100

SHORTCUTS

to crack

QUANTITATIVE

APTITUDE

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IBPS	SBI	UPSC	RBI	RRB	SSC
BSNL	NTPC	BHEL	TNEB	NLC	CBI
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All Central and State Government Exams
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Table of Contents

Splitting a number in the given ratio.

1. Divide 720 in the ratio 2: 3.

720

2 : 3
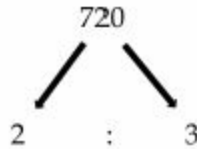
Solution 1:
Total parts = 2 + 3 = 5
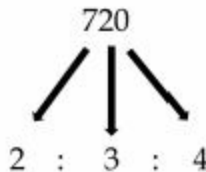First number = (2/5) 720 = 288
Second number = (3/5) 720 = 432

Solution 2:
2x + 3x = 720;   5x = 720;   x = 144
2x = 2(144) = 288;   3x = 3(144) = 432

2. Divide 720 in the ratio 2: 3: 4.

720

2 : 3 : 4

Solution 1:
Total parts = 2 + 3 + 4 = 9
First number = (2/9) 720 = 160; Second number = (3/9) 720 = 240; Third number = (4/9)720 = 320

Solution 2:
2x + 3x + 4x= 720;   9x = 720;   x = 80
2x = 2(80) = 160; 3x = 3(80) = 240; 4x = 4(80) = 320

Shortcut # 2 – Ratio and Proportion
Direct Proportion.

When two parameters are in direct proportion if one parameter increases the other one will also increase and if one parameter decreases the other one will also decrease.
If the parameters A and B are in direct proportion they will satisfy the below equation.

$$\frac{A_1}{A_2} = \frac{B_1}{B_2}$$

Question:

Price of diamond is directly proportional to its weight. If 2 grams of diamond costs $ 45,000 then what is the price of a diamond that weighs 6 grams?

Answer:

Weight of diamond in first case,	A_1	= 2
Weight of diamond in second case,	A_2	= 6
Price of diamond in first case,	B_1	= 45000
Price of diamond in second case,	B_2	=?

According to the equation,

$2/6 = 45000/B_2$

$B_2 = 45000 \times (6/2)$

$B_2 = 135,000$

Shortcut # 3 – Ratio and Proportion
Inverse Proportion.

When two parameters are in inverse proportion if one parameter increases the other one will decrease and if one parameter decreases the other one will decrease.

If the parameters A and B are in inverse proportion they will satisfy the below equation.

$$\frac{A_1}{A_2} = \frac{B_2}{B_1}$$

Question:

Mileage and Engine capacity are inversely proportional. A bike with 100cc engine capacity gives a mileage of 80 km. What will be the mileage given by a bike with 150cc engine capacity?

Answer:

Engine capacity of first bike,	A_1	= 100
Engine capacity of second bike,	A_2	= 150
Mileage of first bike,	B_1	= 80
Mileage of second bike,	B_2	=?

According to the equation,

$100/150 = B_2/80$

$B_2 = 100(80)/150$

$B_2 = 53.33$ km

Finding A: C from A: B and B: C

A : B
↓
B : C
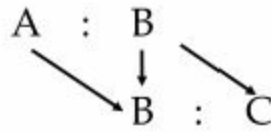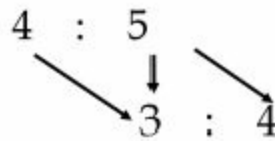
A x B : B x B : B x C

A : B : C

Question:

The ratio between salary of A and B is 4: 5. The ratio between salary of B and C is 3: 4. Find the salary of C if A is earning $3600.
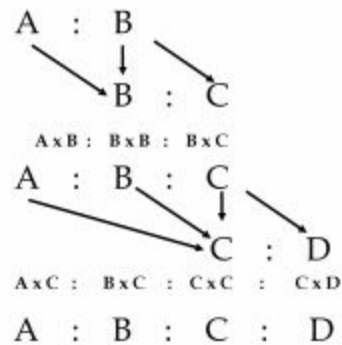
Answer:

4 : 5
↓
3 : 4

4 x 3 : 5 x 3 : 5 x 4

12 : 15 : 20

A: C = 12: 20 = 3: 5

A/C = 3/5

3600/C = 3/5;   C = 6000

Shortcut # 5 – Ratio and Proportion
Finding A: D from A: B, B: C and C: D

A : B
↓
B : C

A x B : B x B : B x C

A : B : C
↓
C : D

A x C : B x C : C x C : C x D

A : B : C : D

Question:

Ratio between salary of A and B is 3: 5, B and C is 4: 5, C and D is 6: 7. If the salary of A is $ 7200, find the salary of D.

Answer:

3 : 5
↓
4 : 5

3 x 4 : 5 x 4 : 5 x 5

12 : 20 : 25
↓
6 : 7

12 x 6 : 20 x 6 : 25 x 6 : 25 x 7

72 : 120 : 150 : 175
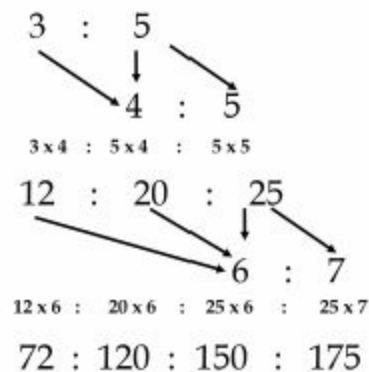
A: D = 72: 175

7200/D = 72/175

D = 17500

Usage of Common Factor x

Question:

Two numbers are in the ratio 4: 5. Sum of their squares is 1025. Find the numbers.

