Percentage

A percentage is a fraction of 100 Denoted by "%"

Successive percentage change
$$= \left(a + b + \frac{ab}{100} \right) \%$$

Population of town is P and increase by R% per annum then population 'x' year ago $= \dfrac{P}{\left(1 + \dfrac{R}{100}\right)^x}$

Population x year ago
$$P\left(1 + \frac{R}{100}\right)^x$$

Population of town is P and decreases by R% per year Population after x years
$$= P\left(1 - \frac{R}{100}\right)^x$$

Population x year ago
$$\frac{P}{\left(1 - \dfrac{R}{100}\right)^x}$$

Percentage $= \dfrac{\text{Value}}{\text{total value}} \times 100$

Percentage Decrements,
$$= \frac{(\text{Initial value} - \text{Final value})}{\text{Initial value}} \times 100$$

Percentage Increament
$$= \frac{(\text{Final value} - \text{Initial value})}{\text{Initial value}} \times 100$$

Value of Machine after n years $P\left(1 - \dfrac{R}{100}\right)^n$

Value of Machine before n years $\dfrac{P}{\left(1 - \dfrac{R}{100}\right)^n}$

Chapter

1

Percentage

🎯 LEARNING OBJECTIVES:

- ❖ Percentage and fractional value of different numbers.
- ❖ Concepts related to election based questions, expenditure based question.
- ❖ Different types of questions that are covered in different competitive exams such as SSC, bank, railway, CAT, etc.
- ❖ Method of solving questions related to percentage.

SOME IMPORTANT CONCEPTS RELATED TO PERCENTAGE

➢ **Percentage:** A percentage is a fraction of 100. It is denoted by the symbol %.

➢ **Per cent increase or decrease:** When a value increases or decreases by a certain percentage, the new value is calculated by multiplying the original value by (100% + percentage increase/decrease)/100%.

➢ **Percentage change:** Percentage change is the difference between the new value and the old value, expressed as a percentage of the old value.

➢ **Fraction to percentage conversion:** To convert a fraction to a percentage, multiply the fraction by 100.

➢ **Percentage to fraction conversion:** To convert a percentage to a fraction, divide the percentage by 100 and simplify the fraction.

➢ **Percentage to decimal conversion:** To convert a percentage to a decimal, divide the percentage by 100.

➢ **Decimal to percentage conversion:** To convert a decimal to a percentage, multiply the decimal by 100.

➢ **Percentage of a number:** To calculate the percentage of a number, multiply the number by the percentage and divide by 100.

➢ **Percentage point:** Percentage point is the difference between two percentages.

➢ **Successive percentage change:** When a value changes by successive percentage changes, the net percentage change is calculated by multiplying the individual percentage changes.

FORMULAE:

➢ Percentage increase = [(new value – old value)/old value] × 100%

➢ Percentage decrease = [(old value – new value)/old value] × 100%

➢ Percentage change = [(new value – old value)/old value] × 100%

➢ Percentage to fraction = $\left(\dfrac{\text{percentage}}{100}\right)$

➢ Fraction to percentage = (fraction × 100)

➢ Percentage to decimal = $\left(\dfrac{\text{percentage}}{100}\right)$

➢ Decimal to percentage = (decimal × 100)

➢ Percentage of a number = (percentage/100) × number

➢ Net percentage change = $a + b + \left(\dfrac{ab}{100}\right)$

where a and b are the successive percentage changes.

➢ If the price of an item decreases, a person can buy a few kg more in A rupees, the actual price of that item.

Actual Price = Rate × $\dfrac{A}{100}$ – Rate × X Per kg

➢ If the population of a city is P and it increases at the rate of R% per annum, then population after 'n' years:

Percentage population = $P \times \left(1 + \dfrac{R}{100}\right)^n$

➢ If the population of a city is P and it decreases at the rate of R% per annum, then population after 'n' years:

Percentage population = $P \times \left(1 - \dfrac{R}{100}\right)^n$

➢ If the population of a city is P and it increases at the rate of R% per annum, then population of the city 'n' years ago :

Population n years ago = $\dfrac{P}{\left(1 + \dfrac{R}{100}\right)^n}$

➢ If the city's population is P and it decreases at the rate of R% per annum, then city's population 'n' years ago:

$$\text{Population } n \text{ years ago} = \frac{P}{\left(1 - \dfrac{R}{100}\right)^{n}}$$

Percentage – Fraction Table

1% = 1/100	25% = 1/4	80% = 4/5
2% = 1/50	33.33% = 1/3	83.33% = 5/6
4% = 1/25	37.50% = 3/8	87.50% = 7/8
5% = 1/20	40% = 2/5	100% = 1
8.33% = 1/12	50% = 1/2	120% = 6/5
10% = 1/10	60% = 3/5	125% = 5/4
12.50% = 1/8	62.50% = 5/8	133.33% = 4/3
16.67% = 1/6	66.67% = 2/3	150% = 3/2
20% = 1/5	75% = 3/4	175% = 7/4

Example 1: Radha saves x% of her income. If her expenditure increases by 20% and her income increases by 28%, then her savings increase by 40%. Find x.

(a) 56   (b) 40

(c) 60   (d) 70

Sol. (b) Expenditure : Saving
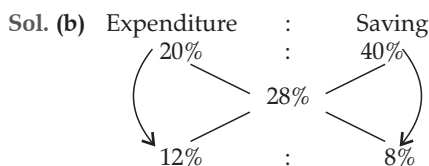
$$\therefore \qquad \text{Savings} = \frac{2}{5} \times 100 = 40\%$$

$$x = 40\%$$

Example 2: The population of a town increased by 15% in 2018 and 10% in 2019. Due to pandemic, it decreased by 10% in 2020. What was the percentage increase in population of town in 3 years?

