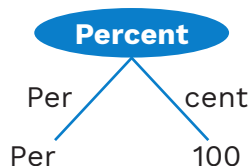


1

Percentage

Introduction

Percentage is one of the most important topics in quantitative aptitude. In combination with ratios, it forms the backbone for various aspects of arithmetic. Percentage is of immense importance for calculation-intensive data interpretation problems. Around four to five problems are asked from the percentage in CAT and OMETs every year.



Definitions

Percentage is a fraction with the denominator equal to 100. It gives the measure of a quantity with an assumption that the total quantity is equal to 100.

- Percentage is nothing but a representation of a fraction.
- The word percentage is taken from the Latin word “percentum” meaning per 100 and it is denoted by the symbol %.

e.g. what % is A out of B?

$$\% \text{ Value} = \frac{A}{B} \times 100$$

Or

what % is 4 out of 5?

$$\% \text{ value} = \frac{4}{5} \times 100 = 80\%$$

- Also $80\% = \frac{80}{100}$, means 80 out of 100.

Hence, % is nothing but a way of representing a fraction.

Rack Your Brain



What is 31.5% of 124?

Concept 1: Converting a fraction into percentage

Multiplying a fraction with 100 would convert it into a percentage value. Refer to the below given example.

Key Note



A fraction with denominator 10 is called as decimal.

Example 1:

Convert the following fractions into percentage:

- | | |
|-------------------|-------------------|
| (A) $\frac{1}{5}$ | (B) $\frac{3}{5}$ |
| (C) $\frac{3}{8}$ | (D) $\frac{5}{7}$ |

Solution:

$$(A) \frac{1}{5} \rightarrow \frac{1}{5} \times 100 = 20\%$$

$$(B) \frac{3}{5} \rightarrow \frac{3}{5} \times 100 = 60\%$$

$$(C) \frac{3}{8} \rightarrow \frac{3}{8} \times 100 = 37.5\%$$

$$(D) \frac{5}{7} \rightarrow \frac{5}{7} \times 100 = \frac{500}{7}\% = 71.42\%$$

Previous Years' Question



In May, John bought the same amount of rice and the same amount of wheat as he had bought in April, but spent ₹150 more due to price increase of rice and wheat by 20% and 12%, respectively. If John had spent ₹450 on rice in April, then how much did he spend on wheat in May?

- (A) 590 (B) 580
(C) 560 (D) 570

Concept 2: Converting a percentage into a fraction

Replace % sign with $\frac{1}{100}$ and reduce the fraction into its simplest form.

Example 1:

Express the following percentage as fraction:

- (A) $11\frac{1}{9}\%$ (B) $62\frac{1}{2}\%$
(C) 30% (D) 40%

Solution:

- (A) $11\frac{1}{9}\% = \frac{100}{9}\% = \frac{100}{9 \times 100} = \frac{1}{9}$
(B) $62\frac{1}{2}\% = \frac{125}{2}\% = \frac{125}{2 \times 100} = \frac{5}{8}$
(C) $30\% = \frac{30}{100} = \frac{3}{10}$
(D) $40\% = \frac{40}{100} = \frac{2}{5}$

Rack Your Brain



The time duration of 4 hours 45 minutes is what % of a day?

Concept 3: Conversion of a percentage into a ratio

To convert a percentage into a ratio, first convert the given percentage into a fraction in simplest form and then to a ratio.

Example 1:

Convert the following percentage values into ratios:

- (A) 72% (B) 35%
(C) 90% (D) 33.33%

Solution:

- (A) $72\% = \frac{72}{100} = 18 : 25$
(B) $35\% = \frac{35}{100} = \frac{7}{20} = 7 : 20$
(C) $90\% = \frac{90}{100} = \frac{9}{10} = 9 : 10$
(D) $33.33\% = 33\frac{1}{3}\% = \frac{100}{3}\% = \frac{100}{3 \times 100} = \frac{1}{3} = 1 : 3$

Concept 4: Conversion of a ratio into percentage

To convert ratio into percentage, first convert the given ratio into a fraction then to a percentage.

Example 1:

Convert the following ratios in percentage:

- (A) 2 : 5 (B) 2 : 3
(C) 2 : 9 (D) 3 : 7

Solution:

- (A) $2 : 5 = \frac{2}{5} \times 100 = 40\%$
(B) $2 : 3 = \frac{2}{3} \times 100 = 66.66\%$
(C) $2 : 9 = \frac{2}{9} \times 100 = 22.22\%$
(D) $3 : 7 = \frac{3}{7} \times 100 = 42.84\%$

Previous Years' Question



In a group of people, 28% of the members are young while the rest are old. If 65% of the members are literates, and 25% of the literates are young, then the percentage of old people among the illiterates is

- (A) 59% (B) 62%
(C) 66% (D) 55%

Important Fraction Percentage Table

1	→	100%
$\frac{1}{2}$	→	50%
$\frac{1}{3}$	→	$33\frac{1}{3}\% = 33.33\%$
$\frac{1}{4}$	→	25%
$\frac{1}{5}$	→	20%
$\frac{1}{6}$	→	$16\frac{2}{3}\% = 16.67\%$
$\frac{1}{7}$	→	$14\frac{2}{7}\% = 14.28\%$
$\frac{1}{8}$	→	$12\frac{1}{2}\% = 12.5\%$
$\frac{1}{9}$	→	$11\frac{1}{9}\% = 11.11\%$
$\frac{1}{10}$	→	10%
$\frac{1}{11}$	→	$9\frac{1}{11}\% = 9.09\%$
$\frac{1}{12}$	→	$8\frac{1}{3}\% = 8.33\%$
$\frac{1}{13}$	→	7.69%
$\frac{1}{14}$	→	7.1428%
$\frac{1}{15}$	→	$6\frac{2}{3}\% = 6.66\%$

$\frac{1}{16}$	→	$6\frac{1}{4}\% = 6.25\%$
$\frac{1}{17}$	→	5.88%
$\frac{1}{18}$	→	5.55%
$\frac{1}{19}$	→	5.26%
$\frac{1}{20}$	→	5%
$\frac{1}{21}$	→	4.76%
$\frac{1}{22}$	→	4.5454%
$\frac{1}{23}$	→	4.35%
$\frac{1}{24}$	→	4.166%
$\frac{1}{25}$	→	4%

Rack Your Brain



83.33% of 360 + 45.45% of 660 = ?

Some Important Related Fraction

$12.5\% = \frac{1}{8}$	$\left[14\frac{2}{7}\% = \frac{1}{7} \right]$
$37.5\% = \frac{3}{8}$	
$62.5\% = \frac{5}{8}$	
$87.5\% = \frac{7}{8}$	
$11\frac{1}{9}\% = \frac{1}{9}$	$\left[57\frac{1}{7}\% = \frac{4}{7} \right]$
$44\frac{4}{9}\% = \frac{4}{9}$	

Rack Your Brain



Find 62% of 132 + 52% of 440 + 21.25% of 300

Concept 5: Basic tools of percentage

Any number is 100% of itself.

Let us consider 420.

$$420 = 100\%$$

$$42 = 10\%$$

$$4.2 = 1\%$$

$$0.42 = 0.1\%$$

These tools are very useful for quick calculations.

Example 1:

Find 21% of 54.

Solution:

$$\text{Since, } 54 = 100\%$$

$$5.4 = 10\%$$

$$0.54 = 1\%$$

These things should be calculated mentally.

Hence,

10% →	5.4
↓ ×2	↓ ×2
20% →	10.8
1% →	0.54
<hr/>	
21% →	11.34

Example 2:

Find 32% of 620.

Solution:

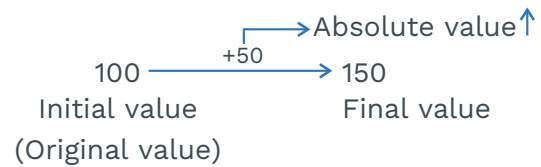
Since we know that:

620 →	100%
62 →	10%
↓ ×3	↓ ×3
186 →	30%
12.4 →	2%
<hr/>	
198.4 →	32%

620 =	100%
62 =	10%
6.2 =	1%
12.4 =	2%

Concept 6: Percentage increase or decrease

Case 1:

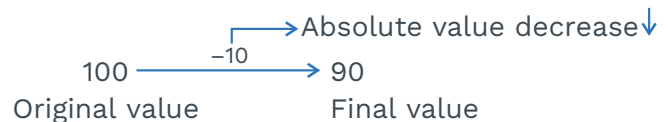


$$\% \text{ Increase} = \frac{\text{Absolute value} \uparrow}{\text{Original value}} \times 100$$

Key Note

Both the examples of **concept 5 & 6**, must be solved mentally by using basic tools of percentage. We do not need pen and paper for that.

Case 2:



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

Example 1:

In a class 20 girls are there. If 4 new girls joined the class, then find the percentage increase in the number of girls.

Solution:

$$\% \text{ increase} = \frac{\text{Absolute} \uparrow}{\text{Original value}} \times 100$$

$$\text{Total girls} \longrightarrow 20 \xrightarrow{+4} 24$$

$$\% \text{ increase} = \frac{4}{20} \times 100 = 20\%$$

Example 2:

There are 20 girls in a class. Find the total number of girls if there is an increase of 20% in the number of girls in the class.



Rack Your Brain

If the length and breadth of a rectangular plot is increased by 6.66% and 5.55% respectively, Then the new area is how much percent more than the original area?

Solution:

New value = Old value + Old value \times (% \uparrow or \downarrow)

$$\begin{aligned}\text{New value} &= \text{old value } (1 + \% \uparrow \text{ or } \downarrow) \\ &= 20(1 + 20\% \uparrow) \\ &= 20\left(1 + \frac{20}{100}\right) = 20 + 4 = 24\end{aligned}$$

Now in the case of decrement:

$$\begin{aligned}\text{New value} &= \text{Old value} - \text{Old value} \times (\% \downarrow) \\ &= \text{Old value } (1 - \% \downarrow)\end{aligned}$$

Example 3:

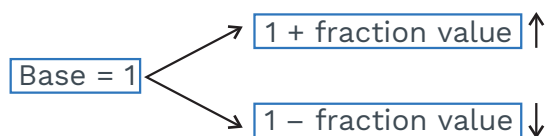
In a school, the total number of students are 500. If due to Covid situation, 30% of the students are not coming to the school, then find how many students are coming to school currently.

