# PERCENTAGE

**PERCENTAGE :**

The word "per cent" 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 form 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 students 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 :*

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

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

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

*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 = ₹ 7700 – ₹ 7000 = ₹700

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

∴ Percentage rise = 10 %.

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

**Example 4 :**

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

**Solution :**

% decrease = $\dfrac{19000 - 17000}{19000} \times 100$

$= \dfrac{2000}{19000} \times 100 = 10.5$ %.

∴ Per cent decrease = 10.5 %.

If A is x % of C and B is y % of C, then A is $\dfrac{x}{y} \times 100$ % 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 = $\dfrac{1}{5}$ .

∴ The required % = $\dfrac{1}{5 \times 5} \times 100 = 4$ %.

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

If two number are respectivley x% and y% less than a third number, then the first numbe if $\left(\dfrac{100-x}{100-y} \times 100\right)$ % of the second and the second is $\left(\dfrac{100-y}{100-x} \times 100\right)$ % 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

$= \dfrac{A \times 100 \times 100 \times 100}{(100-x)(100-y)(100-z)}$ in the begining.

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

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

**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,

Income = $\dfrac{4053 \times 100 \times 100}{(100-3.5)(100-12.5)} = ₹ 4800$.

If the price of a commodity increases by r %, then reduction in consumption, so as not to increase the expenditure is

$\left(\dfrac{r}{100+r} \times 100\right)$ %.

If the price of a commodity decreases by r %, then the increase in consumption so as not to decrease the expenditure is

$\left(\dfrac{r}{100-r} \times 100\right)$ %.

**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 :**

Reduction in consumption = $\left(\dfrac{20}{100+20} \times 100\right)$ %

$= \left(\dfrac{20}{120} \times 100\right)$ % = 16.67 %

**POPULATION FORMULA**

If the original population of a town is P, and the annual increase is r %, then the population after n years is

$P\left(1+\dfrac{r}{100}\right)^n$ and population before n years = $\dfrac{P}{\left(1+\dfrac{r}{100}\right)^n}$

If the annual decrease be r %, then the population after n years is $P\left(1-\dfrac{r}{100}\right)^n$ and

population before n years = $\dfrac{P}{\left(1-\dfrac{r}{100}\right)^n}$

**Example 8 :**

The population of a certain town increased at a certain rate per cent per 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,

$390625\left(1+\dfrac{r}{100}\right)^4 = 456976$

∴ $\left(1+\dfrac{r}{100}\right)^2 = \sqrt{\dfrac{456976}{390625}} = \dfrac{676}{625}$

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

$$= 456976 \times \frac{676}{625} = 494265 \text{ approximately.}$$

**Example 9 :**

The population of a city increases 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 × 1.05 × 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 $\left(x - y - \dfrac{xy}{100}\right)\%$ 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 $\left(\dfrac{x^2}{100}\right)$.

**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.**

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

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

**SUCCESSIVE INCREASE OR DECREASE**

If the value is increased **successively by x % and y %** then the final **increase** is given by

$$\left(x + y + \frac{xy}{100}\right)\%$$

If the value is decreased **successively by x % and y %** then the final **decrease** is given by

$$\left(-x - y - \frac{xy}{100}\right)\%$$

**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 $M = \dfrac{100(y + z)}{x}$

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 $M = \dfrac{100(a + b)}{y - x}$.

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

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

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 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.

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

Now, radius is increased by 10%

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

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

% increase in area $= \dfrac{1.21\pi R^2 - \pi R^2}{\pi R^2} \times 100 = 21\%$

**Shortcut Method:**

Radius is increased by 10%.

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

If the both sides of rectangle are changed by x% and y% respectively, then % effect on area $= x + y + \dfrac{xy}{100}$

(+/– 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**

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

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 ₹x

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

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

$$\left(\frac{1.5x-x}{1.5x}\times 100\right)\% = \frac{100}{3} = 33.33\%$$

**Shortcut method,**

B's salary is less than A's salary by $\left(\dfrac{50}{100+50}\times 100\right)\%$

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

### 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

$$= \frac{25}{100} \times x \qquad .... (i)$$

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

$$= \frac{40}{100} \times y \qquad .... (ii)$$

From (i) and (ii), we get

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

$$\Rightarrow \quad 25x = 40y$$

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

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.

### 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 saving 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%

B spends 70% of his salary and saves 30%

Given that

20% of x = 30% of (50,000 – x)

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

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

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

A's salary ₹30,000

B's salary = ₹50,000 – ₹30,000 = ₹20,000

# EXERCISE

1. If $3x + 7 = x^2 + M = 7x + 5$, what is the value of 120% of $M$?
   (a) 8.90
   (b) 9.90
   (c) 9.98
   (d) None of these

2. $p$ is six times as large as $q$. The percent that $q$ is less than $p$, is :
   (a) $16\dfrac{2}{3}$
   (b) 60
   (c) $83\dfrac{1}{3}$
   (d) 90

3. If two numbers are respectively 20% and 50% of a third number, what is the percentage of the first number to the second ?
   (a) 10
   (b) 20
   (c) 30
   (d) 40

