



# Basic Mathematics

پاکستان کی سب سے بڑی پاسٹ پیپر ویب سائٹ۔ پی ڈی ایف میں ڈلوڈ کرنے کے لیے گوگل پر سرچ کریں

## TestPoint.Pk

1. Problem and ages
2. Speed, Time and distance
3. Compound Interest
4. Average
5. Profit and loss
6. Percentage
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8. Ratio and Proportion

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Problems on Ages

1. Father is aged three times more than his son Ali's. After 8 years, he would be two and a half times of Ali's age. After further 8 years, how many times would he be of Ali's age?

- A. 2 times  
B.  $2\frac{1}{2}$  times  
C.  $2\frac{3}{4}$  times  
D. 3 times

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**Answer:** Option A

**Explanation:**

Let Ali's present age be  $x$  years. Then, father's present age  $= (x + 3x)$  years  $= 4x$  years.

$$\therefore (4x + 8) = \frac{5}{2}(x + 8)$$

$$\Rightarrow 8x + 16 = 5x + 40$$

$$\Rightarrow 3x = 24$$

$$\Rightarrow x = 8.$$

$$\text{Hence, required ratio} = \frac{(4x + 16)}{(x + 16)} = \frac{48}{24} = 2.$$

- 2 - The sum of ages of 5 children born at the intervals of 3 years each is 50 years. What is the age of the youngest child?

- A. 4 years  
B. 8 years  
C. 10 years  
D. None of these

**Answer:** Option A

**Explanation:**

Let the ages of children be  $x$ ,  $(x + 3)$ ,  $(x + 6)$ ,  $(x + 9)$  and  $(x + 12)$  years.

Then,  $x + (x + 3) + (x + 6) + (x + 9) + (x + 12) = 50$

$$\Rightarrow 5x = 20$$

$$\Rightarrow x = 4.$$

$\therefore$  Age of the youngest child  $= x = 4$  years.

3. A father said to his son, "I was as old as you are at the present at the time of your birth". If the father's age is 38 years now, the son's age five years back was:

- A. 14 years  
B. 19 years  
C. 33 years  
D. 38 years

**Answer:** Option A

**Explanation:**

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Let the son's present age be  $x$  years. Then,  $(38 - x) = x$

$$\Rightarrow 2x = 38.$$

$$\Rightarrow x = 19.$$

∴ Son's age 5 years back  $(19 - 5) = 14$  years.

4. A is two years older than B who is twice as old as C. If the total of the ages of A, B and C be 27, the how old is B?

A. 7

B. 8

C. 9

D. 10

E. 11

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**Answer:** Option D

**Explanation:**

Let C's age be  $x$  years. Then, B's age =  $2x$  years. A's age =  $(2x + 2)$  years.

$$\therefore (2x + 2) + 2x + x = 27$$

$$\Rightarrow 5x = 25$$

$$\Rightarrow x = 5.$$

Hence, B's age =  $2x = 10$  years.

5. Present ages of Sameer and Anand are in the ratio of 5 : 4 respectively. Three years hence, the ratio of their ages will become 11 : 9 respectively. What is Anand's present age in years?

A. 24

B. 27

C. 40

D. Cannot be determined

E. None of these

**Answer:** Option A

**Explanation:**

Let the present ages of Sameer and Anand be  $5x$  years and  $4x$  years respectively.

$$\text{Then, } \frac{5x + 3}{4x + 3} = \frac{11}{9}$$

$$\Rightarrow 9(5x + 3) = 11(4x + 3)$$

$$\Rightarrow 45x + 27 = 44x + 33$$

$$\Rightarrow 45x - 44x = 33 - 27$$

$$\Rightarrow x = 6.$$

∴ Anand's present age =  $4x = 24$  years.

6. A man is 24 years older than his son. In two years, his age will be twice the age of his son. The present age of his son is:

A. 14 years

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**B.** 18 years

**C.** 20 years

**D.** 22 years

**Answer:** Option D

**Explanation:**

Let the son's present age be  $x$  years. Then, man's present age =  $(x + 24)$  years.

$$\therefore (x + 24) + 2 = 2(x + 2)$$

$$\Rightarrow x + 26 = 2x + 4$$

$$\Rightarrow x = 22.$$

7. Six years ago, the ratio of the ages of Usman and Rauf was 6 : 5. Four years hence, the ratio of their ages will be 11 : 10. What is Rauf's age at present?

**A.** 16 years

**B.** 18 years

**C.** 20 years

**D.** Cannot be determined

**E.** None of these

**Answer:** Option A

**Explanation:**

Let the ages of Usman and Rauf 6 years ago be  $6x$  and  $5x$  years respectively.

$$\text{Then, } \frac{(6x + 6) + 4}{(5x + 6) + 4} = \frac{11}{10}$$

$$\Rightarrow 10(6x + 10) = 11(5x + 10)$$

$$\Rightarrow 5x = 10$$

$$\Rightarrow x = 2.$$

$$\therefore \text{Rauf, present age} = (5x + 6) = 16 \text{ years.}$$

8. The sum of the present ages of a father and his son is 60 years. Six years ago, father's age was five times the age of the son. After 6 years, son's age will be:

**A.** 12 years

**B.** 14 years

**C.** 18 years

**D.** 20 years

**Answer:** Option D

**Explanation:**

Let the present ages of son and father be  $x$  and  $(60 - x)$  years respectively.

$$\text{Then, } (60 - x) - 6 = 5(x - 6)$$

$$\Rightarrow 54 - x = 5x - 30$$

$$\Rightarrow 6x = 84$$

$$\Rightarrow x = 14.$$

$$\therefore \text{Son's age after 6 years} = (x + 6) = 20 \text{ years..}$$

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9. At present, the ratio between the ages of Fazal and Bilal is 4 : 3. After 6 years, Arun's age will be 26 years. What is the age of Deepak at present ?

- A. 12 years
- B. 15 years
- C. 19 and half
- D. 21 years

**Answer:** Option B

**Explanation:**

Let the present ages of Fazal and Bilal be  $4x$  years and  $3x$  years respectively. Then,

$$4x + 6 = 26 \Leftrightarrow 4x = 20$$

$$x = 5.$$

$$\therefore \text{Bilal's age} = 3x = 15 \text{ years.}$$

10. Sohail is younger than Rizwan by 7 years. If their ages are in the respective ratio of 7 : 9, how old is Sachin?

- A. 16 years
- B. 18 years
- C. 28 years
- D. 24.5 years
- E. None of these

**Answer:** Option D

**Explanation:**

Let Rizwan's age be  $x$  years.

Then, Sohail's age =  $(x - 7)$  years.

$$\therefore \frac{x - 7}{x} = \frac{7}{9}$$

$$\Rightarrow 9x - 63 = 7x$$

$$\Rightarrow 2x = 63$$

$$\Rightarrow x = 31.5$$

Hence, Sohail's age =  $(x - 7) = 24.5$  years.

11. The present ages of three persons in proportions 4 : 7 : 9. Eight years ago, the sum of their ages was 56. Find their present ages (in years).

- A. 8, 20, 28
- B. 16, 28, 36
- C. 20, 35, 45
- D. None of these

**Answer:** Option B

**Explanation:**

Let their present ages be  $4x$ ,  $7x$  and  $9x$  years respectively.

$$\text{Then, } (4x - 8) + (7x - 8) + (9x - 8) = 56$$

$$\Rightarrow 20x = 80$$

$$\Rightarrow x = 4.$$

$\therefore$  Their present ages are  $4x = 16$  years,  $7x = 28$  years and  $9x = 36$  years respectively.

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- 12 Ayesha's father was 38 years of age when she was born while her mother was 36 years old when her brother four years younger to her was born. What is the difference between the ages of her parents?

- A.** 2 years  
**B.** 4 years  
**C.** 6 years  
**D.** 8 years

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Answer: Option C

Explanation:

Mother's age when Ayesha's brother was born = 36 years.

Father's age when Ayesha's brother was born = (38 + 4) years = 42 years.

∴ Required difference = (42 - 36) years = 6 years.

- 13 A person's present age is two-fifth of the age of his mother. After 8 years, he will be one-half of the age of his mother. How old is the mother at present?

- A.** 32 years  
**B.** 36 years  
**C.** 40 years  
**D.** 48 years

**Answer:** Option C

**Explanation:**

Let the mother's present age be  $x$  years.

Then, the person's present age =  $\left(\frac{2}{5}x\right)$  years.

$$\therefore \left(\frac{2}{5}x + 8\right) = \frac{1}{2}(x + 8)$$

$$\Rightarrow 2(2x + 40) = 5(x + 8)$$

$$\Rightarrow x = 40.$$

14. Q is as much younger than R as he is older than T. If the sum of the ages of R and T is 50 years, what is definitely the difference between R and Q's age?

- A.** 1 year  
**B.** 2 years  
**C.** 25 years  
**D.** Data inadequate  
**E.** None of these

**Answer:** Option D

**Explanation:**

**Given that:**

1. The difference of age b/w R and Q = The difference of age b/w Q and T.

2. Sum of age of R and T is 50 i.e. (R + T) = 50.

Question:  $R - Q = ?$ .

Explanation:

$$R - Q = Q - T$$

$$(R + T) = 2Q$$

Now given that,  $(R + T) = 50$

So,  $50 = 2Q$  and therefore  $Q = 25$ .

Question is  $(R - Q) = ?$

Here we know the value(age) of  $Q$  (25), but we don't know the age of  $R$ .

Therefore,  $(R - Q)$  cannot be determined.

15. The age of father 10 years ago was thrice the age of his son. Ten years hence, father's age will be twice that of his son. The ratio of their present ages is:

A. 5 : 2

B. 7 : 3

C. 9 : 2

D. 13 : 4

**Answer:** Option B

**Explanation:**

Let the ages of father and son 10 years ago be  $3x$  and  $x$  years respectively.

$$\text{Then, } (3x + 10) + 10 = 2[(x + 10) + 10]$$

$$\Rightarrow 3x + 20 = 2x + 40$$

$$\Rightarrow x = 20.$$

$$\therefore \text{ Required ratio} = (3x + 10) : (x + 10) = 70 : 30 = 7 : 3.$$

### Important Formulas on "Problems on Ages":

1. If the current age is  $x$ , then  $n$  times the age is  $nx$ .
2. If the current age is  $x$ , then age  $n$  years later/hence =  $x + n$ .
3. If the current age is  $x$ , then age  $n$  years ago =  $x - n$ .
4. The ages in a ratio  $a : b$  will be  $ax$  and  $bx$ .
5. If the current age is  $x$ , then  $\frac{1}{n}$  of the age is  $\frac{x}{n}$ .