Solution:

$$\begin{aligned}\text{New value} &= \text{Old value } (1 - \% \downarrow) \\ &= 500 (1 - 30\%) \\ &= 500 \left(1 - \frac{30}{100}\right) \\ &= 500 - 150 = 350\end{aligned}$$

Concept 7: Multiplying factor

In multiplying factor base always be considered as 1.



So, first of all we have to know about the multiplying factor. (What is multiplying factor)

Let x be a number which is decreased by 12.5%. So, we have to find its multiplying factor.

$$x \frac{-12.5\%}{\frac{1}{8} \downarrow} x - \frac{x}{8} = x \left(1 - \frac{1}{8}\right) = x \times \frac{7}{8}$$

Example 1:

If a number 3636 is decreased by $16\frac{2}{3}\%$, Then find its value after decrement

Solution:

$$3636 \frac{-16\frac{2}{3}\% = 16.66\%}{\frac{1}{6} \downarrow} 3636 \times \frac{5}{6} = 3030$$

$$\text{Multiplying factor} = \left(1 - \frac{1}{6}\right) = \frac{5}{6}$$

Example 2:

If 770 is increased by 14.28%, then find its value after increment, using multiplying factor method

Solution:

$$770 \frac{14.28\% \uparrow}{\frac{1}{7} \uparrow} 770 \times \frac{8}{7} = 880$$

↓

$$\text{Multiplying factor} \left(1 + \frac{1}{7}\right) = \frac{8}{7}$$

Concept 8: Percentage of a quantity

Example 1:

In a school consisting of 800 students, 54% are females. Find the number of female students in the school.

Solution:

The number of female students = 54% of 800 = 432

Alternate Method:

800	→	100%	100%	→	800
400	→	50%	10%	→	80
32	→	4%	1%	→	8
432	→	54%	54%	→	432

Example 2:

What is the net score of a student if he scored 90% marks in a test of 450 marks?

Solution:

Marks scored = 90% of 450 = $\frac{90}{100} \times 450 = 405$

Example 3:

In a garden consisting of 90 flowers, $33\frac{1}{3}\%$ of the flowers are rose. Find the number of other types of flowers.

Solution:

The total number of flowers in the garden = 90 *Given*

The total number of rose flowers

$$= 33\frac{1}{3}\% \text{ of } 90$$

$$= \frac{1}{3} \times 90 = 30$$

So, the total number of other types of flowers = $90 - 30 = 60$

Alternate Method:

$$33\frac{1}{3}\% = \frac{1}{3} \xrightarrow{\text{Rose}}$$

$\frac{1}{3} \rightarrow \text{Total number of flowers}$

3 units → 90

1 unit → 30 (Rose flowers)

Therefore, other type of flowers

= $(3 - 1)$ units = 2 units

= $2 \times 30 = 60$ flowers

Concept 9: One quantity as a percentage of another quantity**Example 1:**

Raghav scored 650 marks on a test of 800 marks. Find the percentage of marks obtained by him.

Solution:

Required percentage
 $= \frac{650}{800} \times 100 = 81.25\%$

Rack Your Brain

In the month of June the sky is cloudy on every date which is a prime number. What percentage of the total number of days in June are not cloudy?

Example 2:

In a company, 600 employees are there. If 40 employees were absent on a day, then find what % of employees were present?

Solution:

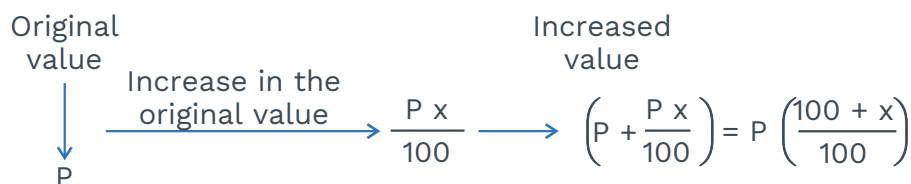
Present employees

$$= 600 - 40 = 560$$

$$\text{Required \%} = \frac{560}{600} \times 100 = 93.33\%$$

Concept 10: Initial to final, and vice-versa

(A) If a value is increased by $x\%$, then to get back the original value, the final value must be decreased by $\left(\frac{x}{x+100} \times 100\right)\%$.



The percentage decrease

$$= \frac{\left[P \left(\frac{100 + x}{100} \right) - P \right]}{P \left(\frac{100 + x}{100} \right)} \times 100 = \left(\frac{x}{100 + x} \times 100 \right) \%$$

In the terms of ratios (or fractions), if a value is increased by $\frac{n}{d}$ then to get back

the original value, the final value must be decreased by $\left(\frac{n}{d+n} \right)$

Example 1:

The remuneration of Rahul last to last year was ₹200 per day and ₹225 per day during the last year. This year due to a state-imposed lockdown, his remuneration was again changed to ₹200 per day.

- Find the percentage increment in his remuneration during the last year.
- Find the percentage decrement in his remuneration during this year over the last year.

Solution:

- The percentage increment in his remuneration during the last year = $\frac{225 - 200}{200} \times 100 = 12.5\% \uparrow$
- The percentage decrement in the remuneration during this year over the last year = $\frac{225 - 200}{225} = \frac{25}{225} \times 100 = \frac{1}{9} \times 100 = 11.11\%$

Points to Remember

In the above example, the numerical changes in both the questions are same but the percentage changes are different due to different denominators (base).

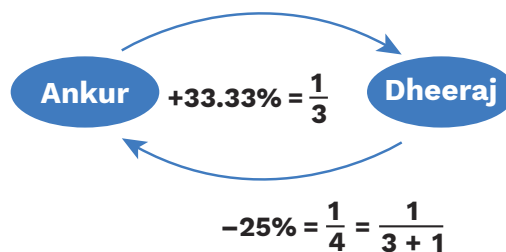
CAT Mantra

The base of a fraction is its denominator. It indicates the original value of any quantity. A change over the base is represented by the numerator of the same fraction.

Example 2:

Dheeraj has 33.33% more chocolates than Ankur. By how much percentage are the chocolates with Ankur less than that of Dheeraj?

Solution:

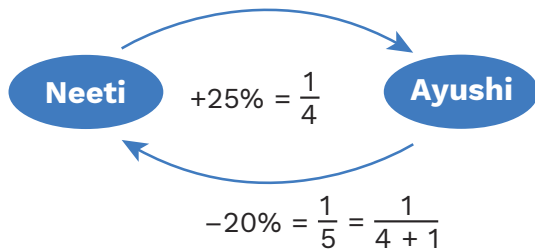


So, Ankur has 25% less chocolates than Dheeraj.

Example 3:

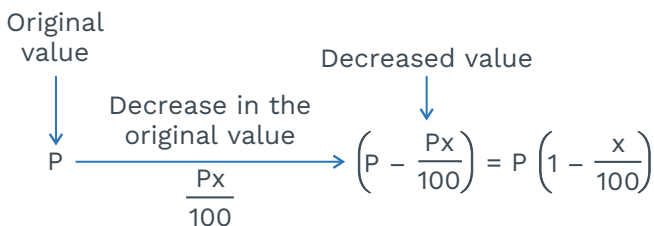
The height of Ayushi is 25% more than the height of Neeti. By how much percentage is the height of Neeti less than that of Ayushi?

Solution:



Thus, the height of Neeti is 20% less than Ayushi.

(B) If a value is decreased by $x\%$, then to get back the original value, the final value must be increased by $\left(\frac{x}{100-x} \times 100\right)$



Now, the % increase

$$= \frac{\left[P - P \left(1 - \frac{x}{100} \right) \right]}{P \left(1 - \frac{x}{100} \right)} \times 100 = \left(\frac{x}{100-x} \times 100 \right) \%$$

In terms of fraction, if a value 'p' is first decreased by $\frac{n}{d}$, then to get back the original number 'p', we have to increase the decreased (or resultant) value by $\frac{n}{d-n}$.

Key Points

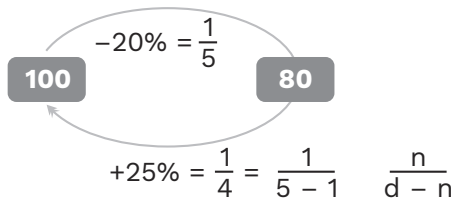
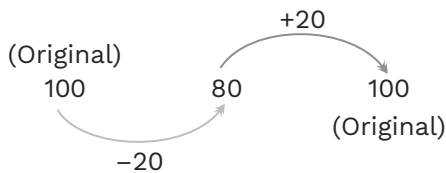
1. If a value 'x' is first increased by $p\%$ to 'y' then 'y' is again decreased to 'x' by $q\%$, then 'p' is always greater than 'q' (for positive values).
 2. If a value 'x' is first decreased by $p\%$ to 'y' and then 'y' is increased by $q\%$ to 'x', then 'p' is always less than 'q'.
 3. If a value 'A' is increased by $p\%$ then again by $q\%$, once again it is increased by $r\%$, then the final value will be same as if you change the order of p, q, r , i.e., A can be first increased by $r\%$ and then by $q\%$ and then by $p\%$ still the result will be the same.
 4. Rule 3 is also applicable for the decreasing of the values. A value 'A' is first decreased by $p\%$ then by $q\%$ and then by $r\%$ and so on. The resultant value will be same as when 'A' is first decreased by $q\%$, then by $p\%$ and then by $r\%$ etc.
- Note:** In the cases 3 and 4 we are discussing the successive increase or decrease in the value.
5. A value 'A' is first increased by $p\%$ then by $q\%$ and then it is reduced by $r\%$ will give the same results as when 'A' is first decreased by $r\%$, i.e. then increased by $q\%$ and then by $p\%$ etc.

Example 4:

Mr. Flash always arrived late at his office. His manager Tony Stark reduced his salary by 20%. After a few months, Mr. Flash improved his behaviour and his salary got increased to his previous salary. Find the percentage increase in the salary of Mr. Flash.