(a) 12.5%   (b) 17.5%

(c) 13.85%   (d) 15%

Sol. (c) Let population = 100

⇒ Population after 3 years

$$= 100 \times \frac{115}{100} \times \frac{110}{100} \times \frac{90}{100} = 113.85$$

$$\text{Percentage increase} = \frac{113.85 - 100}{100} \times 100$$

$$= 13.85\%$$

Example 3: A number P is 20% more than a number Q but 10% less than a number R. What percentage is number Q of number R?

(a) 80%   (b) 85%

(c) 75%   (d) 90%

Sol. (c)

P	:	Q	:	R
6	:	5		
9		:		10
18	:	15	:	20

$$\Rightarrow \text{Required percentage} = \frac{15}{20} \times 100 = 75\%$$

Example 4: If each side of a triangle is increased by 13%, then its area will increase by:

(a) 21.69%   (b) 13%

(c) 27.69%   (d) 26%

Sol. (c)

$$100 \longrightarrow 113$$
$$\downarrow \qquad\qquad \downarrow$$
$$10000 \longrightarrow 12769$$

$$\text{Percentage increase} = \frac{12769 - 10000}{10000} \times 100$$

$$= 27.69\%$$

Example 5: Rita's income is 15% less than Richa's income. By what per cent Richa's income is more than Rita's income?

(a) $15\dfrac{11}{17}\%$ (b) $17\dfrac{11}{17}\%$

(c) $16\dfrac{11}{17}\%$ (d) $14\dfrac{11}{17}\%$

Sol. (b) Rita : Richa = 17 : 20

So, required% = $\dfrac{3}{17} \times 100 = 17\dfrac{11}{17}\%$

Example 6: A person's salary has increased from ₹ 7,000 to ₹ 12,000. What is the percentage increase in his salary?

(a) $71\dfrac{3}{7}\%$ (b) $61\dfrac{1}{7}\%$

(c) $69\dfrac{1}{7}\%$ (d) $76\dfrac{4}{7}\%$

Sol. (a) Increase in salary is ₹ 5,000 i.e., 7,000 → 12,000

So, percentage increase = $\dfrac{5,000}{7,000} \times 100 = 71\dfrac{3}{7}\%$

Example 7: If 49% of $x = y$, they y% of 50 is:

(a) 40% of y (b) 50% of x

(c) 50% of y (d) 24.5% of x

Sol. (d)

$$\frac{x}{y} = \frac{100}{49}$$

$$y\% \text{ of } 50 = \frac{50 \times 49}{100} = 24.5$$

i.e., 24.5% of x.

1 Level — Beginner

1. A team played 40 games in a season and won 24 of them. What per cent of games played did the team win? **[SSC 10+2 2012]**
   (A) 70%   (B) 40%   (C) 60%   (D) 35%

2. 1% of 1% of 25% of 1,000 is: **[SSC 10+2 2014]**
   (A) .025   (B) .0025
   (C) .25   (D) .00025

3. Ram's income is greater than Shyam's income by 20%. Then, the per cent by which Shyam's income is less than Ram's income is: **[SSC 10+2 2013]**
   (A) $16\dfrac{2}{3}$ %   (B) $18\dfrac{2}{5}$ %
   (C) $10\dfrac{1}{5}$ %   (D) $12\dfrac{1}{3}$ %

4. If 125% of x is 100, then x is: **[SSC 2012]**
   (A) 80   (B) 150   (C) 400   (D) 125

5. If 40% of $\dfrac{4}{5}$ of $\dfrac{3}{4}$ of a number is 48, then what is 1% of the same number? **[SSC Sub Inspector 2014]**
   (A) 20   (B) 2   (C) 10   (D) 1

6. In an examination, 75% candidates passed in English and 60% passed in Mathematics. 25% failed in both and 240 passed in the examination. Find the total number of candidates. **[SSC Sub Inspector 2014]**
   (A) 492   (B) 300   (C) 500   (D) 400

7. A shopkeeper purchased 200 bulbs for ₹ 10 each. However, 5 bulbs were fused and had to be thrown away. The remaining were sold at ₹ 12 each. What will be the percentage profit? **[SSC Clerk 2014]**
   (A) 25%   (B) 15%   (C) 13%   (D) 17%

8. A person's salary increased from ₹ 8,100 to ₹ 9,000. What is the percentage increase in his salary? **[SSC CGL 2019]**
   (A) $6\dfrac{1}{9}$%   (B) $13\dfrac{7}{9}$%   (C) $11\dfrac{1}{9}$%   (D) $9\dfrac{1}{9}$%

9. In an examination, 92% of the students passed and 480 students failed. If so, how many students appeared in the examination? **[SSC CGL 2019]**
   (A) 6,200   (B) 5,000   (C) 6,000   (D) 5,800

10. The value of 18% of 15% of $\dfrac{25}{9}$ of 3,800 is: **[SSC CGL 2019]**
    (A) 285   (B) 582   (C) 583   (D) 385

11. Convert $\dfrac{9}{40}$ into percentage: **[SSC CPO 2018]**
    (A) $2\dfrac{1}{2}$ %   (B) 2%
    (C) 22%   (D) $22\dfrac{1}{2}$ %

12. 8% of 5 litres is: **[SSC CPO 2018]**
    (A) 0.4 ml   (B) 400 ml   (C) 40 ml   (D) 4 ml

13. What percentage of ₹ 124 is ₹ 49.60? **[SSC CPO 2018]**
    (A) 250   (B) 16   (C) 123   (D) 40

14. A saves 12% of her income. If she spends ₹ 2,16,128, then her total income is: **[SSC CPO 2018]**
    (A) ₹ 2,42,063   (B) ₹ 2,45,600
    (C) ₹ 2,48,000   (D) ₹ 2,43,560

15. If A's salary is 60% more than B's salary, then by what percentage is B's salary is less than that of A? **[SSC CGL 2019]**
    (A) 47.7%   (B) 33.3%   (C) 37.5%   (D) 45%