Answer:

Substitute the common factor x to the ratio 4: 5

Assume the actual numbers as 4x and 5x

Given,

$(4x)^2 + (5x)^2 = 1025$

$16x^2 + 25x^2 = 1025;$ $\qquad$ $41x^2 = 1025$

$x^2 = 25;$ $\qquad\qquad$ $x = 5$

Substitute x = 5 in 4x and 5x to find the numbers

The numbers are, 20 and 25.

Question:

Two numbers are in the ratio 3: 2. Cube of their difference is 125. Find the numbers.

Answer:

$(3x - 2x)^3 = 125$

$x^3 = 125$

$x = 5$

The numbers are 15 and 10.

Shortcut # 7 – Ratio and Proportion
Finding number of Coins in a bag.

Quantity ratio   ----- Q_1 : Q_2 : Q_3

Value ratio   ----- V_1 : V_2 : V_3

$(Q_1 \times V_1) + (Q_2 \times V_2) + (Q_3 \times V_3) = T$

Common factor X = Total Amount/T

Quantity of each coin = Q_1X, Q_2X, Q_3X

Question:

A bag contains 5 paise, 10 paise and 20 paise coins in the ratio 2:4:5. Total amount in the bag is Rs. 4.50. How many coins are there in 20 paise?

Answer:

T = (2 x 5) + (4 x 10) + (5 x 20)

= 150 paise

= Rs. 1.50

X = 4.50/1.50

X = 3

Quantity of 20 paise coins

= 5 x 3

= 15 coins.

Adding and removing quantities.

Question:

Container 1 has milk and water in the ratio 2 : 5. After adding 4 liters of pure water from container 2, the ratio between milk and water in container 1 became 1 : 3. Find the quantity of milk in the container.

Container 1	Container 2	Container 1 Final
2 : 5	4 lt	1 : 3
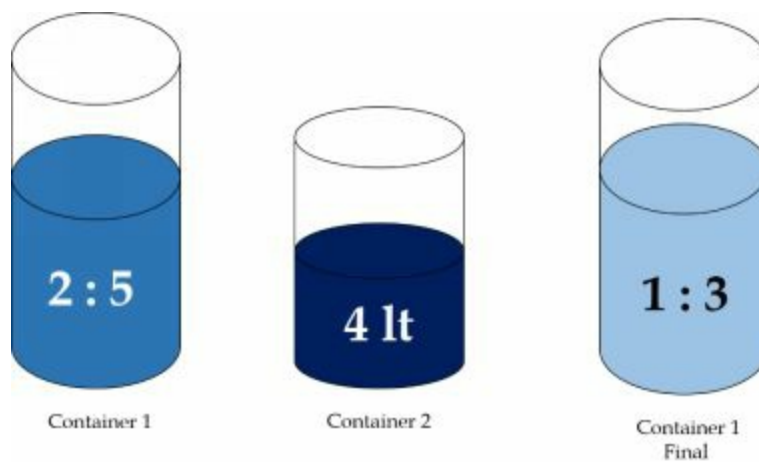
Answer:
Let us assume the actual quantity of milk and water as 2x and 5x.
New quantity of water = 5x + 4
$2x/(5x + 4) = 1/3$
6x = 5x + 4
x = 4
Quantity of milk = 2x
= 2(4)
= 8 liters.

Finding ratio of the profit share.

Income (or) Profit share from a business is determined using two parameters –
Investment and Duration.

Profit share is directly proportional to the duration of investment and the
amount invested.

$P_1 : P_2 : P_3$ = Ratio between profits

T_1, T_2, T_3 = Respective time of investment

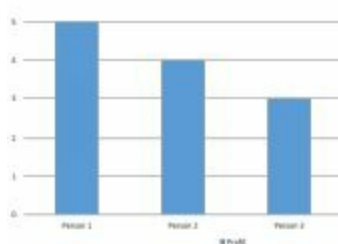I_1, I_2, I_3 = Respective investment

Question:

A started a business investing Rs. 5000. After 1 year B joined him investing
Rs. 6000. After another year C joined them investing Rs. 9000. What is the
ratio between their profit shares at the end of 3 years?

Answer:

$P_1 : P_2 : P_3$ = 5000 x 3 : 6000 x 2 : 9000 x 1

$P_1 : P_2 : P_3$ = 15000 : 12000 x 9000

$P_1 : P_2 : P_3$ = 5 : 4 : 3

Finding average price of a mixture.

$$A_p = \frac{A_1 N_1 + A_2 N_2}{N_1 + N_2}$$

A_p = Average price of the mixture.
A_1 = Price of the first variety.
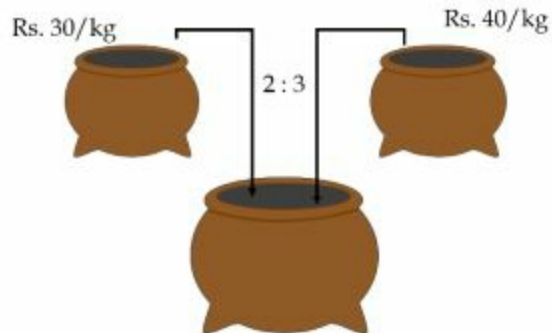A_2 = Price of the second variety.
N_1 = Quantity of the first variety.
N_2 = quantity of the second variety.

