Successive Percentage Change

Example: A car is moving at some constant speed. At first it increases its speed by 25% and then again it increases its speed by 20%. What is the overall percentage increase.

Method 1: Initial speed of the car = x

Speed of the car after 1st increase = x + 25% of x   = 1.25x

Speed of the car after 2nd increase = 1.25x + 20% of 1.25x = 1.50x

Initial speed = x

Final speed = 1.50x

Percentage increase = 50%

Method 2:

Assume the initial speed of the car as 100kmph

Initial speed of the car   = 100

Speed of the car after the 1st increase = 100+25=125

Speed of the car after the 2nd increase =   125+2(12.5)= 150

Initial speed = 100

Final speed = 150

Percentage increase = 50%

Method 3: Shortcut

If the 1st increase/ decrease is **a%** and the 2nd increase/decrease is **b%,** then the overall increase/decrease % will be

$$a + b + ab/100 \ \%$$

In this question **a = 25%** and **b= 20%**

Overall increase/decrease = 25 + 20 + (25)(20)/100

$$= 25 + 20 + 5$$

$$= \textbf{50 \%}$$

Note: If a or b is increase, then include +ve sign

If a or b is decrease, then include -ve sign.

Note : The final answer will be in percentage

Example 5: A city's population was 10,000 at the end of 2008. In 2009, it increased by 25% and in 2010, it decreased by 8%. What was the net percentage change city's population at the end of 2010?

Solution:

$$25 + (\text{-}8) + (25)(\text{-}8)/100 \ \%$$

$$= 25 - 8 - 200/100 \ \%$$

$$= 25 - 8 - 2 \ \%$$

$$= 15 \ \%$$

Question: A fruit seller had some oranges. He sells 70% and still has 420 oranges. How many oranges he had originally?

A. 1400

B. 630

C. 700

D. 1050

▶ Solution

From 100% $\longrightarrow$ sold 70%

$\searrow$ remaining = 30%

A/Q, remaining = 420 oranges

$\Rightarrow$ 30% $\longrightarrow$ 420

$\Rightarrow$ 10% $\longrightarrow$ $\dfrac{420}{3}$ = 140

$\Rightarrow$ 100% $\longrightarrow$ (1400) //.

Question: An agent, gets a commission of 5% on the sales of cloth. If on a certain day, he gets Rs. 12.50 as commission, the cloth sold through him on that day is worth

A. 125

B. 250

C. 500

D. 1000

Solution

Percent commission = 5%, Actual commission = Rs 12.5

$\therefore$ 5% of sales $\longrightarrow$ Rs 12.5

10% of sales $\longrightarrow$ Rs 25

100% $\longrightarrow$ Rs 250.

Question:- A student has to obtain 33% of the total marks to pass. He got 125 marks and failed by 40 marks. The maximum marks are-

A. 400
B. 500
C. 600
D. 800

<u>Solution</u>:

Equate percentage value with the marks to get the answer

Percentage Pass mark = 33%

He got 125 marks and need 40 more marks to pass

∴ **Pass mark**   = 125 + 40 = **165**

33% -----→ 165

Maximum marks = 100%

33% -------→ 165

1% ------→ 165/33= 5

100% = 500

Q. In a test A got 15% of the marks and failed by 7 marks whereas B got 28% and got 32 marks more than the pass mark. What was the pass mark?

A. 45

B. 52

C. 84

D. 300

Solution: Equate percentage value with the price to get the answer

Percentage of A = 15%

Marks of A   = -7   (Deviation from pass mark)

Percentage of B = 28%

Marks of B   = + 32

Percentage difference b/w A and B = 13%

Marks difference b/w A and B   = 39

$\therefore$ 13% = 39 marks

     1% = 3 marks

PROFIT & LOSS

Content

1) **Introduction**

2) **Problems without applying formula**

i.   *SP in terms of CP*

ii. *Difference in percentages*

3) **Problems by applying formula**

i.   *T*ype 1: Number of items is same and the price is different

ii. *T*ype 2: Number of items is different and the price is same

1)Introduction

Cost price (CP)- The price at which an item has been bought.

Selling price (SP)- The price at which an item has been sold.

Profit (P) or loss (L)- The difference between CP and SP.

Profit/loss % = (SP~CP)/CP x 100

Marked Price(MP)- The price at which an item is marked.

Discount(D)- % decrease OR Reduction on the MP.

Mark Up %- The percentage increase over the CP to make the MP.

2) Problems without applying formula

2.i) SP IN TERMS OF CP

If the **profit is 10%**,

SP = CP + 10%CP

   = 110% CP

∴ **SP = 110% CP**   or   **SP = 1.10 CP**

If the **profit is 20%**,

SP = 120% CP   or   **SP = 1.20 CP**

If the **loss is 25%**,

SP = 75% CP   or   **SP = 0.75 CP**

2.ii) Difference in percentage

Example: A man sold an article at 10% profit. Had it been sold for Rs. 50 more, he would have gained 15%. Find the cost price of the article.

