PERCENTAGE & SIMPLE INTEREST AND COMPOUND INTEREST

PERCENTAGE

Percentage calculations essentially imply converting everything in terms of 100.

Thus, 30% $\Rightarrow$ 30 per 100 or 30 over 100 or 30/100 or 0.3

= 300 × (25/100)

= 75 or 300 × 0.25 = 75

40% of 800 = 800 × (40/100)

= 320 or 800 × 0.4 = 320

Or in general,

x% of $y = y \times (x/100) = xy/100$ and

y% of $x = x \times (y/100) = xy/100$

So,

x% of $y = y$% of x

300 as a percentage of 400 = (300/400) × 100

= 75 or (300/400)

= 0.75 which is the same as 75%

300 as a percentage of 900 = (300/900) × 100

= 100/3

= $33\frac{1}{3}$% or 300/900

= 1/3 which is the same as $33\frac{1}{3}$%

x as a percentage of $y = (x/y) \times 100$

In general,

x as a percentage of y is not the same as y as a percentage of x.

In fact, one is the reciprocal of the other.

'What is x as a percentage of y?' is the same as 'what percentage of y is x?'

Application 1

In a class, 60% of the students in Section A are girls, while in Section B only 30% of the students are girls. The number of students in Section B is 50% more than that in Section A. If Section A has 80 students, the number of girls students of Section B is what percentage of the number of girl students in Section A?

Number of students in Section A = 80

Number of students in Section B = 80 + (80 × 0.5) = 120

Number of girl students in Section A = 80 × 0.6 = 48

Number of girl students in Section B = 120 × 0.3 = 36

Number of girl students in Section B as a percentage of the number of girl students in Section A = (36/48) × 100 = 75% [Answer]

70% of a number n is 350 $\Rightarrow 0.7n = 350$

$\Rightarrow n = 350 / 0.7$

$\Rightarrow n = 500$

So, if 70% of a quantity is 350, the quantity is 500.

Or in general,

If x% of y is z, $y = (z/x) \times 100$

Application 2

A person spends 40% of his salary on food and 20% on house rent. If he is left with Rs.8000, what is his salary?

Total spent is 60% and so left over is 40%..

This is 8000 or 40% of salary is 8000.

So, salary = (8000/40) × 100 = Rs.20000 [Answer]

When price increases from Rs.5000 to Rs.6000, the increase is Rs.1000 and this increase is over Rs.5000. Hence the percentage increase

= (1000/5000) × 100

= 20%

If the price comes down from Rs.5000 to Rs.4000, the decrease is Rs.1000, again over Rs.5000. Hence the percentage decrease

= (1000/5000) × 100

= 20%

Thus,

When x changes to y, percentage change = $\{(y - x)/x\} \times 100$

If this quantity is positive, the change is 'increase' and if it is negative, the change is 'decrease'.

Alternatively,

6000/5000 = 1.2 which is 0.2 more than 1 or 20% more.

Similarly, 4000/5000 = 0.8, which is 0.2 less than 1 or 20% less.

Thus,

Percentage change = {(new value/old value) – 1} × 100

Application 3

The table below shows the production (in lakh tonnes) of a company over a 5 year period. Which of the given years showed the maximum change over the previous year?

Year	2002	2003	2004	2005	2006
Production	80	120	110	150	200

Percentage increase in 2003 = {(120 – 80)/80} × 100 = 50%

Or alternatively, {(120/80) – 1} = 0.5 = 50%

Percentage decrease in 2004 = {(120 – 110)/120} × 100 = $8\frac{1}{3}$%

Or alternatively, {(110/120) – 1)} = – 0.0833 = – $8\frac{1}{3}$%

[– sign ⇒ decrease]

Percentage increase in 2005 = {(150 – 110)/110} × 100 = $36\frac{4}{11}$%

Or alternatively, {(150/110) – 1} = 0.3636 = $36\frac{4}{11}$%

Percentage increase in 2006 = {(200 – 150)/150} × 100 = $33\frac{1}{3}$%

Or alternatively, {(200/150) – 1} = 0.3333 = $33\frac{1}{3}$%

So, the maximum percentage change is in 2003. [Answer]

If the salary of a person increases from Rs.8000 by 15%,

the increase = 8000 × (15/100) = 1200 and so

the increased salary = (8000 + 1200) = Rs.9200

If the salary had decreased from Rs.8000 by15%, the decrease is again Rs.1200 and the decreased salary

