

PERCENTAGE

The word “percent” is derived from the latin words “per centum”, which means “per hundred”.

A percentage is a fraction with denominator hundred, It is denoted by the symbol %.

Numerator of the fraction is called the **rate per cent.**

VALUE OF PERCENTAGE:

Value of percentage always depends on the quantity to which it refers:

Consider the statement, “65% of the students in this class are boys”. From the context, it is understood that boys from 65% of the total number of students in the class. To know the value of 65%, the value of the total number of student should be known. If the total number of student is 200, then,

$$\text{The number of boys} = \frac{200 \times 65}{100} = 130;$$

It can also be written as $(200) \times (0.65) = 130$.

Note that the expressions 6%, 63%, 72%, 155% etc. Do not have any value intrinsic to themselves. Their values depend on the quantities to which they refer.

To express the fraction equivalent to %:

Express the fraction with the denominator 100, then the numerator is the answer.

Example 1:

Express the fraction $\frac{11}{12}$ into the per cent.

Solution:

$$\frac{11}{12} = \frac{\frac{11}{12} \times 100}{100} = \frac{91\frac{2}{3}}{100} = 91\frac{2}{3}\%$$

To express % equivalent to fraction:

$$a\% = \frac{a}{100}$$

Example 2:

Express $45\frac{5}{6}\%$ into fraction.

Solution:

$$45\frac{5}{6}\% = \frac{45\frac{5}{6}}{100} = \frac{275}{6 \times 100} = \frac{11}{24}$$

Fraction Equivalents of %	
$1\% = \frac{1}{100}$	$33\frac{1}{3}\% = \frac{1}{3}$
$2\% = \frac{1}{50}$	$40\% = \frac{2}{5}$
$4\% = \frac{1}{25}$	$50\% = \frac{1}{2}$
$5\% = \frac{1}{20}$	$66\frac{2}{3}\% = \frac{2}{3}$
$6\frac{1}{4}\% = \frac{1}{16}$	$60\% = \frac{3}{5}$
$10\% = \frac{1}{10}$	$75\% = \frac{3}{4}$
$11\frac{1}{3}\% = \frac{17}{150}$	$80\% = \frac{4}{5}$
$12\frac{1}{2}\% = \frac{1}{8}$	$96\% = \frac{24}{25}$
$16\% = \frac{4}{25}$	$100\% = 1$
$16\frac{2}{3}\% = \frac{1}{6}$	$115\% = \frac{23}{20}$
$20\% = \frac{1}{5}$	$133\frac{1}{3}\% = \frac{4}{3}$
$25\% = \frac{1}{4}$	



$$\text{Increase \%} = \frac{\text{Increase value}}{\text{Original value}} \times 100$$

Example 3:

Rent of the house is increased from ` 7000 to ` 7700. Express the increase in price as a percentage of the original rent.

Solution:

Increase value = Rs 7700 – Rs 7000 =
Rs 700

$$\text{Increase \%} = \frac{\text{Increase value}}{\text{Original value}} \times 100 = \frac{700}{7000} \times 100 = 10$$

$\therefore \text{Percentage rise} = 10\%$

❖

Example 4:

The cost of a bike last year was Rs 19000. Its cost this year is Rs 17000. Find the per cent decrease in its cost.

$$\text{Decrease \%} = \frac{\text{Decrease value}}{\text{Original value}} \times 100$$

$$\begin{aligned} \text{\% decrease} &= \frac{19000 - 17000}{19000} \times 100 \\ &= \frac{2000}{19000} \times 100 = 10.5\%. \end{aligned}$$

$\therefore \text{Percentage decrease} = 10.5\%.$

❖ If A is x% of C and B is y% of C, then A is $\frac{x}{y} \times 100\%$ of B.

Example 5:

A positive number is divided by 5 instead of being multiplied by 5. By what per cent is the result of the required correct value?

Solution:

Let the number be 1, then the correct answer = 5

The incorrect answer that was obtained $= \frac{1}{5}.$

$$\therefore \text{The required \%} = \frac{1}{5 \times 5} \times 100 = 4\%$$

❖ If two numbers are respectively x% and y% more than a third number, then the first number is $\frac{100+x}{100+y} \times 100\%$ of the second and the second is $\frac{100+y}{100+x} \times 100\%$ of the first.