4. A sum of ₹ 4558 is divided among $A$, $B$ and $C$ such that $A$ receives 20% more than $C$, and $C$ receives 25% less than $B$. What is A's share in the amount ?
   (a) ₹ 1548
   (b) ₹ 1720
   (c) ₹ 1290
   (d) ₹ 1345

5. The digit at unit place of a two-digit number is increased by 100% and the digit at ten places of the same number is increased by 50%. The new number thus formed is 19 more than the original number. What is the original number?
   (a) 22
   (b) 63
   (c) 24
   (d) None of these

6. The owner of a boutique decides to calculate the per centage of customers who purchase hats. If 40 per cent of the store's customers decide to purchase items, and of those customers 15 percent purchase hats, then what per cent of the store's customers purchase hats ?
   (a) 4%
   (b) 6%
   (c) 15%
   (d) 24%

7. Groundnut oil is now being sold at ₹ 27 per kg. During last month its cost was ₹ 24 per kg. Find by how much % a family should reduce its consumption, so as to keep the expenditure same.
   (a) $11\dfrac{1}{9}\%$
   (b) $11\dfrac{1}{11}\%$
   (c) $11\dfrac{9}{10}\%$
   (d) $9\dfrac{1}{10}\%$

8. 10% of the inhabitants of a village having died of cholera, a panic set in, during which 25% of the remaining inhabitants left the village. The population is then reduced to 4050. Find the number of original inhabitants.
   (a) 5000
   (b) 6000
   (c) 7000
   (d) 8000

9. Chunilal invests 65% in machinery, 20% in raw material and still has ₹ 1,305 cash with him. Find his total investment.
   (a) ₹ 6,500
   (b) ₹ 7, 225
   (c) ₹ 8,500
   (d) None of these

10. When the price of a pressure cooker was increased by 15%, the sale of pressure cookers decreased by 15%. What was the net effect on the sales?
    (a) 15% decrease
    (b) no effect
    (c) 2.25% increase
    (d) 2.25% decrease

11. If 12% of 75% is greater than 5% of a number by 75, the number is
    (a) 1875
    (b) 1890
    (c) 1845
    (d) 1860

12. When the price of sugar was increased by 32%, a family reduced its consumption in such a way that the expenditure on sugar was only 10% more than before. If 30 kg were consumed per month before, find the new monthly consumption.
    (a) 20 kg
    (b) 25 kg
    (c) 30 kg
    (d) None of these

13. A's income is 60% of B's income, and A's expenditure is 70% of B's expenditure. If A's income is 75% of B's expenditure, find the ratio of A's savings to B's savings.
    (a) 5 : 1
    (b) 1 : 5
    (c) 3.5 : 1
    (d) 2 : 7

14. The ratio of salary of a worker in July to that in June was $2\dfrac{1}{2} : 2\dfrac{1}{4}$, by what % the salary of July more than salary of June. Also find by what %, salary of June was less than that of July.
    (a) $11\dfrac{1}{9}\%$ and 10%
    (b) 10% and $11\dfrac{1}{9}\%$
    (c) Both 10%
    (d) Both $11\dfrac{1}{9}\%$

15. In a housing society, 30 per cent of the residents are men over the age of 18 and 40 per cent are women over the age of 18. If there are 24 children living in the housing society, then how many total residents live ?
    (a) 32
    (b) 80
    (c) 94
    (d) 112

16. There is an increase of 30% in the production of milk chocolates in Amul Dairy in one month. If now it is 9,100 milk chocolates per month, what was it one month ago?
    (a) 10,000 chocolates
    (b) 9000 chocolates
    (c) 8000 chocolates
    (d) 7000 chocolates

17. In a college election between two rivals, a candidate who got 40% of the total votes polled, was defeated by his rival by 160 votes. The total number of votes polled was
    (a) 900
    (b) 800
    (c) 700
    (d) 600

18. A scooter costs ₹ 25, 000 when it is brand new. At the end of each year, its value is only 80% of what it was at the

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beginning of the year. What is the value of the scooter at the end of 3 years?

(a) ₹10,000     (b) ₹12,500
(c) ₹12,800     (d) ₹12,000

19. The income of A is 150% of the income of B and the income of C is 120% of the income of A. If the total income of A, B and C together is ₹86000, what is C's income ?

(a) ₹30000     (b) ₹32000
(c) ₹20000     (d) ₹36000

20. If the price of sugar is increased by 7%, then by how much per cent should a housewife reduce her consumption of sugar, to have no extra expenditure?

(a) 7 over 107%     (b) 107 over 100%
(c) 100 over 107%     (d) 7%

21. A student X passes his examination with 515 marks, having scored 3% above the minimum. If Y had obtained 710 marks, what % would have been above the minimum?

(a) 40%     (b) 42%
(c) 50%     (d) Cannot be determined

22. Ravi's salary is 150% of Amit's salary. Amit's salary is 80% of Ram's salary. What is the ratio of Ram's salary to Ravi's salary ?