Solution:

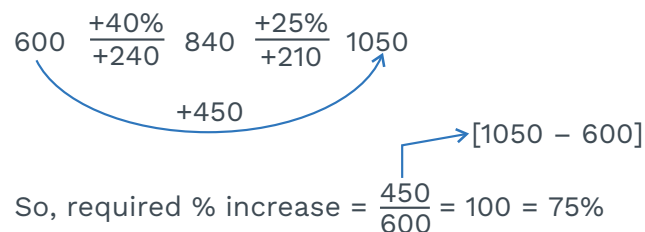
Let the initial salary of Mr. Flash be Rs. 100.

**Alternate Solution:**

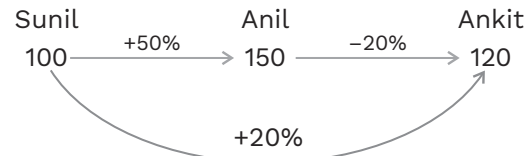
$$\% \text{ increase} = \frac{20}{80} \times 100 = 25\% \uparrow$$

Example 5:

Katrina got a cashback of 40% on the purchase of a shampoo worth ₹600 via Paytm. Her friend transferred some money to her Paytm account and the money with her increased by a further 25%. By how much percent has her Paytm balance increased, if she had only ₹600 in the beginning?

Solution:**Example 6:**

The remuneration of Anil is 50% more than that of Sunil. The remuneration of Ankit is 20% less than that of Anil. By how much percentage the remuneration of Ankit is more than that of Sunil?

Solution:

So, the required percentage change

$$= \frac{20}{100} \times 100 = 20\%$$

Concept 11: Reversing the change by the same %**Example 1:**

If the value of a number is first increased by $x\%$ and then decreased by $x\%$, then the net change is always a decrement (or loss) in the original value.

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

Solution:

Let original number be 100.

$$100 \xrightarrow{+x\%} (100 + x) \xrightarrow{-x\%}$$

$$(100 + x) - (100 + x) \times \frac{x}{100}$$

$$= 100 + x - \frac{100x}{100} - \frac{x^2}{100}$$

$$= 100 + x - x - \frac{x^2}{100}$$

$$\begin{aligned}
 &= 100 - \boxed{\frac{x^2}{100}} \rightarrow \text{Overall change} \\
 &\downarrow \\
 &= 100 - \frac{x^2}{100} \\
 &\downarrow \\
 \text{Net change} &= 100 - \left(\frac{100 - x^2}{100} \right) \\
 &\downarrow \qquad \qquad \downarrow \\
 &\text{Original value} \quad \text{Final value} \\
 &= 100 - 100 + \frac{x^2}{100} \\
 \text{Overall loss} &= \frac{x^2}{100}
 \end{aligned}$$

Previous Years' Question

In 2010, a library contained a total of 11500 books in two categories - fictional and non-fictional. In 2015, the library contained a total of 12760 books in these two categories.

During this period, there was a 10% increase in the fiction category while there was 12% increase in the non-fiction category. How many fiction books were in the library in 2015?

- (A) 6,600 (B) 6,160
(C) 6,000 (D) 5,500

Example 2:

Jethalal purchased articles from a wholesaler at a certain price. His customers always asked for 20% discount, so he increased the list price by 20%. What is the net profit or loss percentage of Jethalal in the whole transaction?

- (A) No loss
(B) No profit
(C) Profit of 1.5%
(D) Loss of 4%

Solution:

Assume the list price to be 100.

$$\begin{array}{ccccc}
 100 & \xrightarrow{+20\%} & 120 & \xrightarrow[\text{-24}]{-20\%} & 96 \\
 & \searrow & & \nearrow & \\
 & & -4 & &
 \end{array}$$

Overall % decrease = $\frac{4}{100} \times 100 = 4\%$
(or loss)

Alternate Solution:

$$\text{Loss \%} = \left(\frac{20}{10} \right)^2 = \frac{400}{100} = 4\%$$

There is always a loss.

Example 3:

Consider that the breadth and length of a regular rectangle was altered by -10% and +25%. Find the percentage change in the area of the rectangle.

- (A) 12.5% (B) 37.5%
(C) 50% (D) 25%

Solution:

Area of rectangle = Length \times Breadth

$$25\% = \frac{+1}{4} \qquad 10\% = \frac{-1}{10}$$

Initial Area	:	Final Area
$l_1 \times b_1$		$l_2 \times b_2$
4×10	:	5×9
40	:	45
$\xrightarrow{\quad +5 \quad}$		

% increase in area

$$= \frac{5}{40} \times 100 = 12.5\% \uparrow$$

Previous Years' Question

In a class, 60% of the students are girls and the rest are boys. There are 30 more girls than boys. If 68% of the students, including 30 boys, pass an examination, the percentage of the girls who did not pass is ____.

Alternate Solution:

$l \times b = \text{area}$

Let length be 1 unit and breadth be 1 unit.

$l \times b = \text{Area}$

$$\begin{array}{ccc} 1 & \times & 1 = 1 \text{ unit}^2 \\ \downarrow +25\% & & \downarrow -10\% \\ 1.25 & \times & 0.9 = 1.125 \text{ unit}^2 \end{array}$$

Hence, the increment in the area of the rectangle is 12.5%.

Example 4:

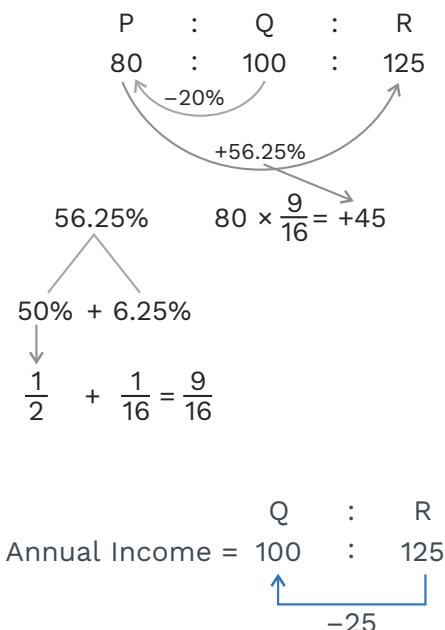
P's annual income is 20% lower than Q's annual income and R's annual income is 56.25% greater than P's annual income. By how much % Q's annual income is less than R's annual income?

- (A) 20%
(B) 40%

- (C) 33.33%
(D) 9.09%

Solution:

Let the annual income of Q be 100.



$$\text{The required value} = \frac{25}{125} \times 100 = 20\%$$

Concept 12: Product constancy

It is the same as the inverse proportion. For example, when the price of rice is Rs. 40/kg, we can purchase 10 kg rice. But when the price of rice increases and it becomes Rs. 50/kg, then we can purchase only 8 kg of rice. So, if we check our expenditure, we will get the same expenses as the previous one.

Price	×	Consumption	=	
Expenditure				Expenditure ₁
Rs. 40/kg.	×	10 kg.	=	Rs. 400
Rs. 50/kg.	×	8 kg.	=	Rs. 400
				Expenditure ₂

So, the product of price and consumption is constant in both the cases.

Some more examples of product constancy:

1. Speed \times Time = Distance
2. Price \times Consumption = Expenditure
3. Efficiency \times Time = Constant
4. Length \times Breadth = Area
5. Rate \times Time = Constant
6. Average \times number of observations = Sum of all observations

Example 1:

If the price of oranges increases by 20%, then by how much percent should its consumption be decreased so that there is no change in the expenditure?

Solution:

Price	\times	Consumption	=	Expenditure
100	\times	100	=	10,000
$\downarrow +20\%$		\downarrow		
120	\times	x	=	10,000

$$\Rightarrow x = \frac{10000}{120} = \frac{500}{6} = \frac{250}{3} = 83\frac{1}{3} \text{ kg}$$

Rack Your Brain



A family decreases its consumption of pulses by 42.84%, because the price of pulses is increased by K%. Find K. (If expenditure remains constant)

$$\text{Therefore, \% reduction} = 100 - 83\frac{1}{3} = 16.67\%$$

$$\text{Or } [P \times C = E]$$

$$1 \times 1 = 1$$

$$1.2 \times k = 1$$

$$k = \frac{1}{1.2} = \frac{5}{6}$$

$$\text{Hence, \% reduction} = 1 - \frac{5}{6} = \frac{1}{6} = 16\frac{2}{3}\%$$

Product Constancy Conditions:

- When one factor of a product is increased by p% then the other factor will be decreased by $\left(\frac{P}{100+P} \times 100\right)\%$

It can be understood that if a factor is increased by $\frac{n}{d}$, then the 2nd factor should

be reduced by $\frac{n}{(d+n)}$.

- When one factor of a product is decreased by P%, then the other factor will be increased by $\left(\frac{P}{100-P} \times 100\right)\%$

It means when one factor of a product is decreased by $\frac{n}{d}$, then the other factor

must be increased by $\left(\frac{n}{d-n}\right)$

Example 2:

If the price of diesel is increased by 25%, then by how much % must a person decrease his consumption so that expenditure would remain same?

Solution:

As the product remains constant

Increase by	Decrease by
$25\% = \frac{1}{4} \uparrow$	$\downarrow \frac{1}{5} = 20\%$

If anything increases by $\frac{1}{n} \uparrow$ then it must be

decreased by $\frac{1}{n+1} \downarrow$ and vice-versa to get

its original value.

Alternate Solution:

$P \times C = \text{Expenditure}$ (Since expenditure will remain the same)

$$P \propto \frac{1}{C}$$

$$25\% = \frac{+1}{4}$$

Price	→	4	:	5
Cons	→	5	:	4

-1

$$\% \text{ reduction in consumption} = \frac{1}{5} \times 100 = 20\%$$

Example 3:

As the price of apples increased by 50%, Ritesh bought 5kg less apples. The amount that he spent on purchasing remained the same, i.e., Rs. 100. Find the new price of apples.

- (A) Rs. 20/kg (B) Rs. 10/kg
(C) Rs. 50/kg (D) Rs. 60/kg

Solution:

$$P \times C = E$$

$$P \propto \frac{1}{C} \quad 50\% = \frac{1}{2}$$

Price	→	2	:	3
Consumption	→	3	:	2

1 unit = 5 kg.

x5 x5

15 kg. 10 kg.