Question:

Two varieties of rice with prices Rs. 30 per kg and Rs. 40 per kg are mixed in the ratio 2 : 3. Find the mean price.

Answer:

$N_1 = 2$; $N_2 = 3$

$A_1 = 30$; $A_2 = 40$

Substitute the values in the above equation.

Mean price = Rs. 36

Shortcut # 11 – Mixtures and Allegation
Allegation Rule.

$$A_1 \qquad A_2$$
$$\searrow \qquad \swarrow$$
$$A_p$$
$$\swarrow \qquad \searrow$$
$$(A_2 \sim A_p) \qquad (A_1 \sim A_p)$$
$$N_1 \quad : \quad N_2$$
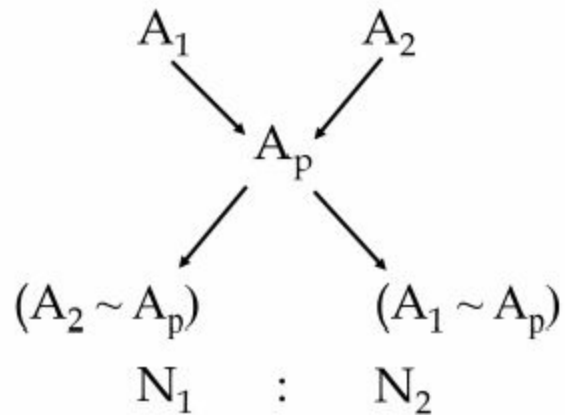
Question:

In what ratio two varieties of rice worth Rs. 40 per kg and Rs. 60 per kg should be mixed to give a variety worth Rs. 46 per kg?

Answer:

$$40 \qquad 60$$
$$\searrow \qquad \swarrow$$
$$46$$
$$\swarrow \qquad \searrow$$
$$(60 \sim 46) \qquad (40 \sim 46)$$
$$14 \quad : \quad 6$$
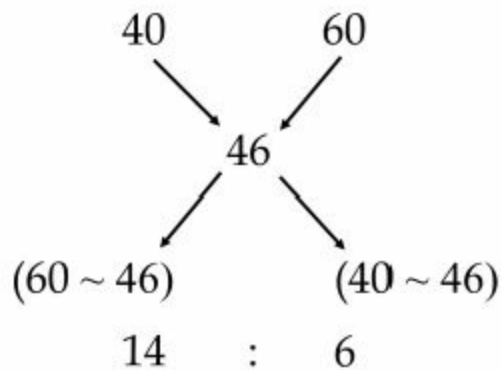
The two mixtures have to be mixed in the ratio 7 : 3 to get Rs. 46 mixture.

Shortcut # 12 – Mixtures and Allegation
Successive removal and replacement type.

$$F = I[1 - (R/I)]^N$$

I – Initial quantity;   R – Removal quantity;

F – Final quantity;   N – Number of processes.

Question:

A container has 1000 liters of wine. 100 liters of wine is drawn from the container and filled with water. This process is done two more times. What is the ratio between wine and water in the final mixture?

Wine   Water
100 ml

Answer:
Number of draws n = 3
FQ = 1000 [1-(100/1000)]^3 = 1000(0.9)^3 = 729
Present quantity of wine = 729
Present quantity of water = 1000 – 729 = 271
Ratio between wine and water = 729 : 271
(Or)

1000 – 100 = 900
900 – 90   = 810
810 – 81   = 729

729 = final quantity of wine.

Common increase or decrease for all the elements.

If all the elements in a series are increased or decreased or multiplied or divided by a certain number, the old average should also be added or subtracted or multiplied or divided respectively to get the new average.

Question:

Average age of a family of four members is 34. What is the average age of the family after 4 years?

Answer:

Since every ones age is increased by four in 4 years, the average will also increase by 4

The new average = 34 + 4 = 38

Proof:

Total age of the family before 4 years = 34 x 4 = 136

Total increased age for four members = 4 x 4 = 16

New total age = 136 + 16 = 152

New average
= 152/4
= 38

Adding or removing or replacing an element.

$$A_1N_1 \sim A_2N_2$$

Question 1:
Average age of 5 students was 18. After adding teacher's age the average became 20. What is the age of the teacher?

Answer = $(18 \times 5) \sim (20 \times 6) = 30$

Question 2:
Average age of 5 students and a teacher was 21. After removing the teacher's age the average became 18. What is the age of the teacher?

Answer = $(21 \times 6) \sim (18 \times 5) = 36$

Question 3:
Average weight of 40 bags is 20kg. After removing 1 bag the average became 19.5. What is the weight of removed bag?

