equal to the selling price of 40 articles. What is the profit or loss percentage?

#### **Solution:**

To obtain the same amount of money, which was needed to purchase 30 articles, we need to sell 40 articles, which is more than what we have got for the same sum. It means we need to arrange 10 more articles apart from the articles which we have purchased. So, there will be a loss.

Now, CP of 30 articles = SP of 40 articles Or,  $CP/SP = 30/40 = 3/4$

Or,  $1 - CP/SP = 1 - 3/4 = 1/4$

So, Loss percentage

$= (1 - CP/SP) \times 100 = 1/4 \times 100 = 25\%$

Alternatively,

CP of 30 articles = SP of 40 articles = Rs 120 (Assume) So, CP of one article = Rs 4 ,SP of one article = Rs 3 Obviously, there is a loss of Re 1 Loss percentage =  $1,4 \times 100 = 25\%$

### **Type 2: Questions in terms of money**

In this type of question, we generally talk about the cost price and selling price questions there are some results which helps us to solve typical these type of questions

Some Important Results

When SPs of two articles are same

1. First one is sold at a profit of  $x\%$  and second one is sold at a profit of  $y\%$ .

Ratio of CP1:CP2  $(100 + y) : (100 + x)$

2. First one is sold at a profit of  $x\%$  and second one is sold at a loss of  $y\%$ .

Ratio of CP1:CP2 =  $(100 - y) : (100 + x)$

3. First one is sold at a loss of  $x\%$  and second one is sold at a loss of  $y\%$ .

Ratio of CP1: CP2 =  $(100 - y) : (100 - x)$

4. First one is sold at a loss of  $x\%$  and second one is sold at a profit of  $y\%$ .

Ratio of CP1: CP2 =  $(100 + y) : (100 - x)$

### **Type-3: Miscellaneous Problems based on % gain and % loss**

**Example-4:** Bharat purchased 90 bags of cement at Rs. 450 each. He sold 30 bags at 20% profit and 20 bags at 6% loss. At what rate per bag should the remainder he sold to gain a profit of 9% on whole transaction

**Solution:**

This question type is nothing else but a combination of ratio and proportion with profit and loss.

In this case, we can solve the question in the following manner:

According to the information given, bags remaining = 40

Let the 40 bags be sold with  $p\%$  gain

Now % gain or loss on the whole lot

= sum of product of gain or loss %s with their respective quantities

Therefore

9% of 90 Bags of Rs. 450 each = 20% of 30 Bags of Rs. 450 each – 6% of 20 Bags of Rs. 450 each +9% of 40 Bags of Rs. 450 each

$(9/100) \times 90 \times 450 = \{(20/100) \times 30 \times 450\} - \{(6/100) \times 20 \times 450\} + \{(p/100) \times 40 \times 450\}$

$9 \times 90 = (20 \times 30) - (6 \times 20) + (p \times 40)$

$p = 8.25\%$

Therefore, the selling price would be =  $108.25/100 \times 450 = \text{Rs. } 487.125$