CAREERS 360

PREPARATION Series

CUET PG MBA 2025

Maths/Quantitative Ability

CONTENTS

A note to the Students

The highly competitive CUET PG MBA exam is within arm's reach and how is your preparation? Are you in search of a resource to hone your mathematical aptitude? Do you need an ebook that can help you assess yourself in the quantitative aptitude section of the CUET PG MBA examination? Look no further, we have got you covered. This extensive ebook designed solely for the quantitative aptitude section of the CUET PG MBA examination is your go-to resource for excellent performance in your examination preparation.

This ebook contains a mix of both previous years and the most important questions of eight different quantitative aptitude topics and it can benefit you in your preparation. Along with solved exercises, practice exercises are also given at the end of each chapter so that the candidate gets ample opportunity to assess themselves during each aspect of their preparation. This ebook is designed to cater to all the mathematical needs of the aspirants. It is also designed after careful analysis of previous years' papers and follows the latest pattern devised by the National Testing Agency (NTA) for the CUET PG MBA exam 2025.

We hope that this ebook be an invaluable resource throughout your preparation phase. Wishing you all the very best.

Warm regards

Team Careers360

ABOUT THE EBOOK

Through the contents of this ebook, a candidate can go through practice exercises and solved examples of the following important quantitative aptitude topics:

1. PARTNERSHIP
2. SIMPLE INTEREST AND COMPOUND INTEREST
3. PROFIT AND LOSS
4. PERCENTAGES
5. PIPES AND CISTERNS
6. TIME-SPEED-DISTANCE
7. PROBLEMS ON TRAIN
8. TIME, WORK AND WAGES

PARTNERSHIP

When a business is operated jointly by two or more individuals, they are referred to as partners, and the arrangement is termed a partnership.

RATIO OF ALLOCATION OF PROFITS:

In instances where all partners invest for the same duration, profits or losses are distributed among them in proportion to their respective investments.

Suppose P and Q invest Rs. x and Rs. y, respectively, for one year in a business, then at the end of the year:

(P's share of profit) : (Q's share of profit) = x : y.

In cases where investments are made for different durations, equivalent capitals are determined for a standard unit of time by multiplying the capital by the number of units of time. Subsequently, gains or losses are apportioned based on these calculated capitals.

Suppose P invests Rs. x for A months and Q invests Rs. y for B months, then,

(P's share of profit) : (Q's share of profit) = xA : yB.

ACTIVE AND SILENT PARTNERS:

A partner who actively manages the business is termed an active partner, while one who solely contributes capital without active involvement is known as a silent partner.

SOLVED EXAMPLES ON PARTNERSHIPS

1. On a partnership basis, A and B invested in a ratio of 5: 6. At the end of 8 months A withdrew his capital. If they shared the eventual profit in the ratio of 5: 9, then what is the number of months for which B invested his capital?

A. 6 months
B. 10 months
C. 12 months
D. 11 months

SOLUTION

A's initial investment is 5x and

B's initial investment is 6x, where x is a positive constant.

⇒ after 8 months,

= A's effective investment for the entire duration is 5x × 8 (8 months) =

= B's effective investment is 6x × t, where t is the number of months

= The total profit is earned for 8 + t months.

= 5x × 8 : 6x × t = 5 : 9 = 40 : 6tx = 5 : 9 = 40 × 9 = 5 × 6tx = 360 = 30tx

= 360/30 = t = t = 12

Hence, the correct answer is 12 months

2. X, Y and Z enter into a partnership. X invests some money at the beginning. Y invests thrice the amount of X after 4 months and Z invest double the amount of Y after 9 months from the beginning. If the annual gain is INR 4,50,000, then what is the share of Y?

A. INR 2,00,000
B. INR 1,50,000
C. INR 1,00,000
D. INR 3,00,000

SOLUTION

Let x be the amount invested by X.

Investment ratio:
- x × 12 : 3x × 8 : 6x × 3
- = 12 : 24 : 18
- = 2 : 4 : 3

Their investment ratio = Ratio of their profit share = 2 : 4 : 3

Total gain = INR 450,000

Share of Y = (4 / (2 + 4 + 3)) × 450,000
= 4 × 50,000
= INR 200,000

Hence, the correct answer is INR 200,000.

3. At the beginning of a partnership business, the capital of B was 3/2 times that of A. After 8 months B withdrew 1/2 of his capital and after 10 months A withdrew 1/4 of his capital. At the end of the year, if the profit incurred is Rs. 53,000, find the amount received by A.

A. Rs. 30,800
B. Rs. 32,000
C. Rs. 30,000
D. Rs. 23,000

SOLUTION

Let A invest Rs. x at the beginning of the partnership business, then the ratio of the profit A and B,

=(x×10+3x/4×2):(3x/2×8+3x/4×4)

=23x/2:15x

=23:30

The amount received by A in the profit,

=(23/53)×53000

= Rs. 23,000

Hence, the correct answer is Rs. 23,000.

4. In a partnership business, B's capital was half of A's. If after 8 months, B withdrew half of his capital and after 2 more months, A withdrew 1/4th of his capital,then the profit ratio of A to B will be:

A. 5 : 2
B. 10 : 23
C. 2 : 5
D. 23 : 10

SOLUTION

Let x be B's capital. Then, A's capital will be 2x.

Profit ratio of A and B = (capital of A × time period of A) : (capital of B × time period of B)

= (2x × 10 + 3/4 × 2x×2) : (x × 8 + x/2 × 4)

= (20x+3x) : (8x+2x)

= 23 : 10

Hence, the correct answer is 23 : 10.

5. A and B started a business partnership by investing in the ratio of 3 : 8. C joined them after 4 months with an amount equal to 3/4th of B. What was their profit (in Rs.) at the end of the year if C got Rs. 24,000 as his share?

A. 1,20,000
B. 1,50,000
C. 90,000
D. 1,80,000

SOLUTION

Ratio of investment = 3 : 8

Let the investment by A = 3x and investment by B = 8x

⇒ Investment by C = 8x × 3/4 = 6x

Ratio in which profit shared

= (capital of A × time period of A) : (capital of B × time period of B) : (capital of C × time period of C)

= (3x × 12) : (8x × 12) : (6x × 8)

= 3 : 8 : 4

Since share of C = Rs. 24000

⇒ 24000 = 4/(3+8+4) × total profit

⇒ Total profit = (24000×15)/4 = Rs. 90000

Hence, the correct answer is 90,000.

PRACTICE EXERCISES

1. A, B and C enter into a partnership with capitals in the ratio 2/3: 3/5: 5/6. After 8 months, A increases his share of capital by 25%. If at the end of the year, the total profit earned is INR 5,820, then the share of C in the profit is:

A. INR 2,050
B. INR 2,350
C. INR 2,450
D. INR 2,250

2. A and B enter into a partnership with capital in the ratio 5: 6. After 4 months, A withdraws 1/5 of his capital, while B increases his capital by 33 1/3%. What is the share (in INR lakhs) of B in the annual profit of INR 6.3 lakhs?

A. 2.34
B. 3.96
C. 2.61
D. 3.69

3. A and B enter into a partnership such that 5 times A's investment is equal to 7 times B's investment. If the total profit is Rs. 12000, then what is the share of A?

A. Rs. 6300
B. Rs. 7000
C. Rs. 8000
D. Rs. 7500

4. X, Y and Z enter into a partnership. X invests some money at the beginning. Y invests thrice the amount of X after 4 months and Z invest double the amount of Y after 9 months from the beginning. If the annual gain is INR 4,50,000, then what is the share of Y?

A. INR 2,00,000
B. INR 1,50,000
C. INR 1,00,000
D. INR 3,00,000

5. In a partnership firm two partners, Vijay and Praveen are working on an assignment. It will take 12 weeks for Vijay to complete the entire assignment alone, while Praveen will take 8 weeks to complete it alone. Due to work pressure, they decided to work on that assignment on an alternate weekly basis. In the first week, Praveen will work and in the second week, Vijay will work, and so on. In how many weeks the work will be completed if they work on an alternate week basis?

A. 8
B. 8.5
C. 9.5
D. 9

ANSWER KEY

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1 - D, 2 - B, 3 - B, 4 - A, 5 - C

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SOLUTION

1. Capitals ratio of A, B and C = 2/3 : 3/5 : 3/4

= 2×30/3 : 3×30/5 : 5×30/6

= 20 : 18 : 25

Capitals ratio of A, B and C after end of the year,

= (20 × 8 + 20 × 5/4 × 4) : 18 × 12 : 25 × 12

= (160 + 100) : 216 : 300

= 260 : 216 : 300

Capitals ratio of A, B and C after end of the year = 260x : 216x : 300x = 65x : 54x : 75x

According to the question,

⇒ 65x + 54x + 75x = 5820

⇒ 194x = 5820

⇒ x = 30

Share of C = 75 × 30 = INR 2250

Hence, the correct answer is INR 2250.

2. Let money invested by A and B be 5x and 6x.

Total money invested by A in the first 4 months = 5x × 4 = 20x.

Total money invested by B in the first 4 months = 6x × 4 = 24x.

According to the question, after 4 months money invested by A = 5x × (4/5) = 4x.

After 4 months money invested by B = 6x × (1 + 100/300) = 6x × (4/3) = 8x.

Total money invested by A in the last 8 months = 4x × 8 = 32x.

Total money invested by B in the last 8 months = 8x × 8 = 64x.

Total money invested by A in a year = 20x + 32x = 52x.

Total money invested by B in a year = 24x + 64x = 88x.

Ratio of money invested by A and B = 52x : 88x = 13 : 22.

B's profit = (630000 / 35) × 22 = 396000.

Hence, the correct answer is 3.96 lakhs.

3. Let A's investment be a and B's be b.

According to the question,

5a = 7b ⇒ a/b = 7/5 ⇒ a:b = 7:5.

In a partnership, the distribution of profit is proportional to the investment.

So, A's share of the profit = (7/(7+5)) × 12000 = 7000.

Hence, the correct answer is Rs. 7000.

4. Let x be the amount invested by X.

Investment ratio:

= x × 12 : 3x × 8 : 6x × 3
= 12 : 24 : 18
= 2 : 4 : 3

Their investment ratio = Ratio of their profit share.
= 2 : 4 : 3

Total gain = INR 450000

Share of Y = 4 / (2 + 4 + 3) × 450000
= 4 × 50000
= INR 200000

Hence, the correct answer is INR 200000.

5. Given, Vijay completes the work in 12 weeks, Praveen completes the work in 8 weeks.

They work on alternate weeks starting with Praveen.

Let the total work = LCM of 12 and 8 = 24 units

Efficiency of Vijay = Work / Time = 24 / 12 = 2

Efficiency of Praveen = 24 / 8 = 3

As they work on an alternate basis

In 1 week work done = 3 units

In 2 weeks work done = 3 + 2 = 5 units

Similarly,

In 8 weeks work done = 20 units

In 9 weeks work done = 20 + 3 = 23 units

The remaining work is done by Vijay

Time taken to complete = (24 - 23) / 2 = 0.5 week

Total time taken to complete the work = 9 + 0.5 = 9.5 weeks

Hence, the correct answer is 9.5.

6. A's initial investment is 5x and

B's initial investment is 6x, where x is a positive constant.

After 8 months:

- A's effective investment for the entire duration is 5x × 8 (8 months).

- B's effective investment is 6x × t, where t is the number of months.

- The total profit is earned for 8 + t months.

So, the ratio of their effective investments is:

$5x \times 8 : 6x \times t = 5 : 9$

$= 40 : 6t\ x = 5 : 9$

$= 40 \times 9 = 5 \times 6t\ x = 360 = 30\ t\ x$

$= 360 / 30 = t = 12$

Hence, the correct answer is 12 months.

SIMPLE INTEREST AND COMPOUND INTEREST

SIMPLE INTEREST

PRINCIPAL

The amount of money borrowed or lent out for a specific period is referred to as the principal or the sum.

INTEREST

The additional money paid for using someone else's money is known as interest.

SIMPLE INTEREST (S.I.)

When the interest on a borrowed sum for a particular period is calculated uniformly, it is termed simple interest.

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

$$\frac{P \times R \times T}{100}$$

$$P = \frac{100 \times S.I.}{R} \quad ; \quad R = \frac{100 \times S.I.}{P} \quad ; \quad T = \frac{100 \times S.I.}{P \times R}$$

COMPOUND INTEREST

1. 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 Rates are different for different years, say R1 R2 , R3 for 1st, 2nd and 3rd respectively,

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

SOLVED EXAMPLES ON SIMPLE AND COMPOUND INTERESTS

1. The simple interest on a certain sum for 3 years at 14% p.a. is INR 4,200 less than the simple interest on the same sum for 5 years at the same rate. Find the sum

A. INR 16,000
B. INR 10,000
C. INR 15000
D. INR 12,000

SOLUTION

Let P be the principal sum.

Rate, R = 14%

Time, n_1 = 3 years

Time, n_2 = 5 years

Simple interest, SI = PnR/100

SI1 = $Pn_1R/100 = P\times3\times14/100$

SI2 = $Pn_2R/100 = P\times5\times14/100$

Difference = 4200

$P\times5\times14/100 – P\times3\times14/100 = 4200$

$\Rightarrow P\times2\times14/100 = 4200$

$\Rightarrow P = 420000/28 = 15000$

Hence, the correct answer is INR 15000

2. INR 2,500, when invested for 8 years at a given rate of simple interest per year, amounted to INR 3,725 on maturity. What was the rate of simple interest that was paid per annum?

A. 6%
B. 6.125%
C. 6.25%
D. 5.875%

SOLUTION

⇒Principal amount, P = Rs. 2500

Final amount with interest = Rs. 3725

Time duration of investment, T = 8 years

Let the rate of interest be R%

We know that, Simple Interest = (P × R × T)/100

According to the simple interest formula,

(2500 × R × 8)/100 = 3725 - 2500

⇒ R = (1225 × 100)/(2500 × 8)

⇒ R = 6.125%

Hence, the correct answer is 6.125%

3. A sum of money doubles itself in 7 years at simple interest. In how much time will it become 5 times itself?

A. 25 years
B. 28 years
C. 23 years
D. 21 years

SOLUTION

Given: Time (T_1) = 7 years

Let Time (T_2) = t years

Case I

Let the principal be x

So, Amount after 7 years = 2x

Simple interest = Amount – Principal = 2x - x = x

Interest = Principal

So, x = (x × R × 7)/100

⇒ R = 100/7%

Case II

Amount = 5x

Interest = 5x - x = 4x

Now, Interest = 4 × Principal

So, 4x = (x × (100/7) × t)/100

⇒ t = 4 × 7 = 28 years

Hence, the correct answer is 28 years

4. A certain sum of money is given at a certain rate for 3 years. Had it been given at a 5% higher rate, it would have fetched INR 600 more. Find the sum.