❖ If two numbers are respectively x% and y% less than a third number, then the

first number is $\frac{100-x}{100-y} \times 100\%$ of the second and the second is $\frac{100-y}{100-x} \times 100\%$ of the first.

❖ x% of a quantity is taken by the first, y% of the remaining is taken by the second and z% of the remaining is taken by third person. Now, if A is left in the fund, then the initial amount

$$= \frac{A \times 100 \times 100 \times 100}{(100-x)(100-y)(100-z)} \quad \text{in the beginning.}$$

❖ x% of a quantity is added. Again, y% of increased quantity is added. Again z% of the increased quantity is added. Now it becomes A, then the initial amount

$$= \frac{A \times 100 \times 100 \times 100}{(100+x)(100+y)(100+z)}$$

Example 6:

3.5% income is taken as tax and 12.5% of the remaining is saved. This leaves Rs. 4,053 to spend. What is the income?

Solution:

By direct method,

$$\text{Income} = \frac{4053 \times 100 \times 100}{(100-3.5)(100-12.5)} = \text{Rs 4800.}$$

❖ If the price of a commodity increases by r%, then reduction in consumption, so as not to increase the expenditure is $\frac{r}{100+r} \times 100\%.$

❖ If the price of a commodity decreases by r%, then the increase in consumption, so as not to decrease the expenditure is $\frac{r}{100-r} \times 100\%.$

Example 7:

If the price of coal be raised by 20%, then find by how much a householder must

reduce his consumption of this commodity so as not to increase his expenditure?

Solution:

$$\begin{aligned}\text{Reduction in consumption} &= \frac{20}{100+20} \times \\ &100\% \\ &= \frac{20}{100+20} \times 100\% = 16.67\%\end{aligned}$$

POPULATION FORMULA

- ❖ If the original population of a town is P , and the annual increase is $r\%$, then the population after n years is $P(1 + \frac{r}{100})^n$ and population before n years = $\frac{P}{(1 + \frac{r}{100})^n}$
- ❖ If the annual decrease be $r\%$, then the population after n years is $P(1 - \frac{r}{100})^n$ and population before n years = $\frac{P}{(1 - \frac{r}{100})^n}$

Example 8:

The population of a certain town increased at a certain rate per cent annum. Now it is 456976. Four years ago, it was 390625. What will it be 2 years hence?

Solution:

Suppose the population increases at $r\%$ per annum. Then, $390625 \left(1 + \frac{r}{100}\right)^4 = 456976$

$$\therefore \left(1 + \frac{r}{100}\right)^2 = \frac{456976}{390625} = \frac{676}{625}$$

$$\text{Population 2 years hence} = 456976 \left(1 + \frac{r}{100}\right)^2$$

$$= 456976 \times \frac{676}{625} = 494265$$

approximately.

Example 9:

The population of a city increase at the rate of 4% per annum. There is an additional annual increase of 1% in the population due to the influx of job seekers. Find percentage increase in the population after 2 years.

Solution:

The net annual increase = 5%

Let the initial population be 100.

❖ Then, population after 2 years = $100 \times 1.05 \times 1.05 = 110.25$

Therefore, % increase in population = $(110.25 - 100) = 10.25\%$

If a number A is increased successively by $x\%$ followed by $y\%$ and then $z\%$, then the final value of A will be

$$A \left(1 + \frac{x}{100}\right) \left(1 + \frac{y}{100}\right) \left(1 + \frac{z}{100}\right)$$

In case a given value decreases by an percentage then we will use negative sign before that.

❖ **First Increase and then decrease:**

If the value is first increased by $x\%$ and then decreased by $y\%$ then there is $x - y - \frac{xy}{100}\%$ increase or decrease, according to the +ve or -ve sign respectively.

If the value is first increased by $x\%$ and then decreased by $x\%$ then there is only decrease which is equal to $\frac{x^2}{100}\%$.

Example 10:

A number is increased by 10% and then it is decreased by 10%. Find the net increase or decrease per cent.

Solution:

$$\% \text{ change} = \frac{10 \times 10}{100} = 1\%$$

i.e. 1% decrease.