= (8000 – 1200) = Rs.6800

Thus,

If the value changes from x by y%, changed value = $x \pm (xy/100)$

Increase of 15% is the same as an increase of 0.15. So, the new salary

= 1.15 × 8000

= Rs.9200

Similarly, in the case of decrease,

the new salary = 0.85 × 8000 = Rs.6800

Thus,

If the value changes by p%, p in decimal form, the new value = old value × $(1 \pm p)$

In a class of 200 students, if 40% are girls and the pass percentage among the girls is 80, the number of girls

= 200 × 0.4

= 80 and

The number of girls passing = 80 × 0.8 = 64

This calculation can be combined to get the number of girls passing as 200 × 0.4 × 0.8 = 200 × 0.32 = 64

Thus,

P% of Q% of $R = R \times P \times Q$, where P and Q are in decimal form.

If the profit of a company increases by 20% in 2005, increases further by 25% in 2006, but comes down by 50% in 2007,

the 2005 profit = (2004 profit) × 1.2,

the 2006 profit = (2005 profit) × 1.25 and

the 2007 profit = (2006 profit) × 0.5

Combining, 2007 profit = 0.5 × 1.25 × 1.2 × 2004 profit

= 0.75 × 2004 profit

⇒ 2007 profit is 25% lower than the initial figure.

Thus, with percentage figures in decimal form,

p% over q% over r% on $x = (1 + p)\ (1 + q)(1 + r) \times x$

Application 4

A machine costing Rs.10 lakhs is entitled for 60% depreciation in the first year, 40% in the second year and 20% in the third year. What is its depreciated value at the end of the third year?

60% depreciation ⇒ depreciated value is 40%.

Depreciated value at the end of first year = 10 × 0.4 = 4

40% depreciation ⇒ depreciated value is 60%.

Depreciated value at the end of second year = 4 × 0.6 = 2.4

20% depreciation ⇒ depreciated value is 80%.

Depreciated value at the end of third year = 2.4 × 0.8 = 1.92

So, the depreciated value at the end of the third year = Rs.1.92 lakhs [Answer]

Alternatively, depreciated value at the end of the third year

= (1 – 0.6)(1 – 0.4)(1 – 0.2) × 10

= 0.4 × 0.6 × 0.8 × 10

= 0.192 × 10 = 1.92

Suppose a family consumes 10 kg of rice in a month spending Rs.300 on rice. This implies price per kg of rice is Rs.30. If the price of rice increases by 25%, the new price is Rs.37.5. If the family cannot afford to spend any extra money on rice, it can only consume (300/37.5) or 8 kg of rice, i.e. the consumption has to be brought down from 10 kg by 2 kg, which is a reduction of 20%. So, if the rice budget remains the same, a 25% increase in price of rice would imply a 20% reduction in rice consumption.

In general,

If xy is constant and x increases/decreases by p% (in decimal form), then y must come down/increase by $\{p/(1 \pm p)\}$% (also in decimal form).

Application 5

In order to boost sales, a shopkeeper brought down the price by 20%. By what percentage should the sales increase to maintain the same sales revenue?

If the initial sales and price were s and p, the initial sales revenue was sp.

The new price is 0.8 p and if the new sales is S, then 0.8 $pS = sp$

$\Rightarrow S / s = 1 / 0.8 = 1.25$

$\Rightarrow$ S is 25% more than s.

So, the sales should increase by 25%. [Answer]

Alternatively, applying the formula, the new sales = 0.2/(1 – 0.2)

= 0.2/0.8

= 0.25 = 25%

Some Important Fraction Equivalents:

%	Equivalent fraction	%	Equivalent fraction
$8\frac{1}{3}$	$\frac{1}{12}$	12.5	$\frac{1}{8}$
$16\frac{2}{3}$	$\frac{1}{6}$	25	$\frac{1}{4}$
$33\frac{1}{3}$	$\frac{1}{3}$	50	$\frac{1}{2}$
$66\frac{2}{3}$	$\frac{2}{3}$	75	$\frac{3}{4}$

SIMPLE INTEREST AND COMPOUND INTEREST

Interest is defined as the amount paid by the borrower to the lender additional to the amount borrowed Interest is generally calculated in two ways

- Simple Interest
- Compound Interest

Simple Interest:

Interest calculated only with respect to the principal amount is termed as Simple Interest.

It can be formulated as $S.I = \frac{PNR}{100}$

P → Principal amount or Amount Borrowed.

N → Number of years.

R → Rate of Interest.

Compound Interest:

Interest calculated with respect to the principal amount and with respect to the accumulated interest is termed as compound interest.