A. INR 8,000
B. INR 5,000
C. INR 6,000
D. INR 4,000

SOLUTION

Increase in simple interest for 3 years at a 5% higher rate = INR 600

Increase in simple interest for 1 year at a 5% higher rate = 600/3 = INR 200

Let P be the principal sum.

(PnR)/100 = S.I.

⇒ (P×1×5)/100 = INR 200

⇒ P = 20000/5 = 4000

Hence, the correct answer is INR 4000

5. What annual instalment will discharge a debt of Rs.9,600 due in 5 years at 10% simple interest?

A. Rs. 1450
B. Rs. 1550
C. Rs. 1500
D. Rs. 1600

SOLUTION

Assume the annual instalment as x.

First-year ⇒ instalment = 100% of x

Second year ⇒ instalment = 110% of x

Third year ⇒ instalment = 120% of x

Fourth year ⇒ instalment = 130% of x

Fifth year ⇒ instalment = 140% of x

100% of x + 110% of x + 120% of x + 130% of x + 140% of x = 9600

⇒ (100+110+120+130+140)% of x = 9600

⇒ 600% of x = 9600

⇒ x = (9600×100)/600 = 1600

So, the annual instalment = Rs. 1600

Hence, the correct answer is Rs. 1600

6. The simple interest received on a sum is 25/36 of the sum. The number of years is equal to the annual rate of interest. What is the annual rate of interest?

A. 9.25 percent
B. 10.25 percent
C. 6.62 percent
D. 8.33 percent

SOLUTION

Rate = R
Time = R

Let the sum value be x, then SI will be:

SI = (x × R × T)/100

⇒ (25/36)x = (x × R^2)/100

⇒ (25/36) = (R^2)/100

⇒ R^2 = (25 × 100)/36

⇒ R^2 = 2500/36

⇒ R = √(2500/36)

⇒ R = √(2500)/√(36)

⇒ R = 50/6

⇒ R ≈ 8.33%

So, the annual rate of interest is 8.33%.

Hence, the correct answer is 8.33%.

7. A certain sum of money becomes triple itself in 26 years at simple interest. In how many years it will become five times of itself?

A. 64 years
B. 52 years
C. 56 years
D. 60 years

SOLUTION

Given: Let the principal be P.

A sum of money becomes triple of itself in 26 years.

Simple interest in this case: 3P - P = 2P

Let the time taken for the amount P to 5P be x years.

Simple interest in this case: 5P - P = 4P

We know simple interest on amount P at r% rate of interest in t years = (Prt)/100

For the same rate of interest r, Simple interest is directly proportional to the time t years.

So, (2P)/(4P) = 26/x

⇒ 1/2 = 26/x

⇒ x = 52 years

Hence, the correct answer is 52 years.

8. What is the present value of Rs.10,000 received in 2 years, if the interest rate is 12% per year discounted semi-annually?

A. Rs.7,020.94
B. Rs. 7,920.90
C. Rs.7,920.94
D. Rs.7,900.94

SOLUTION

Amount, A = 10000

Rate of interest, R = 6% (semi-annually)

Period in years = 2 years

Period computed semi-annually, n = 4

Thus, total amount after n time periods at R% rate of interest, $A = P[1+(R/100)]^n$

So, $10000 = P[1+(6/100)]^4$

$\Rightarrow 10000 = P[(106/100)]^4$

$\Rightarrow P = 7920.94$

Hence, the correct answer is Rs. 7920.94

9. What would be the compound interest on Rs.15,750 at 20% per annum, in two years, if the interest is compounded half-yearly?

A. Rs. 5,213.25
B. Rs. 3,307.5
C. Rs. 7,305.975
D. Rs. 7,309.575

SOLUTION

Principal amount, P = Rs. 15,750

Time calculated half-yearly, t = 2 × 2 = 4 half-years

Rate of interest for a half year, r = 20/2% = 10%

Amount after t half years with interest is compounded at r% per half-year

$= P(1 + r/100)^n$

$= 15750(1 + 10/100)^4$

$= 23059.575$

Compound interest = Rs. (23059.575 – 15750) = Rs. 7309.575

Hence, the correct answer is Rs. 7309.575.

10. The amount of Rs. 10,000 after 2 years, compounded annually with the rate of interest being 10% per annum during the first year and 12% per annum during the second year, would be (in rupees):

A. 11,320
B. 12,000
C. 12,320
D. 12,500

SOLUTION

Present value P = Rs. 10,000

Interest rate for 1st year, r_1 = 10% per annum

Interest rate for 2nd year, r_2 = 12% per annum

Time = 2 years

Amount(A) = $P\times(1+(r_1/100))\times(1+(r_2/100))$

$A = 10000\times(1+(10/100))\times(1+(12/100))$

$= 10000\times(110/100)\times(112/100)$

$= 110 \times 112$

= Rs. 12,320

Hence, the answer is Rs. 12,320.

11. The difference between simple and compound Interest compounded annually on a certain sum of money for 2 years at 4% per annum is Rs. 8. The sum is:

A. Rs. 10,000
B. Rs. 20,000
C. Rs. 5,000
D. Rs. 15,000

SOLUTION

Given:

SI – CI = Rs. 8

Time = 2 years

Rate = 4% per annum

Formula Used:

The difference between CI and SI for the same sum and same rate for 2 years = $(PR^2)/10000$

$8 = P \times (4^2)/10000$

P = Rs. 5,000

Hence, the correct answer is Rs. 5,000.

12. There is a 40% increase in an amount in 8 years at simple interest. What will be the compound interest on Rs.10,000 after 3 years at the same rate?

A. Rs. 1,576.25
B. Rs. 6,305
C. Rs. 7,881.25
D. Rs. 4,728.75

SOLUTION

Given:

There is a 40% increase in the amount in 8 years at SI.

Principal = Rs. 10000

Time = 3 years

Formula Used:

SI = (PRT)/100

CI = $P(1+(R/100))^n - P$

Calculation:

P + (40/100) × P - P = (P × 8 × R)/100

R = 40/8 = 5%

We know that

CI = $10000(1+(5/100))^3$ - 10000

= 10000 × 1.1576 - 10000

= 1576.25

Hence, the correct answer is Rs. 1,576.25.

13. If the difference between the compound interest and simple interest on a certain sum at the rate of 5% per annum for 2 years is Rs. 20, then the sum is:

A. Rs. 2000
B. Rs. 4000
C. Rs. 6000
D. Rs. 8000

SOLUTION

Rate, R = 5%

Term, n = 2 years

CI – SI = Rs. 20

Difference between CI and SI = $(PR^2)/10000$

20 = $(P\times5^2)/10000$

Sum, P = Rs. 8,000

Hence, the correct answer is Rs. 8,000.

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

A. 6%
B. 7%
C. 8%
D. 9%

SOLUTION

$D = P(r/100)^2$

$96 = 15000(r/100)^2$

$r^2 = 960000/15000 = 64$

$r = 8\%$

Hence, the correct answer is 8%.

15. The difference between Compound Interest and Simple Interest on a certain sum of money for 2 years at 5% per annum is Rs. 41. What is the total sum?

A. Rs. 7,200
B. Rs. 9,600
C. Rs. 16,400
D. Rs. 8,400

SOLUTION

The difference between the Simple Interest and Compound Interest on a certain sum of money 'P' for 2 years at 'r' percent per annum is given by:

Compound Interest (CI) - Simple Interest (SI) = $(Pr^n) / (100^n)$

According to the question,
The difference between CI and SI for 2 years is 41.
Therefore, $41 = (P(5)^2) / (100^2)$

So, $P = (41 \times 100 \times 100) / (5 \times 5)$

This implies that P = 16400

Hence, the correct option is Rs. 16,400.

PRACTICE EXERCISES

1. The simple interest on a certain sum of money for 2 years at 5% is Rs. 1600. The compound interest at the same rate after 3 years, interest compounded annually, is:

A. Rs. 2520
B. Rs. 2522
C. Rs. 2555
D. Rs. 2535

2. Albert invested an amount of x rupees in a fixed deposit scheme offering 10% per annum for the first year and 15% per annum for the second year and received an amount of Rs. 20,240 after two years. What is x (in Rs.)?

A. 15,000
B. 16,000
C. 14,000
D. 18,000

3. Rohan borrowed a certain sum of money at simple interest. The rate of interest was 3% per annum for the first 3 years, 4% per annum for the next 5 years and 6% per annum for the next 7 years. If he paid Rs. 2,059 as interest, then what is the sum borrowed (in Rs.)?

A. 2400
B. 2500
C. 2900
D. 3100

4. A person invested a total of Rs. 7,900 in three different schemes of simple interest at 3%, 5% and 8% per annum. At the end of one year, he had the same interest in all three schemes. What is the money (in rupees) invested at 3%?

A. 2900
B. 3500
C. 4000
D. 5600

5. 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 per cent per annum is:

A. Rs. 520
B. Rs. 550
C. Rs. 500
D. Rs. 515

ANSWER KEY

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1 - B, 2 - B, 3 - C, 4 - C, 5 - C

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SOLUTIONS

1. Rate, R = 5%

Term, n = 2 years

Simple interest, SI = Rs.1600

Simple interest after 2 years = (P × n × R) / 100

1600 = (P × 2 × 5) / 100

Sum, P = Rs. 16000

When compounded annually, compound interest after n years = $P[(1+(R/100))^n - 1)]$

Rate, R = 5%

Term, n = 3 years

Compound interest after 3 years = $16000[(1+(5/100))^3 - 1)] = 2522$

Compound interest at the rate of 5% after 3 years interest compounded annually is Rs. 2522

Hence, the answer is Rs. 2522.

2. Given: Albert invested an amount of x rupees in a fixed deposit scheme offering 10% per annum for the first year and 15% per annum for the second year and received an amount of Rs. 20,240 after two years.

Let the x be Rs. 100

Now for the first year, interest of 100 rupees at 10% per annum is = (100×10×1)/100 = Rs. 10

and for the second year interest of (100 + 10) = Rs.110 at 15% per annum is ⇒ (110×15×1)/100 = Rs. 33/2

So now the total amount becomes = (110+33/2) = Rs. 253/2

Here Rs. 253/2 is equivalent to Rs. 20,240

⇒ 100 rupees is equivalent to (20240×100×2)/253 = Rs. 16,000.

Hence, the value of x is Rs.16,000.

3. Let the sum borrowed be p.

We know the formula for simple interest = (p×r×t)/100

So for the first 3 years at a 3% rate per annum, the interest of p rupees is = (p×3×3)/100 = (9p/100),

for the next 5 years at a 4% rate per annum, the interest of p rupees is = (p×4×5)/100 = (20p/100)

and for the next 7 years at a 6% rate per annum, the interest of p rupees is = (p×6×7)/100 = (42p/100)

Here ((9p/100) +(20p/100) +(42p/100)) = 2059

⇒ (9p+20p+42p) = 205900

⇒ 71p = 205900

⇒ p = (205900/71) = Rs. 2,900

Hence, the sum borrowed is Rs. 2,900.

4. Sum = Rs. 7,900

Term, n = 1 year

Let x be the amount invested at 3%, y be the amount invested at 5%, and z be the amount invested at 8%.

(x×1×3)/100 = (y×1×5)/100 = (z×1×8)/100

3x = 5y = 8z

So, x:y:z=40:24:15

Divide Rs 7900 in this ratio. therefore, we get

x = (7900/79)×40

⇒ x = 4000

The money invested at 3% = Rs. 4,000

Hence, the correct answer is Rs. 4,000.

5. Rate, R = 10%

Compound interest = Rs. 525

Term, n = 2 years

Compound interest after 2 years = $P[(1+(R/100))^2 – 1]$

525 = P[(1+(10/100)) – 1)]

525 = P[(1.21 – 1]

P = 525 / 0.21 = Rs. 2500

Simple interest after n years = (PnR)/100

Time = 2n = 4 years

Rate = R ÷ 2 = 5%

Simple interest after 4 years = (2500×4×5)/100 = Rs. 500

Hence, the correct answer is Rs. 500.

PROFIT AND LOSS

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 price, 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 FORMULAS ASSOCIATED WITH PROFIT AND LOSS

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.)

$$\mathrm{SP} = \left[\frac{(100 + \text{ Gain }\%)}{100} \times \mathrm{C.P}\right]$$

Selling Price: (S.P.)

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

Cost Price: (C.P.)

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

Cost Price: (C.P.)

$$\mathrm{C.P.} = \left[\frac{100}{(100 - \text{Loss }\%)} \times \mathrm{S.P.}\right]$$

The gain when an owner uses a false weight instead of the original

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

If an item is sold with a profit of, let's say, 40%, then the selling price (S.P.) equals 140% of the cost price (C.P.).

If an item is sold at a loss of, for instance, 25%, then the selling price (S.P.) equals 75% of the cost price (C.P.).

SOLVED EXAMPLES ON PROFIT AND LOSS

1. Riya could not decide between discount of 30% or two successive discounts of 25% and 5%, both given on shopping of INR 3,840. What is the difference between both the discounts?

A. INR 44
B. INR 48
C. INR 42
D. INR 46

SOLUTION

Single discount of 30% on INR 3840 = (30/100)×3840 = 1152

Successive discount of 25% and 5% on INR 3840 = (25+5-(25×5/100))×3840 = (28.75/100)×3840 = 1104

The difference in discount = 1152 – 1104 = 48

Hence, the correct answer is INR 48.

2. The difference between the cost price and the selling price of a pair of shoes is Rs. 1,200. If the profit is 15%, the selling price is:

A. Rs.8,200
B. Rs.9,200
C. Rs.8,000
D. Rs.9,000

SOLUTION

Given: The difference between the cost price and selling price = Rs. 1200

The difference of percentage between the cost price and selling price = 15%

Because both the differences are equal.