**SPEED TIME, DETENCE**

1. A person crosses a 600 m long street in 5 minutes. What is his speed in km per hour?

- A. 3.6
- B. 7.2
- C. 8.4
- D. 10

**Answer:** Option B

**Explanation:**

$$\text{Speed} = \left( \frac{600}{5 \times 60} \right) \text{m/sec.}$$

$$= 2 \text{ m/sec.}$$

Converting m/sec to km/hr (see important formulas section)

$$= \left( 2 \times \frac{18}{5} \right) \text{km/hr}$$

$$= 7.2 \text{ km/hr.}$$

2. An aeroplane covers a certain distance at a speed of 240 kmph in 5 hours. To cover the same distance in  $1\frac{2}{3}$  hours, it must travel at a speed of:

- A. 300 kmph
- B. 360 kmph
- C. 600 kmph
- D. 720 kmph

**Answer:** Option D

**Explanation:**

$$\text{Distance} = (240 \times 5) = 1200 \text{ km.}$$

$$\text{Speed} = \text{Distance/Time}$$

$$\text{Speed} = 1200 / (5/3) \text{ km/hr.} \quad [\text{We can write } 1\frac{2}{3} \text{ hours as } 5/3 \text{ hours}]$$

$$\therefore \text{Required speed} = \left( 1200 \times \frac{3}{5} \right) \text{km/hr} = 720 \text{ km/hr.}$$

3. If a person walks at 14 km/hr instead of 10 km/hr, he would have walked 20 km more. The actual distance travelled by him is:

- A. 50 km
- B. 56 km
- C. 70 km
- D. 80 km



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**Answer:** Option A

**Explanation:**

Let the actual distance travelled be  $x$  km.

$$\text{Then, } \frac{x}{10} = \frac{x+20}{14}$$

$$\Rightarrow 14x = 10x + 200$$

$$\Rightarrow 4x = 200$$

$$\Rightarrow x = 50 \text{ km.}$$

4. A train can travel 50% faster than a car. Both start from point A at the same time and reach point B 75 kms away from A at the same time. On the way, however, the train lost about 12.5 minutes while stopping at the stations.

The speed of the car is:

A. 100 kmph

B. 110 kmph

C. 120 kmph

D. 130 kmph

**Answer:** Option C

**Explanation:**

Let speed of the car be  $x$  kmph.

$$\text{Then, speed of the train} = \frac{150}{100}x = \left(\frac{3}{2}x\right) \text{ kmph.}$$

$$\therefore \frac{75}{x} - \frac{75}{(3/2)x} = \frac{125}{10 \times 60}$$

$$\Rightarrow \frac{75}{x} - \frac{50}{x} = \frac{5}{24}$$

$$\Rightarrow x = \left(\frac{25 \times 24}{5}\right) = 120 \text{ kmph.}$$

5. Excluding stoppages, the speed of a bus is 54 kmph and including stoppages, it is 45 kmph. For how many minutes does the bus stop per hour?

A. 9

B. 10

C. 12

D. 20

**Answer:** Option B

Due to stoppages, it covers 9 km less.

$$\text{Time taken to cover 9 km} = \left(\frac{9}{54} \times 60\right)_{\text{min}} = 10 \text{ min.}$$

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- 6 In a flight of 600 km, an aircraft was slowed down due to bad weather. Its average speed for the trip was reduced by 200 km/hr and the time of flight increased by 30 minutes. The duration of the flight is:
- A. 1 hour
  - B. 2 hours
  - C. 3 hours
  - D. 4 hours

**Answer:** Option A

Let the duration of the flight be  $x$  hours.

$$\text{Then, } \frac{600}{x} - \frac{600}{x + (1/2)} = 200$$

$$\Rightarrow \frac{600}{x} - \frac{1200}{2x + 1} = 200$$

$$\Rightarrow x(2x + 1) = 3$$

$$\Rightarrow 2x^2 + x - 3 = 0$$

$$\Rightarrow (2x + 3)(x - 1) = 0$$

$$\Rightarrow x = 1 \text{ hr. [neglecting the -ve value of } x]$$

- 7 A man completes a journey in 10 hours. He travels first half of the journey at the rate of 21 km/hr and second half at the rate of 24 km/hr. Find the total journey in km.
- A. 220 km
  - B. 224 km
  - C. 230 km
  - D. 234 km

**Answer:** Option B

**Explanation:**

$$\frac{(1/2)x}{21} + \frac{(1/2)x}{24} = 10$$

$$\Rightarrow \frac{x}{21} + \frac{x}{24} = 20$$

$$\Rightarrow 15x = 168 \times 20$$

$$\Rightarrow x = \left( \frac{168 \times 20}{15} \right) = 224 \text{ km.}$$

- 8 The ratio between the speeds of two trains is 7 : 8. If the second train runs 400 km in 4 hours, then the speed of the first train is:
- A. 70 km/hr
  - B. 75 km/hr
  - C. 84 km/hr
  - D. 87.5 km/hr

**Answer:** Option D

**Explanation:**

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Let the speed of two trains be  $7x$  and  $8x$  km/hr.

$$\text{Then, } 8x = \left(\frac{400}{4}\right) = 100$$

$$\Rightarrow x = \left(\frac{100}{8}\right) = 12.5$$

∴ Speed of first train =  $(7 \times 12.5)$  km/hr = 87.5 km/hr.

- 9 A man on tour travels first 160 km at 64 km/hr and the next 160 km at 80 km/hr. The average speed for the first 320 km of the tour is:

**A.** 35.55 km/hr

**B.** 36 km/hr

**C.** 71.11 km/hr

**D.** 71 km/hr

Answer: Option C

Explanation:

$$\text{Total time taken} = \left(\frac{160}{64} + \frac{160}{80}\right) \text{hrs.} = \frac{9}{2} \text{ hrs.}$$

$$\therefore \text{Average speed} = \left(320 \times \frac{2}{9}\right) \text{km/hr} = 71.11 \text{ km/hr.}$$

- 10 A car travelling with  $\frac{5}{7}$  of its actual speed covers 42 km in 1 hr 40 min 48 sec. Find the actual speed of the car.

**A.**  $17\frac{6}{7}$  km/hr

**B.** 25 km/hr

**C.** 30 km/hr

**D.** 35 km/hr

Answer: Option D

:

$$\text{Time taken} = 1 \text{ hr } 40 \text{ min } 48 \text{ sec} = 1 \text{ hr } 40\frac{4}{5} \text{ min} = 1\frac{51}{75} \text{ hrs} = \frac{126}{75} \text{ hrs.}$$

Let the actual speed be  $x$  km/hr.

$$\text{Then, } \frac{5}{7}x \times \frac{126}{75} = 42$$

$$\Rightarrow x = \left(\frac{42 \times 7 \times 75}{5 \times 126}\right) = 35 \text{ km/hr.}$$

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11. In covering a distance of 30 km, Abid takes 2 hours more than Sameer. If Abid doubles his speed, then he would take 1 hour less than Sameer. Abid's speed is:

- A. 5 kmph
- B. 6 kmph
- C. 6.25 kmph
- D. 7.5 kmph

**Answer:** Option A

**Explanation:**

Let Abid's speed be  $x$  km/hr.

$$\text{Then, } \frac{30}{x} - \frac{30}{2x} = 3$$

$$\Rightarrow 6x = 30$$

$$\Rightarrow x = 5 \text{ km/hr.}$$

12. Rashid is travelling on his cycle and has calculated to reach point A at 2 P.M. if he travels at 10 kmph, he will reach there at 12 noon if he travels at 15 kmph. At what speed must he travel to reach A at 1 P.M.?

- A. 8 kmph
- B. 11 kmph
- C. 12 kmph
- D. 14 kmph

**Answer:** Option C

**Explanation:**

Let the distance travelled by  $x$  km.

$$\text{Then, } \frac{x}{10} - \frac{x}{15} = 2$$

$$\Rightarrow 3x - 2x = 60$$

$$\Rightarrow x = 60 \text{ km.}$$

$$\text{Time taken to travel 60 km at 10 km/hr} = \left(\frac{60}{10}\right) \text{ hrs} = 6 \text{ hrs.}$$

So, Rashid started 6 hours before 2 P.M. *i.e.*, at 8 A.M.

$$\therefore \text{ Required speed} = \left(\frac{60}{5}\right) \text{ kmph.} = 12 \text{ kmph.}$$

13. it takes eight hours for a 600 km journey, if 120 km is done by train and the rest by car. It takes 20 minutes more, if 200 km is done by train and the rest by car. The ratio of the speed of the train to that of the cars is:

- A. 2 : 3
- B. 3 : 2
- C. 3 : 4
- D. 4 : 3

**Answer:** Option C

**Explanation:**

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Let the speed of the train be  $x$  km/hr and that of the car be  $y$  km/hr.

$$\text{Then, } \frac{120}{x} + \frac{480}{y} = 8 \Rightarrow \frac{1}{x} + \frac{4}{y} = \frac{1}{15} \dots(i)$$

$$\text{And, } \frac{200}{x} + \frac{400}{y} = \frac{25}{3} \Rightarrow \frac{1}{x} + \frac{2}{y} = \frac{1}{24} \dots(ii)$$

Solving (i) and (ii), we get:  $x = 60$  and  $y = 80$ .

∴ Ratio of speeds =  $60 : 80 = 3 : 4$ .

14. A farmer travelled a distance of 61 km in 9 hours. He travelled partly on foot @ 4 km/hr and partly on bicycle @ 9 km/hr. The distance travelled on foot is:

**A.** 14 km

**B.** 15 km

**C.** 16 km

**D.** 17 km

**Answer:** Option C

**Explanation:**

Let the distance travelled on foot be  $x$  km.

Then, distance travelled on bicycle =  $(61 - x)$  km.

$$\text{So, } \frac{x}{4} + \frac{(61 - x)}{9} = 9$$

$$\Rightarrow 9x + 4(61 - x) = 9 \times 36$$

$$\Rightarrow 5x = 80$$

$$\Rightarrow x = 16 \text{ km.}$$

15. A man covered a certain distance at some speed. Had he moved 3 kmph faster, he would have taken 40 minutes less. If he had moved 2 kmph slower, he would have taken 40 minutes more. The distance (in km) is:

**A.** 35

**B.**  $36\frac{2}{3}$

**C.**  $37\frac{1}{2}$

**D.** 40

**Answer:** Option D

**Explanation:**

Let distance =  $x$  km and usual rate =  $y$  kmph.

$$\text{Then, } \frac{x}{y} - \frac{x}{y+3} = \frac{40}{60} \Rightarrow 2y(y+3) = 9x \dots(i)$$

$$\text{And, } \frac{x}{y-2} - \frac{x}{y} = \frac{40}{60} \Rightarrow y(y-2) = 3x \dots(ii)$$

On dividing (i) by (ii), we get:  $x = 40$ .

## Important formulas of time and speed and Distance

1. **Speed, Time and Distance:**

$$\text{Speed} = \left( \frac{\text{Distance}}{\text{Time}} \right), \text{ Time} = \left( \frac{\text{Distance}}{\text{Speed}} \right), \text{ Distance} = (\text{Speed} \times \text{Time}).$$

2. **km/hr to m/sec conversion:**

$$x \text{ km/hr} = \left( x \times \frac{5}{18} \right) \text{ m/sec.}$$

3. **m/sec to km/hr conversion:**

$$x \text{ m/sec} = \left( x \times \frac{18}{5} \right) \text{ km/hr.}$$

4. If the ratio of the speeds of A and B is  $a : b$ , then the ratio of the

the times taken by them to cover the same distance is  $\frac{1}{a} : \frac{1}{b}$  or  $b : a$ .

5. Suppose a man covers a certain distance at  $x$  km/hr and an equal distance at  $y$  km/hr. Then,

the average speed during the whole journey is  $\left( \frac{2xy}{x+y} \right)$  km/hr.