Answer = $(20 \times 40) \sim (19.5 \times 39) = 39.5$

Question 4:
Average weight of 40 bags is 20kg. After replacing a bag by another bag the average became 39. What is the difference between the weights of those two bags?
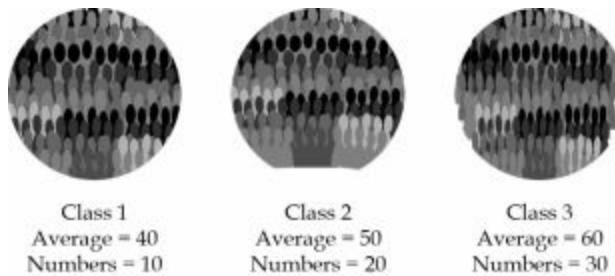
Answer = $(20 \times 40) \sim (20 \times 39) = 20$

Weighted Average

$$A_o = \frac{A_1N_1 + A_2N_2 + \ldots + A_nN_n}{N_1 + N_2 + \ldots + N_n}$$

Question:

Average marks scored by students in three classes are 40, 50, and 60. If there are 10, 20 and 30 students in the classes respectively, find the overall average of the three classes.

Class 1	Class 2	Class 3
Average = 40	Average = 50	Average = 60
Numbers = 10	Numbers = 20	Numbers = 30

Answer:

$A_1 = 40$; $A_2 = 50$; $A_3 = 60$

$N_1 = 10$; $N_2 = 20$; $N_3 = 30$

Substitute in the above formula. We get,

$=[(40 \times 10) + (50 \times 20) + (60 \times 30)]/[10+20+30]$

$=[400 + 1000 + 1800]/60$

$= 53.33$

Shortcut # 16 - Average
Finding the middle subject mark, if the middle subject overlaps.

$$M = A_1 N_1 + A_2 N_2 - A_o N_o$$

Question:

Average marks scored by Sai in 11 subjects is 60. Average marks scored by her in first 6 subjects is 50 and average marks scored by her in last 6 subjects is 62. Find the mark scored by Sai in 6th subject.

Answer:

$A_o = 60$; $N_o = 11$

$A_1 = 50$; $N_1 = 6$

$A_2 = 62$; $N_2 = 6$

Substituting the values in the formula, we get

$M = 50 \times 6 + 62 \times 6 - 60 \times 11$

$= 300 + 372 - 660$

$= 12$

Marks scored by Sai in 6th subject $= 12$

Shortcut # 17 - Average
Finding the middle subject mark if the middle subject is left out.

$$M = A_o N_o - A_1 N_1 - A_2 N_2$$

Question:

The average marks scored by Shradha in 9 subjects is 75. The average marks in first 4 subjects is 69 and average marks in last 4 subjects is 78. Find the marks scored by her in 5th subject.

Answer:

$A_o = 75; N_o = 9$

$A_1 = 69; N_1 = 4$

$A_2 = 78; N_1 = 4$

Substituting the above values in the formula, we get

$M = 75 \times 9 - 69 \times 4 - 78 \times 4$

$= 675 - 276 - 312$

$= 87$

Marks scored by Sradha in 5th subject $= 87$

Percentage Calculation

$$\% = \frac{\text{Value to be compared}}{\text{Value to which it has to be compared}} \times 100$$

V_c = Value to be compared

V_b = Value to which it has to be compared, base value.

Question:

What is the percentage of marks scored by Sai in final exam, if she has scored 1102 out of 1200?

Answer:

V_c = 1102

V_b = 1200

Percentage = (1102/1200) x 100

= 91.83%

Question:

Out of 65000 population, men are 39000. What is the percentage of women?

Answer:
Women = 65000 – 39000 = 26000
Percentage of women = (26000/65000) x 100
= (2/5) 100 = 40 %

Percentage increase or decrease.

$$\text{Percentage change} = \frac{\text{From} \sim \text{To}}{\text{From}} \times 100$$

From – the value from which the change is happening
To – the value to which the change has happened.

If **From** value is less than **To** value, it is % increase

If **From** value is more than **To** value, it is % decrease.

Question:

Sradha's monthly salary is Rs. 40000. If an increment of Rs. 5000 is provided, what is the percentage increase in her salary?

Answer:

From = 40000;   To = 45000.

Substituting the values in the above formula, we get

% increase = [(45000 – 40000)/40000] x 100

= (5000/40000)x 100

= 12.5 % increase

Net change in percentage when two changes are made.

$$\text{Net percentage change} = \pm a \pm b + \frac{(\pm a) \times (\pm b)}{100}$$

a = first percentage change

b = second percentage change

Question:

Salary of Sai was Rs. 20000. If the salary is decreased by 10 percent and then increased by 30 percent, what is the new salary of Sai?

Answer:

a = -10

b = 30

Net change = -10 + 30 + [(-10)(30)/100]

= 20 – 3 = +17% (positive value = % increase)

New salary of Sai

= 20000 + (17/100)20000

= 23400

Note:
If the net change value is negative, it means percentage decrease.

Shortcut # 21 – Percentage
Final value after multiple percentage changes.

$$\text{Final Value} = \left[\frac{100 \pm a}{100}\right] \times \text{Initial Value}$$

$$\text{Final Value} = \left[\frac{100 \pm a}{100} \times \frac{100 \pm b}{100}\right] \times \text{Initial Value}$$

$$\text{Final Value} = \left[\frac{100 \pm a}{100} \times \frac{100 \pm b}{100} \times \frac{100 \pm c}{100}\right] \times \text{Initial Value}$$

(a, b and c) are the percentage changes.
The formula can be expanded or reduce according to the number of changes given in the question.
Substitute '+' for percentage increase.
Substitute '-'for percentage decrease.