Hence, old price of apples

$$= \frac{\text{Rs. } 100}{15} = \frac{20}{3} = \text{Rs. } 6.66/\text{kg}$$

$$\text{New price of apples} = \frac{\text{Rs. } 100}{10} = \text{Rs. } 10/\text{kg}$$

Concept 13: Difference between “by” and “to”

There is a clear difference between “by” and “to”. The term “by” indicates the change in a value and “to” indicates the changed or the final value.

E.g., If the income of Priya is increased by 30%, it means her new income is $100 + 30 = 130\%$ of the original income. If we say that income of Priya has increased to 150%. It can be understood that this 150% is of the originally received income.

Example 1:

Two numbers are respectively 35% and 50% less than a third number. The first number is what percentage of the second number?

Solution:

Let three numbers be A, B and C and the third number be 100.

A :	B	:	C
65 :	50	:	100

$$\text{Required percentage} = \frac{65}{50} \times 100 = 130\%$$

Concept 14: Population based

Original population = P

The rate of growth = r%.

For increase:

$$\text{The population after 'n' years} = P \left(1 + \frac{r}{100} \right)^n$$

Increase (change) in the population

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

For decrease:

$$\text{The population after 'n' years} = P \left(1 - \frac{r}{100} \right)^n$$

$$\text{Decrease in population} = P \left[1 - \left(1 - \frac{r}{100} \right)^n \right]$$

Rack Your Brain



The current value of a machine is 10,000 dollars. If the value becomes 14,440 dollars in next 3 years, then find the annual rate of growth in the value of the machine.

Example 1:

The present population of a city is 50,000. If there is 20% increase in the population every year, then what will be its population three years later?

- (A) 86,400 (B) 76,400
(C) 86,700 (D) 90,000

Solution:

Population after three years

$$= P \left(1 + \frac{r}{100} \right)^n = 50000 \left(1 + \frac{20}{100} \right)^3$$

$$= 50000 \left(1 + \frac{1}{5} \right)^3$$

$$= 50000 \times \frac{6}{5} \times \frac{6}{5} \times \frac{6}{5} = 86,400$$

Hence, option (A) is the correct answer.

Previous Years' Question



In an examination, the maximum possible score is N, while the pass marks is 45% of N. A candidate obtains 36 marks, but falls short of the pass marks by 68%. Which one of the following is correct?

- (A) $N \leq 200$
(B) $243 \leq N \leq 252$
(C) $N \geq 253$
(D) $201 \leq N \leq 242$

Practice Exercise – 1

Level of difficulty – 1

1. A wire manufacturing company purchased a certain amount of raw material, of which 10% was wasted due to improper handling. After using 85% of the remaining raw material, 47.25 kg of raw material was left. How much raw material was purchased initially?
(A) 200 kg
(B) 250 kg
(C) 300 kg
(D) 350 kg
2. The rate of inflation is 2,000% per annum. What is the value of the article two years from now, if it costs Rs. 12 today?
(A) Rs. 5,292
(B) Rs. 5,992
(C) Rs. 6,992
(D) Rs. 7,052
3. A positive real number is first increased by 20%, then decreased by 25% and then finally increased by 10%. This process is repeated 49 more times. What can be said about the new number obtained?
(A) It is less than 45% of the original number.
(B) It is between 45% and 55% of the original number.
(C) It is between 55% and 65% of the original number.
(D) It is greater than 65% of the original number.
4. Due to the rise in price by 9.09%, 2kg wheat is obtainable for Rs. 60. Find the original per kg price of wheat.

- (A) Rs. 5/kg
- (B) Rs. 2.5/kg
- (C) Rs. 10/kg
- (D) Rs. 9/kg

5. Kajal went to a vegetable market with a certain amount of money. With this money she can buy either 40 apples or 70 mangoes. She retains 15% of her money for auto fare. If she buys 35 mangoes, how many more apples can she buy?
(A) 14
(B) 20
(C) 25
(D) 28

Level of difficulty – 2

6. A's income is 75% of B's income and A's expenditure is 80% of B's expenditure. If A's income is 90% of B's expenditure, then find the ratio of A's savings to B's savings.
(A) 1 : 2
(B) 2 : 1
(C) 5 : 2
(D) 3 : 5
7. A trader marks an article 60% above the cost price and makes 12% profit by selling at a certain discount. If the mark-up percentage and the discount percentage are each increased by 10 percentage points, then the percentage change in the profit will be?
(A) It will decrease by 16.67%
(B) It will decrease by 83.33%
(C) It will increase by 21%

- (D) It will decrease by 21%
8. An amount first increased by 14% and then further increased by 45%, such that the final amount becomes Rs. 16,530. How much was the initial amount?
- (A) Rs. 12,000
(B) Rs. 16,000
(C) Rs. 18,000
(D) Rs. 10,000
9. Shopkeeper Laxman sells chocolates at the rate of Rs. 100 per chocolate upto 200 chocolates. He sells chocolates in packets where each packet contains 20 chocolates. For every additional packet, (after 20 chocolates) he allows a discount of Rs. 5 per chocolate for all the packets. What would be the number of packets of chocolates he should sell so that his revenue is maximised?
- (A) 13
(B) 14
(C) 15
(D) 16
10. The income of Mr. Rajesh is 88.88% more than his expenditure. If his income increases by 30% and his expenditure increases by 35%, then his saving increases by Rs. 78,000. Find the difference between his initial income and initial expenditure.
- (A) Rs. 3,20,000
(B) Rs. 4,40,000
(C) Rs. 5,50,000
(D) Rs. 6,60,000
11. There are two types of biscuits P and Q. The type P biscuit has carbohydrates, fats and proteins and type Q has carbohydrates, fats and sugar. These two types of biscuits are mixed in equal proportion to form type 'R' biscuit. Both Type 'P' and 'R' has 30% carbohydrates. The percentage of sugar in type 'Q' and 'R' is 40% and 20%, respectively. Type 'R' has 24% proteins. The percentage of fat in type 'R' biscuit is?
- (A) 26%
(B) 33%
(C) 21%
(D) 22%
12. A sweet seller decreases the price of one kg of sweet by 20% in the first month. In the second month, he increases the price of one kg of sweet by 20%. He follows this particular pattern in the third and the fourth, fifth and sixth month and so on. Find the month in which the price of the sweet per kg goes below 60% of the initial price for the first time.
- (A) 17th month
(B) 16th month
(C) 8th month
(D) 10th month
13. In a class, each student likes at least one of the five subjects namely Physics, Chemistry, Maths, English and Biotechnology. 80% of the students like Physics, 70% of the students like Chemistry, 90% of the students like Maths, 80% of the students like English and 90% like Biotechnology. What is the maximum percentage of the students who like exactly 4 of the 5 subjects?
- (A) 90%

- (B) 70%
- (C) 62%
- (D) 50%

- 14.** Shubham deals in only two types of beverages, cinnamon lime and jasmine crush. He wishes to spend Rs 3.5 lakh to purchase a total of 100 cartons. He can purchase cinnamon lime at Rs 4,000 per carton and jasmine crush at Rs 3,000 per carton. Whenever there is a shortage in the market, he can sell both cinnamon lime and jasmine crush at Rs 6,000 per carton.

Assume that he can sell all the cartons he stocks, then;

for maximum profit, find the number of cartons that he should stock

of cinnamon lime and jasmine crush, respectively:

- (A) 70, 30
- (B) 60, 40
- (C) 50, 50
- (D) None of these

- 15.** There are two schemes of investment where interest is compounded annually. In the first scheme, an amount becomes 81 times in 8 years, whereas in the second scheme, the rate of interest is 70% per annum. Which scheme is better for investment?

- (A) The first scheme
- (B) The second scheme
- (C) Both would yield equal returns
- (D) Cannot be determined

Solutions

1. (D); 350 kg

Let $100x$ of raw material is purchased initially.

10% of raw material was wasted due to improper handling so that remaining raw amount of material after wastage

$$= 100x - 100x \times 10\% = 90x$$

Since, 85% of the remaining raw material is used for the production.

Hence, remaining amount of raw material = $90x - 90x \times 85\% = 13.5x$

$$\Rightarrow 13.5x = 47.25 \text{ kg}$$

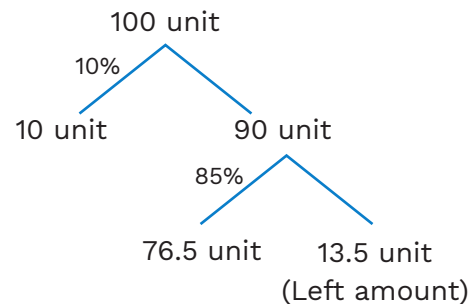
$$x = \frac{47.25}{13.5} = 3.5 \text{ kg}$$

\therefore Amount of raw material purchased initially was

$$= 100x = 100 \times 3.5 = 350 \text{ kg}$$

Alternate Solution:

Let the amount of raw material purchased initially was = 100 unit



$$13.5 \text{ unit} \rightarrow 47.25 \text{ kg}$$

$$1 \text{ unit} \rightarrow \frac{47.25}{13.5} = 3.5 \text{ kg}$$

$$\therefore 100 \text{ unit} \rightarrow 100 \times 3.5 = 350 \text{ kg}$$

Hence, option (D) is the correct answer.

2. (A); Rs. 5,292

Since this question can be done by various methods like straight line method, ratio method or compound interest method.

If we solve it by using the straight-line method.

$$12 \xrightarrow{+2000\%} 12 + 12 \times 2000\% = 12 + 240 = 252$$

(At the end of first year)

$$252 \xrightarrow{+2000\%} 252 + 252 \times 2000\%$$

$$= 252 + 5040 = 5292$$

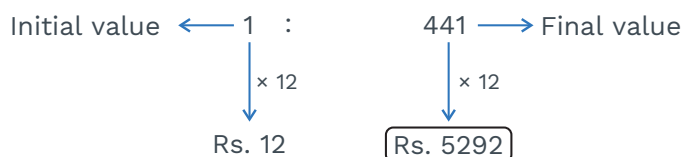
(At the end of second year)

Hence, option (A) is the correct answer.