(a) 1 : 2    (b) 2 : 3    (c) 5 : 6    (d) 6 : 5

23. In a shipment of 120 machine parts, 5 per cent were defective. In an another shipment of 80 machine parts, 10 per cent were also defective. For the two shipments combined, what per cent of the machine parts were defective ?

(a) 6.5 %   (b) 7.0%   (c) 7.5%   (d) 8.0%

24. The sum of two numbers is $\frac{28}{25}$ of the first number. The second number is what percent of the first?

(a) 12%   (b) 14%   (c) 16%   (d) 18%

25. In a class, 65% of the students are boys. On a particular day 80% of girl students were present. What was the fraction of boys who were present that day if the total number of students present that day was 70%?

(a) $\frac{2}{3}$     (b) $\frac{28}{65}$
(c) $\frac{5}{6}$     (d) $\frac{42}{65}$

26. In a competitive examination in State A, 6% candidates got selected from the total appeared candidates. State B had an equal number of candidates appeared and 7% candidates got selected with 80 more candidates got selected than A. What was the number of candidates appeared from each State?

(a) 7600     (b) 8000
(c) 8400     (d) Data inadequate

27. By reduction of 20% in the price of oranges, one can purchase 5 oranges more for ₹2.50. Find the reduced price of the oranges per dozen and also the original price.

(a) 120 paise, 140 paise   (b) ₹0.8, ₹1.5
(c) ₹1.0, ₹1.5   (d) ₹1.2., ₹1.5

28. An inspector rejects 0.08% of the metres as defective. How many metres will he examine to reject 2 metres?

(a) 200 m     (b) 250 m
(c) 2500 m     (d) 3000 m

29. In a certain school, 20% of students are below 8 years of age. The number of students above 8 years of age is $\frac{2}{3}$ of the number of students of 8 years age which is 48. What is the total number of students in the school?

(a) 72     (b) 80
(c) 120     (d) None of these

30. A positive number is by mistake divided by 6 instead of being multiplied by 6. What is the % error on the basis of correct answer?

(a) 3   (b) 97   (c) 17   (d) 83

31. From the salary of an officer, 10% is deducted as house rent, 20% of the rest, he spends on conveyance, 20% of the rest he pays as income tax and 10% of the balance, he spends on clothes. Then, he is left with ₹15,552. Find his total salary.

(a) ₹25,000     (b) ₹30,000
(c) ₹35,000     (d) ₹40,000

32. If the radius of a circle is diminished by 10%, the area is diminished by

(a) 36%   (b) 20%   (c) 19%   (d) 10%

33. Anthony got 30% of the maximum marks in an examination and failed by 10 marks. However, Amar who took the same examination, got 40% of the total marks and got 15 more than the passing marks in the examination. What were the passing marks in the examination ?

(a) 35   (b) 250   (c) 75   (d) 85

34. In an election between two candidates, 75% of the voters cast their votes, out of which 2% of the votes were declared invalid. A candidate got 9261 votes which were 75% of total valid votes. Find the total number of votes enrolled in that election.

(a) 16080   (b) 16800   (c) 18600   (d) 16008

35. Peter could save 10% of his income. But two years later when his income is increased by 20%, he could save the same amount only as before. By how much percent has his expenditure increased?

(a) 22%   (b) $22\frac{2}{9}$%   (c) $23\frac{1}{3}$%   (d) 24%

36. A screw driver and a hammer currently have the same price. If the price of a screw driver rises by 5% and the price of hammer goes up by 3%, then how much more will it cost to buy 3 screw drivers and 3 hammers ?

(a) 3%   (b) 4%   (c) 5%   (d) 8%

37. A company bought a total of 60 computers and 20 printers to modernise billing operations. If the price of each computer was three times the price of each printer then what per cent of the total cost of the purchase was the total cost of the printers ?

(a) 10%   (b) 11%   (c) 15%   (d) 20%

38. What is the total number of candidates at an examination, if 31% fail, and the number of those who pass exceeds the number of those who fail by 247?
    (a) 605  (b) 560  (c) 650  (d) 1,650

39. In an election between two candidates, the candidate who gets 30% of the votes polled is defeated by 15,000 votes. What is the number of votes polled by the winning candidate?
    (a) 11,250  (b) 15,000  (c) 26,250  (d) 37,500

40. In measuring the side of a square, an error of 5% in excess is made. The error % in the calculated area is,
    (a) $10\frac{1}{4}\%$  (b) $10\frac{3}{4}\%$  (c) $1\frac{3}{4}\%$  (d) 25%

41. If A's salary is 25% higher than B's salary, then how much per cent is B's salary lower than A's ?
    (a) $16\frac{1}{3}\%$  (b) 20%  (c) 25%  (d) $33\frac{1}{3}\%$

42. In the month of January, the Railway Police caught 4000 ticketless travellers. In February, the number rise by 5%. However, due to constant vigil by the Police and the Railway staff, the number reduced by 5% and in April it further reduced by 10%. The total number of ticketless travellers caught in the month of April was:
    (a) 3125  (b) 3255  (c) 3575  (d) 3591

43. The total population of a village is 5000. The number of males and females increases by 10% and 15% respectively and consequently the population of the village becomes 5600. What was the number of males in the village?
    (a) 2000  (b) 2500  (c) 3000  (d) 4000