Here the difference in percentage is 5%

The difference in price is Rs 50

5% = Rs 50

CP = 100%

5% = Rs 50

100% = Rs 1000

3) Problems with formula

3.i) Type 1: Number of items is same and the price is different

Example: What is the profit/loss % if an item is bought at Rs 5 and sold at Rs 6?

In this case the CP and SP is given & the no. of item=1(same)

Profit % = (SP-CP)/CP x 100

     = (6-5)/5 x 100
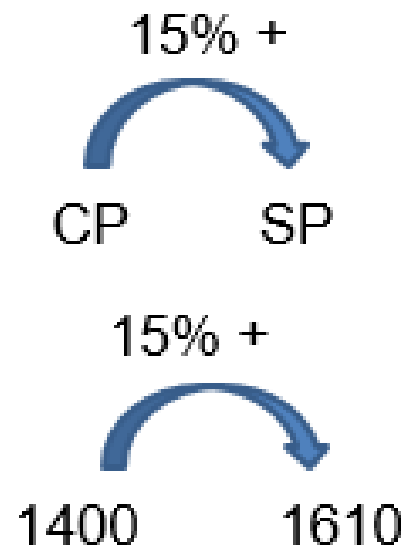
     = 1/5 x 100

     = 20%

*If the selling price is unknown

Example: A man buys an article for Rs. 1400 and sells it at a profit of 15%. What is the selling price of the article?

CP = 1400
Profit = 15%

15% +

CP   SP

15% +

1400   1610

10% = 140
5%   = 70

15% = 210

3.ii) Type 2: Number of items is different and the price is same

Example: What is the profit/loss % if 5 items are bought for Re 1 and 4 items are sold at Re 1?

In this case the price is same but the number items bought and sold is different.

Number of items bought **B = 5**

Number of items sold   **S = 4**

Profit % = (B– S)/ S x 100

$\qquad$ = (5-4)/4 x 100

$\quad$ = 1/4 x 100

=**25%**

*If the items sold is unknown

Example: A vendor bought toffees at 6 for a rupee. How many for a rupee must he sell to gain 20%?

Number of items bought **B = 6**

Number of items sold   **S = ?**

                    Profit = 20%

Profit % = (B– S)/ S x 100

20% = (6-S)/S x 100

Ans : 5

RATIO & PROPORTION

Ratio

▶ We use ratios to make comparisons between two things.

▶ When we express ratios in words, we use the word "to" -- we say "the ratio of something to something else".

▶ The ratio of two quantities a and b of same units is the fraction a/b, where b ≠ 0.

▶ Multiplying or dividing each term by the same nonzero number will give an equal ratio. For example, the ratio 2:4 is equal to the ratio 1:2.

Different types of ratios are:

1) Duplicate ratio: It is the ratio of squares of two numbers.

Duplicate ratio of the fraction $\dfrac{x}{y}$ is given as: $\dfrac{x}{y} = \dfrac{x^2}{y^2}$ or $x : y = x^2 : y^2$

2) Sub-duplicate ratio: It is the ratio between square roots of two numbers.

Duplicate ratio of the fraction $\dfrac{x}{y}$ is given as: $\dfrac{x}{y} = \dfrac{\sqrt{x}}{\sqrt{y}}$ or $x : y = \sqrt{x} : \sqrt{y}$

3) Triplicate ratio: It is the ratio of cubes of two numbers.

Triplicate ratio of the fraction $\dfrac{x}{y}$ is given as $\dfrac{x}{y} = \dfrac{x^3}{y^3}$

4) Sub- Triplicate ratio: It is the ratio between cube roots of two numbers

Sub-Triplicate ratio of the fraction $\dfrac{x}{y}$ is given as $\dfrac{x}{y} = \dfrac{x^{(1/3)}}{y^{(1/3)}}$

5) Compound ratio: It is the ratio of product of first terms in every ratio to that of product of second term in every ratio.

For example:

Compound ratio of $(a : x)$, $(b : y)$, $(c : z)$ is $(abc : xyz)$

PRACTICE QUESTION

Q. A sum of money is to be distributed among A, B, C, D in the proportion of 5 : 2 : 4 : 3. If C gets Rs. 1000 more than D, what is B's share?

a. 500

b. 1500

c. 2000

d. None of these

Solution

Option C.

Let the shares of A, B, C and D be Rs. 5x, 2x, 4x and 3x respectively.

Then, 4x-3x= 1000.

=> x=1000

Q. A mixture contains alcohol and water in the ratio of 7 : 5. If 8 liters of water is added to the mixture, then the ratio becomes 7 : 9. Find the quantity of alcohol in the given mixture?

a. 15 liters
b. 14 liters
c. 19 liters
d. 21 liters

Correct option : (b)

1) Assume quantity of milk and water to be 7x and 5x.