Alternate Solution:

$$\text{1st year } 1 \rightarrow 1 \left(1 + \frac{2000}{100} \right) = 21$$

$$\text{2nd year } 21 \rightarrow 21 \left(1 + \frac{2000}{100} \right) = 441$$



3. (C)

First we will see the percentage change when it is increased by 20% and decrease by 25%.

$$= (20) + (-25) + \frac{(20) \times (-25)}{100} = -10\%$$

Now, number is increase by 10%, therefore:

Percentage change

$$= (-10) + (10) + \frac{(-10) \times (10)}{100} = 1\% \text{ decrease}$$

Therefore number after 50 operation is $(0.99)^{50}$

Now, using binomial theorem:

$$(0.99)^{50} = (1 - 0.01)^{50}$$

$$= {}^{50}C_0 \times (1)^{50} - {}^{50}C_1 \times (1)^{49} \times (0.01) + {}^{50}C_2 \times (1)^{48} \times (0.01)^2 - {}^{50}C_3 \times (1)^{47} \times (0.01)^3 + {}^{50}C_4 \times (1)^{46} \times (0.01)^4 \dots$$

$$= 1 - 0.5 + \frac{50 \times 49}{2} \times (0.01)^2 - \frac{50 \times 49 \times 47}{6} \times (0.01)^3 + \dots$$

$$= (0.5) + (0.1225) - (0.0196) + (0.002303) \dots \dots \dots (\text{Negative higher power terms})$$

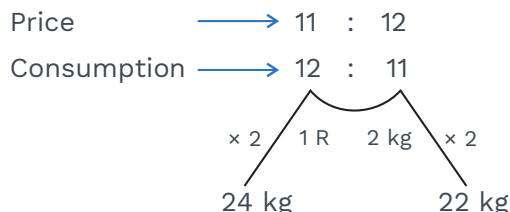
$$= 0.6029$$

i.e., approximately 60% of the original number

Hence option (C) is correct.

4. (B); Rs. 2.5/kg

$$9.09\% = \frac{+1}{11}$$

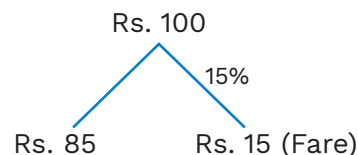


\therefore Initial price of the wheat

$$= \frac{60}{24} = \text{Rs. } 2.5/\text{kg}$$

5. (A); 14

Let she had = Rs. 100



Cost of 40 apples = cost of 70 mangoes
= Rs. 100

70 mangoes = Rs. 100

35 mangoes = Rs. 50

Remaining money = Rs. 85 - 50 = Rs. 35

Since, Rs. 100 \rightarrow 40 apples

Now, for Rs. 35 $\rightarrow \frac{40}{100} \times 35$ apples

$$= \frac{2}{5} \times 35 = 14 \text{ apples can be bought}$$

Hence, option (A) is the correct answer.

6. (A); 1 : 2

Let B's income is Rs. x

A's income = 75% of B's income

$$\text{A's income} = \frac{3}{4} \times x = \frac{3}{4}x$$

Also let B's expenditure = Rs. y

Then, A's expenditure = 80% of B's expenditure = $\frac{4}{5} \times y$

Since, A's income = 90% of B's expenditure

$$\frac{3}{4}x = \frac{9}{10} \times y$$

$$\frac{x}{y} = \frac{9 \times 4}{3 \times 10} = \frac{6}{5}$$

$$x = \frac{6}{5}y$$

Now, we have to find the ratio of their savings.

$$\frac{\text{A's savings}}{\text{B's savings}} = \frac{\frac{3}{4}x - \frac{4}{5}y}{x - y} = \frac{\frac{3}{4} \times \frac{6}{5}y - \frac{4}{5}y}{\frac{6}{5}y - y} = \frac{\frac{18y}{20} - \frac{4y}{5}}{\frac{6y - 5y}{5}} = \frac{\frac{18y - 8y}{20}}{\frac{y}{5}} = \frac{10}{20} = \frac{1}{2}$$

Hence, the ratio of their savings is 1 : 2

Option (A) is the correct answer.

7. (B)

Case-I

Let CP = 100x

P% = 12%

Profit = 12x

SP = 112x

Mark-up % = 60% $\xrightarrow{\uparrow \text{By } 10\% \text{ points}}$

Mark-up = 60x

MRP = 160x

Discount = 160x - 112x
= 48x

Discount % = $\frac{48x}{160x} \times 100$

= 30% $\xrightarrow{\uparrow \text{By } 10\% \text{ points}}$ Discount % = 40%

Earlie profit = 12x

Now profit = 2x

% ↓ in profit = $\frac{10x}{12x} \times 100 = 83.33\%$

Case-II

CP = 100x

MRP = 170x

Discount = 40% of 170x = 68x

Mark-up% = 70%

SP = MRP - Discount

= 102x

Profit = 2x

8. (D); Rs. 10,000

Let the initial amount be 100 units.

100 unit	
+14%	
114 unit	→ Increased amount
+45% [51.3 Unit]	
165.3 unit	
	114 = 100%
	11.4 = 10%
	45.6 = 40%
	5.7 = 5%
	<u>51.3 = 45%</u>

Now, 165.3 unit → Rs. 16530

1 unit → $\frac{16530}{165.3} = \text{Rs. } 100$

∴ 100 unit → 100 × 100 = Rs. 10,000

Hence, initial amount is Rs. 10,000.

9. (C); 15

We know that:

Revenue = Quantity × Price

Assume when his revenue is maximum, he sold 'k' additional packets.

Therefore, number of chocolates sold =
(200 + 20k)

Price per chocolate = (100 - 5k)

$$= 20(10 + k) \times 5(20 - k)$$

$$= 100 \underbrace{(10 + k)}_A \underbrace{(20 - k)}_B$$

Here, the sum of 'A' and 'B' is constant

$$(10 + k) + (20 - k) = 30$$

Therefore product will be maximum when
A = B = 15

$$\text{Now, } 10 + k = 15$$

$$K = 5$$

Therefore, total number of chocolates =
(200 + 20 × 5) = 300

Or the number of packets = $\frac{300}{20} = 15$
packets

Hence, '15' is the correct answer.

10. (A); Rs. 3,20,000

We know that:

$$\begin{array}{l} 11.11\% = \frac{1}{9} \\ \times 8 \\ \hline 88.88\% = \frac{8}{9} \end{array} \times 8$$

$$\begin{array}{rcl} 17 & = & 9 + 8 \\ I & = & E + S \\ 1700 & = & 900 + 800 \\ \downarrow +30\% & & \downarrow +35\% \\ +510 & = & +315 \end{array}$$

⊖

+195

195 Unit → Rs. 78,000

$$1 \text{ Unit} \rightarrow \frac{78000}{195} = \text{Rs. } 400$$

$$800 \text{ unit} \rightarrow 400 \times 800 = \text{Rs. } 320000$$

↓
(I-E)

Hence, option (A) is the correct answer.

11. (A); 26%

	Carbohydrates	Fats	Proteins	Sugar
Biscuit P	30%	22%	48%	—
Biscuit Q	x% → 30%	30%	—	40%
Biscuit R	30%	26%	24%	20%

Type R biscuit has carbohydrates = Avg. of
carbohydrates of biscuit P and Q

$$30\% = \frac{30\% + x}{2}$$

$$60\% = 30\% + x$$

$$x = 30\%$$

% of proteins present in biscuit

$$R = \frac{\% \text{ of proteins in biscuit P} + \% \text{ of proteins in biscuit Q}}{2}$$

$$24\% = \frac{P + 0}{2}$$

% of proteins in biscuit P = 48%

Therefore, fat in biscuit

$$“P” = 100\% - (30\% + 48\%) = 22\%$$

Also, % of fat in biscuit

$$\begin{aligned} Q &= 100\% - (30\% + 40\%) \\ &= 30\% \end{aligned}$$

Hence, % of fat present in biscuit R is the
average of % fat present in biscuit P and %

of fat present in biscuit Q, because biscuit 'P' and 'Q' are mixed in equal proportion.

$$\therefore \% \text{ of fat in biscuit R} = \frac{22\% + 30\%}{2} = 26\%$$

Hence, option (A) is the correct answer.

12. (A); 17th month

Let the price of 1 kg sweet initially = ₹ 100.

After decrement of 20% in 1st month the price becomes

$$= 100 \times 80\% = ₹ 80/\text{kg}.$$

In 2nd month it is increases by 20% again

$$= 80 \times 120\% = ₹ 96/\text{kg}$$

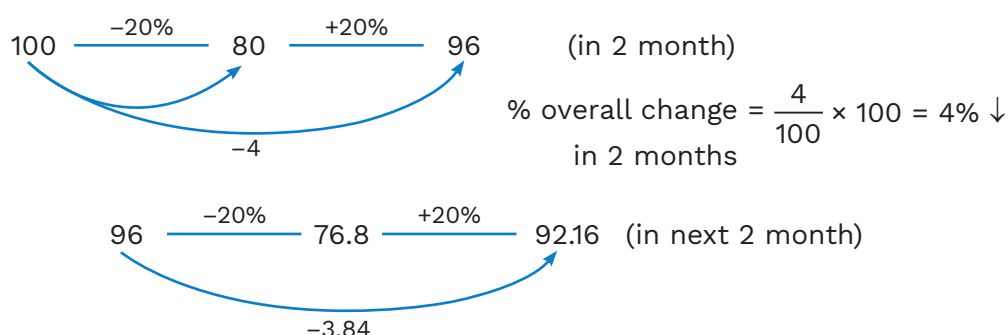
In 3rd month it is again going to be decreased by 20%

$$= 96 \times 80\% = ₹ 76.8/\text{kg}$$

Again in 4th month the price per kg of sweet is going to increase by 20%.

$$= 76.8 \times 120\% = ₹ 92.16/\text{kg}$$

We can observe here:



$$\text{Overall \% decrement in the price of sweet} = \frac{3.84}{96} \times 100$$

$$= 4\% \downarrow$$

After 4 months of calculation, we can observe easily that, after every 2 months, the price of the 1 kg sweet decreases by 4%.

$$\Rightarrow (0.96)^n$$

At $n = 8$, the value is 0.7211 and in the next month the price of the sweet goes down by 20% \Rightarrow Less than 60% of the initial price.

Hence, $8 \times 2 + 1 = 17^{\text{th}}$ month

Or, we can say that after 1 year 5 months. The price of 1 kg sweet will be less than 60% of the initial price.

Hence, option (A) is the correct answer.

13. (A); 90%

Let 'M' be the numbers of the students who like 1 subject.