It can be formulated as $C.I = P(1 + \frac{R}{100})^n - P$

$Amount = P(1 + \frac{R}{100})$

Note: Here amount represents the money paid back to the lender including the principal and interest as well.

Application 1: A invests a sum of Rs.4000 in a bank which gives a simple interest of 10% per annum. B invests Rs.3000 in a private financial company which gives him a compound interest of 12% per annum, compounded annually. If both keep the sum in the bank and with the company respectively for 3 years, who gets a higher interest?

For A

Interest = 4000 × 3 × 0.1

= Rs.1200

For B

Interest = $3000\{1.12^3 - 1\}$

= 3000 (1.404928 − 1)

= 3000 × 0.404928

= Rs.1214.784

Clearly, B gets a higher interest. [Answer]

Application 2: In Application 5, if A had also invested Rs.3000 only but at 12% interest per annum simple interest, what is the excess interest B gets over A in the first year?

Interest for A = 3000 × 1 × 0.12

= Rs.360

Interest for B = $3000 (1.12^1 - 1)$

= Rs.360

So, B does not get any excess interest over A. [Answer]

Application 3: A sum invested for two years yields an interest of Rs.1200 under simple interest and Rs.1260 under compound interest. What is the rate of interest?

Simple interest for two years ..... = Rs.1200 (Given)

Simple interest for one year ..... = Rs.600

Simple interest for the first year ..... = Rs.600 ... (1)

(1) => Compound interest for the first year

= Rs.600 ... (2)

Compound interest for two years = Rs.1260 (Given) .... (3)

(2) and (3) => Compound interest for the second year

= Rs.660 ... (4)

Now, C2 = C (1 + i) 1 ... (5)

(2), (4) and (5) => (1 + i) = 660/600

= 1.1

=> i = 0.1 or

10% rate of interest. [Answer]

CLASS WORK

1. In an office there are 40% female employees. 50% of the male employees are UG graduates. The total 52% of employees are UG graduates out of 1800 employees. What is the number of female employees who are UG graduates?
   (a) 362 (b) 412
   (c) 396 (d) 428

2. Mr.Ravi's salary was reduced by 25% for three months. But after the three months, his salary was increased to the original salary. What is the percentage increase in salary of Mr.Ravi?
   (a) 33.33% (b) 42.85%
   (c) 28.56% (d) 16.66%

3. A school has raised 75% of the amount it needs for a new building by receiving an average donation of Rs.1200 from the parents of the students. The people already solicited represents the parents of 60% of the students. If the School is to raise exactly the amount needed for the new building, what should be the average donation from the remaining students to be solicited?
   (a) Rs.800 (b) Rs.900
   (c) Rs.850 (d) Rs.600

4. The monthly income of Shyama and Kamal together is Rs.28000. The income of Shyama and Kamal is increased by 25% and 12.5% respectively. The new income of Kamal becomes 120% of the new salary of Shyama. What is the new income of Shyama?
   (a) Rs.15000 (b) Rs.16000
   (c) Rs.14000 (d) Rs.18000

5. In an examination, 50% of the students passed in Science and 75% passed in Social, while 20% students failed in both the subjects. If 270 students passed in both subjects, find the total number of students who appeared in the exam?
   (a) 400 (b) 540
   (c) 600 (d) 750

6. In a factory there are three types of bulbs L1, L2 and L3 which produces 20%, 15% and 32% of the total products respectively. L1, L2 and L3 produces 3%, 7% and 2% defective products, respectively. Find the percentage of non-defective products.
   (a) 46% (b) 30%
   (c) 53% (d) 64%

7. In a class, 60% of the students are boys and in an examination, 80% of the girls scored more than 40 marks (Maximum Marks: 150). If 60% of the total students scored more than 40 marks in the same exam, what is the fraction of the boys who scored 40 marks or less?
   (a) 8/15 (b) 7/15
   (c) 4/5 (d) 1/5

8. The prices of two articles are in the ratio 3:4. If the price of the first article be increased by 10% and that of the second by Rs.4, the original ratio remains the same. The original price of the second article is
   (a) Rs.40 (b) Rs.35
   (c) Rs.10 (d) Rs.30

9. Last year there were 610 boys in a school. The number decreased by 20 percent this year. How many girls are there in the school if the number of girls is 175 percent of the total number of boys in the school this year?
   (a) 854 (b) 848
   (c) 798 (d) 782