16. Radha saves 25% of her income. If her expenditure increases by 20% and her income increases by 29%, then her savings increase by: **[SSC CGL 2021]**
    (A) 56%   (B) 52%   (C) 65%   (D) 70%

17. The value of a motorcycle depreciates every year by 4%. What will be its value after 2 years, if its present value is ₹ 75,000? **[SSC CGL 2019]**
    (A) ₹ 72,000   (B) ₹ 70,120
    (C) ₹ 69,120   (D) ₹ 69,000

18. Ajay spends 25% of his salary on house rent, 5% on food, 15% on travel, 10% on clothes and the remaining amount of ₹ 27,000 is saved. What is Ajay's income? **[SBI 2014]**
    (A) ₹ 60,000   (B) ₹ 80,500
    (C) ₹ 60,700   (D) ₹ 70,500

19. The salary of an employee increases every year in the month of July by 10%. If his salary in May 2000 was ₹ 15,000, then his salary in October 2001 was: **[SSC Sub Inspector 2012]**
    (A) ₹ 16,500   (B) ₹ 18,000
    (C) ₹ 18,150   (D) ₹ 19,965

20. 72% of the students of a certain class took biology and 44% took mathematics. If each student took biology or mathematics and 40 took both, then the total number of students in the class was: **[SSC Sub Inspector 2012]**
    (A) 200   (B) 230   (C) 250   (D) 320

21. If 50% of (P – Q) = 30% of (P + Q) and Q = x% of P, then the value of x is: **[SSC Sub Inspector 2013]**
    (A) 30   (B) 25   (C) 20   (D) 50

22. Two persons contested on election of parliament. The winning candidate secured 57% of the total votes polled and won by a majority of 42,000 votes. The number of total votes polled is: **[SSC MT 2013]**
    (A) 4,00,000   (B) 5,00,000
    (C) 6,00,000   (D) 3,00,000

23. A number when reduced by 10% gives 30. The number is: **[SSC MT 2013]**
    (A) 35   (B) $33\dfrac{1}{2}$ (C) $33\dfrac{1}{3}$ (D) 40

24. In a class, if 60% of the students are boys & the number of girls is 36, then the number of boys is:

[SSC CGL 2019]

(A) 65   (B) 54   (C) 60   (D) 58

25. Mohan's income is 40% more than Shyam's income. Shyam's income is what per cent less than Mohan's income?   [SSC CHSL 2021]

(A) $28\frac{2}{7}\%$ (B) $28\frac{5}{7}\%$

(C) $28\frac{3}{7}\%$ (D) $28\frac{4}{7}\%$

2 Level — Intermediate

1. One litre of water is evaporated from 6 litres of a solution containing 5% salt. The percentage of salt in the remaining solution is: [SSC CGL 2014]

(A) $4\frac{4}{9}\%$ (B) $5\frac{5}{7}\%$ (C) 5%   (D) 6%

2. Raghav spends 80% of his income. If his income increases by 12% and his expenditure increases by 17.5%, then what is the percentage decrease in his savings?   [SSC CHSL 2021]

(A) 15%   (B) 10%   (C) 12%   (D) 8%

3. A number is mistakely multiplied by $\frac{7}{5}$ instead of being multiplied by $\frac{3}{2}$. What is the percentage change in the result due to this mistake?

[SSC CHSL 2021]

(A) $6\frac{2}{3}\%$ (B) $7\frac{2}{3}\%$ (C) $3\frac{2}{3}\%$ (D) $5\frac{2}{3}\%$

4. The price of sugar is increased by 24%. A person wants to increase his expenditure by 18% only. By approximately what per cent should he decrease his consumption?   [SSC CGL 2018]

(A) 5.3%   (B) 5.1%   (C) 4.6%   (D) 4.8%

5. A reduction of 20% in the price of sugar enables a purchases to obtain 4 kg more for ₹ 160. The original price of sugar per kg is: [SSC CGL 2019]

(A) ₹ 12   (B) ₹ 10   (C) ₹ 14   (D) ₹ 15

6. The monthly salaries of A and B together amount to ₹ 40,000. A spends 85% of his salary and B spends 95% of his salary. If now their savings are the same, then the salary of A is: [SSC CGL 2014]

(A) ₹ 10,000   (B) ₹ 12,000
(C) ₹ 16,000   (D) ₹ 18,000

7. Rakesh got 273 marks in an examination and scored 5% more than the pass %. If Lokesh got 312 marks, then by what % above the pass mark did he pass the examination?   [SSC CGL 2013]

(A) 20%   (B) 27%   (C) 25%   (D) 15%

8. The price of sugar is increased by 17%. A person wants to increase his expenditure by 5% only. By approximately what % should he decrease his consumption?   [SSC CGL 2018]

(A) 10.3%   (B) 10.7%   (C) 10.9%   (D) 9.9%

9. The radius of a sphere is reduced by 40%. By what per cent will its volume decrease?   [SSC CGL 2019]

(A) 60%   (B) 64%
(C) 72.5%   (D) 78.4%

10. A is 20% less than B and C is 30% more than D. If D is 25% less than A, than, which of the following is true?   [SSC CGL 2019]

(A) B = 0.39 C   (B) C = 0.78 B
(C) B = 0.78 C   (D) C = 0.39 B

11. Ravi scores 72% marks in an examination. If these are 360 marks, then the maximum marks are:

[SSC CGL 2019]

(A) 450   (B) 400   (C) 500   (D) 350

12. If A is 40% less than B and C is 40% of the sum of A and B, then by what percentage is B greater than C?   [SSC CGL 2019]

(A) 60%   (B) $56\frac{1}{4}\%$ (C) $40\frac{1}{8}\%$ (D) 36%

13. If A is 28% more than B and C's 25% less than the sum of A and B, then by what per cent will C be more than A?   [SSC CGL 2018]

(A) 32.2%   (B) 28%
(C) 43%   (D) 33.6%

14. A spends 65% of his income. His income is increased by 20.1% and his expenditure increased by 25%. His savings: [SSC CGL 2018]