Thus, (15/100) of the cost price = 1200

Therefore, the cost price = Rs. 8000

Selling price = cost price + profit

= 8000 + 1200

= 9200

Hence, the correct answer is Rs. 9200.

3. A dishonest merchant sells goods at a 12.5% loss on the cost price but uses 28 g weight instead of 36 g. What is his percentage profit or loss?

A. 6.25% loss
B. 12.5% gain
C. 18.75% gain
D. 10.5% loss

SOLUTION

Let the cost price of 1 gm be Rs. 1.

The cost price of 28 gm = Rs. 28

The cost price of 36 gm = Rs. 36

Selling price after 12.5% loss on 36gm packet = (100-12.5)/100×36 = Rs. 31.5

Here cost price is denoted by CP, selling price is denoted by SP.

Profit% = (SP-CP)/CP×100

= (31.5-28)/28×100

= 12.5%

Hence, the correct answer is a 12.5% gain.

4. A shopkeeper makes a net profit of 44% on selling an article at successive discounts of 10% and 20%. Find the net profit percentage, if the shopkeeper sells the same article at a discount of 15%.

A. 50%
B. 70%
C. 30%
D. 40%

SOLUTION

Let the cost price be CP, the selling price be SP, and the marked price be MP.

Let the MP be 100.

Successive discount of 10% and 20% = 10+20-(10×20/100) = 28%

Therefore, SP = 100 – 28 = 72

Given: SP = 144% of CP

⇒ 72 = (144/100)× CP

CP = 50

If the shopkeeper sells at a 15% discount on MP, then

SP = 100 – 15% of 100 = 85

Therefore, Profit = (SP–CP)/CP×100

= (85-50)/50×100

= 70

Hence, the correct answer is 70%.

5. By selling an article for Rs. 33,000 a man gains 10%.To get a profit of 20%, he has to sell it for:

A. Rs. 30,000
B. Rs. 35,000
C. Rs. 36,000
D. Rs. 36,600

SOLUTION

Let the cost price of the article be Rs. x.

A gain of 10% on the cost price is equal to 0.10x.

So, the selling price is the cost price plus the gain:

Selling Price = Cost Price + Gain = x + 0.10x = 1.10x

Given that the selling price is Rs. 33,000:

⇒ 1.10x = 33,000

⇒ x ≈ 30,000

So, the cost price (x) is Rs. 30,000.

Now, to get a profit of 20%, the selling price needs to be:

New Selling Price = Cost Price + 0.20×Cost Price

⇒ New Selling Price = x + 0.20x = 1.20x

= 1.20 × 30,000 = 36,000

Hence, the correct answer is Rs. 36,000.

6. Raghav purchased a shirt at Rs.1,500 and marked up the price of the shirt by 40%. What is the discount percentage he has to offer in order to get a profit of Rs. 75?

A. 25%
B. 15%
C. 75%
D. 50%

SOLUTION

The cost price of the shirt is Rs. 1,500.

Raghav marked up the price of the shirt by 40%.

Marked Up Price = Cost Price + (40/100 × Cost Price)

Marked Up Price = 1500 + (40/100 × 1500) = 1500 + 600 = 2100

Profit = Marked Up Price − Cost Price = 2100 − 1500 = 600

Discount = Marked Up Price − (Cost Price + Profit)

Discount = 2100 − (1500 + 600) = 525

Discount percentage = (Discount / Marked up price) × 100 = (525 / 2100) × 100 = 25%

Hence, the correct answer is 25%.

7. A person having bought goods for Rs.400 sells half of it at a gain of 5%. At what gain percentage must he sell the remainder, so as to gain 25% on the whole?

A. 30%
B. 25%
C. 20%
D. 45%

SOLUTION

Total cost price = Rs. 400

The cost price of the first half = Rs. 200

Profit = 5% of cost price = (5/100) × 200 = Rs. 10

Selling price of the first half = 200 + 10 = Rs. 210

Total profit = 25% of total cost price = (25/100) × 400 = Rs. 100

Total selling price = 400 + 100 = Rs. 500

Selling price of the second half = Total selling price – Selling price of the first half

= Rs. 500 – Rs. 210 = Rs. 290

The cost price of the second half = Rs. 200

⇒ Profit = Selling price – Cost price = Rs. 290 – Rs. 200 = Rs. 90

So, the profit percentage = (90/200) × 100 = 45%

Hence, the correct answer is 45%.

8. A watch is sold at a profit of 25%. Had it been sold for Rs.120 less then, there would have been a loss of 15%. What is the cost price in rupees?

A. Rs. 400
B. Rs. 350
C. Rs. 200
D. Rs. 300

SOLUTION

Let's denote the cost price (CP) of the watch as x.

The selling price with a 25% profit = CP + (25/100 × CP)

So, SP = x + 0.25x = 1.25x

The selling price with a 15% loss = CP − (15/100 × CP)

So, SP = x − 0.15x = 0.85x

According to the question,

1.25x − 120 = 0.85x

⇒ 0.4x = 120

⇒ x = 120 / 0.4

⇒ x = 300

Hence, the correct answer is Rs. 300.

9. The ratio of the cost price and selling price of an article is 10 : 11. The gain percentage is:

A. 10%
B. 8%
C. 5%
D. 15%

SOLUTION

Let the cost price (CP) and selling price (SP) be 10x and 11x respectively.

Profit percentage = (SP – CP) / CP × 100

= (11x - 10x) / 10x × 100

= (x / 10x) × 100

= 10%

Hence, the correct answer is 10%.

10. The printed price of a TV set is INR 14,500. It is sold for INR 10,000 with two consecutive discounts. If the first discount is 10%, then what is the second discount?

A. 23.37%
B. 25.37%
C. 20.37%
D. 27.37%

SOLUTION

The marked price of the TV = INR 14,500

Selling price of TV = INR 10,000

First discount percentage = 10%

Let the second discount percentage be b%.

Total discount given = ((14500 - 10000) / 14500) × 100 = 31.034%

We know final discount after two consecutive discounts of a% and b% = (a + b - (a × b) / 100)%

So, 31.034 = (10 + b - (10 × b) / 100)%

⇒ 21.034 = b - 0.1b

⇒ b = 21.034 / 0.9

⇒ b = 23.37%

Hence, the correct answer is 23.37%.

11. Mohit purchased a table for Rs.1,260 and due to some scratches on its top, he sold it for Rs.1,197. What is his loss percentage?

A. 7%
B. 4%
C. 6%
D. 5%

SOLUTION

Cost price = Rs. 1,260

Selling price = Rs. 1,197

Loss = 1260 – 1197 = 63

So, the loss percentage = (63/1260) × 100 = 5%

Hence, the correct answer is 5%.

12. A shopkeeper claims to sell his article at a discount of 10% but marks his articles by increasing the cost of each by 20%. His gain percentage is:

A. 18%
B. 12%
C. 8%
D. 16%

SOLUTION

Let 100x be the cost price.

Marked price = 20% above cost price = 100x + 20x = 120x

Discount = 10% of marked price = 10% of 120x = 12x

Selling price = marked price – discount = 120x - 12x = 108x

Gain = selling price – cost price = 108x - 100x = 8x

So, the gain percentage = (8x / 100x) × 100 = 8%

Hence, the correct answer is 8%.

13. A man sells two cows for Rs.15,640 each, gaining 15% on one and losing 15% on the other. Find his total gain or loss.

A. Rs. 720 loss
B. Rs. 360 loss
C. Rs. 720 gain
D. Rs. 360 gain

SOLUTION

The cost price of the cow that's sold at 15% profit = 15640 / (100 + 15%) = Rs. 13600

Profit incurred = SP – CP = 15650 – 13600 = Rs. 2040

The cost price of the cow that's sold at 15% loss = 15640 / (100 - 15%) = Rs. 18400

Loss incurred = CP – SP = 18400 – 15640 = Rs. 2760

Total Loss = 2760 – 2040 = Rs. 720

Hence, the answer is a Rs. 720 loss.

14. Piyush sold a guitar to Anuj at 16% gain and Anuj sold it to Mayank at 32% gain. If Mayank paid Rs.3,828 for the guitar, what amount did Piyush pay for the same?

A. Rs.2,500
B. Rs.3,200
C. Rs.1,600
D. Rs.2,800

SOLUTION

Piyush sold a guitar to Anuj at a 16% gain and Anuj sold it to Mayank at a 32% gain. Mayank paid Rs.3,828 for the guitar.

Final percentage change after two successive increments of A% and B% = (A+B+AB/100)%

The net percentage profit from Piyush to Mayank = (16+32+(16 × 32)/100)% = 53.12%

Selling Price = Cost Price × (1 + Gain%)

Now, the cost price of the guitar to Piyush = 3828 / (100 + 53.12) × 100 = Rs. 2500

Therefore, Piyush paid Rs. 2500 for the guitar.

15. If the cost of 20 books is equal to the selling price of 18 books, then the gain percentage is:

A. 11 1/9%
B. 11 1/3%
C. 11 2/9%
D. 10 1/9%

SOLUTION

Given: 20 × cost price = 18 × selling price

Selling price = (20/18) × cost price

So, the gain percentage = ((20/18) × cost price - cost price)/cost price × 100

= 200/18 = 11 1/9%

Hence, the correct answer is 11 1/9%.

PRACTICE EXERCISES

1. Three successive discounts of 10% is equivalent to a single discount of:

A. 27.1%
B. 19.0%
C. 25.1%
D. 26.2%

2. Rohan sold goods to Ankit worth Rs. 55,000 at a 15% trade discount. How much money did Ankith pay to Rohan?

A. Rs. 8,250
B. Rs.12,550
C. Rs. 22,550
D. Rs. 46,750

3. Ramesh claims that he is selling onions at Rs. 36 per kg, which costs him Rs. 40 per kg, but he gives 800 grams instead of 1 kg. Find Ramesh's percentage of gain or loss.

A. Gain 13.5%
B. Loss 13.5%
C. Loss 12.5%
D. Gain 12.5%

4. A man lost 15% by selling a mobile for Rs.4,675.What will be his gain percentage by selling it for Rs.6,050?

A. 10.5%
B. 9.5%
C. 9%
D. 10%

5. A shopkeeper bought a cycle for INR 1,200 and sold it for INR 1,500. Find his profit/loss percentage.

A. 3% profit
B. 15% profit
C. 30% loss
D. 25% profit

ANSWER KEY

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1 - A, 2 - D, 3 - D, 4 - D, 5 - D

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SOLUTIONS

1. For 3 successive discounts D1, D2, and D3,

Final discount will be (1-(1-D1/100)(1-D2/100)(1-D3/100)) × 100%

Here, D1 = D2 = D3 = 10%

Substituting these values, we get

Final discount = (1-(1-10/100)(1-10/100)(1-10/100)) × 100% = 27.1%

Hence, the correct answer is 27.1%.

2. MP = Rs. 55000

According to the formula,

Selling price (SP) = Marked price (MP) × ((100 - Discount percentage)/100)

⇒ SP = Rs. 55000 × ((100 - 15)/100)

⇒ SP = Rs. 55000 × 85%

⇒ SP = Rs. 55000 × (85/100)

⇒ SP = Rs. 46750

Hence, the correct answer is Rs. 46750

3. The cost price of 1kg onions = Rs. 40

⇒ Cost price of 800g onions = 0.8 × 40 = Rs. 32

As Ramesh sold 800g instead of 1kg,

Selling price of 800g onions = Rs. 36

So, the profit = 36 – 32 = Rs. 4

Therefore, the profit percentage = (4/32) × 100 = 12.5%

Hence, the answer is a 12.5% gain.

4. The selling price of the mobile = Rs. 4,675

Loss percentage = 15%

New selling price = Rs. 6,050

According to the question,

85% of CP = 4,675

⇒ CP = 4675/0.85

⇒ CP = Rs. 5,500

If he sold it for Rs. 6,050, then,

Profit% = ((SP - CP)/CP) × 100

Profit% = (6,050 - 5,500) × (100/5,500)

⇒ 550 × (100/5500)

⇒ 10%

The required Profit% = 10%.

Hence, the correct answer is 10%.

5. The cost price (CP) of the cycle = INR 1,200

The selling price (SP) of the cycle = INR 1,500

Profit percentage = (1500 - 1200)/1200 × 100 = 25%

Hence, the correct answer is 25% profit.

PERCENTAGES

In mathematics, a percentage represents a value or ratio that can be written as a fraction of 100. To calculate the percentage of a number, divide the number by the whole and then multiply by 100. Therefore, a percentage denotes a portion out of one hundred. The term "per cent" translates to "per 100," and it is denoted by the symbol "%".

Given below are a few examples of percentages:

20% is equivalent to 1/5 fraction
25% is equivalent to 1/4 fraction

Percentages are considered dimensionless because they do not have units. Therefore, they are referred to as dimensionless numbers. For example, when we say "50% of a number," it signifies 50 per cent of the whole amount, without any specific dimension attached to it.

FORMULA OF PERCENTAGE

To calculate the percentage, you divide the specific value by the total value and then multiply the result by 100.

Percentage formula: (Value/Total value) × 100

Example: If you have 3 out of 7 apples, the percentage of apples you have is calculated as (3/7) × 100 = 0.4285 × 100 = 42.85 percent.

PERCENTAGE INCREASE/DECREASE:

To calculate the percentage increase or decrease, you need to find the difference between the new value and the original value, and then divide it by the original value. This result is then multiplied by 100 to express it as a percentage.

Percentage Increase Formula:
Percentage Increase = [(Increase in Value) / Original Value] ×100

Percentage Decrease Formula:
Percentage Decrease = [(Decrease in Value) / Original Value] ×100

Example:

Let's say you had ₹50 initially, and now you have ₹70. The percentage increase in your money is calculated as:

Percentage Increase = [(₹70 - ₹50) / ₹50] ×100 = [₹20 / ₹50] ×100 = 0.4 ×100 = 40%

Finding a Percentage of a Number:

To find the percentage of a number, you multiply the given number by the percentage and then divide by 100.

PERCENTAGE OF A NUMBER FORMULA:

Percentage of a Number = (Percentage / 100) ×Number

Example:

If you want to find 20% of 200, you calculate it as:
Percentage of 200 = (20 / 100) ×200 = 0.20 ×200 = 40

FINDING THE ORIGINAL VALUE:

To find the original value before a percentage increase or decrease, you can use specific formulas depending on whether you have the percentage increase or decrease.