## Compound Interest

### Important formulas of Compound Interest

- Let Principal = P, Rate = R% per annum, Time =  $n$  years.
- When interest is compound Annually:**

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

- When interest is compounded Half-yearly:**

$$\text{Amount} = P \left[ 1 + \frac{(R/2)}{100} \right]^{2n}$$

- When interest is compounded Quarterly:**

$$\text{Amount} = P \left[ 1 + \frac{(R/4)}{100} \right]^{4n}$$

- When interest is compounded Annually but time is in fraction, say  $3\frac{2}{5}$  years.**

$$\text{Amount} = P \left( 1 + \frac{R}{100} \right)^3 \times \left( 1 + \frac{\frac{2}{5}R}{100} \right)$$

- When Rates are different for different years**, say  $R_1\%$ ,  $R_2\%$ ,  $R_3\%$  for 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> year respectively.

$$\text{Then, Amount} = P \left( 1 + \frac{R_1}{100} \right) \left( 1 + \frac{R_2}{100} \right) \left( 1 + \frac{R_3}{100} \right).$$

- Present worth of Rs.  $x$  due  $n$  years hence is given by:**

$$\text{Present Worth} = \frac{x}{\left( 1 + \frac{R}{100} \right)^n}$$

### MCQS:

- A bank offers 5% compound interest calculated on half-yearly basis. A customer deposits Rs. 1600 each on 1<sup>st</sup> January and 1<sup>st</sup> July of a year. At the end of the year, the amount he would have gained by way of interest is:

**A.** Rs. 120

**B.** Rs. 121

**C.** Rs. 122

**D.** Rs. 123

**Answer:** Option B

**Explanation:**

$$\begin{aligned} \text{Amount} &= \text{Rs.} \left[ 1600 \times \left( 1 + \frac{5}{2 \times 100} \right)^2 + 1600 \times \left( 1 + \frac{5}{2 \times 100} \right) \right] \\ &= \text{Rs.} \left[ 1600 \times \frac{41}{40} \times \frac{41}{40} + 1600 \times \frac{41}{40} \right] \end{aligned}$$

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$$\begin{aligned} &= \text{Rs.} \left[ 1600 \times \frac{41}{40} \left( \frac{41}{40} + 1 \right) \right] \\ &= \text{Rs.} \left[ \frac{1600 \times 41 \times 81}{40 \times 40} \right] \\ &= \text{Rs.} 3321. \end{aligned}$$

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$$\therefore \text{C.I.} = \text{Rs.} (3321 - 3200) = \text{Rs.} 121$$

2. The difference between simple and compound interests compounded annually on a certain sum of money for 2 years at 4% per annum is Re. 1. The sum (in Rs.) is:

- A. 625  
B. 630  
C. 640  
D. 650

**Answer:** Option A

**Explanation:**

Let the sum be Rs.  $x$ . Then,

$$\text{C.I.} = \left[ x \left( 1 + \frac{4}{100} \right)^2 - x \right] = \left( \frac{676}{625}x - x \right) = \frac{51}{625}x.$$

$$\text{S.I.} = \left( \frac{x \times 4 \times 2}{100} \right) = \frac{2x}{25}.$$

$$\therefore \frac{51x}{625} - \frac{2x}{25} = 1$$

$$\Rightarrow x = 625.$$

3. There is 60% increase in an amount in 6 years at simple interest. What will be the compound interest of Rs. 12,000 after 3 years at the same rate?

- A. Rs. 2160  
B. Rs. 3120  
C. Rs. 3972  
D. Rs. 6240  
E. None of these

**Answer:** Option C

**Explanation:**

Let  $P = \text{Rs.} 100$ . Then, S.I. Rs. 60 and  $T = 6$  years.

$$\therefore R = \left( \frac{100 \times 60}{100 \times 6} \right) = 10\% \text{ p.a.}$$



## Basic Mathematics

Now,  $P = \text{Rs. } 12000$ .  $T = 3$  years and  $R = 10\%$  p.a.

$$\begin{aligned}\therefore \text{C.I.} &= \text{Rs.} \left[ 12000 \times \left\{ \left( 1 + \frac{10}{100} \right)^3 - 1 \right\} \right] \\ &= \text{Rs.} \left( 12000 \times \frac{331}{1000} \right) \\ &= 3972\end{aligned}$$

4. What is the difference between the compound interests on Rs. 5000 for  $1\frac{1}{2}$  years at 4% per annum compounded yearly and half-yearly?
- A.** Rs. 2.04  
**B.** Rs. 3.06  
**C.** Rs. 4.80  
**D.** Rs. 8.30

**Answer:** Option A

**Explanation:**

$$\begin{aligned}\text{C.I. when interest compounded yearly} &= \text{Rs.} \left[ 5000 \times \left( 1 + \frac{4}{100} \right) \times \left( 1 + \frac{\frac{1}{2} \times 4}{100} \right) \right] \\ &= \text{Rs.} \left( 5000 \times \frac{26}{25} \times \frac{51}{50} \right) \\ &= \text{Rs. } 5304.\end{aligned}$$

$$\begin{aligned}\text{C.I. when interest is compounded half-yearly} &= \text{Rs.} \left[ 5000 \times \left( 1 + \frac{2}{100} \right)^3 \right] \\ &= \text{Rs.} \left( 5000 \times \frac{51}{50} \times \frac{51}{50} \times \frac{51}{50} \right) \\ &= \text{Rs. } 5306.04\end{aligned}$$

$$\therefore \text{Difference} = \text{Rs. } (5306.04 - 5304) = \text{Rs. } 2.04$$

5. The compound interest on Rs. 30,000 at 7% per annum is Rs. 4347. The period (in years) is:
- A.** 2  
**B.**  $2\frac{1}{2}$   
**C.** 3  
**D.** 4

## Basic Mathematics

**Answer:** Option A

**Explanation:**

Amount = Rs. (30000 + 4347) = Rs. 34347.

Let the time be  $n$  years.

$$\begin{aligned} \text{Then, } 30000 \left(1 + \frac{7}{100}\right)^n &= 34347 \\ \Rightarrow \left(\frac{107}{100}\right)^n &= \frac{34347}{30000} = \frac{11449}{10000} = \left(\frac{107}{100}\right)^2 \\ \therefore n &= 2 \text{ years.} \end{aligned}$$

6. What will be the compound interest on a sum of Rs. 25,000 after 3 years at the rate of 12 p.c.p.a.?

- A. Rs. 9000.30
- B. Rs. 9720
- C. Rs. 10123.20
- D. Rs. 10483.20
- E. None of these

**Answer:** Option C

**Explanation:**

$$\begin{aligned} \text{Amount} &= \text{Rs.} \left[ 25000 \times \left(1 + \frac{12}{100}\right)^3 \right] \\ &= \text{Rs.} \left( 25000 \times \frac{28}{25} \times \frac{28}{25} \times \frac{28}{25} \right) \\ &= \text{Rs.} 35123.20 \end{aligned}$$

$$\therefore \text{C.I.} = \text{Rs.} (35123.20 - 25000) = \text{Rs.} 10123.20$$

7. At what rate of compound interest per annum will a sum of Rs. 1200 become Rs. 1348.32 in 2 years?

- A. 6%
- B. 6.5%
- C. 7%
- D. 7.5%

**Answer:** Option A

**Explanation:**

Let the rate be  $R\%$  p.a.

$$\text{Then, } 1200 \times \left(1 + \frac{R}{100}\right)^2 = 1348.32$$

## Basic Mathematics

$$\Rightarrow \left(1 + \frac{R}{100}\right)^2 = \frac{134832}{120000} = \frac{11236}{10000}$$

$$\therefore \left(1 + \frac{R}{100}\right)^2 = \left(\frac{106}{100}\right)^2$$

$$\Rightarrow 1 + \frac{R}{100} = \frac{106}{100}$$

$$\Rightarrow R = 6\%$$

8. The least number of complete years in which a sum of money put out at 20% compound interest will be more than doubled is:

A. 3

B. 4

C. 5

D. 6

**Answer:** Option B

**Explanation:**

$$P \left(1 + \frac{20}{100}\right)^n > 2P \Rightarrow \left(\frac{6}{5}\right)^n > 2.$$

$$\text{Now, } \left(\frac{6}{5} \times \frac{6}{5} \times \frac{6}{5} \times \frac{6}{5}\right) > 2.$$

So,  $n = 4$  years.

9. Albert invested an amount of Rs. 8000 in a fixed deposit scheme for 2 years at compound interest rate 5 p.c.p.a. How much amount will Albert get on maturity of the fixed deposit?

A. Rs. 8600

B. Rs. 8620

C. Rs. 8820

D. None of these

**Answer:** Option C

**Explanation:**

$$\text{Amount} = \text{Rs.} \left[ 8000 \times \left(1 + \frac{5}{100}\right)^2 \right]$$

$$= \text{Rs.} \left[ 8000 \times \frac{21}{20} \times \frac{21}{20} \right]$$

$$= \text{Rs. 8820.}$$

## Basic Mathematics

10. The effective annual rate of interest corresponding to a nominal rate of 6% per annum payable half-yearly is:

A. 6.06%

B. 6.07%

C. 6.08%

D. 6.09%

**Answer:** Option D

**Explanation:**

$$\left. \begin{array}{l} \text{Amount of Rs. 100 for 1 year} \\ \text{when compounded half-yearly} \end{array} \right\} = \text{Rs. } \left[ 100 \times \left( 1 + \frac{3}{100} \right)^2 \right] = \text{Rs. 106.09}$$

$$\therefore \text{Effective rate} = (106.09 - 100)\% = 6.09\%$$

11. Simple interest on a certain sum of money for 3 years at 8% per annum is half the compound interest on Rs. 4000 for 2 years at 10% per annum. The sum placed on simple interest is:

A. Rs. 1550

B. Rs. 1650

C. Rs. 1750

D. Rs. 2000

**Answer:** Option C

**Explanation:**

$$\text{C.I.} = \text{Rs. } \left[ 4000 \times \left( 1 + \frac{10}{100} \right)^2 - 4000 \right]$$

$$= \text{Rs. } \left( 4000 \times \frac{11}{10} \times \frac{11}{10} - 4000 \right)$$

$$= \text{Rs. 840.}$$

$$\therefore \text{Sum} = \text{Rs. } \left( \frac{420 \times 100}{3 \times 8} \right) = \text{Rs. 1750.}$$

12. If the simple interest on a sum of money for 2 years at 5% per annum is Rs. 50, what is the compound interest on the same at the same rate and for the same time?