'N' be the numbers of the students who like 2 subjects.

'O' be the numbers of the students who like 3 subjects.

'P' be the numbers of the students who like 4 subjects.

'Q' be the numbers of the students who like 5 subject.

Also, we know that:

$$\text{Number of students} \rightarrow m + n + O + P + Q = 100\%$$

$$\begin{array}{ccccccccc} & & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & & \\ \text{Number of subjects} & \rightarrow & 1 & 2 & 3 & 4 & 5 & & \\ \text{liked by the students} & & & & & & & & \end{array}$$

...(1)

$$\text{Therefore, } M \times 1 + 2 \times N + 3 \times O + 4 \times P + 5 \times Q = 410\%$$

...(2)

Because →

Sub 1	→	Physics	→	80%
Sub 2	→	Chemistry	→	70%
Sub 3	→	Maths	→	90%
Sub 4	→	English	→	80%
Sub 5	→	Biotechnology	→	90%
				<u>410%</u>

Now, we have to find the maximum % of the students who like exactly 4 of the 5 subjects.

Therefore,

let 'M' = 0 'N' = 0 'O' = 0

In ideal condition 'Q' should also be considered as 'O', but if you consider $Q = O$, then 2nd equation will never satisfy the condition.

Hence, $Q \neq 0$ must be considered.

$$\therefore P + Q = 100\% \quad \dots(1)$$

$$4P + 5Q = 410\% \quad \dots(2)$$

Now, solve equation (1) and (2) we get:

$$4P + 4Q = 400\%$$

$$4P + 5Q = 410\%$$

$$\hline - Q = -10\%$$

$$\boxed{Q = 10\%}$$

Then, $P + Q = 100\%$

$$P + 10\% = 100\%$$

$$\boxed{P = 90\%}$$

Hence, option (A) is the correct answer.

14. (C); 36%

Let 'C' and 'J' be the number of cinnamon lime and jasmine crush cartons required respectively.

$$\text{Then, } C + J = 100 \quad \dots(1)$$

$$\text{Also, } 4000C + 3000J \leq 3,50,000$$

$$\text{Or, } 4C + 3J \leq 350 \quad \dots(2)$$

$$4 \times (1) - (2)$$

$$4C + 4J = 400$$

$$4C + 3J \leq 350$$

$$\hline J \leq 50$$

Therefore, $J \leq 50$ and $C \leq 50$

Hence, option (C) is correct.

15. (A); The first scheme

Considering the first scheme and using the formula for Compound Interest, we get:

$$\Rightarrow A = P \left(1 + \frac{R}{100} \right)^T$$

$$\Rightarrow 81P = P \left(1 + \frac{R}{100} \right)^8$$

$$\Rightarrow 81 = \left(1 + \frac{R}{100} \right)^8$$

$$\Rightarrow 3^4 = \left(1 + \frac{R}{100} \right)^{2 \times 4}$$

$$\Rightarrow 3 = \left(1 + \frac{R}{100} \right)^2$$

$$\Rightarrow \left(1 + \frac{R}{100} \right) = \sqrt{3}$$

$$\Rightarrow \left(1 + \frac{R}{100} \right) = 1.732$$

$$\Rightarrow R = 73.2\%$$

So, the first scheme is better.

Practice Exercise – 2

Level of Difficulty – 1

- To qualify for the board exam, a student has to obtain 39% of the total marks. Rohan got 98 marks and yet failed by 19 marks in the annual exam. Find out the total marks in the exam.
(A) 500
(B) 450
(C) 400
(D) 300
- Akhilesh usually saves 36% of his monthly income. In one month, he gives some donations and hence his monthly expenses increase by 25%. He manages to save Rs. 37,000 in that month. Find out his monthly salary (in Rupees).
(A) 1,50,000
(B) 1,75,000
(C) 1,85,000
(D) 1,95,000
- In a company, the amount of work in month 2 is 150% of month 1. Due to this, the company hires new workers who have 25% more efficiency than the usual workers. The number of workers in month 2 is what per cent more than the number of workers in month 1, given that the time taken to do the given work in both the months is the same?
(A) 33.33%
(B) 40%
(C) 25%
(D) 28%
- Due to a 37.5% decrease in the price of chocolates, Anand bought 21 extra chocolates for his daughter at the same price in which he usually gets 'A' chocolates. Find A.
(A) 20
(B) 35
(C) 55
(D) 56
- 'P' is a number such that 80% of 'P' is more than 57% by 25,300. What is 116% of the number 'P'?
(A) 1,20,000
(B) 1,10,000
(C) 1,27,600
(D) None of these
- The vehicle of Mr. Madmax needs 40% more fuel at the speed of 90 kmph than it needs at the speed of 60 kmph. At a constant speed of 60 kmph, Mr. Madmax with K litres of fuel can travel a distance of 322 kms. At a constant speed of 90 kmph with the same K liters of fuel, what distance will he be able to travel?
(A) 214.67 km
(B) 230 km
(C) 242 km
(D) 450.8 km
- Sonia saves 18.75 % of her income. A year later, her income shoots up by 37.5 %, but her savings remain the same. Find the approximate percentage increase in her expenditure.
(A) 48%
(B) 46%
(C) 44%
(D) 42%

8. Archana decided to donate 15% of her monthly income to an NGO. On the day of the donation, she changed her mind and donated Rs. 96,000 which was equal to 80% of what she had decided earlier. What is 40% of her monthly income?
- (A) Rs 4,00,000
(B) Rs 3,20,000
(C) Rs 4,80,000
(D) Rs 5,00,000
9. If the present cost of an article is Rs. 2916 and the annual rate of inflation for that article is 166.67%, then what will be the cost of the same article 3 years from now?
- (A) Rs. 52,300
(B) Rs. 54,300
(C) Rs. 55,200
(D) Rs. 55,296
10. Khushi went shopping for a certain amount. She spent one-third of the amount on groceries. She spent 30% of the remaining amount on chocolates. She further spent one-fifth of the remaining amount on a gift for her sister. She came back with Rs. 336. Find the initial amount with her.
- (A) Rs. 600
(B) Rs. 800
(C) Rs. 900
(D) Rs. 960
- 57% of the valid votes and won by 1,120 votes. Find the total number of voters enrolled in the voting list.
- (A) 15,000 voters
(B) 18,000 voters
(C) 14,000 voters
(D) 16,000 voters
12. The price of the bicycle first increased by 11.11%, then increased by 16.66% and then increased by 7.7% such that the price becomes Rs. 9800. What was the original price of the bicycle?
- (A) Rs. 5,940
(B) Rs. 6,480
(C) Rs. 7,020
(D) Rs. 7,560
13. A Business Group has 3 companies X, Y, Z, and a Trust P which is engaged in charitable activities. Each group company has to donate 5% of its funds to the Trust, excluding the loan which the company has taken from other companies of the group. X has given a loan to Y which is equivalent to 10% of the funds of Y. After receiving the loan, Y has funds that are 2 times the funds of Z. If Z gave Rs 10,000 as a donation to the Trust P, then how much is the approximate contribution of Y to the Trust P?
- (A) Rs 17,000
(B) Rs 18000
(C) Rs 19000
(D) Rs 20000

Level of Difficulty – 2

11. In an election between two candidates, 15% of voters did not vote, 3900 votes were declared invalid and the winner got
14. The price of a watch is first increased by 20% and then decreased by 5%. The price of another digital watch first increased by 25% and then decreased by 10%. If the final price of both the watches is the

- same, then find the ratio of the initial prices of the two watches?
- (A) 75 : 76
(B) 76 : 75
(C) 97 : 71
(D) 71 : 78
- 15.** 9.09% of the voters did not cast their vote in an election involving only 2 candidates. 11.11% of the votes polled were declared invalid. The losing candidate got 33.5% of the valid votes polled and lost by 39,600 votes. The number of voters enrolled on the voter list was.
- (A) 1,47,500
(B) 1,36,500
(C) 1,48,500
(D) 1,62,000
- 16.** Rahul spends 12.5% of his monthly income on house rent, 16.66% of the remaining income on food, 18.75% of the remaining on education and travel, one-third of the remaining on medicines and saves the remaining amount of Rs. 27,300. The monthly income of Rahul (in Rupees) is:
- 17.** The income of Ankit is 60% more than that of Shrikant and the income of Shrikant is 20% less than that of Shishir. If the income of Shishir goes down by 12% and Shrikant goes up by 20%, then the per cent by which Shishir's income would become less than the Shrikant is near to?
- (A) 4%
(B) 6 %
(C) 8 %
(D) 10 %
- 18.** There are two alloys A and B made up of Silver, Copper and Zinc. Alloy A contains 55% Silver and the rest Copper. Alloy B contains 45% Silver, 40% copper and the rest Zinc. Alloys A and B are mixed in a ratio 5 : 3 to form a new alloy. Find the approximate percentage of Silver in the newly formed alloy.
- (A) 55%
(B) 51%
(C) 48%
(D) None of these
- 19.** Data scientists predicted that 20% of people who consume alcohol get liver damage and 80% of the liver patients consume alcohol. If 30% of the population consumes alcohol, then find the % of the total population having liver damage.
- (A) 13%
(B) 9%
(C) 6%
(D) 7.5%
- 20.** There are 5 friends A, B, C, D and E. Income of B is 20% less than the Income of A. Income of C is 12.5% more than the income of B. Income of D is 33.33% more than C's income, but 14.28% less than E's income. E's income is how much per cent more than A's income?
- (A) 20%
(B) 25%
(C) 33.33%
(D) 40%

Level of Difficulty – 3

- 21.** The production of rice as a percentage of total food production was 28% in India in

the year 2019. In the year 2020, the production of rice as a percentage of total food production decreases by 5% points. Total food production in India increased by 20% from the year 2019 to the year 2020. If the total rice production in India in the year 2020 was 138 million tons, then what was the total rice production in India (in million tons) in the year 2019?

- 22.** In a class, 59% of the students are boys and the rest are girls. There are 162 more boys than girls. If 73% of the students in class, including 423 boys, pass an examination, then the approximate percentage of girls who did not pass the exam is:

(A) 44%
(B) 40%
(C) 36%
(D) 32%

- 23.** Shubham was working in company A. He got a letter from company B regarding his recruitment in the company with a hike of 20% on his current salary. Upon learning this, his own company increased his salary by 25%. Company B gave him a hike of 16.66% more when it came to know the increase by company A. This was repeated one more time by company A increasing the salary by 20% more and company B giving a hike of 14.28% more. Finally, Shubham joined company B. What is the percentage increase in Shubham's salary?