Original Value Formula (for Increase):
Original Value = (New Value x 100) / (100 + Percentage Increase)

Original Value Formula (for Decrease):
Original Value = (New Value ×100) / (100 - Percentage Decrease)

Example:

If you have ₹120 after a 20% increase, you can find the original value as:
Original Value = (₹120 ×100) / (100 + 20) = ₹12000 / 120 = ₹100

FINDING THE FINAL VALUE:

To find the final value after a percentage increase or decrease, you apply the percentage change to the original value.

Final Value Formula (for Increase):
Final Value = Original Value + (Original Value ×Percentage Increase)

Final Value Formula (for Decrease):
Final Value = Original Value - (Original Value ×Percentage Decrease)

Example:

If the original value was ₹200 and it increased by 25%, you find the final value as:
Final Value = ₹200 + (₹200 ×0.25) = ₹200 + ₹50 = ₹250

SOLVED EXAMPLES ON PERCENTAGES

1. If both the length and breadth of a cuboid are increased by 50%, then by how much percentage its height should be reduced so that its volume remains the same?

A. 62.34%
B. 55.55%
C. 37.25%
D. 48.75%

SOLUTION

Given,
The length and breadth of a cuboid are increased by 50%.

We know, Volume of cube = L × B × H, where L = length, B = breadth, and H = height

Initial volume V1 = L × B × H

Final volume V2 = 1.5L × 1.5B × H2 (H2 is the new height)

Now, V1 = V2

⇒ 1.5L × 1.5B × H2 = L × B × H

⇒ H2 = (L × B × H) / (1.5L × 1.5B) = H / 2.25

So, the reduction in height = H – H2

= H – (H / 2.25)

= H (1 – 1 / 2.25)

= H × 0.5555

= 55.55% of H

Hence, the correct answer is 55.55%.

2. Raj's income is Rs. 45,000 and his expenditure is Rs. 33,000. If his income is increased by 20% and expenditure by 12%, then what will be the percentage increase in savings?

A. 48%
B. 56%
C. 36%
D. 42%

SOLUTION

Given: Income = Rs. 45000

Expenditure = Rs. 33000

So, savings = (45000 – 33000) = Rs. 12000

After a 20% increase in income, the net income

= (45000 + 45000 × 20 / 100)

= Rs. 54000

After a 12% increase in expenditure, the new expenditure

= (33000 + 33000 × 12 / 100)

= Rs. 36960

Now, the savings = (54000 – 36960) = Rs. 17040.

So, increase percentage in savings = ((17040 – 12000) / 12000) × 100 = 42%.

Hence, the correct answer is 42%.

3. If a number is increased by 84, it becomes 107% of itself. What is the number?

A. 600
B. 900
C. 1500
D. 1200

SOLUTION

Given: If a number is increased by 84, it becomes 107% of itself.
Let the number be y.

⇒ y + 84 = 107% of y
⇒ y + 84 = 1.07y
⇒ 84 = 1.07y – y
⇒ 84 = 0.07y
⇒ y = 1200

Hence, the correct answer is 1200.

4. A person spends 25% of his income on goods for daily use. Furthermore, he spends 18% of the rest on house rent and 16% of the rest on travel. After that, only INR 861 is left with him. What is his salary?

A. INR 1852.33
B. INR 1666.67
C. INR 1563.33
D. INR 1426.33

SOLUTION

Given: The person spends 25% of his income on goods of daily use.

Let the person's total salary be 100,000y.

Then, the person has left 100000y × 75% = 75000y

He spends 18% of the rest on house rent.

Then, the person has 75000y × 82% = 61500y

And 16% of the rest on travel.

Then, the person has 61500y × 84% = 51660y

According to the question,

51660y = 861

⇒ y = 861/51660

So, the total salary is 100000y = (100000 × 861)/51660 = 86100000/51660 = INR 1666 2/3

Hence, the correct answer is INR 1666 2/3.

5. If A is equal to 20% of B and B is equal to 25% of C, then what percentage of C is equal to A?

A. 10
B. 15
C. 5
D. 20

SOLUTION

A = 20% of B
⇒ A = (1/5) × B
⇒ A : B = 1 : 5

Also, B = 25% of C
⇒ B = (1/4) × C
⇒ B : C = 1 : 4

So, A : B : C = 1 : 5 : 20

Let x% of C equal to A.
⇒ (x/100) × C = A
⇒ (x/100) × 20 = 1
⇒ x = 5%

Hence, the correct answer is 5.

6. The sum of two numbers is 680. If the bigger number is decreased by 15% and the smaller number is increased by 15%, then the resultant numbers are equal. Find the smaller number.

A. 307
B. 285
C. 289
D. 304

SOLUTION

Let the bigger number be x.
Smaller number = 680 - x

According to the question,

x(1 - 15%) = (680 - x)(1 + 15%)
⇒ x/(680 - x) = 23/17
⇒ 17x = 23 × 680 - 23x
⇒ 40x = 23 × 680
⇒ x = 23 × 17
⇒ x = 391

So, the smaller number = 680 – 391 = 289

Hence, the correct answer is 289.

7. In an election contested between two candidates, 15% of the total voters did not cast their votes and 100 votes got disqualified. The candidate who won the election won by securing 45% of the total votes and won by a margin of 400 votes. Find the total number of voters.

A. 6,000
B. 3,600
C. 10,000
D. 3,500

SOLUTION

Let total voters be x.
Votes that got disqualified = 100
Percentage of votes for winner = 45%
The margin between the winner and loser = 400 votes

Total votes cast = Total voters – voters who did not cast votes – Number of votes disqualified
= 100% of x – 15% of x – 100
= 85% of x – 100

Now, votes won by winner = 45% of x
So, votes won by loser = 45% of x – 400

According to the question,
Total votes counted = Number of votes for winner + Number of votes for loser
or, 85% of x – 100 = 45% of x + 45% of x – 400
or, 300 = 90% of x – 85% of x
or, 300 = 5% of x
or, 300 = 5/100 x
or, x = 6000

Hence, The total number of voters is 6000.

8. Out of an earning of Rs.720, Pankaj spends 65%. How much does he save?

A. Rs.250
B. Rs.252
C. Rs.253
D. Rs.251

SOLUTION

Total earnings = Rs. 720
He spends 65% of his earnings.
Thus, money spent = Rs.720 × 0.65 = Rs.468
So, money saved = 720 – 468 = Rs. 252

Hence, the correct answer is Rs. 252.

9. A number is decreased by 20% to get another number. The number so obtained is increased by 200% to get a third number. The difference between the third number and the original number is what percentage is more or less than the difference between the second and the third number?

A. 15.7% more
B. 15.7% less
C. 12.5% more
D. 12.5% less

SOLUTION

Let the first number be 100
After a 20% decrease, the second number = 100 – 20 = 80
After a 200% increase in the second number, the third number = 80 + 200/100 × 80 = 240
Difference between the third number and the original number = 240 – 100 = 140
Difference of second and the third number = 240 – 80 = 160

Required percentage = (160 - 140) / 160 × 100
= 12.5%

So, the difference between the third number and the original number is 12.5% less than the difference between the second and the third number.

Hence, the correct answer is 12.5% less.

10. In an election between two candidates, a candidate who gets 64% of the votes polled is elected by a majority of 252 votes. What is the total number of votes polled?

A. 950
B. 900
C. 850
D. 800

SOLUTION

Percentage of votes won by the winner = 64%
The margin by which the winner won the elections = 252 votes
Number of votes for losing candidate = (100 - 64)% = 36%

Let the total number of votes be Q.

According to the question,
Q × (64 - 36) / 100 = 252
⇒ Q × 28 / 100 = 252
⇒ Q = 252 × 100 / 28
⇒ Q = 900

So, the total number of votes is 900.

Hence, the correct answer is 900.

11. 20% of the inhabitants of a village had died of malaria, a panic set in, during which 30% of the remaining inhabitants left the village. The population was then reduced to 12,000. What was the number of inhabitants initially (Consider integral part only)

A. 21000
B. 21428
C. 21500
D. 30428

SOLUTION

Given, 20% of the inhabitants of the village died of malaria
And, 30% of the inhabitants left the village

Let the inhabitants initially be P.

⇒ Reduced = P × (100 - 20%) × (100 - 30%)
⇒ 12000 = P × 80/100 × 70/100
⇒ P = 12000 × 100 × 100 / (70 × 80)
⇒ P = 21428

Hence, the correct answer is 21428.

12. The population of a city is 20,000. It increases by 20% during the first year and 30% during the second year. The population after two years will be:

A. 32,000
B. 40,000
C. 31,200
D. 30,000

SOLUTION

Population after two years= P(1+R1/100)(1+R2/100)

where P is the initial population, R1 is the rate of increase in the first year, and R2 is the rate of increase in the second year.

= 20000(1+20/100)(1+30/100)

= 20000(120/100)(130/100)

= 31200

Hence, the correct answer is 31,200.

13. In a city, 40% of the people are illiterate and 60% are poor. Among the rich, 10% are illiterate. The percentage of the illiterate poor population is:

A. 36
B. 60
C. 40
D. 50

SOLUTION

Let the total population of the city be 100.
The number of illiterate people = 40% of 100 = 40
The number of poor people = 60% of 100 = 60
The number of rich people = (100 – 60) = 40
The number of illiterate rich people = 10% of 40 = 4
The number of illiterate poor people = 40 – 4 = 36

Percentage = Number of illiterate poor people / Total population × 100

Percentage of illiterate poor population = 36 / 100 × 100 = 36%

Hence, the correct answer is 36%.

14. If A is 95% of B, what per cent of A is B?

A. 110 3/19
B. 104 7/19
C. 108 17/19
D. 105 5/19

SOLUTION

Let B be 100.
A is 95% of B, which is 95.

B as a percentage of A is B/A × 100.
= 100/95 × 100.
= 105 5/19.

Hence, the correct answer is 105 5/19.

15. Which of the following has the lowest value?

12% of 625
15% of 555
10% of 720
9% of 845

A. 9% of 845
B. 12% of 625
C. 10% of 720
D. 15% of 555

SOLUTION

12% of 625 = 75

15% of 555 = 83.25

10% of 720 = 72

9% of 845 = 76.05

Here 72 is the least.

Hence, the correct answer is 10% of 720.

PRACTICE EXERCISES

1. A number is increased by 20% and then again by 20%. By what percent should the increased number be reduced so as to get back to the original number?

A) $19\ \frac{11}{31}\%$
B) $30\ \frac{5}{9}\%$
C) 40%
D) 44%

2. 25% of 30% of 850 + 5 × 76 = ?

A) 441.75
B) 441.57
C) 443.57
D) 443.75

3. 38.4% of 1450 + 78.2% of 240 - $?^2$ = 20% of 77.4 Find ?

A) 18
B) 29
C) 27
D) 81

4. A speaks truth in 75% cases and B in 80% of the cases. In what percentage of cases are they likely to contradict each other, narrating the same incident?

A) 5%
B) 15%
C) 35%
D) 45%

5. A person spends 25% of his income on goods for daily use. Furthermore, he spends 18% of the rest on house rent and 16% of the rest on travel. After that, only INR 861 is left with him. What is his salary?

A. INR 1852 1/3
B. INR 1666 2/3
C. INR 1563 1/3
D. INR 1426 1/3

ANSWER KEY

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1 - B, 2 - D, 3 - C, 4 - C, 5 - B

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SOLUTIONS

1. Let's assume the original number is x.

When the number is increased by 20%, it becomes x + 0.2x = 1.2x.

When this increased number is again increased by 20%, it becomes 1.2x + 0.2(1.2x) = 1.2x + 0.24x = 1.44x.

Now, we need to find by what percentage should this increased number be reduced to get back to the original number x.

The percentage reduction needed can be calculated as:

increase / increased value × 100

So, the percentage reduction needed is:

(1.44x - x) / 1.44x × 100 = 0.44x / 1.44x × 100 = 44 / 144 × 100

Simplifying this fraction:

44 / 144 = 11 / 36

Therefore, the percentage reduction needed is 11 / 36 × 100 which is approximately 30.56%.

So, the answer is approximately 30 5/9%, which corresponds to option B.

2. To solve this expression, let's break it down step by step:

1. Calculate 30% of 850: 0.30 ×850 = 255.

2. Calculate 25% of 255: 0.25 ×255 = 63.75.

3. Multiply 5 by 76: 5 ×76 = 380.

4. Add the results from steps 2 and 3: 63.75 + 380 = 443.75.

So, the correct answer is option D) 443.75.

3. 38.4% of 1450 + 78.2% of 240 – ?

2 = 20% of 77.4

or, $?^2$ = 38.4% of 1450 + 78.2% of 240 – 20% of 77.4

or, $?_2$ = 556.8 + 187.68 – 15.48

= 744.48 – 15.48 = 729

∴ ? = √729 = 27

Hence, option C is correct.

4. Given:

P(A) = 3/4

P(B) = 4/5

To find the probability of contradiction, we need to consider the cases where A speaks the truth while B lies or A lies while B speaks the truth.

P(contradiction) = P(A and not B) + P(not A and B)

P(contradiction) = P(A) ×(1 - P(B)) + (1 - P(A)) ×P(B)

P(contradiction) = 3/4 ×1/5 + 1/4 ×4/5

P(contradiction) = 3/20 + 4/20

P(contradiction) = 7/20

So, in 7/20 or 35% of cases, A and B are likely to contradict each other while narrating the same incident.

5. Given: The person spends 25% of his income on goods of daily use.

Let the person's total salary be 100,000y.

Then, the person has left 100000y × 75% = 75000y

He spends 18% of the rest on house rent.

Then, the person has 75000y × 82% = 61500y

And 16% of the rest on travel.

Then, the person has 61500y × 84% = 51660y

According to the question,

51660y = 861

⇒ y = 861 / 51660

So, the total salary is 100000y = (100000 × 861) / 51660 = 86100000 / 51660 = INR 1666 ⅔

Hence, the correct answer is INR 1666 2/3.

PIPES AND CISTERNS

Inlet:

A conduit linked with a tank, cistern, or reservoir, facilitating its filling, is termed an inlet.

Outlet:

A conduit connected with a tank, cistern, or reservoir, facilitating its emptying, is termed an outlet.

If a pipe can fill a tank within x hours, then: the fraction filled in 1 hour. = $\frac{1}{x}$.