A. Rs. 51.25

B. Rs. 52

C. Rs. 54.25

D. Rs. 60

**Answer:** Option A

## Basic Mathematics

### Explanation:

$$\text{Sum} = \text{Rs.} \left( \frac{50 \times 100}{2 \times 5} \right) = \text{Rs.} 500.$$

$$\text{Amount} = \text{Rs.} \left[ 500 \times \left( 1 + \frac{5}{100} \right)^2 \right]$$

$$= \text{Rs.} \left( 500 \times \frac{21}{20} \times \frac{21}{20} \right)$$

$$= \text{Rs.} 551.25$$

$$\therefore \text{C.I.} = \text{Rs.} (551.25 - 500) = \text{Rs.} 51.25$$

13. The difference between simple interest and compound on Rs. 1200 for one year at 10% per annum reckoned half-yearly is:

- A. Rs. 2.50
- B. Rs. 3
- C. Rs. 3.75
- D. Rs. 4
- E. None of these

**Answer:** Option B

### Explanation:

$$\text{S.I.} = \text{Rs} \left( \frac{1200 \times 10 \times 1}{100} \right) = \text{Rs.} 120.$$

$$\text{C.I.} = \text{Rs.} \left[ 1200 \times \left( 1 + \frac{5}{100} \right)^2 - 1200 \right] = \text{Rs.} 123.$$

$$\therefore \text{Difference} = \text{Rs.} (123 - 120) = \text{Rs.} 3.$$

14. The difference between compound interest and simple interest on an amount of Rs. 15,000 for 2 years is Rs. 96. What is the rate of interest per annum?

- A. 8
- B. 10
- C. 12
- D. Cannot be determined
- E. None of these

**Answer:** Option A

### Explanation:

$$\left[ 15000 \times \left( 1 + \frac{R}{100} \right)^2 - 15000 \right] - \left( \frac{15000 \times R \times 2}{100} \right) = 96$$

## Basic Mathematics

$$\begin{aligned}\Rightarrow 15000 \left[ \left( 1 + \frac{R}{100} \right)^2 - 1 - \frac{2R}{100} \right] &= 96 \\ \Rightarrow 15000 \left[ \frac{(100 + R)^2 - 10000 - (200 \times R)}{10000} \right] &= 96 \\ \Rightarrow R^2 &= \left( \frac{96 \times 2}{3} \right) = 64 \\ \Rightarrow R &= 8. \\ \therefore \text{Rate} &= 8\%.\end{aligned}$$

15. The compound interest on a certain sum for 2 years at 10% per annum is Rs. 525. The simple interest on the same sum for double the time at half the rate percent per annum is:

- A. Rs. 400
- B. Rs. 500
- C. Rs. 600
- D. Rs. 800

**Answer:** Option B

**Explanation:**

Let the sum be Rs. P.

$$\begin{aligned}\text{Then, } \left[ P \left( 1 + \frac{10}{100} \right)^2 - P \right] &= 525 \\ \Rightarrow P \left[ \left( \frac{11}{10} \right)^2 - 1 \right] &= 525 \\ \Rightarrow P &= \left( \frac{525 \times 100}{21} \right) = 2500.\end{aligned}$$

$\therefore$  Sum = Rs . 2500.

$$\text{So, S.I.} = \text{Rs. } \left( \frac{2500 \times 5 \times 4}{100} \right) = \text{Rs. 500}$$

## Average

Important formulas of average

1. **Average:**

$$\text{Average} = \left( \frac{\text{Sum of observations}}{\text{Number of observations}} \right)$$

2. **Average Speed:**

Suppose a man covers a certain distance at  $x$  kmph and an equal distance at  $y$  kmph.

Then, the average speed during the whole journey is  $\left( \frac{2xy}{x+y} \right)$  kmph.

### MCQS

1. In the first 10 overs of a cricket game, the run rate was only 3.2. What should be the run rate in the remaining 40 overs to reach the target of 282 runs?

**A.** 6.25

**B.** 6.5

**C.** 6.75

**D.** 7

**Answer:** Option A

**Explanation:**

$$\text{Required run rate} = \left( \frac{282 - (3.2 \times 10)}{40} \right) = \frac{250}{40} = 6.25$$

2. A family consists of two grandparents, two parents and three grandchildren. The average age of the grandparents is 67 years, that of the parents is 35 years and that of the grandchildren is 6 years. What is the average age of the family?

**A.**  $28 \frac{4}{7}$  years

**B.**  $31 \frac{5}{7}$  years

**C.**  $32 \frac{1}{7}$  years

**D.** None of these

**Answer:** Option B

**Explanation:**

$$\begin{aligned} \text{Required average} &= \left( \frac{67 \times 2 + 35 \times 2 + 6 \times 3}{2 + 2 + 3} \right) \\ &= \left( \frac{134 + 70 + 18}{7} \right) \end{aligned}$$

## Basic Mathematics

$$= \frac{222}{7}$$
$$= 31 \frac{5}{7} \text{ years.}$$

3. A grocer has a sale of Rs. 6435, Rs. 6927, Rs. 6855, Rs. 7230 and Rs. 6562 for 5 consecutive months. How much sale must he have in the sixth month so that he gets an average sale of Rs. 6500?

- A. Rs. 4991
- B. Rs. 5991
- C. Rs. 6001
- D. Rs. 6991

**Answer:** Option A

**Explanation:**

Total sale for 5 months = Rs. (6435 + 6927 + 6855 + 7230 + 6562) = Rs. 34009.

$$\begin{aligned} \therefore \text{Required sale} &= \text{Rs. } [(6500 \times 6) - 34009] \\ &= \text{Rs. } (39000 - 34009) \\ &= \text{Rs. } 4991. \end{aligned}$$

4. The average of 20 numbers is zero. Of them, at the most, how many may be greater than zero?

- A. 0
- B. 1
- C. 10
- D. 19

**Answer:** Option D

**Explanation:**

Average of 20 numbers = 0.

$$\therefore \text{Sum of 20 numbers } (0 \times 20) = 0.$$

It is quite possible that 19 of these numbers may be positive and if their sum is  $a$  then 20th number is  $(-a)$ .

5. The average weight of 8 person's increases by 2.5 kg when a new person comes in place of one of them weighing 65 kg. What might be the weight of the new person?

- A. 76 kg
- B. 76.5 kg



## Basic Mathematics

- C. 85 kg
- D. Data inadequate
- E. None of these

**Answer:** Option C

**Explanation:**

Total weight increased =  $(8 \times 2.5)$  kg = 20 kg.

Weight of new person =  $(65 + 20)$  kg = 85 kg.

6. The captain of a cricket team of 11 members is 26 years old and the wicket keeper is 3 years older. If the ages of these two are excluded, the average age of the remaining players is one year less than the average age of the whole team. What is the average age of the team?

- A. 23 years
- B. 24 years
- C. 25 years
- D. None of these

**Answer:** Option A

**Explanation:**

Let the average age of the whole team by  $x$  years.

$$\therefore 11x - (26 + 29) = 9(x - 1)$$

$$\Rightarrow 11x - 9x = 46$$

$$\Rightarrow 2x = 46$$

$$\Rightarrow x = 23.$$

So, average age of the team is 23 years.

7. The average monthly income of P and Q is Rs. 5050. The average monthly income of Q and R is Rs. 6250 and the average monthly income of P and R is Rs. 5200. The monthly income of P is:

- A. 3500
- B. 4000
- C. 4050
- D. 5000

**Answer:** Option B

**Explanation:**

Let P, Q and R represent their respective monthly incomes. Then, we have:

$$P + Q = (5050 \times 2) = 10100 \dots (i)$$

$$Q + R = (6250 \times 2) = 12500 \dots (ii)$$

$$P + R = (5200 \times 2) = 10400 \dots (iii)$$

$$\text{Adding (i), (ii) and (iii), we get: } 2(P + Q + R) = 33000 \text{ or } P + Q + R = 16500 \dots (iv)$$

Subtracting (ii) from (iv), we get  $P = 4000$ .

$\therefore$  P's monthly income = Rs. 4000.

## Basic Mathematics

8. The average age of husband, wife and their child 3 years ago was 27 years and that of wife and the child 5 years ago was 20 years. The present age of the husband is:

- A.** 35 years  
**B.** 40 years  
**C.** 50 years  
**D.** None of these

**Answer:** Option B

**Explanation:**

Sum of the present ages of husband, wife and child =  $(27 \times 3 + 3 \times 3)$  years = 90 years.

Sum of the present ages of wife and child =  $(20 \times 2 + 5 \times 2)$  years = 50 years.

∴ Husband's present age =  $(90 - 50)$  years = 40 years.

9. A car owner buys petrol at Rs.7.50, Rs. 8 and Rs. 8.50 per litre for three successive years. What approximately is the average cost per litre of petrol if he spends Rs. 4000 each year?

- A.** Rs. 7.98  
**B.** Rs. 8  
**C.** Rs. 8.50  
**D.** Rs. 9

پاکستان کی سب سے بڑی پاسٹ پیپر ویب سائٹ۔ پی ڈی ایف میں ڈلوڈ کرنے کے لیے گوگل پر سرچ کریں

## TestPoint.Pk

**Answer:** Option A

**Explanation:**

$$\text{Total quantity of petrol consumed in 3 years} = \left( \frac{4000}{7.50} + \frac{4000}{8} + \frac{4000}{8.50} \right) \text{ litres}$$

$$= 4000 \left( \frac{2}{15} + \frac{1}{8} + \frac{2}{17} \right) \text{ litres}$$

$$= \left( \frac{76700}{51} \right) \text{ litres}$$

Total amount spent = Rs.  $(3 \times 4000)$  = Rs. 12000.

$$\therefore \text{Average cost} = \text{Rs.} \left( \frac{12000 \times 51}{76700} \right) = \text{Rs.} \frac{6120}{767} = \text{Rs.} 7.98$$

10. In Arun's opinion, his weight is greater than 65 kg but less than 72 kg. His brother does not agree with Arun and he thinks that Arun's weight is greater than 60 kg but less than 70 kg. His mother's view is that his weight cannot be greater than 68 kg. If all are them are correct in their estimation, what is the average of different probable weights of Arun?

- A.** 67 kg.  
**B.** 68 kg.  
**C.** 69 kg.

## Basic Mathematics

**D.** Data inadequate

**E.** None of these

**Answer:** Option A

**Explanation:**

Let Arun's weight by X kg.

According to Arun,  $65 < X < 72$

According to Arun's brother,  $60 < X < 70$ .

According to Arun's mother,  $X \leq 68$

The values satisfying all the above conditions are 66, 67 and 68.

$$\therefore \text{Required average} = \left( \frac{66 + 67 + 68}{3} \right) = \left( \frac{201}{3} \right) = 67 \text{ kg.}$$

11. The average weight of A, B and C is 45 kg. If the average weight of A and B be 40 kg and that of B and C be 43 kg, then the weight of B is:

**A.** 17 kg

**B.** 20 kg

**C.** 26 kg

**D.** 31 kg

**Answer:** Option D

**Explanation:**

Let A, B, C represent their respective weights. Then, we have:

$$A + B + C = (45 \times 3) = 135 \dots (i)$$

$$A + B = (40 \times 2) = 80 \dots (ii)$$

$$B + C = (43 \times 2) = 86 \dots (iii)$$

$$\text{Adding (ii) and (iii), we get: } A + 2B + C = 166 \dots (iv)$$

$$\text{Subtracting (i) from (iv), we get : } B = 31.$$

$$\therefore \text{B's weight} = 31 \text{ kg.}$$

12. The average weight of 16 boys in a class is 50.25 kg and that of the remaining 8 boys is 45.15 kg. Find the average weights of all the boys in the class.