44. An empty fuel tank of a car was filled with A type petrol. When the tank was half-empty, it was filled with B type petrol. Again when the tank was half-empty, it was filled with A type petrol. When the tank was half-empty again, it was filled with B type petrol. What is the percentage of A type petrol at present in the tank?
    (a) 33.5%  (b) 37.5%  (c) 40%  (d) 50%

45. In an examination, 65% students passed in Civics and 60% in Histroy, 40% passed in both of these subjects. If 90 students failed in History and Civics both, then what is the total number of students?
    (a) 600  (b) 650  (c) 700  (d) 750

46. 40% of the people read newspaper X, 50% read newspaper Y and 10% read both the papers. What percentage of the people read neither newspaper?
    (a) 10%  (b) 15%  (c) 20%  (d) 25%

47. 40% of the students in a college play basketball, 34% of the students play tennis and the number of students who play both the games is 234. The number of students who neither play basketball nor tennis is 52%. Determine the total number of students in the college.
    (a) 750  (b) 960  (c) 900  (d) 850

48. The length of a rectangular plot is increased by 25%. To keep its area unchanged, the width of the plot should be :
    (a) kept unchanged  (b) increased by 25%
    (c) increased by 20%  (d) reduced by 20%

49. A store raised the price of an item by exactly 10 per cent. Which of the following could not be the resulting price of the item ?
    (a) ₹5.50  (b) ₹7.60
    (c) ₹11.00  (d) ₹12.10

50. When the cost of petroleum increases by 40%, a man reduces his annual consumption by 20%. Find the percentage change in his annual expenditure on petroleum.
    (a) 20%  (b) 16%
    (c) 12%  (d) 40%

51. A reduction of 20% in the price of an apple enable a man to buy 10 apple more for ₹54. The reduced price of apple per dozen is
    (a) ₹4.32  (b) ₹12.96
    (c) ₹10.80  (d) ₹14.40

52. After three successive equal percentage rise in the salary the sum of 100 rupees turned into 133 rupees and 10 paise. Find the percentage rise in the salary.
    (a) 13%  (b) 10%
    (c) 15%  (d) 14%

53. In an examination in which full mark were 500, A got 10% less than B. B got 25% more than C. C got 20% less than D. If a got 360 marks what % of full mark was obtained by D.
    (a) 90%  (b) 80%
    (c) 50%  (d) 60%

54. In an examination 35% of total student failed in Hindi 45% failed in English and 20% in both. Find the percentage of those who passed in both the subjects.
    (a) 40%  (b) 60%
    (c) 50%  (d) 30%

55. In an examination 80% of student passed in English 85% in mathematics and 75% in both English and mathematics. If 40 student failed in both the subject find total number of students.
    (a) 350  (b) 400
    (c) 450  (d) 600

56. The length of a rectangle is increased by 15% and breadth decreased by 15%. Then the area of the new rectangle is
    (a) unchanged  (b) increased by 2.25%
    (c) decreased by 2.25%  (d) increased by 15%

## ANSWER KEY

| 1 | (b) | 8 | (b) | 15 | (b) | 22 | (c) | 29 | (d) | 36 | (b) | 43 | (c) | 50 | (c) |
|---|-----|---|-----|----|-----|----|-----|----|-----|----|-----|----|-----|----|-----|
| 2 | (c) | 9 | (d) | 16 | (d) | 23 | (b) | 30 | (b) | 37 | (a) | 44 | (b) | 51 | (b) |
| 3 | (d) | 10 | (d) | 17 | (b) | 24 | (a) | 31 | (b) | 38 | (c) | 45 | (a) | 52 | (b) |
| 4 | (a) | 11 | (a) | 18 | (c) | 25 | (d) | 32 | (c) | 39 | (c) | 46 | (c) | 53 | (b) |
| 5 | (d) | 12 | (b) | 19 | (d) | 26 | (b) | 33 | (d) | 40 | (a) | 47 | (c) | 54 | (a) |
| 6 | (b) | 13 | (b) | 20 | (a) | 27 | (d) | 34 | (b) | 41 | (b) | 48 | (d) | 55 | (b) |
| 7 | (a) | 14 | (a) | 21 | (b) | 28 | (c) | 35 | (b) | 42 | (d) | 49 | (b) | 56 | (c) |

# HINTS & EXPLANATIONS

1. **(b)** If $3x + 7 = x^2 + M = 7x + 5$

   ie, $3x + 7 = 7x + 5$

   or, $4x = 2$, $\therefore x = \dfrac{1}{2}$

   and $3x + 7 = x^2 + M$

   or, $\dfrac{1}{4} + M = \dfrac{3}{2} + 7 \Rightarrow M + \dfrac{1}{4} = 8 + \dfrac{1}{2}$

   $\therefore M = 8\dfrac{1}{4}$, 120% of M = 9.90

2. **(c)** $p = 6q$. So, $q$ is less than $p$ by $5q$.