If a pipe can empty a tank in y hours, then: the portion emptied in 1 hour.= $\frac{1}{y}$.

If a pipe can fill a tank in x hours and another pipe can empty the full tank in y hours (where y > x), then on opening both the pipes, the net portion filled in 1 hour. = $\left(\frac{1}{x}-\frac{1}{y}\right)$.

If a pipe can fill a tank in x hours and another pipe can empty the full tank in y hours (where x > y), then on opening both the pipes, the net portion emptied in 1 hour. = $\left(\frac{1}{y}-\frac{1}{x}\right)$.

SOLVED EXAMPLES ON PIPES AND CISTERNS

1. Pipe A can fill an empty tank in 30 hours and B can fill it in 10 hours. Due to a leakage in the tank, it takes pipes A and B together 1.5 hours more to fill it completely that it would have otherwise taken. What is the time taken by the leakage alone to empty the same tank completely, starting when the tank is completely full?

A. 42 hours
B. 40 hours
C. 36 hours
D. 45 hours

SOLUTION

Time taken by pipe A to fill a tank = 30 hours
Part of tank filled by pipe A in an hour = 1/30

Time taken by pipe B to fill a tank = 10 hours
Part of tank filled by pipe B in an hour = 1/10

Part of the tank filled by pipes A and B together in an hour = 1/30 + 1/10 = (1+3)/30 = 2/15

Time taken by pipes A and B together to fill the tank = 15/2 = 7.5 hours

Let x be the time taken by the leakage to empty the tank.
Part of tank emptied by the leakage in an hour = 1/x

Time taken by pipes A and B together to fill the tank along with the leakage = 7.5 + 1.5 = 9 hours

Part of the tank filled by pipes A and B along with the leakage = 1/9

(1/30) + (1/10) - (1/x) = 1/9

(1/x) = ((1+3)/30) - (1/9)

= (36-30)/270

= 6/270

= 1/45

Therefore, x = 45

Hence, the correct answer is 45 hours.

2. Three pipes A, B and C can fill a cistern in 6 hours. After working at it together for 2 hours, C is closed and A and B fill it in 7 hours more. The time taken by C alone to fill the cistern is:

A. 14 hours
B. 15 hours
C. 16 hours
D. 17 hours

SOLUTION

In 1 hour (A + B + C) fills 1/6 of the tank.

In 2 hours (A + B + C) fills (1/6) × 2 = 1/3 of the tank.

In 7 hours (A + B) fills the remaining (1 - 1/3) = 2/3 of the tank.

In 1 hour (A + B) fills 2/21 of the tank.

Therefore, C's 1 hour of work = (A + B + C)'s 1-hour work – (A + B)'s 1-hour work = 1/6 - 2/21 = 1/14

Therefore, C alone can fill the tank in 14 hours.

The correct answer is 14 hours.

3. Pipes P and Q can fill a tank in 10 and 12 hours respectively and C can empty it in 6 hours. If all three are opened at 7 AM at what time will one-fourth of the tank be filled?

A. 10 AM
B. 10 PM
C. 11 PM
D. 11 AM

SOLUTION

Pipe P hourly work = 1/10 unit
Pipe Q hourly work = 1/12 unit
Pipe C hourly work = -1/6 unit

When all pipes are working together, the tank will be filled in x hours.
The volume of the cistern was filled in one hour by two inlet pipes and one outlet pipe.

⇒ 1/10 + 1/12 - 1/6 = 1/x

⇒ 1/x = (6 + 5 - 10)/60

⇒ 1/x = 1/60

Therefore, x = 60

Thus, 1/4 of the tank is filled in (1/4) × 60 = 15 hours

At 7:00 AM, all pipes start working, so 7:00 AM + 15 hours = 10:00 PM

Hence, the correct answer is 10 PM.

4. A swimming pool has 3 drain pipes. The first two pipes A and B, operating simultaneously, can empty the pool in half the time that C, the 3rd pipe, alone takes to empty it. Also pipe A, working alone, takes half the time taken by pipe B. Together they take 6 hours 40 minutes to empty the pool. The time taken by pipe A to empty the pool, (in hours) is:

A. 15 hours
B. 10 hours
C. 30 hours
D. 7 hours

SOLUTION

Let the time taken by pipe B to empty the tank be 2x hours. Time taken by pipe A to empty the tank be x hours.

(A and B) takes half of the time that C takes. ⇒ (2/(1/(2x)+1/x))=(2/(1+2)/(2x))=(4x/3) hours

Pipes A, B, and C together take 6 hours and 40 minutes to empty the pool.

⇒ (1/x)+(1/(2x))+(3/(4x))=(1/(6+40/60))

⇒ (1/x)+(1/(2x))+(3/(4x))=(1/(6+2/3))

⇒ (4+2+3)/(4x)=(3/20)

⇒ 9×20=4x×3

⇒ x=(9×20)/(4×3)

Therefore, x=15 hours

Hence, the correct answer is 15 hours.

5. Two pipes can independently fill a bucket in 20 minutes and 25 minutes. Both are opened together for 5 minutes after which the second pipe is turned off. What is the time taken by the first pipe alone to fill the remaining portion of the bucket?

A. 11 minutes
B. 16 minutes
C. 20 minutes
D. 15 minutes

SOLUTION

1 minute work of Pipe 1 = 1/20
1 minute work of Pipe 2 = 1/25

After 5 minutes of operation, the fraction of the work completed = (1/20 + 1/25) × 5 = (9/100) × 5 = 9/20

Remaining tank = (1 - 9/20) = 11/20

The remaining tank will be filled by Pipe 1 alone with an efficiency of 1/20.

Thus, (11/20) ÷ (1/20) = 11 minutes

Hence, the correct answer is 11 minutes.

6. Two inlet pipes can fill a cistern in 10 and 12 hours respectively and an outlet pipe can empty 80 gallons of water per hour. All three pipes working together can fill the empty cistern in 20 hours. What is the capacity (in gallons) of the tank?

A. 360
B. 300
C. 600
D. 900

SOLUTION

Let the time taken by the outlet pipe to empty the tank be x hours.

One hour's work of Pipe A = 1/10

One hour's work of Pipe B = 1/12

One hour's work of Pipe C = -1/x

When all pipes work together, the tank will be emptied in 20 hours. So, (1/10) + (1/12) - (1/x) = (1/20)

⇒ (1/10) + (1/12) - (1/20) = (1/x)

⇒ (1/x) = (6 + 5 - 3)/60

⇒ (1/x) = 8/60

Therefore, x = 15/2 = 7.5 hours

Therefore, the outlet pipe can empty the tank in 7.5 hours.

In one hour, it empties 80 gallons.

In 7.5 hours, it empties 80 × 7.5 = 600 gallons

The capacity of the tank is 600 gallons.

Hence, the correct answer is 600 gallons.

7. Pipes A, B and C can fill a tank in 15,30 and 40 hours, respectively. Pipes A, B and C are opened at 6 A.M. , 8 A.M. and 10 A.M. , respectively, on the same day. When will the tank be full?

A. 3: 20 P.M.
B. 11: 20 P.M.
C. 7: 20 P.M.
D. 5: 20 P.M.

SOLUTION

A = 15, B = 30, and C = 40

Total work = 120

Efficiency of A = 8

Efficiency of B = 4

Efficiency of C = 3

From 6 am to 8 am, A and B

Total work = 2 × 12 = 24 units

Remaining work = 120 – 16 – 24 = 80 units, A, B, and C completed together

Time = 80/(8 + 4 + 3) = 5 1/3 = 5 hours 20 minutes

So tank fills = 10 am + 5 hours 20 minutes = 3 pm 20 minutes

Hence, the correct answer is 3 pm 20 minutes.

8.Pipes A and B can fill a tank in 16 hours and 24 hours, respectively, whereas pipe C can empty the full tank in 40 hours. All three pipes are opened together, but pipe C is closed after 10 hours. After how many hours will the remaining part of the tank be filled?

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

SOLUTION

Total Work = Least Common Multiple (LCM) of 16, 24, and 40 = 240

Let the total capacity of the tank be 240 units

Efficiency of A = 240/16 = 15 units

Efficiency of B = 240/24 = 10 units

Efficiency of C = 240/(-40) = -6 units (Since C is emptying pipe)

When all three pipes were opened together for 10 hours,
Work done = (15 + 10 - 6) × 10 = 190 units

Remaining work = 240 units - 190 units = 50 units

Now, Pipe C is closed and the remaining tank will be filled by A and B in = 50/(15 + 10) hours = 50/25 = 2 hours

Hence, the correct answer is 2.

9. Two pipes A and B can fill a tank in 12 hours and 18 hours, respectively. Both pipes are opened simultaneously. In how much time will the empty tank be filled completely?

A. 9 hours 30 minutes
B. 8 hours
C. 7 hours 12 minutes
D. 10 hours 24 minutes

SOLUTION

Hourly work of pipe A = 1/12
Hourly work of pipe B = 1/18
Hourly work of pipe A and B = 1/12 + 1/18

= (15 + 10)/180
= 25/180
= 5/36

Thus, the tank can be filled completely in 36/5 hours = 7.2 hours = 7 hours 12 minutes

Hence, the correct answer is '7 hours 12 minutes'

10. Pipes P and Q can fill a tank in 18 and 27 minutes, respectively, whereas pipe R can empty the full tank in 54 minutes. P and Q were opened together for 6 minutes and then closed and R was opened. The tank was emptied by R alone in:

A. 35 minutes
B. 45 minutes
C. 30 minutes
D. 40 minutes

SOLUTION

Given:
Pipe P filling time = 18 minutes
Pipe Q filling time = 27 minutes
Pipe R empty time = 54 minutes

P and Q opened for 6 minutes

Now,
Take LCM of 18, 27, and 54 which is 54.
Total work = 54
Efficiency of P = 3
Efficiency of Q = 2
Efficiency of R = 1

Work done by P and Q in 6 minutes = (3 + 2) × 6 = 30

Pipe R empties the tank = 30/1 = 30 minutes

Hence, pipe R will empty the tank in 30 minutes.

PRACTICE EXERCISES

1. Three pipes, A, B and C, can fill a cistern in 12, 18 and 24 minutes, respectively. If all the pipes are opened together for 7 minutes, what will be the volume of the water that overflows as the percentage of the total volume of the cistern?

A. 23 2/3 percent
B. 26 5/18 percent
C. 23 1/3 percent
D. 26 7/18 percent

2. Pipes A and B together can fill an empty tank in 6 2/3 minutes. If A takes 3 minutes more than B to fill the tank, then the time (in minutes) in which A alone would fill one-third part of the tank is:

A. 6
B. 5
C. 5.5
D. 4.5

3. Pipes A and B can empty a full tank in 18 hours and 24 hours, respectively. Pipe C alone can fill the tank in 36 hours. If the tank is 5/6 full and all three pipes are opened together, then in how many hours will the tank be emptied?

A. 15
B. 14
C. 13
D. 12

4. Pipes A, B and C together can fill a cistern in 12 hours. All the three pipes are opened together for 4 hours and then C is closed. A and B together take 10 hours to fill the remaining part of the cistern. C alone will fill two-thirds of the cistern in:

A. 60 hours
B. 40 hours
C. 48 hours
D. 50 hours

5. An inlet pipe can fill an empty tank in 3.6 hours, while an outlet pipe can drain a completely filled tank in 6.3 hours. If both the pipes are opened simultaneously when the tank is empty, in how many hours will the tank get completely filled?

A. 9
B. 8.4
C. 8.1
D. 8.7

ANSWER KEY

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1 - D, 2 - B, 3 - D, 4 - B, 5 - B

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SOLUTIONS

1. Let the volume of the cistern be 72 units.

Pipe A can fill the cistern in 12 minutes.
The rate of filling = 72/12 = 6 units per minute

Similarly, pipe B can fill the cistern in 18 minutes.
The rate of filling = 72/18 = 4 units per minute

Finally, pipe C can fill the cistern in 24 minutes.
The rate of filling = 72/24 = 3 units per minute

When all the pipes are opened together, the total rate of filling = 6 + 4 + 3 = 13 units per minute

Therefore, in 7 minutes the total volume of water filled in the cistern is 91 units.

The volume of the water that overflows is the difference between the volume of water filled in the cistern and the volume of the cistern itself is 19 units.

Therefore, the percentage of the total volume of the cistern that overflows is,
= (19/72) × 100 = 26 7/18%

Hence, the correct answer is 26 7/18%.

2. Given: Pipes A and B together can fill an empty tank in 6 2/3 = 20/3 minutes.

A takes 3 minutes more than B to fill the tank.

In x minutes, pipe B by itself can empty the entire tank.

The complete tank can be emptied in (x + 3) minutes with just Pipe A.

According to the question,
$(1/(x+3)) + (1/x) = 3/20$

$\Rightarrow ((x+x+3)/(x^2+3x)) = 3/20$

$\Rightarrow ((2x+3)/(x^2+3x)) = 3/20$

$\Rightarrow 40x + 60 = 3^2 + 9x$

$\Rightarrow 3x^2 - 31x - 60 = 0$

$\Rightarrow 3x^2 - 36x + 5x - 60 = 0$

$\Rightarrow 3x(x - 12) + 5(x - 12) = 0$

$\Rightarrow (x - 12)(3x + 5) = 0$

$\Rightarrow x - 12 = 0$

$\Rightarrow x = 12$

Pipe B takes 12 minutes to empty the entire tank.

The amount of time pipe A needs to empty a full tank is 12 + 3 = 15 minutes.

The time in which A alone would fill one-third part of the tank = 15 × (1/3) = 5 minutes.

Hence, the correct answer is 5 minutes.

3. Time taken by pipe A to empty a full tank = 18 hours
Part of tank drained by pipe A in an hour = 1/18

Time taken by pipe B to empty a full tank = 24 hours
Part of tank drained by pipe B in an hour = 1/24

Time taken by pipe C to fill a full tank = 36 hours
Part of tank filled by pipe C in an hour = 1/36

Part of the tank emptied by pipes A, B, and C in an hour = -1/18 - 1/24 + 1/36
= (-4 - 3 + 2)/72
= -5/72

Time taken by pipes A, B, and C to empty the tank = 72/5

Time taken by pipes A, B, and C to empty 5/6th of the tank = (5/6) × (72/5)
= 72/6
= 12 hours

Hence, the correct answer is 12.