**A.** 47.55 kg

**B.** 48 kg

**C.** 48.55 kg

**D.** 49.25 kg

**Answer:** Option C

**Explanation:**

## Basic Mathematics

$$\begin{aligned}\text{Required average} &= \left( \frac{50.25 \times 16 + 45.15 \times 8}{16 + 8} \right) \\ &= \left( \frac{804 + 361.20}{24} \right) \\ &= \frac{1165.20}{24} \\ &= 48.55\end{aligned}$$

13. A library has an average of 510 visitors on Sundays and 240 on other days. The average number of visitors per day in a month of 30 days beginning with a Sunday is:

- A. 250
- B. 276
- C. 280
- D. 285

**Answer:** Option D

**Explanation:**

Since the month begins with a Sunday, there will be five Sundays in the month.

$$\begin{aligned}\text{Required average} &= \left( \frac{510 \times 5 + 240 \times 25}{30} \right) \\ &= \frac{8550}{30} \\ &= 285\end{aligned}$$

14. If the average marks of three batches of 55, 60 and 45 students respectively is 50, 55, 60, then the average marks of all the students is:

- A. 53.33
- B. 54.68
- C. 55
- D. None of these

**Answer:** Option B

**Explanation:**

$$\begin{aligned}\text{Required average} &= \left( \frac{55 \times 50 + 60 \times 55 + 45 \times 60}{55 + 60 + 45} \right) \\ &= \left( \frac{2750 + 3300 + 2700}{160} \right)\end{aligned}$$

## Basic Mathematics

$$\begin{aligned} &= \frac{8750}{160} \\ &= 54.68 \end{aligned}$$

15. A pupil's marks were wrongly entered as 83 instead of 63. Due to that the average marks for the class got increased by half ( $1/2$ ). The number of pupils in the class is:

- A. 10
- B. 20
- C. 40
- D. 73

**Answer:** Option C

**Explanation:**

Let there be  $x$  pupils in the class.

$$\text{Total increase in marks} = \left( x \times \frac{1}{2} \right) = \frac{x}{2}$$

$$\therefore \frac{x}{2} = (83 - 63) \Rightarrow \frac{x}{2} = 20 \Rightarrow x = 40.$$

## Profit and Loss

### IMPORTANT FACTS

**Cost Price:**

The price, at which an article is purchased, is called its **cost price**, abbreviated as **C.P.**

**Selling Price:**

The price, at which an article is sold, is called its **selling prices**, abbreviated as **S.P.**

**Profit or Gain:**

If S.P. is greater than C.P., the seller is said to have a **profit** or **gain**.

**Loss:**

If S.P. is less than C.P., the seller is said to have incurred a **loss**.

### IMPORTANT FORMULAE

- Gain = (S.P.) - (C.P.)
- Loss = (C.P.) - (S.P.)
- Loss or gain is always reckoned on C.P.
- Gain Percentage: (Gain %)  

$$\text{Gain \%} = \left( \frac{\text{Gain} \times 100}{\text{C.P.}} \right)$$
- Loss Percentage: (Loss %)  

$$\text{Loss \%} = \left( \frac{\text{Loss} \times 100}{\text{C.P.}} \right)$$
- Selling Price: (S.P.)  

$$\text{SP} = \left[ \frac{(100 + \text{Gain \%})}{100} \times \text{C.P.} \right]$$
- Selling Price: (S.P.)  

$$\text{SP} = \left[ \frac{(100 - \text{Loss \%})}{100} \times \text{C.P.} \right]$$
- Cost Price: (C.P.)  

$$\text{C.P.} = \left[ \frac{100}{(100 + \text{Gain \%})} \times \text{S.P.} \right]$$
- Cost Price: (C.P.)  

$$\text{C.P.} = \left[ \frac{100}{(100 - \text{Loss \%})} \times \text{S.P.} \right]$$
- If an article is sold at a gain of say 35%, then S.P. = 135% of C.P.
- If an article is sold at a loss of say, 35% then S.P. = 65% of C.P.
- When a person sells two similar items, one at a gain of say  $x\%$ , and the other at a loss of  $x\%$ , then the seller always incurs a loss given by:  

$$\text{Loss \%} = \left( \frac{\text{Common Loss and Gain \%}}{10} \right)^2 = \left( \frac{x}{10} \right)^2.$$
- If a trader professes to sell his goods at cost price, but uses false weights, then  

$$\text{Gain \%} = \left[ \frac{\text{Error}}{(\text{True Value}) - (\text{Error})} \times 100 \right] \%$$

### MCQ

- Alfred buys an old scooter for Rs. 4700 and spends Rs. 800 on its repairs. If he sells the scooter for Rs. 5800, his gain percent is:

**A.**  $4\frac{4}{7}\%$

**B.**  $5\frac{5}{11}\%$

**C.** 10%

## Basic Mathematics

**D.** 12%

**Answer:** Option B

**Explanation:**

Cost Price (C.P.) = Rs. (4700 + 800) = Rs. 5500.

Selling Price (S.P.) = Rs. 5800.

Gain = (S.P.) - (C.P.) = Rs.(5800 - 5500) = Rs. 300.

$$\text{Gain \%} = \left( \frac{300}{5500} \times 100 \right) \% = 5\frac{5}{11}\%$$

2. The cost price of 20 articles is the same as the selling price of  $x$  articles. If the profit is 25%, then the value of  $x$  is:

**A.** 15

**B.** 16

**C.** 18

**D.** 25

**Answer:** Option B

**Explanation:**

Let C.P. of each article be Re. 1 C.P. of  $x$  articles = Rs.  $x$ .

S.P. of  $x$  articles = Rs. 20.

Profit = Rs. (20 -  $x$ ).

$$\therefore \left( \frac{20 - x}{x} \times 100 = 25 \right)$$

$$\Rightarrow 2000 - 100x = 25x$$

$$125x = 2000$$

$$\Rightarrow x = 16.$$

3. If selling price is doubled, the profit triples. Find the profit percent.

**A.**  $66\frac{2}{3}$

**B.** 100

**C.**  $105\frac{1}{3}$

**D.** 120

**Answer:** Option B

**Explanation:**

Let C.P. be Rs.  $x$  and S.P. be Rs.  $y$ .

Then,  $3(y - x) = (2y - x) \Rightarrow y = 2x$ .

Profit = Rs. ( $y - x$ ) = Rs. ( $2x - x$ ) = Rs.  $x$ .

$$\therefore \text{Profit \%} = \left( \frac{x}{x} \times 100 \right) \% = 100\%$$

## Basic Mathematics

4. In a certain store, the profit is 320% of the cost. If the cost increases by 25% but the selling price remains constant, approximately what percentage of the selling price is the profit?

- A. 30%
- B. 70%
- C. 100%
- D. 250%

**Answer:** Option B

**Explanation:**

Let C.P. = Rs. 100. Then, Profit = Rs. 320, S.P. = Rs. 420.

New C.P. = 125% of Rs. 100 = Rs. 125

New S.P. = Rs. 420.

Profit = Rs. (420 - 125) = Rs. 295.

$$\therefore \text{Required percentage} = \left( \frac{295}{420} \times 100 \right) \% = \frac{1475}{21} \% = 70\% \text{ (approximately).}$$

5. A vendor bought toffees at 6 for a rupee. How many for a rupee must he sell to gain 20%?

- A. 3
- B. 4
- C. 5
- D. 6

**Answer:** Option C

**Explanation:**

C.P. of 6 toffees = Re. 1

S.P. of 6 toffees = 120% of Re. 1 = Rs.  $\frac{6}{5}$

For Rs.  $\frac{6}{5}$ , toffees sold = 6.

For Re. 1, toffees sold =  $\left( 6 \times \frac{5}{6} \right) = 5$ .

6. The percentage profit earned by selling an article for Rs. 1920 is equal to the percentage loss incurred by selling the same article for Rs. 1280. At what price should the article be sold to make 25% profit?

- A. Rs. 2000
- B. Rs. 2200
- C. Rs. 2400
- D. Data inadequate

**Answer:** Option A

**Explanation:**



## Basic Mathematics

Let C.P. be Rs.  $x$ .

$$\text{Then, } \frac{1920 - x}{x} \times 100 = \frac{x - 1280}{x} \times 100$$

$$\Rightarrow 1920 - x = x - 1280$$

$$\Rightarrow 2x = 3200$$

$$\Rightarrow x = 1600$$

$$\therefore \text{ Required S.P.} = 125\% \text{ of Rs. } 1600 = \text{Rs. } \left( \frac{125}{100} \times 1600 \right) = \text{Rs } 2000.$$

7. A shopkeeper expects a gain of 22.5% on his cost price. If in a week, his sale was of Rs. 392, what was his profit?

A. Rs. 18.20

B. Rs. 70

C. Rs. 72

D. Rs. 88.25

**Answer:** Option C

**Explanation:**

$$\text{C.P.} = \text{Rs. } \left( \frac{100}{122.5} \times 392 \right) = \text{Rs. } \left( \frac{1000}{1225} \times 392 \right) = \text{Rs. } 320$$

$$\therefore \text{ Profit} = \text{Rs. } (392 - 320) = \text{Rs. } 72.$$

8. A man buys a cycle for Rs. 1400 and sells it at a loss of 15%. What is the selling price of the cycle?

A. Rs. 1090

B. Rs. 1160

C. Rs. 1190

D. Rs. 1202

**Answer:** Option C

**Explanation:**

$$\text{S.P.} = 85\% \text{ of Rs. } 1400 = \text{Rs. } \left( \frac{85}{100} \times 1400 \right) = \text{Rs. } 1190$$

9. Sam purchased 20 dozens of toys at the rate of Rs. 375 per dozen. He sold each one of them at the rate of Rs. 33. What was his percentage profit?

A. 3.5

B. 4.5

C. 5.6

D. 6.5

**Answer:** Option C

## Basic Mathematics

### Explanation:

$$\text{Cost Price of 1 toy} = \text{Rs. } \left( \frac{375}{12} \right) = \text{Rs. } 31.25$$

$$\text{Selling Price of 1 toy} = \text{Rs. } 33$$

$$\text{So, Gain} = \text{Rs. } (33 - 31.25) = \text{Rs. } 1.75$$

$$\therefore \text{Profit \%} = \left( \frac{1.75}{31.25} \times 100 \right) \% = \frac{28}{5} \% = 5.6\%$$

10 Some articles were bought at 6 articles for Rs. 5 and sold at 5 articles for Rs. 6. Gain percent is:

A. 30%

B.  $33\frac{1}{3}\%$

C. 35%

D. 44%

**Answer:** Option D

### Explanation:

Suppose, number of articles bought = L.C.M. of 6 and 5 = 30.

$$\text{C.P. of 30 articles} = \text{Rs. } \left( \frac{5}{6} \times 30 \right) = \text{Rs. } 25.$$

$$\text{S.P. of 30 articles} = \text{Rs. } \left( \frac{6}{5} \times 30 \right) = \text{Rs. } 36.$$

$$\therefore \text{Gain \%} = \left( \frac{11}{25} \times 100 \right) \% = 44\%.$$

11. On selling 17 balls at Rs. 720, there is a loss equal to the cost price of 5 balls. The cost price of a ball is:

A. Rs. 45

B. Rs. 50

C. Rs. 55

D. Rs. 60

**Answer:** Option D

### Explanation:

$$(\text{C.P. of 17 balls}) - (\text{S.P. of 17 balls}) = (\text{C.P. of 5 balls})$$

$$\Rightarrow \text{C.P. of 12 balls} = \text{S.P. of 17 balls} = \text{Rs. } 720.$$

$$\Rightarrow \text{C.P. of 1 ball} = \text{Rs. } \left( \frac{720}{12} \right) = \text{Rs. } 60.$$

## Basic Mathematics

12. When a plot is sold for Rs. 18,700, the owner loses 15%. At what price must that plot be sold in order to gain 15%?

**A.** Rs. 21,000

**B.** Rs. 22,500

**C.** Rs. 25,300

**D.** Rs. 25,800

**Answer:** Option C

**Explanation:**

$$85 : 18700 = 115 : x$$

$$\Rightarrow x = \left( \frac{18700 \times 115}{85} \right) = 25300.$$

Hence, S.P. = Rs. 25,300.