   $\therefore$ Required percentage $= \left(\dfrac{5q}{p} \times 100\right)\%$

   $= \left(\dfrac{5q}{6q} \times 100\right)\% = 83\dfrac{1}{3}\%$

3. **(d)** Let the third number be 100. Then, the first and second numbers will be 20 and 50, respectively.

   Required % $= \dfrac{20}{50} \times 100 = 40\%$

4. **(a)** Let B get ₹ x. Then C gets = 75% of $x = \dfrac{3x}{4}$

   and A gets = 120% of $\dfrac{3x}{4} = \dfrac{120}{100} \times \dfrac{3x}{4} = \dfrac{9x}{10}$

   Now, $\dfrac{9x}{10} + \dfrac{3x}{4} + x = 4558$

   $\Rightarrow \dfrac{53x}{20} = 4558 \Rightarrow x = \dfrac{4558 \times 20}{53} = 1720$

   Hence, A's share $= \dfrac{9x}{10} = ₹ \dfrac{9 \times 1720}{10} = ₹ 1548$

5. **(d)** Working with options, we have

   | Original number | New number | Difference |
   |---|---|---|

   (a) 22, 34, 12
   (b) 63, 96, 33
   (c) 24, 38, 14

   Obviously, (d) is the correct option.

6. **(b)** Let total customers be 100
   40 of them purchase item and 15% of 40 =

   $\dfrac{15}{100} \times 40 = 6$ customers purchase hats which is only

   6% of total customers.

7. **(a)** % change in rate $= \dfrac{27 - 24}{24} \times 100 = \dfrac{100}{8}\%$

   For fixed expenditure, % change in consumption

   $= \dfrac{\% \text{ change in rate}}{100 + \% \text{ change in rate}} \times 100$

   $= \dfrac{100/8}{100\left[1 + \dfrac{1}{8}\right]} \times 100 = \dfrac{100}{9}\% = 11\dfrac{1}{9}\%$

8. **(b)** Let the total number of original inhabitants be x. Then, $(100 - 25)\%$ of $(100 - 10)\%$ of $x = 4050$

   $\Rightarrow \left(\dfrac{75}{100} \times \dfrac{90}{100} \times x\right) = 4050 \Rightarrow \dfrac{27}{40}x = 4050$

   $\Rightarrow x = \left(\dfrac{4050 \times 40}{27}\right) = 6000.$

   $\therefore$ Number of original inhabitants = 6000.

9. **(d)** Let he had originally ₹ x. Then
   65% of x + 20% of x + 1305 = x
   0.65x + 0.2x + 1305 = x
   $\Rightarrow 0.15x = 1305 \Rightarrow x = ₹ 8700$
   $\therefore$ His total investment = 65% of 8700 + 20% of 8700
   = 85% of 8700 = ₹ 7395

10. **(d)** Net effect on sale $= -\dfrac{(\text{common \% change})^2}{100}$

    $= \dfrac{-(15)^2}{100} = 2.25\%$ decrease

11. (a) Let the number be x,

Then, $\dfrac{12}{100} \times \dfrac{75}{100} \times x - \dfrac{5}{100} \times x = 75$

$\Rightarrow \quad \dfrac{9x}{100} - \dfrac{5x}{100} = 75 \Rightarrow \dfrac{4x}{100} = 75$

$\Rightarrow \quad x = \dfrac{75 \times 100}{4} = 1875$

12. (b) Since, expenditure = price × consumption

$\therefore 110\% \text{ of } 30 = \dfrac{132}{100} \times$ new consumption

$\Rightarrow \dfrac{110}{100} \times 30 = \dfrac{132}{100} \times$ new consumption

$\Rightarrow$ New consumption = 25 kg

13. (b) Let B's Income = ₹ x

A's Income = ₹ $\dfrac{3}{5}x$

And B's expenditure = ₹ y

A's expenditure = ₹ $\dfrac{7}{10}y$

Also, $\dfrac{3}{5}x = \dfrac{3}{4} \cdot \dfrac{7}{10}y$

$\dfrac{\text{A' savings}}{\text{B' savings}} = \dfrac{x-y}{\dfrac{3}{5}x - \dfrac{7}{10}y} = \dfrac{\dfrac{7}{8}y - y}{\dfrac{3}{5} \cdot \dfrac{7}{8}y - \dfrac{7}{10}y} = \dfrac{-y/8}{\dfrac{21y}{40} - \dfrac{7}{10}y}$

$= \dfrac{5}{25} \approx 1:5$

14. (a) Let the salary of July be ₹ $\dfrac{5}{2}x$

and the salary of June be ₹ $\dfrac{9}{4}x$.

Required percentages

$= \dfrac{\dfrac{5}{2}x - \dfrac{9}{4}x}{\dfrac{9}{4}x} \times 100$ and $\dfrac{\dfrac{5}{2}x - \dfrac{9}{4}x}{\dfrac{5}{2}x} \times 100$

$= \dfrac{100}{9}\%$ and $\dfrac{100}{10}\% = 11\dfrac{1}{9}\%$ and 10%

15. (b) 30% of the residents are children.