2) Find the total quantity of mixture (x)

Therefore,

$$\frac{7x}{(5x + 8)} = \frac{7}{9}$$

Solving this we get the value of x = 2

3) Quantity of alcohol in the mixture = (7x) = (7 x 2) = 14 liters

Time & Work

Concept :

Work from Days:

If A can do a piece of work in n days, then A's 1 day's work $=1/n$

Days from Work:

If A's 1 day's work $=1/n$,then A can finish the work in n days

Q. If A can do a piece of work in 10 days and B can complete in 15 days in how many days the work will be completed if they work together.

Soln.:- A's 1 Day Work= 1/10

B's 1 Day Work= 1/15

(A+B)'s combined 1 Day Work= (1/10) + (1/15)

= 1/6

Therefore, the work will be completed in 6 days.

Let the total work be assumed as LCM(10,15)= 30

Now to complete 30 units A takes 10 days

To complete 30 units B takes 15 days

Units done in 1 day by A = 3

Units done in 1 day by B = 2

Units done in 1 day by A & B = 5

To complete 30 units they will take 30/5 = 6days

Q. A can lay railway track between two given stations in 16 days and B can do the same job in 12 days. With help of C, they did the job in 4 days only. Then, C alone can do the job in:

A. 46/5

B. 47/5

C. 48/5

D. 10

LCM of $16, 12, 4 = 48$ units

$A \to 16$ days $\Rightarrow 3$ units/day

$B \to 12$ days $\to 4$ units/day

$A+B+C \to 4$ days $\to 12$ units/day

$C's$ rate $\to 12 - (4+3)$

$\qquad\qquad = 5$ units/day.

$\therefore C's$ time $= \dfrac{48 \text{ units}}{5 \text{ units/day}}$
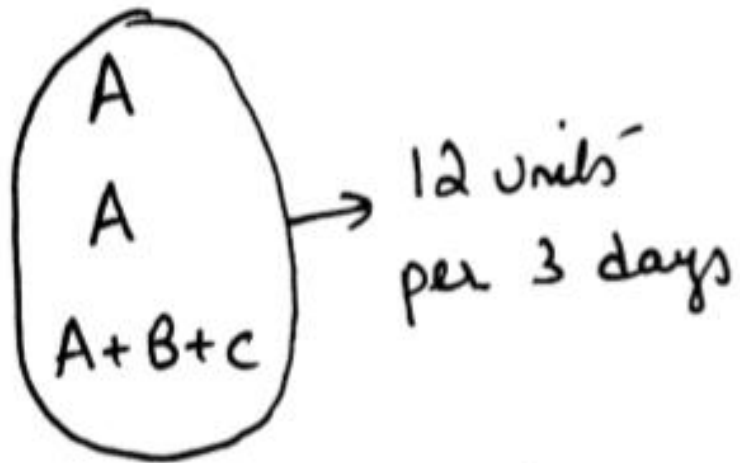
$\qquad\qquad = \dfrac{48}{5}$ days.

Q. A, B and C can do a piece of work in 20, 30 and 60 days respectively. In how many days can A do the work if he is assisted by B and C on every third day?

A. 10

B. 12

C. 15

D. 20

$A \rightarrow 20$ days $\rightarrow 3$ units/day

$B \rightarrow 30$ days $\rightarrow 2$ units/day

$C \rightarrow 60$ days $\rightarrow 1$ unit/day

$$
\boxed{\begin{array}{c} A \\ A \\ A+B+C \end{array}} \rightarrow \begin{array}{l} 12 \text{ units} \\ \text{per } 3 \text{ days} \end{array}
$$

12 units in 3 days.

$\Rightarrow$ 60 units in $\dfrac{3}{12} \times 60$

$$= \boxed{15 \text{ days}}$$

MDW FORMULA

$$\frac{MDH}{W} = \text{Constant}$$

Where,

M = Number of men

D = Number of days

H = Number of hours per day

W = Amount of work

- If M_1 men can do W_1 work in D_1 days working H_1 hours per day and M_2 men can do W_2 work in D_2 days working H_2 hours per day, then

$$\frac{M_1 D_1 H_1}{W_1} = \frac{M_2 D_2 H_2}{W_2}$$

Q. 6 men can pack 12 boxes in 7 days by working for 7 hours a day. In how many days can 14 men pack 18 boxes if they work for 9 hours a day?

a. 3.5 days
b. 5 days
c. 7.5 days
d. 12 days

$$\frac{m_1 d_1 h_1}{w_1} = \frac{m_2 d_2 h_2}{w_2}$$

$$\Rightarrow d_2 = \frac{m_1 d_1 h_1 w_2}{w_1 m_2 h_2}$$

$$= \frac{6 \times 7 \times 7 \times 18}{12 \times 14 \times 9}$$

$$\Rightarrow d_2 = 3.5 \text{ days}$$