- ❖ Average percentage rate of change over a period.

$$= \frac{(\text{New Value} - \text{Old Value})}{\text{Old Value}} \times \frac{100}{n} \% \text{ where } n = \text{period.}$$

- ❖ The percentage error = $\frac{\text{The Error}}{\text{True Value}} \times 100\%$

SUCCESSIVE INCREASE OR DECREASE

- ❖ In the value is increased successively by $x\%$ and $y\%$ then the final increase is given by

$$x + y + \frac{xy}{100}\%$$

- ❖ In the value is decreased successively by $x\%$ and $y\%$ then the final decrease is given by

$$-x - y - \frac{xy}{100}\%$$

Example 11:

The price of a car is decreased by 10% and 20% in two successive years. What per cent of price of a car is decreased after two years?

Solution:

Put $x = -10$ and $y = -20$, then

$$-10-20+\frac{-10)(-20)}{100} = -28\%$$

∴ The price of the car decreases by 28%.

STUDENT AND MARKS

- ❖ The percentage of passing marks in an examination is $x\%$. If a candidate who

scores y marks fails by z marks, then the maximum marks $M = \frac{100(y+z)}{x}$

- ❖ A candidate scoring $x\%$ in an examination fails by 'a' marks, while another candidate who scores $y\%$ marks gets 'b' marks more than the minimum required passing marks. Then the maximum marks $M = \frac{100(a+b)}{y-x}$

- ❖ In an examination $x\%$ and $y\%$ students respectively fail in two different subjects while $z\%$ students fail in both subjects then the % age of student who pass in both the subjects will be $\{100-(x + y - z)\}\%$

Example 12:

Vishal requires 40% to pass. If he gets 185 marks, falls short by 15 marks, what was the maximum he could have got?

Solution:

If Vishal has 15 marks more, he could have scored 40% marks.

Now, 15 marks more than 185 is $185+15 = 200$

Let the maximum marks be x , then 40% of $x = 200$

$$\Rightarrow \frac{40}{100} \times x = 200 \Rightarrow x = \frac{200 \times 100}{40} = 500$$

Thus, maximum marks = 500

Alternate method:

$$\text{Maximum marks} = \frac{100(185+15)}{40} = \frac{100 \times 200}{40} = 500$$

Example 13:

A candidate scores 15% and fails by 30 marks, while another candidate who scores 40% marks, gets 20 marks more than the minimum required marks to pass

the pass the examination. Find the maximum marks of the examination.

Solution:

By short cut method:

$$\text{Maximum marks} = \frac{100(30+20)}{40-15} = 200$$

2-DIMENSIONAL FIGURE AND AREA

- ❖ If the sides of a triangle, square, rectangle, rhombus or radius of a circle are increased by $a\%$, its area is increased by $\frac{a(a+200)}{100}\%$
- ❖ If the sides of a triangle, square, rectangle, rhombus or radius of a circle are decreased by $a\%$ Then its area is decreased by $\frac{a(200-a)}{100}\%$.

Example 14:

If the radius of a circle is increased by 10%, what is the percentage increase in its area?

Solution:

Let R be the radius of circle.

$$\text{Area of Circle, } A = \pi R^2$$

Now, radius is increased by 10%

$$\text{New radius, } R' = R + 10\% \text{ of } R = 1.1 R$$

$$\text{New Area, } A' = \pi(1.1R)^2 = 1.21 \pi R^2$$

% increase in area =

$$\frac{1.21\pi R^2 - \pi R^2}{\pi R^2} \times 100 = 21\%$$

Shortcut Method:

Radius is increases by 10%.

$$\text{So, Area is increased by } \frac{10(10+200)}{100} = 21\%$$

- ❖ If the both sides of rectangle are changed by $x\%$ and $y\%$ respectively, then % effect on area = $x + y + \frac{xy}{100}$ (+/- according to increase or decrease)

Example 15:

If the length and width of a rectangular garden were each increased by 20%, then what would be the per cent increase in the area of the garden?

Solution:

By direct formula

$$\% \text{ increase in area} = \frac{20(20+200)}{100} = 44\%$$

- ❖ If A's income is $r\%$ more than that of B, then B's income is less than that of A by $\left(\frac{r}{100+r} \times 100\right)\%$
- ❖ If A's income is $r\%$ less than that of B, then B's income is more than that of A by $\left(\frac{r}{100-r} \times 100\right)\%$

Example 16:

If A's salary is 50% more than B's, then by what percent B's salary is less than A's salary?