∴ 30% of the total residents = 24

∴ Total number of residents in the society

$= \dfrac{24}{30} \times 100 = 80$

16. (d) Let one month ago, production be x chocolates.
Then, 130 % of x = 9100

$\Rightarrow$ x $= \dfrac{9100 \times 100}{130} = 7000$ chocolates

17. (b) Let total number of votes polled be x.
Then, votes polled by other candidate
$= (100 - 40)\%$ of x = 60% of x
Now 60% of x – 40% of x = 160

$\Rightarrow \dfrac{20x}{100} = 160 \Rightarrow$ x = 800 votes

18. (c) Cost of scooter = ₹25,000
Cost of scooter decrease 20% each year with respect to the cost of scooter at the end of 3 years

$= 25,000\left(1 - \dfrac{20}{100}\right)^3$

$= 25,000 \times \dfrac{4}{5} \times \dfrac{4}{5} \times \dfrac{4}{5} = ₹12,800$

19. (d) Suppose Income of B = ₹ x

Income of A = $\dfrac{150}{100} \times x = ₹ \dfrac{3x}{2}$

Income of C = $\dfrac{120}{100} \times \dfrac{3x}{2}$

$\dfrac{6}{5} \times \dfrac{3x}{2} = \dfrac{9x}{5}$

$\therefore \quad x + \dfrac{3x}{2} + \dfrac{9x}{5} = 86000$

$\dfrac{10x + 15x + 18x}{10} = 86000$

43x = 860000

x = 20000

So, income of C = $\dfrac{9}{5} \times 20000 = ₹\,36000$

20. (a) % reduction in consumption

$= \dfrac{\% \text{ change in price}}{100 + \% \text{ change in price}} \times 100$

$= \dfrac{7}{100 + 7}\% = \dfrac{7}{107}\%$

21. (b) ∵ $\dfrac{\text{Marks of y}}{\text{Marks of x}} = \dfrac{100 + \% \text{ above minimum of y}}{100 + \% \text{ above minimum of x}}$

$\Rightarrow \dfrac{710}{515} = \dfrac{100 + y}{103} \Rightarrow 100 + y = \dfrac{710 \times 103}{515} = 142$

$\Rightarrow$ y = 42%

22. (c) Let the salary of Ram be ₹ 100.
Then, salary of Amit = ₹ 80 and salary of Ravi = ₹ 120
Ratio of Ram's salary to Ravi's salary = 100 : 120
$= 5 : 6$

23. (b) Total no. of machine parts in both the shipments
$= (120 + 80) = 200$
Total defective machine parts in both the shipments
$= 120 \times 5\% + 80 \times 10\% = 6 + 8 = 14$

Therefore, required % $= \dfrac{14}{200} \times 100 = 7\%$

**24. (a)** Let the numbers be x and y. Then,

$$x + y = \frac{28}{25}x \Rightarrow y = \frac{28}{25}x - x \Rightarrow y = \frac{3}{25}x$$

$$\Rightarrow \frac{y}{x} = \left(\frac{3}{25} \times 100\right)\% = 12\%.$$

**25. (d)** Let the class has 100 students.
⇒ Number of girls = 35 and number of boys = 65.
Since total number of present students = 70 and number of girls present = 80% of 35 = 28, so number of boys present = 70 – 28 = 42.
⇒ Required fraction = 42/65.

**26. (b)** Let the number of candidates appeared from each state be x.
Then, 7% of x – 6% of x = 80 ⇒ 1% of x = 80
⇒ x = 80 × 100 = 8000.

**27. (d)** Let original price be ₹ x per orange. Then,
Reduced rate = (1 – 0.2)x = ₹ 0.8 x

$$\therefore \frac{2.50}{0.8x} - \frac{2.50}{x} = 5 \Rightarrow \frac{25}{8x} - \frac{2.5}{x} = 5 \Rightarrow x = \frac{1}{8}$$

$$\therefore \text{ Original price of oranges per dozen } \frac{1}{8} \times 12 = ₹1.5$$

and Reduced price = ₹ (0.8)(1.5) = ₹ 1.2

**28. (c)** Let the inspector examined x metres,
then 0.08% of x = 2

$$\Rightarrow \frac{x \times 0.08}{100} = 2 \text{ or } x = \frac{200}{0.08} = 2500 \text{ metres}$$

**29. (d)** Let the number of students be x. Then,
Total number of students of 8 years and above 8 years
= (100 – 20)% of x = 80% of x.

$$\therefore 80\% \text{ of } x = 48 + 2/3 \text{ of } 48 \Rightarrow \frac{80}{100}x = 80 \Rightarrow x = 100.$$

**30. (b)** Let the number be x. Then,

$$\% \text{ error } = \frac{6x - x/6}{6x} \times 100 = \frac{35}{36} \times 100 = 97.2\%$$

**31. (b)** Let the total salary be ₹ x.
Then, (100 – 10)% of (100 – 20)% of (100 – 20)% of (100 – 10)% of x = 15552

$$\Rightarrow \left(\frac{90}{100} \times \frac{80}{100} \times \frac{80}{100} \times \frac{90}{100} \times x\right) = 15552$$

$$\Rightarrow x = \left(\frac{15552 \times 10000}{64 \times 81}\right) = 30,000.$$