(A) 40%
(B) 45%
(C) 60%
(D) 75%

- 24.** Price of the bicycle first increased by 11.11%, then increased by 6.66%, then

increased by 7.14%, then increased by 6.25% and then increased by 12.5%, such that the price becomes Rs. 13,600. What was the original price (in Rupees) of the bicycle?

- 25.** Manufacturing a product requires 3 raw materials A, B, C in the ratio 1 : 2 : 4, respectively, by quantity. The cost per ton of A, B and C is in the ratio 3 : 4 : 6, respectively. The product is sold at a profit of 20 per cent. Due to rising inflation, if the costs of A and B and C increase by 30 per cent, 40 per cent and 10 per cent, respectively, what should be the approximate per cent increase in the selling price of the product, so that the profit per cent remains the same?

(A) 17%
(B) 19%
(C) 20%
(D) 23%

- 26.** Raja bought a shotgun of Rs. 10,10,101. He sold it to Ram at a profit of 33.33%, Ram sold it to Mohan at a loss of 22.22%, Mohan sold it to Roy at a loss of 81.25%, Roy sold it to Neil at a profit of 6.66%, Neil sold it to Nitin at a profit of 28.57%, and Nitin, in turn, sold it to Mukesh at a profit of 275%. What is the difference between the CP (in Rupees) of Raja and Mukesh ?

- 27.** Ratan is considering 3 alternatives to invest his surplus cash for a month. He wishes to guarantee maximum return on his investment. He has 3 options, each of which can be utilized fully or partially in conjunction with others.

(A) 0.75%
(B) 1%

- (C) 1.5%
(D) 2%

- 28.** There are 2 factories A and B in Chandigarh. In factory A, the number of male employees is 60% more than the number of its female employees. In factory B, the number of female employees is 60% less than its number of male employees. If the total number of employees in factory A and factory B together are 6400, then what could be the maximum number of total employees in factory B?
- (A) 6,160
(B) 5,880
(C) 5,600
(D) 5,320

- 29.** The production of rice formed 30% of the total food grain produced in India in the year 2018. In the year 2019, the share of rice in the total food grain production

decreased by 10 percentage points. Find the percentage change in the production of Rice, from 2018 to 2019, if the total food grain production in India increased by 25% from 2018 to 2019.

- (A) Decreased by 16.66%
(B) Increased by 16.66%
(C) Decreased by 12.5%
(D) Increased by 12.5%

- 30.** In a basketball tournament, A central region team for the national games has played 20 matches so far and won 40% of them. If they win 60% of the remaining matches, their overall winning percentage will be 50%. Suppose they win 80% of the remaining matches, then the total number of matches won by the team in this tournament will be:

- (A) 20
(B) 16
(C) 24
(D) 28

Solutions

1. (D)

Given that Rohan got 98 marks and he failed by 19 marks.

So, the qualifying marks in the annual exam = $98 + 19 = 117$

It is also given that qualifying marks = 39% of the total marks

$$\Rightarrow 39\% \text{ of total marks} = 117$$

$$\Rightarrow 100\% \text{ of total marks} = 117 \times 100/39 = 300.$$

Hence, option (D) is the correct answer.

2. (C)

Let us assume his usual Income = Rs. 100

So, Expenditure = Rs. 64 and Savings = Rs. 36

Expenses increases by 25%

This month Expenditure

$$= 64 + 64 \times (25/100) = \text{Rs. } 80.$$

Hence, Present Savings

$$= 100 - 80 = \text{Rs. } 20$$

But according to the question his savings in that month is 37,000.

$$\text{So, } 20\% = 37,000$$

$$\text{Then, } 100\% = 1,85,000$$

Hence, option (C) is the correct answer.

3. (B)

Let there be 100 workers in month 1 and total work = 100 units i.e. each worker can do 1 unit.

Now, new total work = 150 units

If workers with the same efficiency joined, then 50 more workers are needed.

But since 25% more efficient workers joined, therefore, the number of new workers = $50/(1.25) = 40$

Therefore, in month 2, there will be $100 + 40 = 140$ workers

Hence, workers in month 2 are 40% more than the workers in month 1

Hence, option (B) is the correct answer.

4. (B)

Let's assume that he initially bought A chocolates at the price of Rs. B per chocolate.

Since, in this case, expenditure is constant.

$$\text{Expenditure} = A \times B = (A + 21) \times (5/8) \times B$$

Solving which we will get $A = 35$

Hence, option (B) is the correct answer.

5. (C)

As per the given condition in the question-

$$(P \times 80\%) - (P \times 57\%) = 25,300$$

$$23\% \times P = 25,300$$

$$P = 1100 \times 100 = 1,10,000$$

Now we have to find 116% of P.

$$\therefore 116\% \text{ of } 1,10,000 = 116 \times 1100 = 1,27,600$$

Hence, option (C) is the correct answer.

6. (B)

Fuel required to Travel 322 km at a speed of 60 kmph = K litres

So, fuel required to Travel 322 km at a speed of 90 kmph

$$= K + 40\% \text{ of } K = 1.4K \text{ litres}$$

With 1.4K litres of fuel, the vehicle can travel a distance of 322 km at a speed of 90 kmph

So, with K litres fuel, the vehicle can travel a distance

$$= 322/1.4 = 230 \text{ km at a speed of 90 kmph}$$

Hence, option (B) is the required answer.

7. (B)

$$18.75\% = 3/16 \text{ and } 37.5\% = 3/8$$

Let's assume earlier Sonia's income

$$= 16K, \text{ Savings} = 3/16 \times 16K = 3K \text{ and}$$

$$\text{expenditure} = \text{Income} - \text{Savings} = 13K$$

A year Later her Income

$$= 16K + 37.5\% \text{ of } 16K = 22K$$

Her Savings = same as earlier = 3K

$$\text{Her expenditure} = 19K$$

Percentage increase in the expenditure

$$= \{(19K - 13K)/13K\} \times 100 \text{ which is approximately equals to } 46\%$$

Hence, option (B) is the correct answer.

8. (B)

Let the monthly salary of Archana is

$$= \text{Rs } K$$

And her donation to orphanage

$$= 15\% \text{ of } K = 0.15K$$

But at the time of donation, she had changed her mind and donated 80% of the previous one.

Actual donation to the orphanage

$$= 0.15K \times 80\%$$

Since it is given in the question that she had donated Rs. 96,000 after changing her decision.

$$0.15K \times 80\% = 96,000$$

$$K = \text{Rs. } 8,00,000$$

Now, we have to find the 40% of her monthly salary = 40% of

$$8,00,000 = \text{Rs. } 3,20,000$$

Hence, option (B) is the correct answer.

9. (D)

Present cost = Rs. 2916 units

$$166.67\% = 100\% + 66.67\%$$

$$= 1 + 2/3 = 5/3$$

Cost of the article 1 year from now
 $= 2916 \times (8/3)$
 Cost of the article 2 years from now
 $= 2916 \times (8/3)^2$
 Similarly, the cost of article 3 years from now
 $= 2916 \times (8/3)^3 = 55,296$
 Hence, option (D) is the correct answer.

10. (C)

Let's assume the initial total amount
 $=$ multiple of 3 and 5 $=$ Rs. 150k
 Amount spent on grocery $=$ 50k
 Remaining amount $=$ 100k
 Amount spent on chocolates
 $=$ 30% of 100k $=$ 30k
 Remaining amount $=$ 70k
 Amount spent on gift $= 1/5 \times 70k = 14k$
 Amount left with her
 $= 56k = 336$, which means $k = 6$
Initial amount with her
 Rs. 150k 150×6 Rs. 900
 Hence, option (C) is the correct answer.

Level of Difficulty – 1

11. (C)

Let us assume that total voters $= 20K$
 $3x$ voters did not vote, then remaining voters $= (20k - 3k) = 17K$
 Invalid votes $= 3,900$
 Valid votes $= (17K - 3,900)$
 And winner candidate gets
 $= 57\% \times (17K - 3,900)$
 Losing candidate gets
 $= 43\% \times (17K - 3,900)$
 Difference between the number of votes
 $= 14\% \times (17K - 3,900) = 1120$
 Solving which we will get $K = 700$
 Thus, the total number of voters enrolled
 $= 20K = 14,000$
 Hence, option (C) is the correct answer.

12. (C)

$11.11\% = 1/9$, $16.66\% = 1/6$ and $7.77\% = 1/13$
 Let the original price of the bicycle was $= K$
 According to the question $K \times \frac{10}{9} \times \frac{7}{6} \times \frac{14}{13}$
 $= 9,800$
 $\Rightarrow K = 7,020$
 So, the original price of the bicycle was Rs. 7,020
 Hence, option (C) is the correct answer.

13. (B)

As per the question,
 Z's donation to Trust P $=$ Rs 10,000
 $\therefore 5\%$ of Z's fund $=$ 10,000
 \therefore Z's fund $=$ Rs. 2,00,000
 Now, Y's new fund $= 2 \times$ Z's funds
 \therefore Y's new fund $=$ Rs 4,00,000
 Now, let Y's original fund be Rs a.
 Thus, 110% of $a = 4,00,000$, then
 $a =$ approximately Rs. 3,63,636
 Hence, Y's contribution to Trust P $= 5\%$ of $a = 5\%$ of 3,63,636 $=$ Rs 18,182, which is approximately equals to Rs. 18,000
 Hence, option (B) is the correct answer.

14. (A)

Let the initial prices of both the watches be ₹ x and ₹ y .
 Then $x \times 120\% \times 95\% = y \times 125\% \times 90\%$
 $x \times \frac{120}{100} \times \frac{95}{100} = y \times \frac{125}{100} \times \frac{90}{100}$
 $x \times 120 \times 95 = y \times 125 \times 90$
 $\frac{x}{y} = \frac{125 \times 90}{120 \times 95} = \frac{75}{76}$
 Hence, option (A) is the correct answer.