Solution:

Let B's salary be $Rs x$

Then, A's salary = $x + 50\% \text{ of } x = 1.5x$

B's salary is less than A's salary by

$$\frac{1.5x - x}{1.5x} \times 100\% = \frac{100}{3} = 33.33\%$$

Shortcut method,

B's salary is less than A's salary by

$$\frac{50}{100+50} \times 100\% = 33.33\%$$

$$= \frac{50}{150} \times 100\% = 33.33\%$$

Example 17:

Ravi's weight is 25% that of Meena's and 40% that of Tara's. What percentage of Tara's weight is Meena's weight.

Solution:

Let Meena's weight be x kg and Tara's weight be y kg. Then Ravi's weight = 25% of Meena's weight

$$= \frac{25}{100} \times x \quad \dots\dots(i)$$

Also, Ravi's weight = 40% of Tara's weight

$$= \frac{40}{100} \times y \quad \dots\dots(ii)$$

From (i) and (ii), we get

$$\frac{25}{100} \times x = \frac{40}{100} \times y$$

$$\Rightarrow 25x = 40y$$

$$\Rightarrow 5x = 8y \Rightarrow x = \frac{8}{5}y$$

Meena's weight as the percentage of Tara's weight

$$= \frac{x}{y} \times 100 = \frac{\frac{8}{5}y}{y} \times 100$$

$$= \frac{8}{5} \times 100 = 160$$

Hence, Meena's weight is 160% of Tara's weight.

B spends 70% of his salary and saves 30%

Given that

$$20\% \text{ of } x = 30\% \text{ of } (50,000 - x)$$

$$\frac{20}{100} \times x = \frac{30}{100} \times (50,000 - x)$$

$$\frac{50x}{100} = \frac{30 \times 50,000}{100}$$

$$\Rightarrow x = \frac{30 \times 50,000 \times 100}{100 \times 50} = 30,000$$

A's salary Rs 30,000

B's salary = Rs 50,000 - Rs 30,000 = Rs 20,000

Example 18:

The monthly salaries of A and B together amount to `50,000. A spends 80% of his salary and B spends 70% of his salary. If now their savings are the same, then find the salaries of A and B.

Solution:

Let A's salary by x , then B's salary $(50,000 - x)$

A spends 80% of his salary and saves 20%

9. PERCENTAGE

Percentage

'Per cent' means 'per hundred'. It is denoted by the symbol %. Here $x\%$ means x per hundred or $\frac{1}{100}x$.

Thus, any percentage can be converted into an equivalent fraction by dividing it by 100.

$$\text{e.g. } 20\% = \frac{20}{100} = \frac{1}{5}, \quad 150\% = \frac{150}{100} = \frac{3}{2}$$

Also, any fraction or decimal can be converted into its equivalent percentage by multiplying with 100.

$$\text{e.g. } \frac{1}{5} = \frac{1}{5} \times 100 = 20\%; \frac{3}{2} = \frac{3}{2} \times 100 = 150\% .$$

Important Formulae

$$1. \text{ Percentage increase} = \frac{\text{Increase}}{\text{Original Value}} \times 100\%$$

$$2. \text{ Percentage decrease} = \frac{\text{Decrease}}{\text{Original Value}} \times 100\%$$

3. If the price of the commodity increases by $r\%$ then the reduction in consumption so as not to

increase the expenditure is $\frac{r}{100+r} \times 100\%$

4. If the price of the commodity decreases by $r\%$ then the reduction in consumption so as not to

increase the expenditure is $\frac{r}{100-r} \times 100\%$

5. If A 's income is $r\%$ more than B 's income then B 's income is less than A 's income by $\frac{r}{100+r} \times 100\%$

6. If A 's income is $r\%$ less than B 's income then B 's income is more than A 's income by $\frac{r}{100-r} \times 100\%$