(A) increase by 11%   (B) increase by 5%
(C) decrease by 5%   (D) decrease by 11%

15. If 25% of half of x is equal to 2.5 times the value of 30% of one-fourth of y, then x is what per cent more or less than y?   [SSC 2018]

(A) $33\frac{1}{3}\%$ more   (B) 50% more

(C) $33\frac{1}{3}\%$ less   (D) 50% less

16. The income of A is 24% more than the income of B. By what per cent is the income of B is less than income of A?   [SSC CPO 2018]

(A) $\frac{600}{31}\%$ (B) $\frac{150}{7}\%$

(C) $\frac{600}{29}\%$ (D) $\frac{500}{31}\%$

17. If 20% of $a = b$, then $b\%$ of 20 is equal to:

    [SSC CPO 2018]

(A) 4% of a (B) 2% of a

(C) 16% of %   (D) 8% of a

18. A's salary is 35% more than B's salary. How much per cent in B's salary less than that of A's?

    [SSC CGL 2019]

(A) 20%   (B) 35%

(C) 26%   (D) 17.5%

19. Amrya owns $66\frac{2}{3}\%$ of a property. If 30% of the property that she owns is ₹ 1,25,000, then 45% of the value of property is: **[SSC 2019]**

(A) ₹ 2,70,000   (B) ₹ 2,81,250

(C) ₹ 2,25,000   (D) ₹ 2,62,500

3 Level — Expert

1. If $(x + 20)\%$ of 250 is 25% more than $x\%$ of 220, then 10% of $(x + 50)$ is what % less than 15% of x?

    [SSC CGL 2019]

(A) $16\frac{2}{3}$ (B) $8\frac{1}{3}$ (C) $13\frac{1}{3}$ (D) $33\frac{1}{3}$

2. A student multiplies a number with $\frac{3}{4}$ instead of $\frac{4}{3}$. What is the error percentage?   **[SSC CGL 2019]**

(A) 59.67%   (B) 43.75%

(C) 67.45%   (D) 39.34%

3. A is 150% of B and B is 40% of C. If A + B + C = 20, then the value of 2B + 3C – 4A is:

    [SSC CHSL 2021]

(A) 16   (B) 14   (C) 20   (D) 15

4. Lucky spends 85% of her income. If her expenditure increases by $x\%$, savings increase by 60% income increases by 26%, then what is the value of x?

    [SSC CGL 2021]

(A) 30%   (B) 34%   (C) 26%   (D) 20%

5. The price of a commodity increases by 28%. However, the expenditure of it increases by 12%. What is the percentage increase or decrease in consumption?

    [SSC CHSL 2021]

(A) 16% increase   (B) 12.5% decrease

(C) 12.5% increase   (D) 16% decrease

6. By mistake, the reciprocal of a positive fraction got typed in place of itself and there by, its value got reduced by $\frac{175}{4}\%$. What was the value of fraction?

    [SSC CGL 2021]

(A) $\frac{1}{2}$ (B) $\frac{4}{3}$ (C) $\frac{3}{4}$ (D) $\frac{1}{4}$

7. Two students A and B appeared for an examination. A secured 8 marks more than B and the marks of the former was 55% of the sum of their marks. The marks obtained by A and B, respectively, are:

    [SSC CHSL 2021]

(A) 44, 36   (B) 36, 28   (C) 38, 30   (D) 40, 32

8. If decreasing 180 by $x\%$ gives the same result as increasing 60 by $x\%$, then $x\%$ of 410 will be more than $(x + 20)\%$ of 210 by: **[SSC CHSL 2021]**

(A) 36.57%   (B) 31.67%

(C) 33.33%   (D) 39.46%

9. The income of A is 25% more than that of B and the income of C is 65% less than the sum of the income of A and B. Income of C is what per cent less than the income of A?   **[SSC CGL 2019]**

(A) 28%   (B) 32%   (C) 32%   (D) 37%

10. If 60% of $(x – y) = 45\%$ of $(x + y)$ and $y = k\%$ of x, then 21% of k is equal to: **[SSC CGL 2019]**

(A) 1   (B) 6   (C) 7   (D) 3

11. If A is 48% more than B and C is 60% less than the sum of A and B, then A is what % more than C?

    [SSC CGL 2019]

(A) 50.2%   (B) 49.8%

(C) 49.2%   (D) 50.8%

12. If 40% of a number is less than its 60% by 30, then the 20% of that number is: **[SSC CGL 2019]**

(A) 60   (B) 40   (C) 50   (D) 30

13. If $x\%$ of y is 150 and $y\%$ of z is 300, then the relation between x and z is: **[SSC CGL 2018]**

(A) $z = x$ (B) $z = \frac{x}{3}$

(C) $z = \frac{x}{2}$ (D) $z = 2x$

14. The sum of salaries of A and B together is ₹ 43,000. A spends 95% of his salary and B spends 80% of his salary. If now their savings are the same, what is B's salary?   **[SSC CGL 2019]**

(A) ₹ 8,000   (B) ₹ 34,400

(C) ₹ 10,600   (D) ₹ 8,600

15. Sudha spends 80% of her income. When her income is increased by 30%, she increases her expenditure by 25%. Her savings: **[SSC CHSL 2018]**

(A) increased by 5%   (B) decreased by 30%

(C) decreased by 5%   (D) increased by 50%

16. The price of an article increases by 20% every year. If the difference between the price at the end of third and fourth years is ₹ 259.20, then 40% of the price at the end of 2nd year is: **[SSC CHSL 2018]**

(A) 484   (B) 432

(C) 384   (D) 472

17. The ratio of the income of A to that of B is 5 : 7. A and B save ₹ 4,000 and ₹ 5,000, respectively. If the expenditure of A is equal to $66\frac{2}{3}\%$ of the expenditure of B, then the total income of A and B is:

[SSC CGL 2018]