15. (C)

Let's assume the number of voters enrolled $= N$

The number of voters who cast their votes = $N - N/11 = 10/11 \times N$

Number of valid votes polled

$$= 8/9 \times 10/11 \times N$$

The losing candidate got 33.5% of the valid votes polled, so the winning candidate must have got 66.5% of the valid votes polled.

So, losing candidate lost by $(66.5\% - 33.5\%) = 33\%$ of the valid votes polled
 $= 38400$

$$\Rightarrow 33\% \text{ of } 8/9 \times 10/11 \times N = 39,600$$

$$\Rightarrow 33/100 \times 8/9 \times 10/11 \times N = 39,600$$

$$\Rightarrow N = 1,48,500$$

Hence, option (C) is the correct answer.

16. 69120

Let's assume that the monthly income of Rahul = Rs. K

Rent paid = $1/8$ K, So, the amount left after paying rent = $(7/8) \times K$

Similarly, the amount left after food expense

$$= (5/6) \times (7/8) \times K$$

Amount left after deducting travel and educational expenses

$$= (13/16) \times (5/6) \times (7/8) \times K$$

Amount left after deducting the medical expenses

$$= (2/3) \times (13/16) \times (5/6) \times (7/8) \times K$$

$$= \text{Savings} = 27,300$$

Solving this we will get $K = 69,120$.

17. (C)

Let the income of Shrikant be Rs. 100.

Income of Ankit = $100 \times 160\% = \text{Rs. } 160$

Given, the income Shrikant is 20% less than that of Shishir

So, income of Shishir

$$= 100 / (0.8) = \text{Rs. } 125$$

Now, according to question,

Shisir's new income = 88% of

$$125 = \text{Rs. } 110$$

And Shrikant's new income

$$= 120\% \text{ of } 100 = 120$$

\therefore Required % = $(10/120) \times 100 = 8.33\%$, which approximately equals to 8%

Hence, option (C) is the correct answer.

18. (B)

Let's assume total quantity of alloy

A = 500 kg and total quantity of alloy

B = 300 kg

Silver in alloy A = 55% of 500 = 275 kg

Silver in alloy B = 45% of 300 = 135 kg

Total silver in new alloy

$$= 275 + 135 = 410 \text{ kg}$$

Total quantity of new alloy

$$= 500 + 300 = 800 \text{ kg}$$

% of Silver in new alloy = $(410/800) \times 100$

= approximately equal to 51%

Hence, option (B) is the correct answer.

19. (D)

Let the total population be 100K.

Population which consumes alcohol

$$= 30\% \text{ of } 100K = 30K$$

Population which consumes alcohol and has liver damage

$$= 20\% \text{ of } 30K = 6K$$

Also, it is given in the question that 80% of liver patients consume alcohol.

80% of total liver patients = patients having liver damage and consuming alcohol = 6K

So, total liver patients = $6K / (0.8) = 7.5K$
= 7.5% of the total population.

Hence, option (D) is the correct answer.

20. (D)

Let's assume the income of A = 100K

So, the income of B = 80K

$$\text{Income of C} = 80K + 12.5\% \text{ of } 80K = 90K$$

Income of D = $90K + 33.33\%$ of $90K = 120K$
 Income of D = $120K =$ Income of E – $(14.28\%$ of Income of E)
 Income of E = $140K$
 Thus, the income of E ($140K$) is 40% more than the income of A
 Hence, option (D) is the correct answer.

Level of Difficulty – 3

21. 140

Rice production as a percentage of total food production in the year 2020
 $= 28\% - 5\% = 23\%$
 Total Rice production in the year 2020
 $= 23\%$ of total food production
 $= 138$ million tons
 Solving which we will get total food production in the year 2020 = 600 million tons
 Total food production in the year 2019
 $= 600/(1.2) = 500$ million tons
 Total rice production in India in the year 2019 = 28% of $500 = 140$ million tons

22. (C)

Let's assume the total students in class = $100K$
 Boys = $59K$ and girls would be $41K$
 Given $59K - 41K = 162$, solving which we will get $K = 9$
 So, total students = $100K = 900$, Boys = $59K = 531$ and Girls = $41K = 369$
 Total students who pass the examination = 73% of $900 = 657$
 Boy who passed the exam = 423
 So, girls who passed the exam = $657 - 423 = 234$
 Number of girls who did not pass the exam = $369 - 234 = 135$

% of total girls who did not pass the exam = $(135/369) \times 100 = \text{Approx. } 36\%$
 Hence, option (C) is the correct answer.

23. (C)

Let Shubham's current salary be K
 1st offer given by company B = $(6/5) K$
 2nd offer given by company
 $B = (6/5) \times (7/6) K$
 3rd offer given by company
 $B = (6/5) \times (7/6) \times (8/7) K = (8/5) K = 1.6K$
 Now, the percentage increase in salary = 60%
 Hence, option (C) is the correct answer.

24. 8960

We know that $11.11\% = 1/9$, $6.66\% = 1/15$, $7.14\% = 1/14$, $6.25\% = 1/16$ and $12.5\% = 1/8$
 Let the original price of the bicycle was = K
 According to the question $K \times (10/9) \times (16/15) \times (15/14) \times (17/16) \times (9/8) = 13,600$
 Solving which we will get $K = \text{Rs. } 8,960$
 Hence, the original price of the bicycle was Rs. 8,960.

25. (B)

Since the problem asks us to find a per cent value, we can assume any suitable initial value of the quantities of A, B and C used as well as their price (since the final answer is independent of the initial values assumed).
 We know that the quantity of A, B and C used is $1 : 2 : 4$
 Let the quantities of A, B and C used to be 1 ton, 2 tons and 4 tons, respectively.
 We know that the cost per ton of A, B and C is in the ratio $3 : 4 : 6$
 Let the cost per ton of A, B and C be Rs. 30, 40 and 60, respectively.

Thus, total cost of the product
 $= (1 \times 30 + 2 \times 40 + 4 \times 60)$
 $= \text{Rs. } 350$
 Since the product is sold at 20% profit,
 the selling price of the product
 $= 120\% \text{ of } 350 = \text{Rs. } 420$
 New cost per ton of A = 130% of
 $30 = \text{Rs. } 39$
 New cost per ton of B = 140% of
 $40 = \text{Rs. } 56$
 New cost per ton of C = 110% of
 $60 = \text{Rs. } 66$
 Since the quantities of A, B and C used
 are the same, new total cost of the prod-
 uct $= 1 \times 39 + 2 \times 56 + 4 \times 66 = \text{Rs. } 415$
 Since the product is still sold at 20%
 profit, the selling price of the product
 $= 120\% \text{ of } 415 = \text{Rs. } 498$
 Thus, the percent increase in the selling
 price $= \{(498 - 420)/420\} \times 100 = \text{approx-}$
 $\text{imately } 19\%$
 Hence, option (B) is the correct answer.

26. 0

Let the Cost price of Raja = K
 CP of Mukesh $= 10,10,101 \times (4/3) \times (7/9) \times$
 $(3/16) \times (16/15) \times (9/7) \times (15/4) = 10,10,101$
 Hence, the difference between CP of Raja
 and Mukesh $= 10,10,101 - 10,10,101 = 0$.

27. (B)

As one can clearly see, the returns in
 mutual funds are better than debt funds.
 So, he must invest in mutual funds.
 For guaranteed return
 Return in stock market rise = Return in
 stock market fall.
 Let suppose he invested 100x in the mu-
 tual fund of PQR and 100y in the mutual
 fund of RQP.

Return when the stock market rise
 $= 6x - 3y$

Return when the stock market fall
 $= -4x + 5y$

So, for guaranteed return

$$\Rightarrow 6x - 3y = -4x + 5y$$

$$10x = 8y$$

$$x : y = 4 : 5$$

Now let $x = 4k$ and $y = 5k$

Total investment

$$= 100x + 100y = 400k + 500k = 900k$$

Guaranteed return

$$= 6x - 3y = -4x + 5y = 9k$$

Maximum guaranteed return

$$= \left\{ \left(\frac{9k}{900k} \right) \times 100 \right\} = 1\%$$

Hence, option (B) is the correct answer.

28. (B)

Let's assume the number of female em-
 ployees in factory A = 100a, so the num-
 ber of male employees in factory A would
 be 160a and the total employees in fac-
 tory A would be 260a

Let's assume the number of male em-
 ployees in factory A = 100b, so the num-
 ber of female employees in factory A
 would be 40b and the total employees in
 factory B would be 140b

According to the question

$$260a + 140b = 6,400$$

$$13a + 7b = 320$$

We need to find the maximum value of
 140b, which we will get for the maximum
 value of b.

To get a maximum value of b, a value
 must be minimum.

As a would-be, a natural number, start
 putting the value of $a = 1$, and then we
 will get b in a fraction.

Now if we put $a = 2$, then we will get $b = 42$, which will be the maximum value of b .

Hence, the maximum number of total employees in the factory

$$B \quad 140b \quad 140 \times 42 \quad 5,880$$

Hence, option (B) is the correct answer.

29. (A)

Let's assume the total food grains production in India in 2018 = 100 kg

Rice production in 2018 = 30% of

$$100 = 30 \text{ kg}$$

Rice production in 2018 as a percentage of total food production = 30%

Rice production in 2019 as a percentage of total food production

$$= 30\% - 10\% = 20\%$$

Total food grains production in India in 2019

$$= 1.25 \times 100 = 125 \text{ kg}$$

Rice production in 2019 = 20% of

$$125 = 25 \text{ kg}$$

% decrease in Rice production

$$= (5/30) \times 100 = 16.66\%$$

Hence, option (A) is the correct answer.

30. (C)

The central region team has played a total of 20 matches so far.

The number of matches won by the team so far = $20 \times 40\% = 8$ matches.

Let the remaining number of matches be 'K'.

The number of matches won by the central region team in the remaining matches = $60\% \times K = 0.6K$

Now according to the question:

$$(8 + 0.6K)/(20 + K) = 1/2$$

Solving, which we will get $K = 20$

Since it is given in the question that the central region team has won 80% of the remaining matches.

Number of matches won by the team in the remaining matches

$$= 20 \times 80\% = 16 \text{ matches.}$$

Now, we have to find the total number of matches won by the central region team = $8 + 16 = 24$ matches.

Hence, option (C) is the correct answer.