Question:

Salary of Shradha is Rs. 30000. It is increased by 10%, then decreased by 20% and again increased by 30%. What is her final salary?

Answer:

a = +10;   b = -20;   c = +30

Substitute the values in the above formula, we get

Final Value

= (11/10)(8/10)(13/10) x 30000

= 34320

Net percentage change when (a %) increase and (a %) decrease.

$$\text{Net percentage change} = \frac{a^2}{100} \quad \% \text{ decrease}$$

Question:

Price of a watch was Rs. 1000. The price is increased by 10% and then decreased by 10%. What is the price of the watch now?

Answer:

a = 10

Net change in percentage = $10^2/100$ = 1% decrease.

New price of watch = 1000 – (1/100)1000

= 1000 – 10

= 990

Question:

Price of a product increased by 20% and the sales was reduced by 20%. By what percentage the income has reduced?

Answer:

a = 20%

Percentage reduction in income

= $20^2/100$

= 4%

Shortcut # 23 – Percentage
Steady percentage increase or decrease.

$$\text{Final Value} = \left[\frac{100 \pm a}{100}\right]^n \times \text{Initial Value}$$

a – steady rate of percentage increase or decrease.
Substitute '+' for percentage increase.
Substitute '-'for percentage decrease.
n – Number of times the percentage change occurs.

Question:

The population of a city is 200000. The population increases by 10% every year. What will be the population of the city after 3 years?

Answer:

$a = + 10$

Initial Value = 200000

Substitute the values in the above equation, we get

Final Value = $200000[1.1]^3$

Final Value = 266200

Population of the city after three years

= 266200

Profit or Loss Percentage.

$$\text{Profit or Loss Percentage} = \frac{S.P \sim C.P}{C.P} \times 100$$

S.P – Selling Price.

C.P – Cost Price.

Question:

A bike worth Rs. 40000 is sold for Rs. 46000. What is the profit percentage?

Answer:

S.P = 46000;   C.P = 40000

Substitute the values in the above equation, we get

P% = [(46000-40000)/40000]x100   = 15% profit

Question:

A mobile phone worth Rs. 9900 is sold for Rs. 9000. What is the percentage loss?

Answer:

S.P = 9000;   C.P = 9900

Substitute the values in the above equation, we get

L% = [(9900-9000)/9900] x 100;   L% = 9.09% loss

Shortcut # 25 – Profit, Loss and Discount
Net Profit or Loss Percentage when two changes are made.

$$\text{Net Profit or Loss \% } = \ \pm a \pm b + \frac{(\pm a) \times (\pm b)}{100}$$

a = percentage profit or loss in the first case.

b = percentage profit or loss in the second case.

Substitute '+' for profit percentage.
Substitute '-' for loss percentage.

Question:
A product worth $ 3000 is sold for 10% profit and then for 20% loss. What is the overall profit or loss percentage in the sale?

Answer:
Net change = 10 – 20 + [(10)(-20)/100]

= -12

The value obtained is negative.

This indicates that a loss is incurred in the sale.

12% loss.

Shortcut # 26 – Profit, Loss and Discount
Finding selling price after multiple changes.

$$S.P = \left[\frac{100 \pm a}{100} \right] \times C.P$$

$$S.P = \left[\frac{100 \pm a}{100} \times \frac{100 \pm b}{100} \right] \times C.P$$

$$S.P = \left[\frac{100 \pm a}{100} \times \frac{100 \pm b}{100} \times \frac{100 \pm c}{100} \right] \times C.P$$

(a, b and c) are the profit or loss percentages.
The formula can be expanded or reduce according to the number of changes given in the question.
Substitute '+' for profit percentage.
Substitute '-' for loss percentage.
Question:

A watch worth Rs. 5000 is sold by A to B at 10% loss. B sold it to C at 30% loss. C sold it to D at 40% profit. What is the price at which D bought the watch?

Answer:

a = -10; b = -30; c = 40

C.P = 5000

Substitute the values in the above equation, we get

S.P = (9/10)(7/10)(14/10) x 5000

S.P = 4410

Shortcut # 27 – Profit, Loss and Discount
Steady Profit or Loss.

$$\text{Selling Price} = \left[\frac{100 \pm a}{100}\right]^n \times \text{Cost Price}$$

a – steady rate of profit or loss percentage.
Substitute '+' for profit percentage.
Substitute '-' for loss percentage.
n – Number of times the percentage change occurs.

Question:

The price of a laptop decreases by 20% every year. It the laptop was bought for Rs. 45000, at what price will it be sold after 2 years?

Answer:

$a = -20$

$C.P = 45000$

Substitute the values in the above equation, we get

$S.P = 45000[0.8]^2$

$S.P = 28800$

Selling price after two years

$= Rs.\ 28800$

Shortcut # 28 – Profit, Loss and Discount
Net gain or loss percentage when (a %) profit and (a %) loss occurs.

$$\text{Net Loss Percentage} = \frac{a^2}{100} \text{ \% loss}$$

a – percent loss and percentage gain.

Question:

Two laptops were sold for the same selling price. The first one is sold at 50% profit and the second one is sold at 50% loss. Due to this sale what is the profit or loss percentage incurred by the seller?