7. Let the population of a town be P and it increases at the rate of $r\%$ per annum, then

$$(a) \text{Population after } n \text{ years} = P(1 + \frac{r}{100})^n$$

$$(b) \text{Population } n \text{ years ago} = \frac{P}{(1 + \frac{r}{100})^n}$$

8. Let the present value of the machine be P and if it depreciates at the rate of $r\%$ per annum, then

$$(a) \text{Value of machine after } n \text{ years} = P(1 - \frac{r}{100})^n$$

$$(b) \text{Value of machine } n \text{ years ago} = \frac{P}{(1 - \frac{r}{100})^n}$$

Example 1: Express $\frac{3}{2}$ as rate per cent.

$$\text{Solution: } = G \times 100\% = 150\%$$

Example 2: Find 25% of 1000.

$$\text{Solution: } 25\% \text{ of } 1000 = (\frac{25}{100} \times 1000) = 250$$

Example 3: What per cent of 6 is 144?

$$\text{Solution: Required percentage} = (144 \times 100\%) = 2400\%$$

Example 4: What per cent of 2.5 kg is 15 g?

$$\text{Solution: Required percentage} = (\frac{15}{2.5 \times 1000} \times 100\%) = 0.6\%$$

Example 5: If the price of tea falls by 12%, by how much per cent must a house holder increases its consumption, so as not to decrease its expenditure on tea?

$$\begin{aligned}
 \text{Solution: Increase \% in consumption} &= \left\{ \frac{r}{100-r} \times 100 \right\} \% = \left\{ \frac{12}{100-12} \times 100 \right\} \% \\
 &= \left\{ \frac{12}{88} \times 100 \right\} \% = \frac{150}{11} \% = 13\frac{7}{11} \%
 \end{aligned}$$

Example 6: The value of a machine depreciates at the rate of 10% per annum. If its present value is Rs.162000, what was the value of the machine 2 year ago?

Solution: Value of the machine 2 years ago = Rs. $\left[\frac{162000}{\left(1 - \frac{10}{100}\right)^2} \right] = \text{Rs. } (162000 \times \frac{10}{9} \times \frac{10}{9})$
= Rs. 200000

Example 7: I

Find the new price of cornflakes per kg.

$$\text{Solution: Original Price} = \frac{\text{Difference in price}}{\text{Difference in percent}} \times 100 = \frac{10}{25} \times 100 = \text{Rs.}40$$

$$\text{New price} = 40 \times \frac{125}{100} = \text{Rs.}50$$

EXERCISE

1. $0.05 = ?\%$
(a) 5 (b) 0.05
(c) 0.5 (d) 50

2. $20 \times ? = 25\% \text{ of } 800$
(a) 10 (b) 15
(c) 8 (d) 12

3. What is 40% of 40% equal to?
(a) 0.16% (b) 16%
(c) 1.6% (d) 0.016%

4. $9 : 4 = ?$
(a) 125% (b) 200%
(c) 225% (d) 250%

5. A school mini bus brakes from 60 m/h to 40 m/h. What is the percentage decrease in speed?
(a) 33.3% (b) 66.6%
(c) 77.7% (d) 45%

6. The price of a book is reduced by 25%, what is the ratio of change in price to the old price?
(a) $1 : 4$ (b) $4 : 1$
(c) $5 : 4$ (d) $4 : 5$

7. What percent decrease in salaries would exactly cancel out the 25% increase?
(a) 25% (b) 20%
(c) 24% (d) 27%

8. A's income is 40% more than B's income. How much per cent is B's income less than A's?
(a) $28\frac{2}{7}\%$ (b) $26\frac{1}{3}\%$
(c) $28\frac{4}{7}\%$ (d) $26\frac{2}{3}\%$

9. If A's height is 50% less than that of B, how much percent B's height is more than that of A?
(a) 100% (b) 80%
(c) 150% (d) 50%

10. A's salary is 20% of B's salary which is 25% of C's salary. What percentage of C's salary is A's salary?
(a) 8% (b) 5%
(c) 6% (d) 4%

11. The population of a city increases at the rate of 5% per annum. There is additional annual increase of 5% due to influx of job seekers. The percent increase in population after 3 yr is
(a) 33.1% (b) 33%
(c) 34% (d) 33.24%

12. In an examination, 32% students failed in Mathematics and 40% failed in English. If 22% of the students failed both the subjects then percentage of students who passed in both the subject was
(a) 30% (b) 40%
(c) 50% (d) None