4. Pipes A, B, and C together can fill the cistern in 12 hours. So, their combined rate is 1/12 cistern per hour.

All three pipes are opened together for 4 hours, so they fill 4 × 1/12 = 1/3 of the cistern.

This leaves 1 - 1/3 = 2/3 of the cistern to be filled.

Pipes A and B together take 10 hours to fill this remaining part. So, their combined rate is 2/(3 × 10) = 1/15 cistern per hour.

Since A, B, and C together have a rate of 1/12 cistern per hour, and A and B together have a rate of 1/15 cistern per hour, the rate of pipe C alone is 1/12 - 1/15 = 1/60 cistern per hour.

Therefore, pipe C alone will fill two-thirds of the cistern in (2/3) × 60 = 40 hours.

Hence, the correct answer is 40 hours.

5. The rate at which the inlet pipe can fill the tank is 1 tank per 3.6 hours, or 1/3.6 tanks per hour.

The rate at which the outlet pipe can drain the tank is 1 tank per 6.3 hours, or 1/6.3 tanks per hour.

When both pipes are opened simultaneously, the net rate of filling the tank is the rate of the inlet pipe minus the rate of the outlet pipe.

Net rate = 1/3.6 - 1/6.3

Time = 1 / Net rate

Time = 1 / (1/3.6 - 1/6.3)

Time = 1 / (5/18 - 10/63) = 1 / (5/42) = 42/5

Time = 8.4

Hence, the correct answer is 8.4.

TIME-SPEED-DISTANCE

1. Speed, Time and Distance:

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

2. km/hr to m/s conversion is given below:

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

3. m/s to km/hr conversion is given below

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

4. Given the ratio of the speeds of A and B is a: b, then the ratio of the times taken by them to cover the same distance is $\frac{1}{a} : \frac{1}{b}$ or b: a.

5. Suppose a man travels a certain distance at x km/hr and the same distance at y km/hr Then, the average speed during the whole journey is $\left(\frac{2xy}{x+y}\right)$ km/hr.

SOLVED EXAMPLES ON TIME-SPEED-DISTANCE

1. A student walked 6 km from his house to reach the metro station, then boarded a metro that had an average speed of 60 km/hr, and reached the destination. It took 3 hours for the entire journey. If the average speed of the entire journey is 32 km/hr, then the speed of walking is _____.

A. 1.5 km/hr
B. 3 km/hr
C. 2 km/hr
D. 4 km/hr

SOLUTION

Total distance travelled by him = 32 × 3 = 96 km

Distance covered on metro = 96 - 6 = 90 km

Time taken by the metro to cover 90 km = 90/60 = 1.5 hours

Remaining time = 3 - 1.5 = 1.5 hours

Speed of walking = 6/1.5 = 4 km/hr

Hence, the correct answer is 4 km/hr.

2. Menu and Daya travel from point A to B, a distance of 105 km, at speeds of 10 km/hr and 25 km/hr, respectively. Daya reaches point B first and returns immediately and meets Menu at point C. Find the distance from point A to point C.

A. 35 km
B. 60 km
C. 45 km
D. 62 km

SOLUTION

The distance of A and B = 105 km

Let's assume that they meet at point C, and CB = x
Then AC = (105 - x)

Speed of Daya = 25 km/hr
Speed of Menu = 10 km/hr

Distance covered by Daya = (105 + x)
Menu covers (105 - x)

Since, Time = Distance / Speed

So, (105 + x) / 25 = (105 - x) / 10

⇒ 1050 + 10x = 2625 - 25x

⇒ 35x = 1575

⇒ x = 45

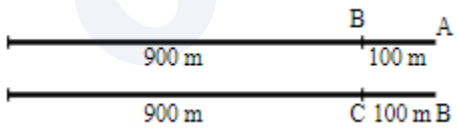
So, distance from AC = (105 - 45) = 60 km

Hence, the correct answer is 60 km.

3. In a 1000 m race, Arjun, Balaji, and Charan are running. Arjun beats Balaji by 100 m, and Balaji beats Charan by 100 m. In the next 1000 m race (the speeds are the same as in the previous), Balaji gives Charan a head start of 100 m, and Arjun gives Balaji a head start of 100 m. Find the distance by which the winner is ahead of the person just behind him.

A. 100 m
B. 40 m
C. 30 m
D. 20 m

SOLUTION



Let us denote Arjun by A, Balaji by B, and Charan by C.

In a 1000 m race, Arjun beats Balaji by 100 m. Hence, while Arjun covers 1000 m, Balaji covers 900 m.

So, Speed of Arjun: Speed of Balaji = 1000 : 900 = 10 : 9 = 100 : 90

In a 1000 m race, Balaji beats Charan by 100 m. Hence, while Balaji covers 1000 m, Charan covers 900 m.

So, Speed of Balaji: Speed of Charan = 1000 : 900 = 10 : 9 = 90 : 81

Hence, Speed of Arjun : Speed of Balaji : Speed of Charan = 100 : 90 : 81

Let the speed of Arjun, Balaji, and Charan be 100s, 90s, and 81s respectively.

In the next race, Arjun has to cover = 1000 m, Balaji has to cover = 1000 – 100 = 900 m, and Charan has to cover = 900 – 100 m = 800 m.

Also, Time taken by Arjun to reach the finish line = 1000 / (100s) = 10 / s

Time taken by Balaji to reach the finish line = 900 / (90s) = 10 / s

Time taken by Charan to reach the finish line = 800 / (81s)

It is visible that Charan will be the winner. By that time, Arjun will cover = 100s × (800 / 81s) ≈ 980 m, Balaji will cover = 90s × (800 / 81s) ≈ 880 m

Now, the distance by which the winner is ahead of the person just behind him = 1000 - 980 = 20 m

Hence, the correct answer is 20 m.

4. Ram starts from point A at 8 A.M. and reaches point B at 2 P.M. on the same day. On the same day, Raju starts from point B at 8 A.M. and reaches point A at 6 P.M. on the same day. Both points A and B are separated by only a straight line track. At what time do they both meet?

A. 11:45 A.M.
B. 9:42 a.m
C. 10:42 a.m
D. 12:42 P.M.

SOLUTION

Let the distance be D.

Time taken by Ram is 6 hrs and that by Raju is 10 hrs.

So, speed of Ram = D/6 and speed of Raju = D/10.

Now, the relative speed = (D/6) + (D/10) = (5D + 3D)/30 = 8D/30.

Required time = D / (8D/30) = 30 / 8 hr = 225 min = 3 hr 45 min.

So, they will meet at (8 A.M. + 3 hr 45 min) = 11:45 A.M.

Hence, the correct answer is 11:45 A.M.

5. A man rows a boat a certain distance downstream in 9 hours, while it takes 18 hours to row the same distance upstream. How many hours will it take him to row three-fifth of the same distance in still water?

A. 9.5
B. 7.2
C. 10
D. 12

SOLUTION

Given: Time taken for upstream = 18 hours
Time taken for downstream = 9 hours

LCM of 9 and 18 is 18.

Let the distance be 18 km.

Downstream speed = Distance / Time = 18 / 9 = 2 km/hr

Upstream speed = 18 / 18 = 1 km/hr

Speed of the boat in still water = (1 + 2) / 2 = 3 / 2 = 1.5 km/hr

Now, (3/5)th of 18 km = (3/5) × 18 = 54/5 km

Thus, the boat can row (54/5) km with a speed of 1.5 km/hr = (54/5) / 1.5 = (54/7.5) = 7.2 hours

Hence, the correct answer is 7.2 hours.

6. A policeman spotted a thief 40 metres ahead of him. The moment they both saw each other they started running in the same direction on the same track. The thief was running at 10 m/sec and the policeman was chasing him at the speed of 12 m/sec. How much distance (in metres) the policeman needed to cover to catch the thief?

A. 180
B. 240
C. 200
D. 225

SOLUTION

The relative speed of the police to the thief = 12 – 10 = 2 m/sec

Now, the total time taken to catch the thief = 40 / 2 = 20 sec

So, distance travelled by the police = 20 × 12 = 240 m

Hence, the correct answer is 240.

7. A person travels in a car at 40 km/hr for 3 hours, on a bike at 30 km/hr for 2 hours, and in a train at 80 km/hr for 5 hours. What is the average speed at which he travelled?

A. 56 km/hr
B. 60 km/hr
C. 62 km/hr
D. 58 km/hr

SOLUTION

We know Distance = Speed × Time

Distance travelled by the person travelling at 40 km/hr for 3 hours = 40 × 3 km = 120 km

Distance travelled by the person travelling at 30 km/hr for 2 hours = 30 × 2 km = 60 km

Distance travelled by the person travelling at 80 km/hr for 5 hours = 80 × 5 km = 400 km

Now, Average Speed = Total Distance / Total Time

= (120 + 60 + 400) / (3 + 2 + 5)

= 580 / 10

= 58 km/hr

Hence, the correct answer is 58 km/hr.

8. A jeep travels to a place 300 km away at an average speed of 60 km/hr and returns at a speed of 30 km/hr. What is the average speed (in km/hr) for the whole journey?

A. 75
B. 80
C. 40
D. 60

SOLUTION

Distance for one-way journey = 300 km
Average speed for the first part of the journey = 60 km/h
Average speed for the return part of the journey = 30 km/hr

We know, Time = Distance / Speed

So, Time taken for the first part of the journey = 300 / 60 = 5 hr

Time taken for the return part of the journey = 300 / 30 = 10 hr

Now, Average speed = Total Distance / Total Time = (300 + 300) / (5 + 10) = 600 / 15 = 40 km/hr

Hence, the correct answer is 40 km/hr.

9. In a linear race of 500 m, A can beat B by 50 m, and in a race of 600 m, B can beat C by 60 m. By how many metres will A beat C in a race of 400 m?

A. 70
B. 68
C. 76
D. 72

SOLUTION

Distance for one-way journey = 300 km
Average speed for the first part of the journey = 60 km/h
Average speed for the return part of the journey = 30 km/hr

We know, Time = Distance / Speed

So, Time taken for the first part of the journey = 300 / 60 = 5 hr

Time taken for the return part of the journey = 300 / 30 = 10 hr

Now, Average speed = Total Distance / Total Time = (300 + 300) / (5 + 10) = 600 / 15 = 40 km/hr

Hence, the correct answer is 40 km/hr.

10. Two cities A and B are 135 km apart on a straight track. One car starts from A at 8 A.M. and travels towards B at 25 km/hr. Another car starts from B at 9 A.M. and travels towards A at a speed of 30 km/hr. At what time will they meet?

A. 11 a.m
B. 10 a.m
C. 10.45 a.m
D. 11.30 a.m

SOLUTION

Let the bus and car meet after time t hours from 9 A.M.

Total distance covered by car and bus together = Total distance between cities = 135 km

Distance travelled by car moving at 25 km/hr from 8 A.M. = 25(t + 1) km

Distance travelled by the bus moving at 30 km/hr from 9 A.M. = 30(t) km

Total distance covered by car and bus together = 135 km

So, 25(t + 1) + 30(t) = 135

⇒ 55t = 110

⇒ t = 2 hours

So, they meet after 2 hours from 9 A.M. That is, 11 A.M.

Hence, the correct answer is 11 A.M.

11. A thief stole jewellery from a shop at 8:15 P.M. and left on a bike at a speed of 60 km/hr. The police were informed at 8:30 P.M. If the police want to arrest the thief at 9:00 P.M., what should be the minimum speed of the police jeep?

A. 60 km/hr
B. 80 km/hr
C. 90 km/hr
D. 75 km/hr

SOLUTION

Total time travelled by the thief = 9:00 - 8:15 = 45 min = 3/4 hour

Speed of thief = 60 km/hr

Distance travelled = 60 × 3/4 = 45 km

Total time travelled by the thief = 9:00 - 8:30 = 30 min = 1/2 hour

Speed of police = 45 / (1/2) = 90 km/hr

Hence, the correct answer is 90 km/hr

12. R jogs at twice the speed of walking and runs at twice the speed of jogging. From his home to office, he covers half of the distance by walking and the rest by jogging. From his office to home, he covers half the distance jogging and the rest by running. What is his average speed (in km/hr) in a complete round from his home to office and back home if the distance between his office and home is 10 km and he walks at the speed of 5 km/hr?

A. 60/8
B. 60/9
C. 80/9
D. 90/8

SOLUTION

R's jogging speed = 5 × 2 = 10 km/hr
R's running speed = 10 × 2 = 20 km/hr

Now,
At the time of going to his office, time taken = 5/5 + 5/10 = 1 + 0.5 = 1.5 hours
At the time of returning to his home, time taken = 5/10 + 5/20 = 0.5 + 0.25 = 0.75-hour

Total time = 1.5 + 0.75 = 2.25 hours or 9/4 hours

Total distance covered by R = 20 km

So, average speed = 20 / (9/4) = (20 × 4) / 9 = 80/9 km/hr

Hence, the correct answer is 80/9 km/hr.

13. Prasad goes 96 kilometres on a bike at a speed of 16 km/hr, 124 kilometres at 31 km/hr in a car, and 105 kilometres at 7 km/hr in a horse cart. Find his average speed for the entire distance travelled.

A. 16 km/hr
B. 13 km/hr
C. 17 km/hr
D. 11 km/hr

SOLUTION

Total distance travelled = 96 + 124 + 105 = 325 km

Total time taken = 96/16 + 124/31 + 105/7 = 6 + 4 + 15 = 25 hours

Average speed = Total distance / Total time taken = 325 / 25 = 13 km/hr

Hence, the correct answer is 13 km/hr.

14. Vikas covered a certain distance by bike. If he covers 40% of the distance at 40 km/hr, 50% of the distance at 25 km/hr and the remaining 10% distance at 10 km/hr. Find his average speed over the whole distance.

A. 25 km/hr
B. 28 km/hr
C. 26 km/hr
D. 30 km/hr

SOLUTION

Let the total distance be 100x.

We know the average speed:

Average speed = Total distance / Sum of total speed

= 100x / (100x × 40% / 40 + 100x × 50% / 25 + 100x × 10% / 10)

= 100x / (100x × 40 / 40 × 100 + 100x × 50 / 25 × 100 + 100x × 10 / 10 × 100)

= 100x / (x + 2x + x)

= 100x / 4x

= 25 km/hr

Hence, the correct answer is 25 km/hr.