Answer:
Assume that the selling price of each laptop = Rs. 150
Cost price of first laptop:
150 = (150/100)CP
$C.P_1$ = 100
Cost price of second laptop:
150 = (50/100)CP
$C.P_2$ = 300
Total cost price = 100 + 300 = 400
Total selling price = 150 + 150 = 300
Loss % = (100/400)100 = 25%
(Or)
$(a^2/100)$% loss = $(50^2/100)$%loss = 25% loss.

Note:
Shortcut applicable only when selling price of both products are equal.

Shortcut # 29 – Profit, Loss and Discount
Discount, Marked Price and Selling Price.

$$S.P = \left[\frac{100 \pm d}{100}\right] \times M.P$$

d – Discount percentage

M.P = Marked price or Market price of the product

Question:

A product is marked Rs. 450 by the seller. If he sells at a price of Rs. 330, what is the discount provided in percentage?

Answer:

M.P = 450

S.P = 330

Substitute the values in the above equation, we get

D% = [(450-330)/450]x100

D% = 26.67%

Discount provided in percentage = 26.67%

One variable linear equation.

Question:

Age of father is twice that of son at present. After 5 years, sum of their ages will be 100. What is the present age of father?

Answer:

Assume age of son = S

Age of father = 2S

Age of father after 5 years = 2S + 5

Age of son after 5 years = S + 5

Given,

(2S + 5) + (S + 5) = 100

3S + 10 = 100

S = 30

Present age of father = 2S = 60

One variable quadratic equation.

Question:

Sum of the ages of father and son is 45. Product of their ages is 350. What is the difference between their ages?

Answer:

Age of father = F; Age of son = S

F + S = 45; F = 45 – S --- Equ (1)

F x S = 350 --- Equ (2)

Sub Equ (1) in (2)

(45 – S)S = 350

45S – S² = 350

S² – 45S + 350 = 0

By solving this quadratic equation, we get

S = 10, 35. (Neglect 35 since son's age cannot be greater than father's.)

From (1) Father's age = 35

Difference between their ages = 35 -10 = 25

Formula to find roots of a quadratic equation:

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

A – Coefficient of x²;   b - coefficient of x;   c – constant

Shortcut # 32 – Problems on ages
Simultaneous equations.

Question:

Sum of ages of father and son at present is 40. After 5 years the ratio between their ages become 7 : 3. Find the present ages of father and son.

Answer:

Assume present age of father = F

Assume present age of son = S

Given, F + S = 40 --- Equ (1)

Father's age after 5 years = F + 5

Son's age after 5 years = S + 5

Given, (F + 5)/(S + 5) = 7/3, which gives

3F + 15 = 7S + 35

3F – 7S = 20 --- Equ (2)

By solving Equ (1) and (2), we get

Age of son, S = 10

Age of father, F = 30

Shortcut # 33 – Problems on ages
Solution using common factor 'x'.

$$A - C = d \left\{ \begin{array}{ccc} A & : & B \\ C & : & D \end{array} \right\} B - D = d$$

$$\text{Common factor 'x'} = \frac{\text{Difference in years}}{d}$$

Question:
Age of MS and VK were in the ratio 4 : 3 five years back. Their ages will be in the ratio 5 : 4 in two years. Find their present ages.

Answer:
Difference between the two compared years = 7.
Difference in ratio = 1

$x = 7/1 = 7$

Age of MS and VK 5 years ago = 4x and 3x

$4x = 4(7) = 28$

$3x = 3(7) = 21$

Age of MS at present = 28 + 5 = 34

Age of VK at present = 21 + 5 = 26

Note:
This method is applicable only when 'd' is equal on both sides.
The ratios can be modified to get 'd' same in both sides.

Relative Speed – Same direction

When two objects are moving we have to take relative speed for the calculation.

Relative speed of two objects moving in same direction
$= S_1 \sim S_2$

Relative speed of two objects moving in opposite direction
$= S_1 + S_2$

$$\text{Time taken} = \frac{\text{Distance}}{\text{Relative Speed}}$$

Question:
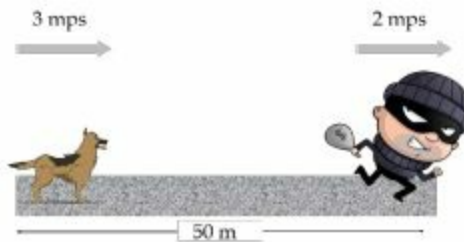
A thief standing 50 away from a dog starts running away from it at a speed of 2 m/s. The dog suddenly starts chasing him at a speed of 3m/s. How long will the dog take to catch the thief?

Answer:

D = 50m; $S_1 = 3$; $S_2 = 2$

Time taken, T = 50/(3-2) = 50 seconds

Distance travelled by the thief = Speed x Time to catch

= 2 x 50 = 100 m

Distance travelled by the dog = 3 x 50 = 150 m

Relative Speed – Opposite direction

When two objects are moving we have to take relative speed for the calculation.