13. In an examination of n questions, a student replied 15 out of the first 20 questions correctly. Of the remaining questions, he answered one -third correctly. All the questions have the same credit. If the student gets 50% marks, the value of n is:
(a) 30 (b) 67
(c) 50 (d) 82

14. A's marks in Biology are 20 less than 25% of the total marks obtained by him in Biology, Maths and Drawing. If his marks in Drawing be 50, what are his marks in Maths?
(a) 60 (b) 47
(c) 63 (d) cannot be determined

15. In an election, a candidate who gets 76% of the votes is elected by a majority of

31. The price per kg of sugar decreases by 20%. By what percentage should the consumption be increased such that expenditure remain the same?

- (a) 18% (b) 30%
(c) 20% (d) 25%

32. 24% of x + 28% of 500 = 219, find the value of x ?

- (a) 329.17 (b) 330.17
(c) 392.71 (d) 239.17

33. The value of mobile price depreciates at rate of 3%. The price of mobile in June 2012 is 10000. What could be the rate of mobile in June 2014?

- (a) 9408 (b) 9409
(c) 9410 (d) 9412

34. The price of a Fan is 2000. After 2 year the price of fan is 500. The value of fan depreciates, at the rate of $R\%$ find $R\%$?

- (a) 33.55 (b) 50
(c) 43.33 (d) 43.55

35. The value of a machine depreciates at rate of 20% per annum. If its value is Rs. 3200, what was the value of the machine 2 years ago?

- (a) 3240 (b) 1620
(c) 6800 (d) 5000

ANSWER KEY

1	a	8	c	15	b	22	b	29	c
2	a	9	a	16	c	23	a	30	b
3	a	10	b	17	a	24	a	31	d
4	c	11	a	18	c	25	d	32	a
5	a	12	c	19	c	26	b	33	b
6	a	13	c	20	c	27	d	34	b
7	b	14	d	21	d	28	c	35	d

SOLUTIONS

1. $0.05 = \frac{5}{100} = \left(\frac{5}{100} \times 100 \right) \% = 5\%$

2. Let $20 \times x = 25\%$ of 800

Then, $x = \left(\frac{25}{100} \times 800 \times \frac{1}{20} \right) = 10$

3. 40% of 40% =

$$\frac{40}{100} \times \frac{40}{100} = \frac{16}{100} = 16\%$$

4. $9 : 4 = \left(\frac{9}{4} \times 100 \right) \% = 225\%$

5. % change = $\frac{60-40}{60} \times 100\% = 33.3\%$

6. Let the old price be Rs. 100.

$$\therefore \frac{\text{change in price}}{\text{old price}} = \frac{25}{100} = \frac{1}{4}$$

7. Let the original salary be Rs. 100.

New salary = Rs. 125

Decrease on Salary $125 - 100 = 25$

$$\text{Decrease on } 100 = \left(\frac{25}{125} \times 100 \right) \% = 20\%$$

8. Let B's income = Rs. 100

Then, A's income = Rs. 140

$$\text{Required \%} = \left(\frac{40}{140} \times 100 \right) \% = 28\frac{4}{7}\%$$

9. Let B's height = 100 units

Then, A's height = 50 units

Required \% = $\left(\frac{50}{50} \times 100 \right) \% = 100\%$

10. A = 20% of B; B=25% of C

$$A = \left(\frac{20}{100} \times \frac{25}{100} \times 100 \right) \% \text{ of C} = 5\% \text{ of C}$$

11. Total rate of increase in population per annum = 10%

Initially, let the population be 1000.

Population after 3 year

$$= 1000 \left(1 + \frac{10}{100} \right)^3 = 1331$$

$$\text{Increase \%} = \left(\frac{1331}{1000} \times 100 \right) \% = 33.1\%$$

12. $n(A) = 32, n(B) = 40, n(A \cap B) = 22$

So, $n(A \cup B) = n(A) + n(B) - n(A \cap B) = 32 + 40 - 22 = 50$

Percentage failed in either or both the subjects = 50

Hence, percentage of pass

$$= (100 - 50) \% = 50\%$$

13. $15 + \frac{1}{3}(n - 20) = 50\% \text{ of } n = \frac{n}{2}$

$$\Leftrightarrow 90 + 2n - 40 = 3n \Leftrightarrow n = 50.$$

14. Let $B + M + D = x$. Then, $B = 25\% \text{ of } x$
 $- 20$

$$= \left(\frac{25}{100} x - 20 \right) = \left(\frac{x}{4} - 20 \right) \text{ and } D = 50.$$

$$\frac{x}{4} - 20 + M + 50 = x \text{ or } M = \left(\frac{3x}{4} - 30 \right).$$

So, marks in Maths cannot be determined.