**32. (c)** If the radius is diminised by r%, then

Area is diminished by $\left(2r - \frac{r^2}{100}\right)\% = 2 \times 10 - \frac{10^2}{100} = 19\%$

**33. (d)** Let the maximum marks be x.
Then, x × 30% + 10 = x × 40% – 15
⇒ x × 10% = 25 or x = 250

Therefore, passing marks = $250 \times \frac{30}{100} + 10 = 85$

**34. (b)** Let the total number of votes enrolled be x. Then,
Number of votes cast = 75% of x. Valid votes = 98% of (75% of x).
∴ 75% of [98% of (75% of x)] = 9261

$$\Rightarrow \left(\frac{75}{100} \times \frac{98}{100} \times \frac{75}{100} \times x\right) = 9261$$

$$\Rightarrow x = \left(\frac{9261 \times 100 \times 100 \times 100}{75 \times 98 \times 75}\right) = 16800.$$

**35. (b)** Let original income = Rs. 100. Then, saving = ₹ 10 and expenditure = ₹ 90.
New income = ₹ 120, New saving = ₹ 10.
New expenditure = ₹ (120 – 10) = ₹ 110.
Increase in expenditure = ₹ (110 – 90) = ₹ 20.

$$\therefore \text{ Increase } \% = \left(\frac{20}{90} \times 100\right)\% = 22\frac{2}{9}\%.$$

**36. (b)** Let the original price of a screw driver and a hammer be ₹ 100 each.
Then, price of 3 screw drivers and 3 hammers = ₹ 600
Now, after increase of 5%, the price of 3 screw drivers = ₹ 315
And after 3% increase the price of 3 hammers = ₹ 309
Increased price of 3 hammers and 3 screw drivers = ₹ 624

Therefore, % increase in price = $\frac{24}{600} \times 100 = 4\%$

**37. (a)** Suppose price of the printer = P
∴ Price of a computer = 3P
Total cost of 60 computers = 180 P
Total cost of 20 printers = 20 P
∴ Total cost of the purchase = 200 P
Thus total cost of the printers is 10% of the total cost.

**38. (c)** Let the total number of candidates = x
Then, number of passed candidates
= (100 – 31)% of x = 69% of x
Now, 69 % of x – 31% of x = 247
⇒ 38% of x = 247

$$\Rightarrow \frac{38}{100}x = 247 \Rightarrow x = \frac{247 \times 100}{38} = 650$$

**39. (c)** Let the total number of votes be x
∴ votes polled by winning candidate
= (100 – 30)% of x = 70% of x

Now, 70% of x – 30% of x = 15,000

$\Rightarrow$ 40% of x = 15,000

$\Rightarrow x = \dfrac{15000 \times 100}{40} = 37,500$

$\therefore$ number of votes polled by winning candidate

= 70% of 37500

$= \dfrac{70 \times 37500}{100} = 26,250$

**40.** **(a)** If side is increased by a%, area increased by

$\left( 2a + \dfrac{a^2}{100} \right)\%$

$= 2 \times 5 + \dfrac{5^2}{100} = 10\dfrac{1}{4}\%$

**41.** **(b)** Let B's salary be ₹ 100,

then A's salary = ₹ 125

% lesser $= \dfrac{125 - 100}{125} \times 100 = \dfrac{25}{125} \times 100$

$= \dfrac{1}{5} \times 100 = 20\%$

**Short cut method:**

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

$\left( \dfrac{25}{100 + 25} \times 100 \right)\% = 20\%$

**42.** **(d)** Number of ticketless travellers in April

$= 4000 \times \left( 1 + \dfrac{5}{100} \right)\left( 1 - \dfrac{5}{100} \right)\left( 1 - \dfrac{10}{100} \right)$

$= \left( 4000 \times \dfrac{21}{20} \times \dfrac{19}{20} \times \dfrac{9}{10} \right) = 3591.$

**43.** **(c)** Let the number of males be x. Then, number of females = (5000 – x).

$\therefore$ 10% of x + 15% of (5000 – x) = (5600 – 5000)

$\Rightarrow \dfrac{10}{100}x + \dfrac{15}{100}(5000 - x) = 600$

$\Rightarrow 10x + 75000 - 15x = 60000.$

$\Rightarrow 5x = 15000 \Rightarrow x = 3000.$

**44.** **(b)** Let the capacity of the tank be 100 litres. Then,

**Initially :** A type petrol = 100 litres.

**After first operation :**

A type petrol $= \left( \dfrac{100}{2} \right) = 50$ litres;

B type petrol = 50 litres.

**After second operation :**

A type petrol $= \left( \dfrac{50}{2} + 50 \right) = 75$ litres;

B type petrol = (50/2) = 25 litres

**After third operation :**

A type petrol $= \left( \dfrac{75}{2} \right) = 37.5$ liters;

B type petrol $= \left( \dfrac{25}{2} + 50 \right) = 62.5$ litres.

$\therefore$ Required percentage = 37.5%.