15. In a 1200 m race, bike A beats bike B by 100 m. Bike B beats bike C by 100 m in a 600 m race. If bike A beats bike C by 30 sec in a 720 m race, then what is the speed of bike C?

A. 17/3 m/sec
B. 26/9 m/sec
C. 17/9 m/sec
D. 26/3 m/sec

SOLUTION

When bike A covers 1200 m, bike B covers 1100 m

Ratio of speed = 12 : 11

Also,

When bike B covers 600 m, bike C covers 500 m

Ratio of speed = 6 : 5

The ratio of the speed of A, B, and C = 72 : 66 : 55

So, when bike A covers 720 m, then bike C covers 550 m

⇒ Difference = 720 - 550 = 170 m

Now,

Bike C will cover the remaining 170 m in 30 sec

⇒ Speed of bike C = 170 / 30 = 17 / 3 m/sec

PRACTICE EXERCISES

1. A thief seeing a policeman from a distance of 300 m starts running at a speed of 10 km/h. The policeman gives chase immediately at a speed of 12 km/h and the thief is caught. What is the distance run by the thief?

A. 2 km
B. 2.5 km
C. 3.2 km
D. 1.5 km

2. In a 1500 m race, X beats Y by 100 m and X beats Z by 240 m. By what distance does Y beat Z in the same race?

A. 160 m
B. 140 m
C. 150 m
D. 200 m

3. Two persons started running on a circular track at a speed of 20 m/s and 30m/s in opposite directions. If the circumference of the circular track is 100 m, find how many distinct points they will cross each other.

A. 2
B. 3
C. 5
D. 10

4. The speed of the boat down the stream is 125% of the speed in still water. If the boat takes 30 minutes to cover 20 km in still water, then how much time (in hours) will it take to cover 15 km upstream?

A. 3/4
B. 1/2
C. 1/4
D. 1

5. A man drives his car for 24 km at a speed of 48 km/h and for the next 1.5 hours, he drives at a speed of 80 km/h. Find his average speed (in km/h) for the entire journey.

A. 64
B. 72
C. 68
D. 75

ANSWER KEY

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1 - D, 2 - C, 3 - C, 4 - B, 5 - B

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SOLUTIONS

1. The distance between the thief and the policeman = 300 m

The speed of the thief = 10 km/h.

The speed of a policeman = 12 km/h.

The relative speed = 12 – 10 = 2 km/h or 5/9 m/s.

Time = Distance / Speed

The time = (300 × 9) / 5 = 540 s

The thief is running at a speed of 10 km/h or 50/18 m/s.

The distance run by the thief = (50/18) × 540 = 1500 m

Hence, the answer is 1500 m or 1.5 km.

2. Given: The length of the race = 1500 m
And, X beats Y by 100 m
And X beats Z by 240 m.

When X is at 1500 m,
Y will be at 1500 – 100 = 1400 m
Z will be at 1500 – 240 = 1260 m

The ratio of distance covered by Y and Z = 1400 : 1260 = 10 : 9

Distance by Y beats Z = (10-9)/10 × 1500 = 150 m.

Hence, the correct answer is 150 m.

3. The ratio of the speed of both of the runners = 20 : 30 = 2 : 3
They will meet 5 times (sum of the ratio of their speeds)
Hence, the correct answer is 5.

4. Speed of boat in still water = 20 / (30 / 60) km/h

= 40 km/h

Speed of boat downstream = 50 km/h (As it is 125% more than the speed of the boat in still water)

Speed of current = 50 km/h – 40 km/h = 10 km/h

The time it will take to cover 15 km upstream

= Distance / (Speed in still water – speed of current)

= 15 / 30 = 1/2 hr

Hence, the correct answer is 1/2 hr.

5. Average speed = Total distance / Total time

Time taken to travel the distance of 24 km with a speed of 48 km/h
= 24 / 48 = 1/2 = 0.5 hr

The man drives for the next 1.5 hours he drives at a speed of 80 km/h
∴ Distance travelled in 1.5 hours with a speed of 80 km/h
= 80 × 1.5 = 120 km

∴ Total distance travelled
= 24 km + 120 km = 144 km

And the total time taken
= 0.5 hour + 1.5 hour = 2 hour

Therefore, Average speed = 144 / 2 = 72 km/h

Hence, the correct answer is 72 km/h.

PROBLEMS ON TRAIN

1. Speed, Time and Distance:

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

2. km/hr to m/s conversion is given below:

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

3. m/s to km/hr conversion is given below

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

SOLVED EXAMPLES ON PROBLEMS ON TRAIN

1. A train 180 m long moving at a speed of 20 m/sec overtakes a man moving at a speed of 10 m/sec in the same direction. The train passes the man in:

A. 6 sec
B. 9 sec
C. 18 sec
D. 27 sec

SOLUTION

Distance = length of train = 180 m
Speed of train = 20 m/s
Speed of man = 10 m/s

The direction of both the train and the man is the same.
So, relative speed = 20 - 10 = 10 m/s

Required time = 180 / 10 = 18 sec.

Hence, the correct answer is 18 sec.

2. A train 100 metres long is running at a speed of 30 km/hr. The time (in seconds) in which it will pass a man standing near the railway line is:

A. 10
B. 11
C. 12
D. 15

SOLUTION

Distance covered by train when the train crosses a standing man = length of the train

Distance = 100 m

Speed = 30 km/hr = 30 × (5/18) m/s = 25/3 m/s

Required time = 100 / (25/3) = 300 / 25 = 12 sec

Hence, the correct answer is 12 sec.

3. A train is running at a speed of 116 km/hr. The distance covered by the train (in metres) in 18 seconds is:

A. 900 metres
B. 1160 metres
C. 508 metres
D. 580 metres

SOLUTION

Given: The speed of the train is 116 km/hr.

To convert it into m/sec, multiply with 5/18.

⇒ (116 × 5/18) = 580/18 m/s

The distance covered in 18 seconds = Speed × Time = (580/18) × 18 = 580 metres

Hence, the correct answer is 580 metres.

4. A moving train passes a 50-metre-long platform in 14 seconds and a lamp post in 10 seconds. The speed of the train (in km/hr) is:

A. 24 km/hr
B. 36 km/hr
C. 40 km/hr
D. 45 km/hr

SOLUTION

Length of platform = 50 m
Time taken to pass the platform = 14 s
Time taken to pass the lamp post = 10 s

Let the length of the train be l and the train's speed be s.

s = (l + 50) / 14 ----------(1)

s = l / 10 ----------(2)

⇒ (l + 50) / 14 = l / 10

⇒ 10l + 500 = 14l

⇒ 500 = 4l

⇒ l = 500 / 4 = 125 m

Speed of the train = (125 / 10) × (18 / 5) = 45 km/hr

Hence, the answer is 45 km/hr

5. A train, 500 metres long and running at a uniform speed, passes a station in 35 seconds. If the length of the platform is 221 metres, the speed of the train in km/h is:

A. 72
B. 74.16
C. 24.76
D. 78.54

SOLUTION

Given: The distance of the train is 500 m and the length of the platform is 221 m. The time taken by the train is 35 seconds.

We know that speed = distance / time.

Total distance = 500 + 221 = 721 m

Speed = 721 / 35 m/s

To convert m/s into km/h, multiply with 18/5, we get,

(721 × 18) / (35 × 5) km/h

= 74.16 km/h

Hence, the correct answer is 74.16 km/h.

6. A train, 200 metres long, is running at a speed of 54 km/h. The time in seconds that will be taken by the train to cross a 175-metres-long bridge is:

A. 12.5
B. 20
C. 25
D. 10

SOLUTION

Given: Length of train = 200 m and length of bridge = 175 m. Its speed is 54 km/h.

To convert km/h into m/s, multiply with 5/18, we get:

54 × (5/18) = 15 m/s

We know that time = distance / speed.

(200 + 175) / 15 = 375 / 15 = 25 seconds

Hence, the correct answer is 25 seconds.

7. At what time will a 100-metre-long train running at a speed of 50 km/h cross a pillar?

A. 7 seconds
B. 72 seconds
C. 7.2 seconds
D. 70 seconds

SOLUTION

Given: The distance of the train is 100 m.
The speed of the train is 50 km/h.

To convert km/h into m/s, multiply with 5/18, we get:

50 × (5/18) = 125/9 m/s

So, the train takes time to cross the pillar is 100 / (125/9).

36/5 = 7.2 seconds

Hence, the correct answer is 7.2 seconds.

8. 150 metres long train passes a telegraphic post in 12 seconds. Find the speed of the train. (in km/h)

A. 50
B. 12.5
C. 25
D. 45

SOLUTION

Given: The distance of the train is 150 m and its time taken is 12 seconds.

We know that speed = distance / time.

To convert m/s into km/h multiply by 18/5 and we get,

So, the speed of the train is 150 / 12 × 18/5 = 45 km/h.

Hence, the correct answer is 45 km/h.

9. If a train is 60 metres long and travelling at 36 km/hr, how long will it take to pass by a telegraph post?

A. 9 seconds
B. 8 seconds
C. 7 seconds
D. 6 seconds

SOLUTION

Given: The distance of the train is 60 m and its speed is 36 km/h.

To convert km/h into m/s, multiply by 5/18 and we get,

= 36 × (5/18) = 10 m/s

We know that time = distance / speed

So, the train will take the required time, 60 / 10 = 6 seconds.

Hence, the correct answer is 6 seconds.

10. A 240-metre-long train passes a telegraph post in 16 seconds. What is the speed of the train?

A. 50 km/h
B. 52 km/h
C. 54 km/h
D. 56 km/h

SOLUTION

Given: The distance of the train is 240 m and it takes 16 seconds to cross the telegraph post.

We know that speed = distance / time.

To convert m/s into km/h, multiply with 18/5, we get,

So, the train speed is given as, 240 / 16 m/s.

(240 / 16) × (18 / 5) = 54 km/h

Hence, the correct answer is 54 km/h.

PRACTICE EXERCISES

1. If a train is 75 metres long and moving at 60 km/hr, how long does it take to pass by a certain telegraph post?

A. 3.5 seconds
B. 4.5 seconds
C. 5 seconds
D. 5.4 seconds

2. A 100-metre-long train is running at a speed of 120 km/h. The time taken to pass a person standing near the line is:

A. 1 second
B. 3 seconds
C. 5 seconds
D. 7 seconds

3. The time taken for a train of length 110 metres running at a speed of 72 km/h to cross a bridge of length 132 metres is:

A. 9.8 seconds
B. 12.1 seconds
C. 12.42 seconds
D. 14.3 seconds

4. A 110-metre-long train is running at a speed of 60 km/h. At what time will it pass a man who is running at 6 km/h in the direction opposite to that in which the train is going?

A. 5 seconds
B. 6 seconds
C. 7 seconds
D. 10 seconds

5. Two trains are moving in opposite directions at speeds of 43 km/h and 51 km/h, respectively. The time taken by the slower train to cross a man sitting in the faster train is 9 seconds. What is the length (in metres) of the slower train?

A. 235
B. 338.4
C. 470
D. 940

ANSWER KEY

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1 - B, 2 - B, 3 - B, 4 - B, 5 - A

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SOLUTION

1. Given: The distance of the train is 75 m and its speed is 60 km/h.

We know that time = distance / speed.

To convert km/h into m/s, multiply with 5/18, we get,

60 km/h = 60 × (5/18) = 50/3 m/s

So, the train will take the required time, 75 / (50/3) = 4.5 seconds.

Hence, the correct answer is 4.5 seconds.

2. Given: The distance of the train is 100 m and its speed is 120 km/h.

We know that time = distance / speed.

To convert km/h into m/s, multiply with 5/18, we get,

120 km/h = 120 × (5/18) m/s

So, the time required to pass a person standing near the line is 100 × 18 / (120 × 5) = 3 seconds.

Hence, the correct answer is 3 seconds.

3. Given: The distance of the train is (110 + 132) = 242 m and its speed is 72 km/h.

We know that time = distance / speed.

To convert km/h into m/s, we multiply by 5/18.

72 km/h = 72 × (5/18) m/s = 20 m/s

So, the time taken by the train to cross the bridge = 242 / 20 = 12.1 seconds.

Hence, the correct answer is 12.1 seconds.

4. Given:

A 110-meter-long train is running at a speed of 60 km/h.

The speed of the man who is running in the direction opposite to that in which the train is going is 6 km/h.

Relative speed = (60 + 6) km/h = 66 km/h = 66 × 5/18 = 55/3 m/sec

Therefore, the time taken to pass the man = 110 × 3/55 = 6 seconds.

Hence, the required time is 6 seconds.

5. Given:

The speed of two trains = 43 km/h and 51 km/h.

They are moving in opposite directions.

Relative speed = (43 + 51) km/h = 94 km/h.

Relative speed in meters/second = 94 × 5/18 meters/second.

Distance covered by the trains in 9 seconds = 94 × 5/18 × 9 = 235 meters.

Since this is the distance covered in crossing the man.

Hence, the length of the slower train is 235 meters.

TIME, WORK AND WAGES

Work from Days:

If A can do a piece of work in n days, then A's 1 day's work = $\frac{1}{n}$.

Days from Work:

If A's 1 day's work = $\frac{1}{n}$, then A can finish the work in n days.

Ratio:

If A is twice as good a workman as B, then:

Ratio of work done by A and B = 2: 1.

Ratio of times taken by A and B to finish a work =1: 2.

Chain Rule

If M1 persons can do W_1 work in D_1 days and M_2 persons can do W_2 work in D_2 days, then:

$$M_1 \times D_1 \times W_2 = M_2 \times D_2 \times W_1$$

This formula states that the product of the number of persons, the number of days, and the amount of work done is constant in two different scenarios. It's a general relationship used to calculate or compare different work scenarios.

SOLVED EXAMPLES ON PROBLEMS ON TIME, WORK AND WAGES

1. A company employed 700 men and 300 women and the average wage was Rs.450 per day. If a man got Rs.50 more than a woman, then the daily wage of the woman is:

A. Rs. 350
B. Rs. 375
C. Rs. 415
D. Rs. 435

SOLUTION

Number of men = 700

Number of women = 300

The average wage of a man and a woman combined = Rs. 450

Let the average wage of a woman be Rs. x.