(A) ₹ 25,200   (B) ₹ 24,000

(C) ₹ 26,400   (D) ₹ 28,800

18. A is 25% more than B and B is 40% less than C. If C is 30% more than D, then by what per cent is A less than D? [SSC CGL 2018]

(A) 1.5%   (B) 2.5%   (C) 4%   (D) 5%

19. If decreasing 110 by $x\%$ gives the same result as increasing 50 by $x\%$, then $x\%$ of 650 is what percentage more than $(x-10)\%$ of 780? [SSC CGL 2019]

(A) 17%   (B) 12%   (C) 18%   (D) 14%

20. Raghav spends 80% of his income. If his income increases by 12% and the savings decrease by 10%, then what will be the percentage increase in his expenditure? [SSC CGL 2018]

(A) 20.5%   (B) 16%   (C) 17.5%   (D) 22%

ANSWER KEY

Level-1: Beginner

1.	(C)	2.	(A)	3.	(A)	4.	(A)	5.	(B)	6.	(D)	7.	(D)	8.	(C)	9.	(C)	10.	(A)
11.	(D)	12.	(B)	13.	(D)	14.	(B)	15.	(C)	16.	(A)	17.	(C)	18.	(A)	19.	(C)	20.	(C)
21.	(B)	22.	(D)	23.	(C)	24.	(B)	25.	(D)										

Level-2: Intermediate

1.	(D)	2.	(B)	3.	(A)	4.	(D)	5.	(B)	6.	(A)	7.	(A)	8.	(A)	9.	(D)	10.	(B)
11.	(C)	12.	(B)	13.	(D)	14.	(A)	15.	(B)	16.	(A)	17.	(A)	18.	(C)	19.	(B)		

Level-3: Expert

1.	(A)	2.	(B)	3.	(B)	4.	(D)	5.	(B)	6.	(B)	7.	(A)	8.	(D)	9.	(D)	10.	(D)
11.	(C)	12.	(D)	13.	(D)	14.	(D)	15.	(D)	16.	(B)	17.	(B)	18.	(B)	19.	(D)	20.	(C)

Solutions with Detailed Explanations

Level-1: BEGINNER

1. Option (C) is correct.

Explanation: Required percentage = $\frac{24}{40} \times 100 = 60\%$

2. Option (A) is correct.

Explanation: $\frac{1}{100} \times \frac{1}{100} \times \frac{25}{100} \times 1{,}000 = 0.025$

3. Option (A) is correct.

Explanation:

$$R = S + 0.2S = 1.2S$$

$$\text{Required}\% = \left(\frac{R-S}{R}\right) \times 100$$

$$= \left(1 - \frac{S}{R}\right) \times 100$$

$$= \left(1 - \frac{1}{1.2}\right) \times 100$$

$$= \frac{100}{6} = 16\frac{2}{3}\%$$

4. Option (A) is correct.

Explanation:

$$\frac{125}{100} \times x = 100$$

$$\Rightarrow \quad x = \frac{100 \times 100}{125} \Rightarrow 80$$

5. Option (B) is correct.

Explanation:

Let the number = x

$$\frac{40}{100} \times \frac{4}{5} \times \frac{3}{4} \times x = 48$$

$$\frac{6}{25} x = 48$$

$$x = \frac{48 \times 25}{6} = 200$$

$$\Rightarrow \quad 1\% \text{ of } 200 = 2$$

6. Option (D) is correct.

Explanation: Let the total number of students be x.

Let A and B represent the sets of students who passed in English and Mathematics, respectively.

$$\Rightarrow \quad n(A \cup B) = n(A) + n(B) - n(A \cap B)$$
$$= 75\% \text{ of } x + 60\% \text{ of } x - (x - 25\% \text{ of } x)$$
$$= \frac{3}{4}x + \frac{3}{5}x - \frac{3}{4}x = \frac{3}{5}x$$

So, $\quad \dfrac{3}{5}x = 240$

$$x = 400$$

7. Option (D) is correct.

Explanation:
$$\text{Total C.P.} = 200 \times 10 = ₹\, 2,000$$
$$\text{Total S.P.} = 12 \times 195 = ₹\, 2,340$$
$$\% \text{ profit} = \frac{2,340 - 2,000}{2,000} \times 100 = 17\%$$

8. Option (C) is correct.

Explanation: Increase in salary = ₹ 900. i.e.,
$$8,100 \rightarrow 9,000$$

Percentage increase $= \dfrac{900}{8,100} \times 100 = 11\dfrac{1}{9}\%$

9. Option (C) is correct.

Explanation: Let total number of students who appeared in an examination be x.

According to the question,

$$x \times \frac{8}{100} = 480$$
$$\Rightarrow \quad x = 6,000$$

10. Option (A) is correct.

Explanation: $\dfrac{18}{100} \times \dfrac{15}{100} \times \dfrac{25}{9} \times 3,800 = 285$

11. Option (D) is correct.

Explanation: $\dfrac{9}{40} \times 100 = \dfrac{45}{2}\% = 22\dfrac{1}{2}\%$

12. Option (B) is correct.

Explanation:
$$5 \text{ litres} = 5,000 \text{ ml}$$
$$8\% \text{ of } 5 \text{ litres} = 5,000 \times \frac{8}{100}$$
$$= 400 \text{ ml}$$

13. Option (D) is correct.

Explanation:

According to the question,
$$124 \times x\% = 49.60$$
$$\Rightarrow \quad x = \frac{4,960}{124} = 40$$

14. Option (B) is correct.

Explanation:

$$12\% = \frac{3 \rightarrow \text{Saving}}{25 \rightarrow \text{Income}}$$

$$\text{Expenditure} = 22 \text{ units} = 2,16,128$$
$$1 \text{ unit} = 9824$$
$$25 \text{ units} = 245600$$

So, total income $= ₹\, 2,45,600$

15. Option (C) is correct.

Explanation:

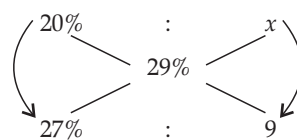Let salary of A and B are A and B, respectively.