15. Let the total number of votes polled be x . Thus, votes polled by other candidate

$$= (100 - 76) \% \text{ of } x = 24\% \text{ of } x$$

$$\therefore 76\% \text{ of } x - 24\% \text{ of } x = 468$$

$$\Rightarrow 52\% \text{ of } x = 468 \Rightarrow \frac{52}{100} \times x = 468$$

$$\Rightarrow x = \frac{468 \times 100}{52} = 900$$

16. Let the number of persons eligible to vote be x .

Then, number of eligible persons between 18 and 25 = 15% of x

Number of persons between 18 and 25, who Voted = 75% of 15% of x

$$= \left(\frac{75}{100} \times \frac{15}{100} \times x \right) = \frac{9x}{80}$$

\therefore Required percentage

$$= \left(\frac{9x}{80} \times \frac{1}{x} \times 100 \right) \% = 11.25\%$$

17. Let the total marks be x .

Then, $(30\% \text{ of } x) + 15$

$= (40\% \text{ of } x) - 35$

$$\Leftrightarrow \frac{30}{100} x + 15 = \frac{40}{100} x - 35$$

$$\Leftrightarrow \frac{1}{10} x = 50 \Leftrightarrow x = 500$$

So, passing marks = $(30\% \text{ of } 500) + 15$

$$= \left(\frac{30}{100} \times 500 + 15 \right) = 165.$$

Pass percentage = $\left(\frac{165}{500} \times 100 \right) \% = 33\%$

18. Let the price of a chair be Rs. x .

Then, price of a table = Rs. $(x + 400)$.

So, $6(x + 400) + 6x = 4800$

$$\Leftrightarrow 12x = 2400 \Leftrightarrow x = 200$$

Price of a table = Rs. 600

Price of a chair = Rs. 200.

Required percentage =

$$\left(\frac{400}{600} \times 100 \right) \% = 66\frac{2}{3}\%$$

19. Let the total sales be Rs. x .

Then, $5\frac{1}{2}\% \text{ of } x + \frac{1}{2}\% (x - 10000)$

$$= 1990$$

$$\Leftrightarrow \frac{11}{2} \times \frac{1}{100} \times x + \frac{1}{2} \times \frac{1}{100} \times (x - 10000)$$

$$= 1990$$

$$\Leftrightarrow 12x - 10000 = 398000$$

$$\Leftrightarrow 12x = 408000$$

$$\Leftrightarrow x = 34000.$$

$$20. \% \text{ excess} = \frac{40}{100-40} \times 100\% = 66\frac{2}{3}\%$$

$$21. \text{ Saving} = [100 - (30 + 12 + 28)]\% = 30\%$$

$$\therefore 30\% \text{ of } x = 810$$

$$\Rightarrow \frac{30x}{100} = 810$$

$$\Rightarrow x = \frac{810 \times 100}{30} = \text{Rs. } 2700$$

22. Let the original price be Rs. 100.

New final price = 95% of (110% of Rs. 100)

$$= \text{Rs. } \frac{95}{100} \times \frac{110}{100} \times 100$$

$$= \text{Rs. } 104.5$$

\therefore Increase in price = 4.5%

23. Let the original number be x .

Final number obtained = 125% of (75% of x)

$$= \frac{125}{100} \times \frac{75}{100} \times x = \frac{15x}{16}$$

$$= x - \frac{15x}{16} = 8$$

$$= x = 128$$

24. Let the larger number be x ,

$$\text{Then, } x - 20 = \frac{20}{100} x \Leftrightarrow x - \frac{1}{5} x = 20$$

$$\Leftrightarrow \frac{4}{5} x = 20 \Leftrightarrow x = \left\{ 20 \times \frac{5}{4} \right\} = 25$$