13. 100 oranges are bought at the rate of Rs. 350 and sold at the rate of Rs. 48 per dozen. The percentage of profit or loss is:

**A.**  $14\frac{2}{7}\%$  gain

**B.** 15% gain

**C.**  $14\frac{2}{7}\%$  loss

**D.** 15 % loss

**Answer:** Option A

**Explanation:**

$$\text{C.P. of 1 orange} = \text{Rs. } \left( \frac{350}{100} \right) = \text{Rs. } 3.50$$

$$\text{S.P. of 1 orange} = \text{Rs. } \left( \frac{48}{12} \right) = \text{Rs. } 4$$

$$\therefore \text{Gain\%} = \left( \frac{0.50}{3.50} \times 100 \right) \% = \frac{100}{7} \% = 14\frac{2}{7}\%$$

14. A shopkeeper sells one transistor for Rs. 840 at a gain of 20% and another for Rs. 960 at a loss of 4%. His total gain or loss percent is:

**A.**  $5\frac{15}{17}\%$  loss

**B.**  $5\frac{15}{17}\%$  gain

**C.**  $6\frac{2}{3}\%$  gain

**D.** None of these

**Answer:** Option B

## Basic Mathematics

### Explanation:

$$\text{C.P. of 1st transistor} = \text{Rs. } \left( \frac{100}{120} \times 840 \right) = \text{Rs. } 700.$$

$$\text{C.P. of 2nd transistor} = \text{Rs. } \left( \frac{100}{96} \times 960 \right) = \text{Rs. } 1000$$

So, total C.P. = Rs. (700 + 1000) = Rs. 1700.

Total S.P. = Rs. (840 + 960) = Rs. 1800.

$$\therefore \text{Gain \%} = \left( \frac{100}{1700} \times 100 \right)_{\%} = 5\frac{15}{17}\%$$

15. A trader mixes 26 kg of rice at Rs. 20 per kg with 30 kg of rice of other variety at Rs. 36 per kg and sells the mixture at Rs. 30 per kg. His profit percent is:

- A. No profit, no loss
- B. 5%
- C. 8%
- D. 10%
- E. None of these

**Answer:** Option **B**

### Explanation:

C.P. of 56 kg rice = Rs. (26 x 20 + 30 x 36) = Rs. (520 + 1080) = Rs. 1600.

S.P. of 56 kg rice = Rs. (56 x 30) = Rs. 1680.

$$\therefore \text{Gain} = \left( \frac{80}{1600} \times 100 \right)_{\%} = 5\%.$$

## Percentage

### 1. Concept of Percentage:

By a certain **percent**, we mean that many hundredths.  
Thus, x percent means x hundredths, written as x%.

To express x% as a fraction: We have,  $x\% = \frac{x}{100}$ .

$$\text{Thus, } 20\% = \frac{20}{100} = \frac{1}{5}.$$

To express  $\frac{a}{b}$  as a percent: We have,  $\frac{a}{b} = \left(\frac{a}{b} \times 100\right)\%$ .

$$\text{Thus, } \frac{1}{4} = \left(\frac{1}{4} \times 100\right)\% = 25\%.$$

### 2. Percentage Increase/Decrease:

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

$$\left[\frac{R}{(100 + R)} \times 100\right]\%$$

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

$$\left[\frac{R}{(100 - R)} \times 100\right]\%$$

### 3. Results on Population:

Let the population of a town be P now and suppose it increases at the rate of R% per annum, then:

$$1. \text{ Population after } n \text{ years} = P \left(1 + \frac{R}{100}\right)^n$$

$$2. \text{ Population } n \text{ years ago} = \frac{P}{\left(1 + \frac{R}{100}\right)^n}$$

### 4. Results on Depreciation:

Let the present value of a machine be P. Suppose it depreciates at the rate of R% per annum. Then:

$$1. \text{ Value of the machine after } n \text{ years} = P \left(1 - \frac{R}{100}\right)^n$$

$$2. \text{ Value of the machine } n \text{ years ago} = \frac{P}{\left(1 - \frac{R}{100}\right)^n}$$

$$3. \text{ If A is R\% more than B, then B is less than A by } \left[\frac{R}{(100 + R)} \times 100\right]\%.$$

$$4. \text{ If A is R\% less than B, then B is more than A by } \left[\frac{R}{(100 - R)} \times 100\right]\%.$$

## Basic Mathematics

1. A batsman scored 110 runs which included 3 boundaries and 8 sixes. What percent of his total score did he make by running between the wickets?

A. 45%

B.  $45\frac{5}{11}\%$

C.  $54\frac{6}{11}\%$

D. 55%

**Answer:** Option B

**Explanation:**

$$\text{Number of runs made by running} = 110 - (3 \times 4 + 8 \times 6)$$

$$= 110 - (60)$$

$$= 50.$$

$$\therefore \text{Required percentage} = \left( \frac{50}{110} \times 100 \right) \% = 45\frac{5}{11}\%$$

2. Two students appeared at an examination. One of them secured 9 marks more than the other and his marks was 56% of the sum of their marks. The marks obtained by them are:

A. 39, 30

B. 41, 32

C. 42, 33

D. 43, 34

**Answer:** Option C

**Explanation:**

Let their marks be  $(x + 9)$  and  $x$ .

$$\text{Then, } x + 9 = \frac{56}{100}(x + 9 + x)$$

$$\Rightarrow 25(x + 9) = 14(2x + 9)$$

$$\Rightarrow 3x = 99$$

$$\Rightarrow x = 33$$

So, their marks are 42 and 33.

3. A fruit seller had some apples. He sells 40% apples and still has 420 apples. Originally, he had:

A. 588 apples

B. 600 apples

C. 672 apples

D. 700 apples

**Answer:** Option D

**Explanation:**

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## Basic Mathematics

Suppose originally he had  $x$  apples.

Then,  $(100 - 40)\%$  of  $x = 420$ .

$$\Rightarrow \frac{60}{100} \times x = 420$$

$$\Rightarrow x = \left( \frac{420 \times 100}{60} \right) = 700.$$

4. What percentage of numbers from 1 to 70 have 1 or 9 in the unit's digit?

A. 1

B. 14

C. 20

D. 21

**Answer:** Option C

**Explanation:**

Clearly, the numbers which have 1 or 9 in the unit's digit, have squares that end in the digit 1. Such numbers from 1 to 70 are 1, 9, 11, 19, 21, 29, 31, 39, 41, 49, 51, 59, 61, 69.

Number of such number = 14

$$\therefore \text{Required percentage} = \left( \frac{14}{70} \times 100 \right) \% = 20\%.$$

5. If  $A = x\%$  of  $y$  and  $B = y\%$  of  $x$ , then which of the following is true?

A. A is smaller than B.

B. A is greater than B

C. Relationship between A and B cannot be determined.

D. If  $x$  is smaller than  $y$ , then A is greater than B.

E. None of these

**Answer:** Option E

**Explanation:**

$$x\% \text{ of } y = \left( \frac{x}{100} \times y \right) = \left( \frac{y}{100} \times x \right) = y\% \text{ of } x$$

$$\therefore A = B.$$

6. If 20% of  $a = b$ , then  $b\%$  of 20 is the same as:

A. 4% of  $a$

B. 5% of  $a$

C. 20% of  $a$

D. None of these

Answer: Option A

## Basic Mathematics

Explanation:

$$20\% \text{ of } a = b \Rightarrow \frac{20}{100}a = b.$$

$$\therefore b\% \text{ of } 20 = \left( \frac{b}{100} \times 20 \right) = \left( \frac{20}{100}a \times \frac{1}{100} \times 20 \right) = \frac{4}{100}a = 4\% \text{ of } a.$$

7. 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 of age which is 48. What is the total number of students in the school?

- A. 72
- B. 80
- C. 120
- D. 150
- E. 100

**Answer:** Option E

**Explanation:**

Let the number of students be  $x$ . Then,

Number of students above 8 years of age =  $(100 - 20)\%$  of  $x = 80\%$  of  $x$ .

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

$$\Rightarrow \frac{80}{100}x = 80$$

$$\Rightarrow x = 100.$$

8. Two numbers A and B are such that the sum of 5% of A and 4% of B is two-third of the sum of 6% of A and 8% of B. Find the ratio of A : B.

- A. 2 : 3
- B. 1 : 1
- C. 3 : 4
- D. 4 : 3

**Answer:** Option D

**Explanation:**

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

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

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

$$\Rightarrow \left( \frac{1}{20} - \frac{1}{25} \right) A = \left( \frac{4}{75} - \frac{1}{25} \right) B$$

$$\Rightarrow \frac{1}{100}A = \frac{1}{75}B$$



## Basic Mathematics

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

∴ Required ratio = 4 : 3

9. A student multiplied a number by  $\frac{3}{5}$  instead of  $\frac{5}{3}$ .

What is the percentage error in the calculation?

A. 34%

B. 44%

C. 54%

D. 64%

**Answer:** Option D

**Explanation:**

Let the number be  $x$ .

$$\text{Then, error} = \frac{5}{3}x - \frac{3}{5}x = \frac{16}{15}x.$$

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

10. In an election between two candidates, one got 55% of the total valid votes, 20% of the votes were invalid. If the total number of votes was 7500, the number of valid votes that the other candidate got, was:

A. 2700

B. 2900

C. 3000

D. 3100

**Answer:** Option A

**Explanation:**

Number of valid votes = 80% of 7500 = 6000.

∴ Valid votes polled by other candidate = 45% of 6000

$$= \left( \frac{45}{100} \times 6000 \right) = 2700.$$

11. Three candidates contested an election and received 1136, 7636 and 11628 votes respectively. What percentage of the total votes did the winning candidate get?

A. 57%

B. 60%

C. 65%

D. 90%

## Basic Mathematics

**Answer:** Option A

**Explanation:**

Total number of votes polled =  $(1136 + 7636 + 11628) = 20400$ .

$$\therefore \text{Required percentage} = \left( \frac{11628}{20400} \times 100 \right) \% = 57\%.$$

12. Two tailor's X and Y are paid a total of Rs. 550 per week by their employer. If X is paid 120 percent of the sum paid to Y, how much is Y paid per week?

- A.** Rs. 200
- B.** Rs. 250
- C.** Rs. 300
- D.** None of these

**Answer:** Option B

**Explanation:**

Let the sum paid to Y per week be Rs.  $z$ .