**45.** **(a)** Let the total number of students be x.

Number of students passed in one or both is given by :

$n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$= 65\%$ of x + 60% of x – 40% of x

$= \left( \dfrac{65}{100}x + \dfrac{60}{100}x - \dfrac{40}{100}x \right) = \dfrac{85}{100}x = \dfrac{17}{20}x.$

Failed in both $= \left( x - \dfrac{17}{20}x \right) = \dfrac{3x}{20}.$

$\therefore \dfrac{3x}{20} = 90 \Rightarrow x = \left( \dfrac{90 \times 20}{3} \right) = 600.$

**46.** **(c)** n(A) = 40, n(B) = 50, n(A $\cap$ B) = 10.

n(A $\cup$ B) = n (A) + n (B) – n (A $\cap$ B)

= 40 + 50 – 10 = 80.

$\therefore$ Percentage reading either or both newspapers = 80%.

Hence, percentage reading neither newspaper

= (100 – 80)% = 20%

**47.** **(c)** Let the numnber of students be 100.

Then number of students who play both the games

= (34 + 40) – (48) = 26

If 26 students play both the games, then the total number of students = 100

Therefore, if 234 students play both the games, then the total number of students

$$= \frac{100}{26} \times 234 = 900$$

48. **(d)** Let the original length and breadth be both 10 cm each.

Then original area = 100 cm$^2$

New length = $10 \times 1.25 = 12.5$ cm

Let new breadth be x. Then, 12.5x = 100

$$\Rightarrow \quad x = \frac{100}{12.5} = 8 \text{cm}$$

Hence, % reduction in breadth $= \frac{2}{10} \times 100 = 20\%$

49. **(b)** $5 + 10\% = 5.50$

$10 + 10\% = 11$

$11 + 10\% = 12.10$

50. **(c)** **First expenditure:** Suppose 100 litres of petroleum at 100 units of money per litre, then total expenditure = $100 \times 100$ units of money = 10000 units of money.

**Second expenditure:** Now 80 litres of petroleum at 140 units of money per litre, total expenditure = $80 \times 140$ units of money = 11200 units.

$\Rightarrow$ Expenditure increases by

$$\frac{11200 - 10000}{10000} \times 100 = 12\%$$

**Short-cut:** Exp$_1$ = PX, Exp$_2$ = 1.4P(0.8X) = 1.12 PX.

$\Rightarrow$ Directly we see, answer = 12%.

51. **(b)** Let the original price of apple be ₹ x /dozen.

New price ₹ $= \frac{4x}{5}$ /dozen.

$$= \quad \frac{54}{\frac{4x}{5}} - \frac{54}{x} = \frac{10}{12}$$

$$\Rightarrow \quad 54\left(\frac{5}{4x} - \frac{1}{x}\right) = \frac{5}{6}$$

$$\Rightarrow \quad 54\left(\frac{1}{4x}\right) = \frac{5}{6}$$

$$\Rightarrow \quad 4x = \frac{54 \times 6}{5}$$

$$\Rightarrow \quad \frac{4x}{5} = 12.96$$

52. **(b)** Let rise in salrary be x%

$$100\left(1 + \frac{x}{100}\right)\left(1 + \frac{x}{100}\right)\left(1 + \frac{x}{100}\right) = 133.1$$

$$\left(1 + \frac{x}{100}\right)^3 = \frac{133.1}{100} = 1.331$$

$$1 + \frac{x}{100} = 1.1$$

$$\frac{x}{100} = 0.1 \Rightarrow x = 10$$

Rise in salary is 10%

53. **(b)** $360 = x - \frac{x \times 10}{100} = \frac{9x}{10} \Rightarrow x = 400$

when x is mark obtained by B mark obtained by C = y

$$400 = y + y \times \frac{25}{100} = \frac{5y}{4}$$

$y = 320$

mark obtained by D = z

$$320 = z - z \times \frac{20}{100} = \frac{4z}{5}$$

$z = 400$

% of mark obtained of D $= \frac{400}{500} \times 100 = 80\%$

54. **(a)** Let A and B be the sets of student who failed in Hindi and English respectively

Then n (A) = 35

n (B) = 45

$n(A \cap B) = 20$

$n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$= 35 + 45 - 20 = 60$

% of student failed in Hindi or English or both = 60%

% percentage passed = 100 – 60 = 40%

55. **(b)** Let total no. of student = x

Let A and B represent the sets of students who passed in English and mathematics respectively

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$

$$= 80\% \text{ of } x + 85\% \text{ of } x - 75\% \text{ of } x$$

$$= \frac{80}{100}x + \frac{85}{100}x - \frac{75x}{100} = \frac{90x}{100} = \frac{9x}{10}$$

∴ Students failed in both subjects

$$= x - \frac{9x}{10} = \frac{x}{10}$$

So, $\frac{x}{10} = 40 \qquad x = 400$

56. **(c)** $A = l \times b$

$$A' = \left(l + \frac{15}{100}l\right)\left(b - \frac{15}{100}b\right) = 1.15\, l \times 0.85\, b$$

$A' = 0.9775\, A$

% change $= \frac{A - 0.9775A}{A} \times 100 = 2.25\%$