25. 5% of A + 4% of B = $\frac{2}{3}$ (6% of A + 8% of B)

$$\Leftrightarrow \frac{5}{100} A + \frac{4}{100} B = \frac{2}{3} \left(\frac{6}{100} A + \frac{8}{100} B \right)$$

$$\Leftrightarrow \frac{1}{20} A + \frac{1}{25} B = \frac{1}{25} A + \frac{4}{75} B$$

$$\Leftrightarrow \frac{1}{100} A = \frac{1}{75} B \Leftrightarrow \frac{A}{B} = \frac{100}{75} = \frac{4}{3}$$

26. Let the number be x . Then, Error

$$= \frac{5}{3} x - \frac{3}{5} x = \frac{16}{15} x$$

$$\text{Error \%} = \left(\frac{16x}{15} \times \frac{3}{5x} \times 100 \right) \% = 64\%$$

27. Let the original value of the tempo be Rs. x .

Then, 1.3% of $\frac{4}{5}$ of x = 910

$$\Leftrightarrow \frac{13}{10} \times \frac{1}{100} \times \frac{4}{5} \times x = 910$$

$$\Leftrightarrow x = \left(\frac{910 \times 10 \times 100 \times 5}{13 \times 4} \right) = 87500.$$

28. Let the total production be x lakh tons.

Then,

15% of x - 10% of x = (40 - 30) lakh tons

$\Leftrightarrow 5\% \text{ of } x = 10 \text{ lakh tons}$

$$\Leftrightarrow x = \left(\frac{10 \times 100}{5} \right) = 200 \text{ lakh tons.}$$

29. We have : $x + x\% \text{ of } 150 = 150$

$$\Leftrightarrow x + \frac{x}{100} \times 150 = 150$$

$$\Leftrightarrow \frac{5}{2}x = 150$$

$$\Leftrightarrow x = \left(\frac{150 \times 2}{5}\right) = 60$$

30. Let the original price be Rs. x per kg

Reduced price = Rs. $\frac{4x}{5}$ per kg

$$\therefore \frac{100}{4x} - \frac{100}{x} = 2.5$$

$$\Rightarrow \frac{500}{4x} - \frac{100}{x} = \frac{25}{10}$$

$$\Rightarrow \frac{100}{4x} = \frac{25}{10}$$

$$\Rightarrow x = \frac{100 \times 10}{4 \times 25} = 10$$

Reduced price = Rs. $\left(\frac{4 \times 10}{5}\right)$ per kg = 8

31. Increase % = $\left\{ \frac{r}{100-r} \times 100 \right\} \%$

$$= \left\{ \frac{20}{100-20} \times 100 \right\} \%$$

$$= \left\{ \frac{20}{80} \times 100 \right\} \% = 25\%$$

32. (a) 329.17

$$0.24 \times x + (0.28 \times 500) = 219$$

$$x = \frac{219 - (0.28 \times 500)}{0.24} = 329.17$$

33. (b) 9409

Value of mobile after 2 years

$$= 10,000 \times \left(1 - \left(\frac{3}{100}\right)\right)^2$$

$$= 10000 \times \left(\frac{97}{100}\right)^2$$

$$= 9409$$

34. Ans: (b) 50

It depreciates at the rate of R% per annum then value of the fan after n years =

$$P \left[1 - \left(\frac{R}{100}\right)\right]^n$$

$$2000 = \frac{500}{\left(1 - \frac{r}{100}\right)^2}$$

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

$$\left(1 - \frac{r}{100}\right) = \frac{1}{2}$$

$$\frac{100-r}{100} = \frac{1}{2}$$

$$R = 50\% \text{ (depreciation)}$$

35. Let the present value of a machine be P. suppose it depreciates at the rate of R% per annum.

Then, Value of the machines n years ago

$$= \left(\frac{P}{1 - \left(\frac{R}{100}\right)^n} \right)$$

$$R\% = 20\%; \text{ present value} = 3200; n = 2$$

Value of a machine 2 years ago

$$= Rs \left[\frac{3200}{1 - \left(\frac{20}{100}\right)^2} \right]$$

$$= \frac{3200}{\left(\frac{80}{100}\right)^2} = 5000$$