So, according to the question,
$$A : B = 160 : 100$$
$$\text{Required}\% = \frac{60}{160} \times 100 = 37.5\%$$

16. Option (A) is correct.

Explanation:

Expenditure : Saving
3 : 1
20% : x
29%
27% : 9

$$x - 29 = 27 \Rightarrow x = 56\%$$

17. Option (C) is correct.

Explanation: Value after two years

$$= 75,000 \times \frac{96}{100} \times \frac{96}{100} = ₹\, 69,120$$

18. Option (A) is correct.

Explanation:

Saving percentage $= (100 - 55)\% = 45\%$

If the income of Ajay be ₹x, then,

$$\frac{45 \times x}{100} = 27,000$$
$$\Rightarrow \quad x = ₹\, 60,000$$

19. Option (C) is correct.

Explanation: Salary in May, 2000 = ₹ 15,000

Salary in July, 2000 $\Rightarrow 15,000 + 10\%$ of 15,000

$= ₹\, 16,500$

Salary in October 2001 = 16,500 + 10% of 16,500

$= ₹\, 18,150$

20. Option (C) is correct.

Explanation: Let the total number of students in class be x.

Maths ⟍ ⟍ Biology

$$\frac{72x}{100} - 40 \quad (40) \quad \frac{44x}{100} - 40$$
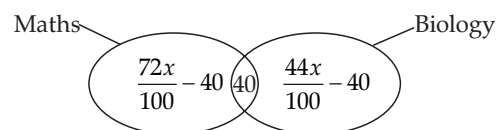
$$\frac{72x}{100} - 40 + 40 + \frac{44x}{100} - 40 = x$$

$$\Rightarrow \frac{72x}{100}x + \frac{44x}{100} - x = 40$$

$$\Rightarrow \quad x = \frac{40 \times 100}{16} \Rightarrow x = 250$$

21. Option (B) is correct.

Explanation:

$$\frac{P-Q}{2} = (P+Q)\times\frac{30}{100}$$

$\Rightarrow \qquad 5(P-Q) = (P+Q)\times 3$

$\Rightarrow \qquad 5P-3P = 5Q+3Q$

$\Rightarrow \qquad 2P = 8Q$

$\Rightarrow \qquad P = 4Q$

Also, $\qquad Q = \dfrac{x}{100}\times P$

$\Rightarrow \qquad Q = \dfrac{x}{100}\times 4Q \Rightarrow \dfrac{4x}{100} = 1$

$\Rightarrow \qquad x = 25$

22. Option (D) is correct.

Explanation: % of votes secured by the second candidate = $(100-57)\% = 43\%$

Let total votes polled be x.

According to question,

$\qquad (57-43)\%$ of x = 42,000

$\Rightarrow \qquad 14\%$ of x = 42,000

$\Rightarrow \qquad x = 3,00,000$

23. Option (C) is correct.

Explanation: Let the number be x

$\Rightarrow \qquad x - 10\%$ of x = 30

$\Rightarrow \qquad x - \dfrac{10}{100}x = 30$

$\Rightarrow \qquad \left(\dfrac{100-10}{100}\right)x = 30$

$\Rightarrow \qquad x = \dfrac{30\times 100}{90} = 33\dfrac{1}{3}$

Hence, the number is $33\dfrac{1}{3}$

24. Option (B) is correct.

Explanation: According to the question,

Number of girls = $(100-60)\% = 40\%$

$\Rightarrow \qquad 40\% = 36$

So, $\qquad 60\% = 54$

Number of boys = 54

25. Option (D) is correct.

Explanation:

Mohan : Shyam = 7 : 5

Shyam's income is less by = $\dfrac{2}{7}\times 100\% = 28\dfrac{4}{7}\%$

Level-2: INTERMEDIATE

1. Option (D) is correct.

Explanation: Quantity of salt = 5% of 6 litres = 300 ml

Quantity of water = 6,000 ml – 300 ml = 5,700 ml

Quantity of water left after evaporation

$\qquad = (5,700-1000)$ ml = 4,700 ml

% of salt = $\dfrac{300 \text{ ml}}{(4,700+300)\text{ml}}\times 100 = 6\%$

2. Option (B) is correct.

Explanation:

Expenditure : Saving

4 : 1

17.5 : 10%

12%

22 : 5.5
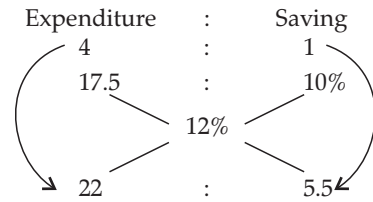
10% decrease in savings.

3. Option (A) is correct.

Explanation: Required percentage change

$$= \frac{\dfrac{3}{2}-\dfrac{7}{5}}{\dfrac{3}{2}}\times 100\% = \frac{20\%}{3} \Rightarrow 6\frac{2}{3}\%$$

4. Option (D) is correct.

Explanation:

$\qquad P = 100 \longrightarrow 124$

$\qquad C = 124 \longrightarrow 100 \qquad 118$

Consumption decrease = $\dfrac{6}{124}\times 100 = 4.8\%$

5. Option (B) is correct.

Explanation: As price is reduced by 20% or $\dfrac{1}{5}$ factor.

Then consumption will increase by a factor of —, as expenditure is constant.