10. Weights of two friends A and B are in the ratio of 1:2. A's weight increases by 20% and the total weight of A and B together becomes 60 kg, with an increase of 30%. By what percent the weight of B increase?
    (a) 30% (b) 35%
    (c) 40% (d) 45%

11. The total number of girls in a class is 45% more than the total number of boys in the class. The total number of students in the class is 294 then what is the difference between the total number of girls and boys?
    (a) 54 (b) 52
    (c) 76 (d) 78

12. A number is mistakenly divided by 8 instead of being multiplied by 8. What is the percentage of error in the result?
    (a) 98.43 (b) 98.34
    (c) 95.76 (d) 97.76

13. In an examination Ammu scored 56% marks, Saran scored 90% marks and Rima scored 650 marks that is 65% then find the total marks of three students.
    (a) 2110 (b) 1250
    (c) 2450 (d) 2010

14. The rates of simple interest in two banks M and N are in the ratio of 9:8. Ashwini wants to deposit her total savings in two banks in such a way that she receives equal half-yearly interest from both. She should deposit the savings in banks M and N in the ratio of
    (a) 8:1 (b) 9:1
    (c) 8:9 (d) 9:8

15. Bank lent Rs.15,000 to Surya at 10% SI for 8 years. Meanwhile, Bank implemented a new scheme due to which interest rate reduced by 4%. By this Surya paid Rs.19,500 in total. Then after how many years after Surya took the loan, the Bank introduced the scheme?
    (a) 14 years (b) 14.5 years
    (c) 12 years (d) 12.5 years

16. Mr. Akash lent a part of Rs.16000 to Mr. Balu at 8% SI. Rest to Mr. Chandru at 6% SI. After 5 years he got an amount of Rs.21500 in total. Then what is the amount paid by Balu in total?
(a) Rs.9000 (b) Rs.9800
(c) Rs.7000 (d) Rs.11700

17. On simple interest, a sum of money becomes Rs.11,500 in 3 years and Rs.13,500 in 7 years. How much money is deposited?
(a) Rs.10,500 (b) Rs.10, 250
(c) Rs.10,000 (d) Rs.9,500

18. A sum of 1750 is divided into two parts such that the interests on the first part at 8% simple interest per annum and that on the other part at 6% simple interest per annum are equal. The interest on each part (In rupees) is
(a) 60 (b) 65
(c) 70 (d) 40

19. The rate of interest on a sum of money is 3% per annum for the first 2 years, 5% per annum for the period next 3 years, 7% per annum for the period beyond 5 years. If the simple interest accrued by the sum for a total period of 9 years is Rs.1960, what is the sum?
(a) Rs.3000 (b) Rs.5000
(c) Rs.4000 (d) Rs.5500

20. Two persons Andrews and Bea borrowed Rs.25,000/- and Rs.50,000/- respectively from Charles at different rates of simple interest. The interest payable by Andrews at the end of the first five years and that payable by Bea at the end of the first six years is equal. If the total interest payable by Andrews and Bea for one year is Rs.1,1000/- then at what rate percent did Bea borrow the money from Charles?
(a) 8 (b) 10
(c) 12 (d) 9

21. Out of a sum of Rs.1800, a part was lent at 8% SI and the other at 6% SI. If the interest on the first part after 3 years is equal to the interest on the second part after 8 years, then the second sum is
(a) Rs.1200 (b) Rs.800
(c) Rs.700 (d) Rs.1300

22. Mr. Khan invests Rs.15000 as fixed deposit at a bank at the rate of 10% per annum SI. But due to reason he has to withdraw the entire money after 5 years, for which the bank allowed him a lower rate of interest. If he gets Rs.8250 less than what he would have got at the end of 10 years, the rate of interest allowed by the bank is
(a) 8% (b) 8.5%
(c) 9% (d) 9.5%

23. What sum of money will amount to Rs.650 in 5 years and Rs.750 in 7 years at simple Interest?
(a) 300 (b) 400
(c) 500 (d) 600

24. William Abel took an educational loan from a Bank for his 2 years course of B.E. He took the loan of Rs.8 lakh such that he would be charged at 6% p.a. at CI during his course and at 9% CI after the completion of the course. He returned half of the amount which he had to be paid on the completion of his studies and remaining after 2 years. What is the total amount returned by William Abel?
(a) Rs.983,420 (b) Rs.926,277
(c) Rs.916,266 (d) Rs.926,288

25. C.I. Rs.7500 for 3 years at 6% for 1st year and 8% for 2nd year and 10% for 3rd year will be
(a)1725.6 (b) 1652.8
(c) 1834.9 (d) 1944.6