Average wage of man = Rs. (x+50)

We know the sum of wages = Average wage × Count of people

So, the sum of wages of women = x × 300

And, the sum of wages of men = (x+50) × 700

Now, Average wage of all people = Total Sum of wages / Count of people

⇒ 450 = (300x + 700(x+50)) / (300+700)

⇒ 450 × 1000 = 1000x + 35000

⇒ 1000x = 415000

⇒ x=415

Hence, the correct answer is Rs. 415.

2. The daily wages of A and B, respectively, are Rs. 3.50 and Rs. 2.50. When, A finishes a certain work, he gets a total wage of Rs. 63. When B does the same work, he gets a total wage of Rs. 75. If both of them do it together, what is the cost of the work?

A. Rs. 67.50
B. Rs. 67.50
C. Rs. 60.50
D. Rs. 70.50

SOLUTION

The daily wages of A and B are Rs. 3.50 and Rs. 2.50, respectively.

A gets a total wage of Rs. 63.

So, Time taken by A = 63/3.5 = 18 days

B gets a total wage of Rs. 75.

So, Time taken by B = 75/2.5 = 30 days

(A + B)'s 1 day's work = 1/18 + 1/30 = 4/45

Therefore, Required time = 45/4 days.

Therefore, Total wages = (45/4) × (3.5 + 2.5) = (45/4) × 6 = Rs. 67.50

Hence, the correct answer is Rs. 67.50.

3. A and B worked together and received a total of Rs. 18,000 for 15 days. A's efficiency in the work was 5 times that of B's. The daily wage of A (in Rs.) was:

A. 800
B. 600
C. 1,200
D. 1,000

SOLUTION

Let the daily wage of A be Wa and the daily wage of B be Wb.

Given that A's efficiency is 5 times that of B's.

⇒ Wa = 5 × Wb

Also, given that A and B together received a total of Rs. 18,000 for 15 days.

⇒ 15 × (Wa + Wb) = 18,000

Substituting Wa = 5 × Wb into the equation,

⇒ 15 × (5 × Wb + Wb) = 18,000

⇒ Wb = Rs. 200

Therefore, the daily wage of A is:

⇒ Wa = 5 × Wb = 5 × 200 = Rs. 1,000

Hence, the answer is 1,000.

4. A certain factory employed 600 men and 400 women and the average wage was Rs. 2.55 per day. If a woman got 50 paise less than a man, the daily wages of a man and a woman would be _____.

A. Man Rs. 2.75, Woman Rs. 2.25
B. Man Rs. 5.30, Woman Rs. 2.50
C. Man Rs. 2.50, Woman Rs. 2.00
D. Man Rs. 3.25, Woman Rs. 2.75

SOLUTION

Given: The factory employed 600 men and 400 women and the average wage was Rs. 2.55 per day.

Total wages of 600 men and 400 women are (600 + 400) × 2.55 = Rs. 2550

Let a man's wage be x.

So, a woman's wage = (x - 0.50) = x - 0.5

So, the total wages of the 600 men and 400 women = 600x + 400(x - 0.5)

According to the question,

600x + 400(x - 0.5) = 2550

⇒ 1000x = 2750

Therefore, x = 2.75

So, a man's wage is Rs. 2.75.

A woman's wage = (2.75 - 0.50) = Rs. 2.25

Hence, the correct answer is Man Rs. 2.75, Woman Rs. 2.25.

5. A contractor has the target of completing a work in 40 days. He employed 20 persons who completed 1/4th of the work in 10 days and left. The number of persons he has to employ to finish the remaining part as per the target is:

A. 10
B. 20
C. 40
D. 30

SOLUTION

Given:
20 persons completed 1/4th of the work in 10 days and left.
Now the contractor has 30 more days to complete the job.

We know the formula:
(M1 × D1) / W1 = (M2 × D2) / W2
Where M1 and M2 are men, D1 and D2 are days, and W1 and W2 are work done.

Let n be the number of men should be added.

(20 × 10) / (1/4) = (n × 30) / (3/4)

⇒ 20 × 10 = n × 10

Therefore, n = 20

Hence, the answer is 20.

6. A can do a piece of work in 5 days and B in 4 days. How long will they take to do the same work when working together?

A. 9 days
B. 2 2/9 days
C. 12
D. 10

SOLUTION

Given: A can do a piece of work in 5 days and B in 4 days.
If a man can do the work in n days, then one day's work of the man = 1/n.

1 day work of A = 1/5

1 day work of B = 1/4

1 day work of (A+B) together = 1/5 + 1/4 = (4+5)/20 = 9/20.

(A+B) together can complete the work in = 20/9 = 2 2/9 days

Hence, the answer is 2 2/9 days.

7. A certain number of men completed a piece of work in 60 days. If there were 8 men more, the work could be finished in 10 days less. The number of men originally was:

A. 36
B. 40
C. 30
D. 32

SOLUTION

Given:
Let the original number of men be x.
x men can finish it in 60 days.
(x+8) men can finish it in 50 days.

According to the question:
$M_1D_1 = M_2D_2$

$\Rightarrow 60x = 50(x+8)$

⇒ 10x = 400

Therefore, x = 40 days

There were 40 men originally.

Hence, the answer is 40.

8. A and B together complete a work in 20 days, B and C together complete the same work in 30 days, and C and A together complete the same work in 24 days. In how many days A, B and C together can complete the same work?

A. 8 days
B. 16 days
C. 12 days
D. 15 days

SOLUTION

Given: A and B can do a piece of work in 20 days. B and C can do it in 30 days, and A and C can do it in 24 days.

We know:
If a man can do the work in n days, then one day's work of the man = 1/n.

(A + B)'s 1 day's work is 1/20.
(B + C)'s 1 day's work is 1/30.
(A + C)'s 1 day's work is 1/24.

Adding the above three equations we get:
2(A + B + C)'s 1 day's work = 1/20 + 1/30 + 1/24 = (6+4+5)/120 = 15/120 = 1/8

⇒ (A + B + C)'s 1 day's work = 1/16

Therefore, (A + B + C) together will complete the work in 16 days.

Hence, the answer is 16 days.

9. P, Q and R can do a piece of work in 60 days, 100 days and 80 days respectively. They together work to finish the work and receive Rs. 2256. Then, P will get ___.

A. Rs. 576
B. Rs. 752
C. Rs. 960
D. Rs. 564

SOLUTION

Given: P, Q, and R can do a piece of work in 60 days, 100 days, and 80 days.

The total work of P, Q, and R is LCM of (60,100,80) = 1200 units

One day's work of P = 1200/60 = 20

One day's work of Q = 1200/100 = 12

One day's work of R = 1200/80 = 15

The amount will be divided among P, Q, and R as per the ratio of the work done by each in 1 day.

The ratio of 1 day's work of P, Q, and R = 20 : 12 : 15

The amount received by P = (20/(20+12+15)) × 2256 = (20/47) × 2256 = 960

Hence, the correct answer is Rs. 960.

10. X and Y can complete a piece of work in 12 and 60 days respectively. They are contracted to complete the work together for Rs. 24,000. What will be the share of X?

A. Rs. 18,000
B. Rs. 16,000
C. Rs. 20,000
D. Rs. 21,000

SOLUTION

Given: X and Y can complete a piece of work in 12 and 60 days.

The total work of X and Y is LCM of (12, 60) = 60 units

1 day's work by X = 60/12 = 5

1 day's work by Y = 60/60 = 1

So, the ratio of their efficiency = 5 : 1

Share of X = (5/6) × 24000 = Rs. 20000

Hence, the correct answer is Rs. 20,000.

11. A can do a piece of work in 48 days. If B is 50% more efficient than A, then in how many days can B do the same work?

A. 24
B. 32
C. 18
D. 15

SOLUTION

Let the total work to be done = 1

Then, A's one day work = (total work) / (total days taken by A) = 1 / 48

B's one-day work = 150% of A's one-day work (because B is 50% more efficient)

= (1 / 48) × (150 / 100) = 1 / 32

Total time taken by B to do total work = 1 / (1/32) = 32 days

Hence, the correct answer is 32.

12. Together X and Y can complete a work in 9 days, Y and Z in 12 days and X and Z in 18 days. Who is the most efficient worker among X, Y and Z?

A. X
B. Y
C. Z
D. Cannot be determined

SOLUTION

X and Y one day work = 1/9
X's one day work + Y's one day work = 1/9 .....(1)

Y and Z one day work = 1/12
Y's one day work + Z's one day work = 1/12 ..... (2)

X and Z one day work = 1/18
X's one day work + Z's one day work = 1/18 .....(3)

Equation (1) – Equation (2)
X's one day work – Z's one day work = 1/9 – 1/12 = 1/36 .....(4)

Equation (3) + Equation (4)
2 × X's one day work = 1/18 + 1/36 = 1/12
X's one day work = 1/24.....(5)

Equation (1) – Equation (5)
Y's one day work = 1/9 - 1/24 = 5/72

Equation (3) – Equation (5)
Z's one day work = 1/18 - 1/24 = 1/72

X can complete a work in 24 days.
Y can complete a work in 14 2/5 days
Z can complete a work in 72 days.

Hence, Y is the most efficient.

13. 3 men and 5 women can do work in 14 days while 5 men can do it in 14 days. 5 men and 5 women can complete the work in _____.

A. 13 days
B. 11 days
C. 10 days
D. 12 days

SOLUTION

5 men can do 1 work in 14 days.

3 men will do 3/5 work in 14 days.

Remaining work = 1 - 3/5 = 2/5

5 women do 2/5 work in 14 days.

Time taken by 5 women to do the work = (14 × 5) / 2 = 35 days

5 men + 5 women's 1 day work = 1/14 + 1/35 = (5 + 2) / 70 = 7/70 = 1/10

Therefore, Required time = 10 days.

Hence, the correct answer is 10.

14. D alone can do a work in 20 days and E alone can do the same work in 25 days. If they work on it together for 8 days. then the fraction of the work that is left is:

A. 11/25
B. 7/25
C. 9/100
D. 51/100

SOLUTION

D alone can do a work in 20 days and E alone can do the same work in 25 days.

D's 1 day's work = 1/20

E's 1 day's work = 1/25

(D + E)'s 1 day's work = 1/20 + 1/25 = 9/100

(D + E)'s 8 days work = (9/100) × 8 = 18/25

Work left after 8 days = 1 - 18/25 = 7/25

Hence, the correct answer is 7/25.

15. A alone can complete half of a work in 150 days. In 50 days, what percentage of the work will be completed by A?

A. 16.67 percent
B. 15 percent
C. 20 percent
D. 22.5 percent

SOLUTION

A alone can complete half of a work in 150 days.

So, A can do the full work in 150 × 2 = 300 days.

A's 1 day's work = 1/300.

A's 50 days work = (1/300) × 50 = 1/6.

Percentage of work done = (1/6) / 1 × 100 = 16.67%.

Hence, the correct answer is 16.67%.

PRACTICE EXERCISES

1. X and Y together can do a piece of work in 30 days. Z alone can do it in 60 days. If they worked together, then in how many days they can finish the work?

A. 50 days
B. 25 days
C. 45 days
D. 20 days

2. A, B and C are Accountants. A alone can file a return in 6 hours and B alone can file the same return in 10 hours. All three together can do it in 3 hours. In what time will C alone file the same return?

A. 15 hours
B. 4 hours
C. 7 hours
D. 8 hours

3. M alone can complete a work in 50 days and N alone can complete the same work in 100 days. If both of them work together, then in 25 days what percentage work of the total work will be completed?

A. 60%
B. 55%
C. 75%
D. 80%

4. P alone can complete a work in 15 days and Q alone can complete the same work in 12 days. They start the work together but after 3 days P leaves the work. How much time will Q take to finish the remaining work?

A. 7.2 days
B. 7.8 days
C. 8.5 days
D. 6.6 days

5. Anil alone takes 2 hrs 40 mins to complete a work and Sumit alone can complete the same work in half time of Anil. How much time will be taken by Sumit to complete the work?

A. 70 mins
B. 90 mins
C. 75 mins
D. 80 mins

ANSWER KEY

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1 - D, 2 - A, 3 - C, 4 - B, 5 - D

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SOLUTION

1. X and Y together can do a piece of work in 30 days.

1 day's work of X + Y = 1/30.

Z alone can do it in 60 days.

1 day's work of Z = 1/60.

So, 1 day's work of X + Y + Z = 1/30 + 1/60 = 1/20.

Therefore, they will finish the work in 20 days working together.

Hence, the correct answer is 20 days.

2. The rate of A = 1/6 returns per hour,
The rate of B = 1/10 returns per hour,
The rate of A, B, and C together = 1/3 returns per hour.

The rate of C = (rate of A, B, and C) – (rate of A) – (rate of B) = 1/3 - 1/6 - 1/10

The rate of C = (10 - (5 + 3)) / 30

The rate of C = 2/30 = 1/15 returns per hour.

The time for C to file the return = 1/(rate of C) = 1/(1/15) = 15 hours

Therefore, C alone can file the same return in 15 hours.

Hence, the correct answer is 15 hours.

3. Given:
M can complete a work in 50 days.
N can complete the same work in 100 days.
Both work together for 25 days.

We know that the work completed is the product of work rate and time.

Work rate of M = 1/50 per day and work rate of N = 1/100 per day.

Work rate of M and N together = Rate of M + Rate of N

= 1/50 + 1/100

= 3/100 per day.

Now, work completed in 25 days = work rate × time = (3/100) × 25 = 0.75 = 75%

Hence, the correct answer is 75%.

4. P alone can complete a work in 15 days.

P's 1 day's work = 1/15

Q alone can complete the same work in 12 days.

Q's 1 day's work = 1/12

(P + Q)'s 1 day's work = 1/15 + 1/12 = 3/20

(P + Q)'s 3 days work = (3/20) × 3 = 9/20

Remaining work = 1 - 9/20 = 11/20

Q's will complete the remaining work in (11/20) / (1/12) = (11/20) × (12/1) = 33/5 = 6.6 days

Hence, the correct answer is 6.6 days.

5. Given: Anil alone takes 2 hrs 40 mins to complete a work and Sumit alone can complete the same work in half the time of Anil.

2 hrs 40 mins = (2 × 60) + 40 = 160 mins.

So, the time taken by Sumit = 160 / 2 = 80 mins.

Hence, the correct answer is 80 mins.

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