According to question,

$\qquad \dfrac{1}{4}\times x = 4$ kg

$\therefore \qquad x = 16$ kg

Price of 16 kg = 160

$\therefore \qquad$ Price of 1 kg = $\dfrac{160}{16} = ₹ 10$

So, price of sugar is ₹ 10/ kg

6. Option (A) is correct.

Explanation: Let the monthly salary of A be x, monthly salary of B is (40,000 – x)

$\qquad$ Savings of A = $(100-85)\%$ of $x = 0.15\,x$

$\qquad$ Savings of B = $(100-95)\%$ of $(40,000-x)$

$\qquad\qquad\qquad = 0.05\,(40,000-x)$

$\qquad 0.15x = 0.05\,(40,000-x)$

$\Rightarrow \quad 0.15x + 0.05x = 40,000\times 0.05$

$\Rightarrow \qquad 0.2x = 2,000$

$\Rightarrow \qquad x = ₹ 10,000$

7. Option (A) is correct.

Explanation:

Let passing marks = p

$\qquad p\times 1.05 = 273$

$\qquad\qquad p = 260$

Lokesh passing% = $\dfrac{312-260}{260}\times 100 = 20\%$

8. **Option (A) is correct.**

Explanation:

$$100 \longrightarrow 117 \quad -12$$
$$\longrightarrow 105$$

$$\% \text{ decrease} = \frac{12}{117} \times 100 = 10.3\%$$

9. **Option (D) is correct.**

Explanation:

$$\frac{R_1}{R_2} = \frac{60}{100} = \frac{3}{5}$$

$$\text{Volume} = V_1 : V_2 = 27 : 125$$

$$\text{Volume decrease} = \frac{98}{125} \times 100 = 78.4\%$$

10. **Option (B) is correct.**

Explanation:

Let $\quad\quad\quad\quad B = 100$

$$A : B : C : D = 80 : 100 : 78 : 60$$

$$C = 0.78 \, B$$

11. **Option (C) is correct.**

Explanation:

$$72\% \text{ of marks} = 360$$

$$100\% \text{ of marks} = \frac{360 \times 100}{72} = 500$$

12. **Option (B) is correct.**

Explanation:

$$A \;:\; B \;:\; C$$
$$60 \;:\; 100 \;:\; 64$$

$$\text{Required}\% = \frac{36}{64} \times 100 = 56\frac{1}{4}\%$$

13. **Option (D) is correct.**

Explanation:

Suppose $\quad\quad B = 100$, then $A = 128$,

$$C = \frac{3}{4}(A+B) = \frac{3}{4} \times 228 = 171$$

$$128 : 100 : 171$$
$$+43$$

Required percentage $= \dfrac{43}{128} \times 100$

$$= \frac{1,075}{32} = 33.59 \approx 33.6\%$$

14. **Option (A) is correct.**

Explanation:

$$I = E : S$$

$$+20.1\% \left(\begin{array}{l} 400 = 260 : 140 \\ 480.4 = 325 : 155.4 \end{array} \right) +15.4$$

$$\Rightarrow \quad \text{Savings}\% = \frac{15.4}{140} \times 100 = 11\%$$

15. **Option (B) is correct.**

Explanation: According to the question,

$$\frac{1}{4} \times \frac{1}{2} \times x = \frac{5}{2} \times \frac{3}{10} \times \frac{1}{4} \times y$$

$$\frac{x}{y} = \frac{3}{2}$$

$$\text{Required}\% = 3 - 2/2 \times 100 = 50\%$$

$x \to 50\%$ more than y

16. **Option (A) is correct.**

Explanation: According to the question,

$$A : B = 124 : 100 = 31 : 25$$

So, $\quad \text{required}\% = \dfrac{6}{31} \times 100 = \dfrac{600}{31}\%$

17. **Option (A) is correct.**

Explanation:

Given, $\quad 20\%$ of $a = b$

Then, $b\%$ of $20 = 20\%$ of $b = 20\%$ of 20% of a

$$= \frac{1}{5} \times \frac{1}{5} \times a = \frac{1}{25} \times a = 4\% \text{ of } a$$

18. **Option (C) is correct.**

Explanation: $A : B = 135 : 100$

$$\text{Required}\% = \frac{35}{135} \times 100 \approx 26\%$$

19. **Option (B) is correct.**

Explanation: Let total property be x.

$$x \times \frac{2}{3} \times \frac{3}{10} = 12,500$$

$$\Rightarrow \quad\quad\quad x = 6,25,000$$

$$x \times \frac{45}{100} = ₹\ 2,81,250$$

Level-3: EXPERT

1. **Option (A) is correct.**

Explanation:

$$\frac{(x+20)}{100} \times 250 = \frac{125}{100} \times \frac{x}{100} \times 220$$

$$x = 200$$

$$\Rightarrow 10\% \text{ of } (x + 50) = \frac{10}{100} \times 250 = 25$$

$$\Rightarrow \quad 15\% \text{ of } x = \frac{15}{100} \times 200 = 30$$

$$\Rightarrow \quad \text{Required}\% = \frac{30 - 25}{30} \times 100$$

$$= \frac{5}{30} \times 100 = 16\frac{2}{3}\%$$

2. **Option (B) is correct.**

Explanation: Let number be 12.

According to the question,

$$12 \times \frac{3}{4} = 9 \quad\quad\quad\quad\quad (9 + 7 = 16)$$

$$12 \times \frac{4}{3} = 16$$

$$\% \text{ error} = \frac{7}{16} \times 100 = 43.75\%$$

3. Option (B) is correct.

Explanation:

$$A : B = 150 : 100 = 3 : 2$$
$$B : C = 40 : 100 = 2 : 5$$
$$A : B : C = 3 : 2 : 5$$
$$= 3a : 2a : 5a$$
$$A + B + C = 20$$
$$\Rightarrow \quad 10a = 20$$
$$\Rightarrow \quad a = 2$$
$$\Rightarrow \quad 2B + 3C - 4A = 2\,(2a) + 3\,(5a) - 4\,(3a)$$
$$= 7a = 14$$

4. Option (D) is correct.

Explanation:

Income	Expenditure	Saving
200	170	30
↓ 26% Increase		↓ 60%
252		48

As, $252 - 48 = 204$

% Expenditure increase $= \dfrac{204 - 170}{170} = \dfrac{34}{170} = 20\%$

5. Option (B) is correct.

Explanation: Let price, consumption and expenditure are P, C and E, respectively.