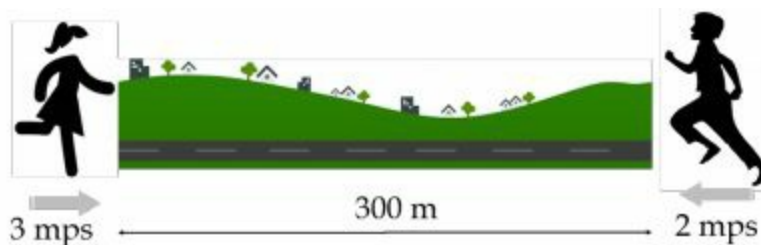Relative speed of two objects moving in same direction
$$= S_1 \sim S_2$$

Relative speed of two objects moving in opposite direction
$$= S_1 + S_2$$

$$\text{Time taken} = \frac{\text{Distance}}{\text{Relative Speed}}$$

Question:

Two friends start from their home 300 m apart and walk towards each other at a speed of 2mps and 3mps. How long (in minutes) will they take to meet each other?

3 mps   300 m   2 mps

Answer:

D = 300m

S$_1$ = 2mps;   S$_2$ = 3mps

T = 3000/(2+3) = 60 seconds

Time taken in minutes = 60/60 = 1 minute.

Shortcut # 36 – Time, Speed and Distance
Average Speed – Different distance and time

$$\text{Average Speed} = \frac{\text{Total Distance}}{\text{Total Time}} = \frac{D_1 + D_2 + \ldots + D_n}{\frac{D_1}{S_1} + \frac{D_2}{S_2} + \ldots + \frac{D_n}{S_n}}$$

Question:

A man travels from a point to other. The first 100 km he travels at a speed of 25 kmph. The next 80 km he travels at a speed of 40 kmph. The last 120 km he travels at a speed of 20 kmph. What is the average speed of his journey?
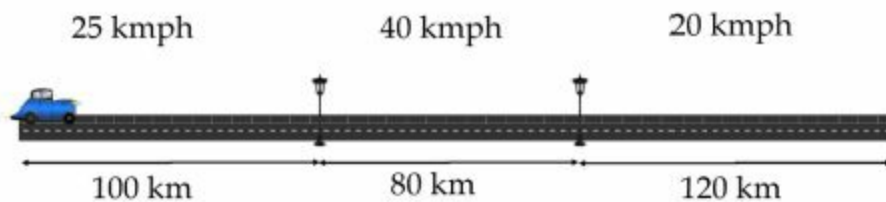
Answer:

$$= \frac{100 + 80 + 120}{\frac{100}{25} + \frac{80}{40} + \frac{120}{20}}$$

$= 300/12$

$= 25$ kmph

Shortcut # 37 – Time, Speed and Distance
Average Speed – Distance is same.

General formula when distance is same in all the cases.

$$\frac{n}{\text{Average Speed}} = \frac{1}{S_1} + \frac{1}{S_2} + \dots + \frac{1}{S_n}$$

Formula for 2 cases with same distance.

$$\frac{2}{\text{Average Speed}} = \frac{1}{S_1} + \frac{1}{S_2} \qquad \text{Average Speed} = \frac{2\,S_1\,S_2}{S_1 + S_2}$$
(Or)

Question:

Sai travels from her house to office at a speed of 50kmph. She suddenly returns home at a speed of 60kmph. What is her average speed?

80 km

50 kmph   60 kmph
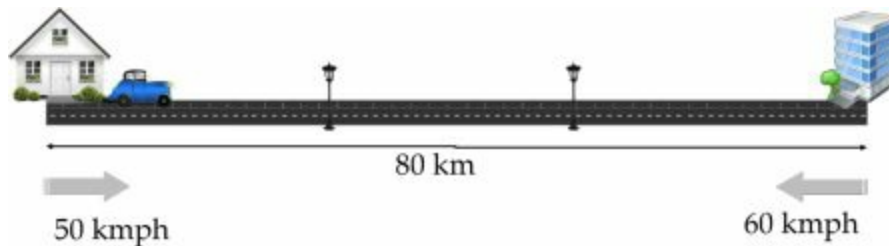
Answer:

$S_1 = 50$; $S_2 = 60$

$S_a = 2(50 \times 60)/(50+60)$

$= 6000/110$ $= 54.54$ kmph

Note: Distance value is unnecessary.

Shortcut # 38 – Time, Speed and Distance
Average Speed – Time taken is same in all the cases.

$$\text{Average Speed} = \frac{S_1 + S_2 + S_3}{3}$$
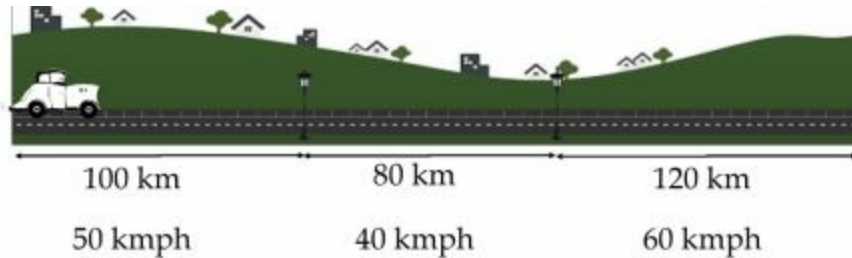
Question:

A man travels from a point to other. The first 100 km he travels at a speed of 50 kmph. The next 80 km he travels at a speed of 40 kmph. The last 120 km he travels at a speed of 60 kmph. What is the average speed of his journey?

100 km	80 km	120 km
50 kmph	40 kmph	60 kmph

Answer:
Time taken in the first case = 100/50 = 2 hours
Time taken in the second case = 80/40 = 2 hours
Time taken in the third case = 120/60 = 2 hours

Time taken is same in all the cases. So, average speed can be calculated by directly taking the average of the speeds in each case.