Then,  $z + 120\%$  of  $z = 550$ .

$$\Rightarrow z + \frac{120}{100}z = 550$$

$$\Rightarrow \frac{11}{5}z = 550$$

$$\Rightarrow z = \left( \frac{550 \times 5}{11} \right) = 250.$$

13. Gauri went to the stationers and bought things worth Rs. 25, out of which 30 paise went on sales tax on taxable purchases. If the tax rate was 6%, then what was the cost of the tax free items?

- A.** Rs. 15
- B.** Rs. 15.70
- C.** Rs. 19.70
- D.** Rs. 20

**Answer:** Option C

**Explanation:**

Let the amount taxable purchases be Rs.  $x$ .

$$\text{Then, } 6\% \text{ of } x = \frac{30}{100}$$

$$\Rightarrow x = \left( \frac{30}{100} \times \frac{100}{6} \right) = 5.$$

$$\therefore \text{Cost of tax free items} = \text{Rs. } [25 - (5 + 0.30)] = \text{Rs. } 19.70$$

## Basic Mathematics

14. Rajeev buys good worth Rs. 6650. He gets a rebate of 6% on it. After getting the rebate, he pays sales tax @ 10%. Find the amount he will have to pay for the goods.

- [A.](#) Rs. 6876.10
- [B.](#) Rs. 6999.20
- [C.](#) Rs. 6654
- [D.](#) Rs. 7000

**Answer:** Option A

**Explanation:**

$$\text{Rebate} = 6\% \text{ of Rs. } 6650 = \text{Rs. } \left( \frac{6}{100} \times 6650 \right) = \text{Rs. } 399.$$

$$\text{Sales tax} = 10\% \text{ of Rs. } (6650 - 399) = \text{Rs. } \left( \frac{10}{100} \times 6251 \right) = \text{Rs. } 625.10$$

$$\therefore \text{Final amount} = \text{Rs. } (6251 + 625.10) = \text{Rs. } 6876.10$$

15. The population of a town increased from 1,75,000 to 2,62,500 in a decade. The average percent increase of population per year is:

- [A.](#) 4.37%
- [B.](#) 5%
- [C.](#) 6%
- [D.](#) 8.75%

**Answer:** Option B

**Explanation:**

$$\text{Increase in 10 years} = (262500 - 175000) = 87500.$$

$$\text{Increase\%} = \left( \frac{87500}{175000} \times 100 \right) \% = 50\%.$$

$$\therefore \text{Required average} = \left( \frac{50}{10} \right) \% = 5\%.$$

## Simple Interest

1. **Principal:**

The money borrowed or lent out for a certain period is called the **principal** or the **sum**.

2. **Interest:**

Extra money paid for using other's money is called **interest**.

3. **Simple Interest (S.I.):**

If the interest on a sum borrowed for certain period is reckoned uniformly, then it is called **simple interest**.

Let Principal = P, Rate = R% per annum (p.a.) and Time = T years. Then

(i). Simple Interest =  $\left( \frac{P \times R \times T}{100} \right)$

(ii).  $P = \left( \frac{100 \times \text{S.I.}}{R \times T} \right)$ ;  $R = \left( \frac{100 \times \text{S.I.}}{P \times T} \right)$  and  $T = \left( \frac{100 \times \text{S.I.}}{P \times R} \right)$ .

1. A sum of money at simple interest amounts to Rs. 815 in 3 years and to Rs. 854 in 4 years. The sum is:

A. Rs. 650

B. Rs. 690

C. Rs. 698

D. Rs. 700

**Answer:** Option C

**Explanation:**

S.I. for 1 year = Rs. (854 - 815) = Rs. 39.

S.I. for 3 years = Rs.(39 x 3) = Rs. 117.

∴ Principal = Rs. (815 - 117) = Rs. 698.

2. Mr. Thomas invested an amount of Rs. 13,900 divided in two different schemes A and B at the simple interest rate of 14% p.a. and 11% p.a. respectively. If the total amount of simple interest earned in 2 years be Rs. 3508, what was the amount invested in Scheme B?

A. Rs. 6400

B. Rs. 6500

C. Rs. 7200

D. Rs. 7500

E. None of these

**Answer:** Option A

**Explanation:**

## Basic Mathematics

Let the sum invested in Scheme A be Rs.  $x$  and that in Scheme B be Rs.  $(13900 - x)$ .

$$\text{Then, } \left( \frac{x \times 14 \times 2}{100} \right) + \left( \frac{(13900 - x) \times 11 \times 2}{100} \right) = 3508$$

$$\Rightarrow 28x - 22x = 350800 - (13900 \times 22)$$

$$\Rightarrow 6x = 45000$$

$$\Rightarrow x = 7500.$$

So, sum invested in Scheme B = Rs.  $(13900 - 7500) = \text{Rs. } 6400$ .

3. A sum fetched a total simple interest of Rs. 4016.25 at the rate of 9 p.c.p.a. in 5 years. What is the sum?

A. Rs. 4462.50

B. Rs. 8032.50

C. Rs. 8900

D. Rs. 8925

E. None of these

**Answer:** Option D

**Explanation:**

$$\text{Principal} = \text{Rs. } \left( \frac{100 \times 4016.25}{9 \times 5} \right)$$

$$= \text{Rs. } \left( \frac{401625}{45} \right)$$

$$= \text{Rs. } 8925.$$

4. How much time will it take for an amount of Rs. 450 to yield Rs. 81 as interest at 4.5% per annum of simple interest?

A. 3.5 years

B. 4 years

C. 4.5 years

D. 5 years

**Answer:** Option B

## Basic Mathematics

### Explanation:

$$\text{Time} = \left( \frac{100 \times 81}{450 \times 4.5} \right) \text{ years} = 4 \text{ years.}$$

5. Reena took a loan of Rs. 1200 with simple interest for as many years as the rate of interest. If she paid Rs. 432 as interest at the end of the loan period, what was the rate of interest?

- A. 3.6
- B. 6
- C. 18
- D. Cannot be determined
- E. None of these

**Answer:** Option B

### Explanation:

Let rate = R% and time = R years.

$$\text{Then, } \left( \frac{1200 \times R \times R}{100} \right) = 432$$

$$\Rightarrow 12R^2 = 432$$

$$\Rightarrow R^2 = 36$$

$$\Rightarrow R = 6.$$

6. A sum of Rs. 12,500 amounts to Rs. 15,500 in 4 years at the rate of simple interest. What is the rate of interest?

- A. 3%
- B. 4%
- C. 5%
- D. 6%
- E. None of these

**Answer:** Option D

### Explanation:

$$\text{S.I.} = \text{Rs. } (15500 - 12500) = \text{Rs. } 3000.$$

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## Basic Mathematics

$$\text{Rate} = \left( \frac{100 \times 3000}{12500 \times 4} \right) \% = 6\%$$

7. An automobile financier claims to be lending money at simple interest, but he includes the interest every six months for calculating the principal. If he is charging an interest of 10%, the effective rate of interest becomes:

- A.** 10%
- B.** 10.25%
- C.** 10.5%
- D.** None of these

Answer: Option B

Explanation:

Let the sum be Rs. 100. Then,

$$\text{S.I. for first 6 months} = \text{Rs.} \left( \frac{100 \times 10 \times 1}{100 \times 2} \right) = \text{Rs.} 5$$

$$\text{S.I. for last 6 months} = \text{Rs.} \left( \frac{105 \times 10 \times 1}{100 \times 2} \right) = \text{Rs.} 5.25$$

So, amount at the end of 1 year = Rs. (100 + 5 + 5.25) = Rs. 110.25

∴ Effective rate = (110.25 - 100) = 10.25%

8. A lent Rs. 5000 to B for 2 years and Rs. 3000 to C for 4 years on simple interest at the same rate of interest and received Rs. 2200 in all from both of them as interest. The rate of interest per annum is:

- A.** 5%
- B.** 7%
- C.**  $7\frac{1}{8}\%$
- D.** 10%

Answer: Option D

Explanation:

## Basic Mathematics

Let the rate be R% p.a.

$$\text{Then, } \left( \frac{5000 \times R \times 2}{100} \right) + \left( \frac{3000 \times R \times 4}{100} \right) = 2200.$$

$$\Rightarrow 100R + 120R = 2200$$

$$\Rightarrow R = \left( \frac{2200}{220} \right) = 10.$$

∴ Rate = 10%.

9. A sum of Rs. 725 is lent in the beginning of a year at a certain rate of interest. After 8 months, a sum of Rs. 362.50 more is lent but at the rate twice the former. At the end of the year, Rs. 33.50 is earned as interest from both the loans. What was the original rate of interest?

- A. 3.6%
- B. 4.5%
- C. 5%
- D. 6%
- E. None of these

**Answer:** Option E

**Explanation:**

Let the original rate be R%. Then, new rate = (2R)%.

Note:

Here, original rate is for 1 year(s); the new rate is for only 4 months i.e.  $\frac{1}{3}$  year(s).

$$\therefore \left( \frac{725 \times R \times 1}{100} \right) + \left( \frac{362.50 \times 2R \times 1}{100 \times 3} \right) = 33.50$$

$$\Rightarrow (2175 + 725) R = 33.50 \times 100 \times 3$$

$$\Rightarrow (2175 + 725) R = 10050$$

$$\Rightarrow (2900)R = 10050$$

$$\Rightarrow R = \frac{10050}{2900} = 3.46$$

∴ Original rate = 3.46%



## Basic Mathematics

10. A man took loan from a bank at the rate of 12% p.a. simple interest. After 3 years he had to pay Rs. 5400 interest only for the period. The principal amount borrowed by him was:

- A. Rs. 2000
- B. Rs. 10,000
- C. Rs. 15,000
- D. Rs. 20,000

**Answer:** Option C

**Explanation:**

$$\text{Principal} = \text{Rs.} \left( \frac{100 \times 5400}{12 \times 3} \right) = \text{Rs.} 15000.$$

11. A sum of money amounts to Rs. 9800 after 5 years and Rs. 12005 after 8 years at the same rate of simple interest. The rate of interest per annum is:

- A. 5%
- B. 8%
- C. 12%
- D. 15%

**Answer:** Option C

**Explanation:**

$$\text{S.I. for 3 years} = \text{Rs.} (12005 - 9800) = \text{Rs.} 2205.$$

$$\text{S.I. for 5 years} = \text{Rs.} \left( \frac{2205}{3} \times 5 \right) = \text{Rs.} 3675$$

$$\therefore \text{Principal} = \text{Rs.} (9800 - 3675) = \text{Rs.} 6125.$$

$$\text{Hence, rate} = \left( \frac{100 \times 3675}{6125 \times 5} \right) \% = 12\%$$

12. What will be the ratio of simple interest earned by certain amount at the same rate of interest for 6 years and that for 9 years?

- A. 1 : 3
- B. 1 : 4

## Basic Mathematics

C. 2 : 3

D. Data inadequate

E. None of these

**Answer:** Option C

**Explanation:**

Let the principal be P and rate of interest be R%.

$$\therefore \text{Required ratio} = \frac{\left( \frac{P \times R \times 6}{100} \right)}{\left( \frac{P \times R \times 9}{100} \right)} = \frac{6PR}{9PR} = \frac{6}{9} = 2 : 3.$$

13. A certain amount earns simple interest of Rs. 1750 after 7 years. Had the interest been 2% more, how much more interest would it have earned?