$$P \times C = E$$

Let, $\quad 25 \times 4 = 100$

Then, after changes new expenditure

$= 32 \times 3.5 = 112$

So, percentage decrease $= \dfrac{0.5}{4} \times 100$

$= 12.5\%$ (decrease)

6. Option (B) is correct.

Explanation:

Correct $\rightarrow \dfrac{4}{3} \times 12 \longrightarrow 16$

Wrong $\rightarrow \dfrac{3}{4} \times 12 \longrightarrow 9$

-7 (By option)

% reduction $= \dfrac{7}{16} \times 100 = \dfrac{175}{4}\%$

7. Option (A) is correct.

Explanation:

$$A - B = 8$$
$$A = (A + B) \times \dfrac{55}{100}$$
$$\dfrac{A}{A + B} = \dfrac{11}{20} \Rightarrow \dfrac{A}{B} = \dfrac{11 \rightarrow 44}{9 \rightarrow 36}$$

8. Option (D) is correct.

Explanation:

$$\dfrac{180}{60} = \dfrac{(100 + x)\%}{(100 - x)\%}$$
$$\Rightarrow \quad x = 50$$

$$50\% \text{ of } 410 = 205$$
$$70\% \text{ of } 210 = 147$$

So, required% $= \dfrac{205 - 147}{147} \times 100 = 39.46\%$

9. Option (D) is correct.

Explanation:

25% more $= \dfrac{5}{4}$

$$C = 35\% \text{ of } (A + B)$$

A	:	B	:	C
500		400		315

-185

Required% $= \dfrac{185}{500} \times 100 = 37\%$

10. Option (D) is correct.

Explanation:

$$60\% \text{ of } (x - y) = 45\% \text{ of } (x + y)$$
$$\Rightarrow \quad \dfrac{3}{5}(x - y) = \dfrac{9}{20}(x + y)$$
$$\Rightarrow \quad 4\,(x - y) = 3x + 3y$$
$$\Rightarrow \quad x = 7y$$
$$\Rightarrow \quad x : y = 7 : 1$$
$$7 \times \dfrac{k}{100} = 1 \Rightarrow k = \dfrac{100}{7}$$
$$\Rightarrow \quad 21\% \text{ of } k = \dfrac{21}{100} \times \dfrac{100}{7} = 3$$

11. Option (C) is correct.

Explanation:

$$A : B : C = 148 : 100 : \dfrac{248 \times 40}{100}$$
$$= 148 : 100 : 99.2$$
$$\text{Required}\% = \dfrac{48.8}{99.2} \times 100 = 49.2\%$$

12. Option (D) is correct.

Explanation:

$(60\% \text{ of } x) - (40\% \text{ of } x) = 30$

$\Rightarrow \quad 20\% \text{ of } x = 30$

13. Option (D) is correct.

Explanation:

$$x\% \text{ of } y = 150 \qquad \text{...(1)}$$
$$y\% \text{ of } z = 300 \qquad \text{...(2)}$$

$(1) \div (2)$

$$\dfrac{x}{z} = \dfrac{1}{2} \Rightarrow z = 2x$$

14. Option (D) is correct.

Explanation:

$$5\% \text{ of A} = 20\% \text{ of B}$$
$$\dfrac{A}{B} = \dfrac{4}{1}$$
$$\Rightarrow \quad 5 \text{ units} = 43,000$$
$$\therefore \quad \text{B's salary} = 8,600$$

15. Option (D) is correct.

Explanation:

$$\begin{array}{ccc} I & = E & S \\ 100 & = 80 & 20 \\ 130 & = 100 & 30 \end{array}$$

Savings increased by 50%

16. Option (B) is correct.

Explanation:

We know, $20\% = \dfrac{1}{5}$

$$\begin{aligned} \text{Let price} &= 625 \\ \text{end of Ist year} &= 750 \\ \text{IInd year} &= 900 \\ \text{IIIrd year} &= 1{,}080 \\ \text{IVth year} &= 1{,}296 \\ \text{Difference} &= 216 = 259.20 \\ 40\% \text{ of } 900 &= 360 = 432 \end{aligned}$$

17. Option (B) is correct.

Explanation:

$$66\tfrac{2}{3}\% = \tfrac{2}{3}$$

$$\begin{array}{ccc} I & = 5 & : & 7 \\ E & \to 2 & : & 3 \\ \hline S & \to 4{,}000 & : & 5{,}000 \\ & 12{,}000 & : & 10{,}000 \end{array}$$

$15 - 14 \text{ unit} = 12{,}000 - 10{,}000$

$1 \text{ unit} - 2{,}000$

$12 \text{ units} \to 24{,}000$

18. Option (B) is correct.

Explanation: According to the question,

$$A : B : C : D = 195 : 156 : 260 : 200$$

$$\text{Required\%} = \dfrac{5}{200} \times 100 = 2.5\%$$

19. Option (D) is correct.

Explanation:

$$110\left(\dfrac{100 - x}{100}\right) = 50\left(\dfrac{100 + x}{100}\right)$$

$$x = \dfrac{75}{2}\%$$

$$x\% \text{ of } 650 = 243.75$$

$$(x - 10)\% \text{ of } 780 = 214.50$$

$$\text{Required more\%} = \dfrac{29.25}{214.5} \times 100 = 13.63\% \approx 14\%$$

20. Option (C) is correct.

Explanation:

$$\begin{array}{cccc} I & : & S = & E \\ 500 & : & 100 = & 400 \\ 560 & : & 90 = & 470 \end{array} \Bigg] + 70$$

$$\left(\text{Expenditure} = 80\% = \dfrac{4}{5}\right)$$

$$I : S = 5 : 1$$

$$\% \, I = \dfrac{70}{400} \times 100 = 17.5\%$$

■   ■   ■