A. Rs. 35

B. Rs. 245

C. Rs. 350

D. Cannot be determined

E. None of these

**Answer:** Option D

**Explanation:**

We need to know the S.I., principal and time to find the rate.

Since the principal is not given, so data is inadequate.

14. A person borrows Rs. 5000 for 2 years at 4% p.a. simple interest. He immediately lends it to another person at  $6\frac{1}{4}$ % p.a for 2 years. Find his gain in the transaction per year.

A. Rs. 112.50

B. Rs. 125

C. Rs. 150

## Basic Mathematics

**D.** Rs. 167.50

**Answer:** Option A

**Explanation:**

$$\text{Gain in 2 years} = \text{Rs.} \left[ \left( 5000 \times \frac{25}{4} \times \frac{2}{100} \right) - \left( \frac{5000 \times 4 \times 2}{100} \right) \right]$$

$$= \text{Rs.} (625 - 400)$$

$$= \text{Rs.} 225.$$

$$\therefore \text{Gain in 1 year} = \text{Rs.} \left( \frac{225}{2} \right) = \text{Rs.} 112.50$$

## Ratio and Proportion

**1. Ratio:**

The ratio of two quantities  $a$  and  $b$  in the same units, is the fraction  $\frac{a}{b}$  and we write it as  $a : b$ . In the ratio  $a : b$ , we call  $a$  as the first term or **antecedent** and  $b$ , the second term or **consequent**.

Eg. The ratio  $5 : 9$  represents  $\frac{5}{9}$  with antecedent = 5, consequent = 9.

**Rule:** The multiplication or division of each term of a ratio by the same non-zero number does not affect the ratio.

Eg.  $4 : 5 = 8 : 10 = 12 : 15$ . Also,  $4 : 6 = 2 : 3$ .

**2. Proportion:**

The equality of two ratios is called proportion.

If  $a : b = c : d$ , we write  $a : b :: c : d$  and we say that  $a, b, c, d$  are in proportion.

Here  $a$  and  $d$  are called **extremes**, while  $b$  and  $c$  are called **mean terms**.

Product of means = Product of extremes.

Thus,  $a : b :: c : d \Leftrightarrow (b \times c) = (a \times d)$ .

**3. Fourth Proportional:**

If  $a : b = c : d$ , then  $d$  is called the fourth proportional to  $a, b, c$ .

**Third Proportional:**

$a : b = c : d$ , then  $c$  is called the third proportion to  $a$  and  $b$ .

**Mean Proportional:**

Mean proportional between  $a$  and  $b$  is  $ab$ .

**4. Comparison of Ratios:**

We say that  $(a : b) > (c : d) \Leftrightarrow \frac{a}{b} > \frac{c}{d}$

**5. Compounded Ratio:**

The compounded ratio of the ratios:  $(a : b), (c : d), (e : f)$  is  $(ace : bdf)$ .

**7. Duplicate Ratios:**

Duplicate ratio of  $(a : b)$  is  $(a^2 : b^2)$ .

Sub-duplicate ratio of  $(a : b)$  is  $(a : b)$ .

Triplicate ratio of  $(a : b)$  is  $(a^3 : b^3)$ .

Sub-triplicate ratio of  $(a : b)$  is  $(a^{1/3} : b^{1/3})$ .

If  $\frac{a}{b} = \frac{c}{d}$ , then  $\frac{a+b}{a-b} = \frac{c+d}{c-d}$ . [componendo and dividendo]

**8. Variations:**

We say that  $x$  is directly proportional to  $y$ , if  $x = ky$  for some constant  $k$  and we write,  $x \propto y$ .

We say that  $x$  is inversely proportional to  $y$ , if  $xy = k$  for some constant  $k$  and

we write,  $x \propto \frac{1}{y}$ .

## Basic Mathematics

1. A and B together have Rs. 1210. If  $\frac{4}{15}$  of A's amount is equal to  $\frac{2}{5}$  of B's amount, how much amount does B have?

A. Rs. 460

B. Rs. 484

C. Rs. 550

D. Rs. 664

**Answer:** Option B

**Explanation:**

$$\frac{4}{15} A = \frac{2}{5} B$$

$$\Rightarrow A = \left( \frac{2}{5} \times \frac{15}{4} \right) B$$

$$\Rightarrow A = \frac{3}{2} B$$

$$\Rightarrow \frac{A}{B} = \frac{3}{2}$$

$$\Rightarrow A : B = 3 : 2.$$

$$\therefore \text{B's share} = \text{Rs.} \left( 1210 \times \frac{2}{5} \right) = \text{Rs. 484.}$$

2. Two numbers are respectively 20% and 50% more than a third number. The ratio of the two numbers is:

A. 2 : 5

B. 3 : 5

C. 4 : 5

D. 6 : 7

**Answer:** Option C

**Explanation:**

Let the third number be x.

## Basic Mathematics

$$\text{Then, first number} = 120\% \text{ of } x = \frac{120x}{100} = \frac{6x}{5}$$

$$\text{Second number} = 150\% \text{ of } x = \frac{150x}{100} = \frac{3x}{2}$$

$$\therefore \text{Ratio of first two numbers} = \left( \frac{6x}{5} : \frac{3x}{2} \right) = 12x : 15x = 4 : 5.$$

3. A sum of money is to be distributed among A, B, C, D in the proportion of 5 : 2 : 4 : 3. If C gets Rs. 1000 more than D, what is B's share?

- A. Rs. 500  
B. Rs. 1500  
C. Rs. 2000  
D. None of these

**Answer:** Option C

**Explanation:**

Let the shares of A, B, C and D be Rs. 5x, Rs. 2x, Rs. 4x and Rs. 3x respectively.

Then,  $4x - 3x = 1000$

$\Rightarrow x = 1000.$

$\therefore$  B's share = Rs. 2x = Rs. (2 x 1000) = Rs. 2000.

4. Seats for Mathematics, Physics and Biology in a school are in the ratio 5 : 7 : 8. There is a proposal to increase these seats by 40%, 50% and 75% respectively. What will be the ratio of increased seats?

- A. 2 : 3 : 4  
B. 6 : 7 : 8  
C. 6 : 8 : 9  
D. None of these

**Answer:** Option A

**Explanation:**

Originally, let the number of seats for Mathematics, Physics and Biology be 5x, 7x and 8x respectively.

Number of increased seats are (140% of 5x), (150% of 7x) and (175% of 8x).

$$\Rightarrow \left( \frac{140}{100} \times 5x \right), \left( \frac{150}{100} \times 7x \right) \text{ and } \left( \frac{175}{100} \times 8x \right)$$

## Basic Mathematics

$$\Rightarrow 7x, \frac{21x}{2} \text{ and } 14x.$$

$$\therefore \text{The required ratio} = 7x : \frac{21x}{2} : 14x$$

$$\Rightarrow 14x : 21x : 28x$$

$$\Rightarrow 2 : 3 : 4.$$

5. In a mixture 60 litres, the ratio of milk and water 2 : 1. If this ratio is to be 1 : 2, then the quantity of water to be further added is:

A. 20 litres

B. 30 litres

C. 40 litres

D. 60 litres

**Answer:** Option D

**Explanation:**

$$\text{Quantity of milk} = \left( 60 \times \frac{2}{3} \right) \text{ litres} = 40 \text{ litres.}$$

Quantity of water in it = (60 - 40) litres = 20 litres.

New ratio = 1 : 2

Let quantity of water to be added further be x litres.

$$\text{Then, milk : water} = \left( \frac{40}{20 + x} \right).$$

$$\text{Now, } \left( \frac{40}{20 + x} \right) = \frac{1}{2}$$

$$\Rightarrow 20 + x = 80$$

$$\Rightarrow x = 60.$$

$\therefore$  Quantity of water to be added = 60 litres.

## Basic Mathematics

6. The ratio of the number of boys and girls in a college is 7 : 8. If the percentage increase in the number of boys and girls be 20% and 10% respectively, what will be the new ratio?

- A. 8 : 9
- B. 17 : 18
- C. 21 : 22
- D. Cannot be determined

**Answer:** Option C

**Explanation:**

Originally, let the number of boys and girls in the college be  $7x$  and  $8x$  respectively. Their increased number is (120% of  $7x$ ) and (110% of  $8x$ ).

$$\Rightarrow \left( \frac{120}{100} \times 7x \right) \text{ and } \left( \frac{110}{100} \times 8x \right)$$

$$\Rightarrow \frac{42x}{5} \text{ and } \frac{44x}{5}$$

$$\therefore \text{ The required ratio} = \left( \frac{42x}{5} : \frac{44x}{5} \right) = 21 : 22.$$

7. Salaries of Raiz and Salman are in the ratio 2 : 3. If the salary of each is increased by Rs. 4000, the new ratio becomes 40 : 57. What is Salman's salary?

- A. Rs. 17,000
- B. Rs. 20,000
- C. Rs. 25,500
- D. Rs. 38,000

**Answer:** Option D

**Explanation:**

Let the original salaries of Raiz and Salman be Rs.  $2x$  and Rs.  $3x$  respectively.

$$\text{Then, } \frac{2x + 4000}{3x + 4000} = \frac{40}{57}$$

$$\Rightarrow 57(2x + 4000) = 40(3x + 4000)$$

$$\Rightarrow 6x = 68,000$$

$$\Rightarrow 3x = 34,000$$

$$\text{Salman's present salary} = (3x + 4000) = \text{Rs.}(34000 + 4000) = \text{Rs. } 38,000.$$



## Basic Mathematics

8. If  $0.75 : x :: 5 : 8$ , then  $x$  is equal to:

A. 1.12

B. 1.2

C. 1.25

D. 1.30

**Answer:** Option B

**Explanation:**

$$(x \times 5) = (0.75 \times 8) \Rightarrow x = \left( \frac{6}{5} \right) = 1.20$$

9. The sum of three numbers is 98. If the ratio of the first to second is 2 : 3 and that of the second to the third is 5 : 8, then the second number is:

A. 20

B. 30

C. 48

D. 58

**Answer:** Option B

**Explanation:**

Let the three parts be A, B, C. Then,

$$A : B = 2 : 3 \text{ and } B : C = 5 : 8 = \left( 5 \times \frac{3}{5} \right) : \left( 8 \times \frac{3}{5} \right) = 3 : \frac{24}{5}$$

$$\Rightarrow A : B : C = 2 : 3 : \frac{24}{5} = 10 : 15 : 24$$

$$\Rightarrow B = \left( 98 \times \frac{15}{49} \right) = 30.$$

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## Basic Mathematics

10. If Rs. 782 be divided into three parts, proportional to  $\frac{1}{2} : \frac{2}{3} : \frac{3}{4}$ , then the first part is:

A. Rs. 182

B. Rs. 190

C. Rs. 196

D. Rs. 204

**Answer:** Option D

**Explanation:**

Given ratio =  $\frac{1}{2} : \frac{2}{3} : \frac{3}{4} = 6 : 8 : 9$ .

∴ 1<sup>st</sup> part = Rs.  $\left( 782 \times \frac{6}{23} \right) = \text{Rs. } 204$

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