Average speed = (50 + 40 + 60)/3
= 50 kmph

Circular race – Time in which the runners meet at the starting point

$$\text{LCM } (T_1, T_2, \ldots T_n) = \text{LCM } \left(\frac{D}{S_1}, \frac{D}{S_2}, \ldots, \frac{D}{S_n}\right)$$

D – Circumference of the race track.

$S_1, S_2, \ldots, S_n$ – Speed of the individual runners.

$T_1, T_2, \ldots, T_n$ – Time taken by the respective runners to complete one round the track.

Question:

Three persons participate in a race on a circular track of length 400m. They can run at a speed of 2mps, 4mps and 5mps respectively. How long will they take to meet in the starting point for the first time?

Answer:

Time taken by each person to complete one circle

Person 1 = 400/2 = 200 seconds = T_1

Person 2 = 400/4 = 100 seconds = T_2

Person 3 = 400/5 = 80 seconds = T_3

LCM(T_1, T_2, T_3) = 400 seconds

Time taken by them to meet at starting point for the first time = 400 seconds.

Train crossing a stationary object with negligible width.

$$\text{Time taken to cross} = \frac{L_t}{S_t}$$

L_t – Length of the train

S_t – Speed of the train

Conversion from Kmph to mps	<|>	kmph x (5/18) = mps				
Kmph	18	36	54	72	90	108
mps	5	10	15	20	25	30

Question:

A train of length 450m is travelling at a speed of 54kmph. How long will it take to cross a pole?

450 m long   54kmph speed

Answer:

Speed of train S_T in m/s = 54x(5/18)

= 15mps

Length of train = L_T = 450m

Time taken to cross = 450/15

= 30 seconds

Shortcut # 41 – Trains
Train crossing a stationary object with considerable length.

$$\text{Time taken to cross} = \frac{L_t + L_p}{S_t}$$

L_t – Length of the train; L_p – Length of the platform
S_t – Speed of the train

Conversion from Kmph to mps	<|>	kmph x (5/18) = mps				
Kmph	18	36	54	72	90	108
mps	5	10	15	20	25	30

Question:

A train of length 200m crosses a platform of length 150m at a speed of 72kmph. How long will the train take to cross the platform?

200 m long   72 kmph speed   150 m long
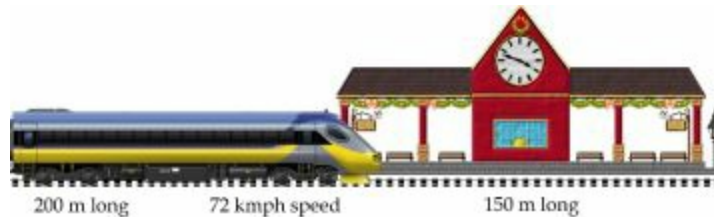
Answer:

L_t = 200m

L_p = 150m

S_t = 72x(5/18) = 20mps

Time taken to cross the platform = (200+150)/20

= 17.5 seconds

Shortcut # 42 – Trains
Two trains crossing in the opposite directions.

$$\text{Time taken to cross} = \frac{L_1 + L_2}{S_1 + S_2}$$

L_1 – Length of the train 1; $\qquad$ L_2 – Length of train 2

S_1 – Speed of the train 1; $\qquad$ S_2 – Speed of train 2

Conversion from Kmph to mps			<|>	kmph x (5/18) = mps		
Kmph	18	36	54	72	90	108
mps	5	10	15	20	25	30

Question:

Two trains A and B of length 200m and 300 are travelling at a speed of 54kmph and 36kmph respectively in opposite directions. How long will they take to cross each other?

Answer:

$L_1 = 200$; $L_2 = 300$

$S_1 + S_2 = 66 + 24 = 90$ kmph $= 25$ mps.

Substitute the values in the above equation, we get

T = (200+300)/(25)

= 20 seconds

Train crossing another train from the same direction.

$$\text{Time taken to cross} = \frac{L_1 + L_2}{S_1 \sim S_2}$$

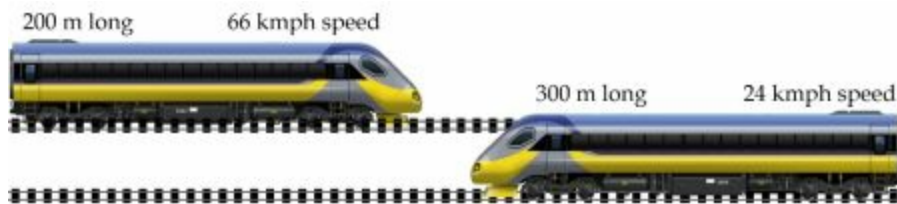L_1 – Length of the train 1; L_2 – Length of train 2

S_1 – Speed of the train 1; S_2 – Speed of train 2

Conversion from Kmph to mps		<|>	kmph x (5/18) = mps		
Kmph	18	36	54	72	90	108
mps	5	10	15	20	25	30

Question:

Two trains A and B of length 200m and 300 are travelling at a speed of 66 kmph and 30 kmph respectively in same directions. How long will they take to cross each other?

200 m long   66 kmph speed

300 m long   30 kmph speed

Answer:

$L_1 = 200$; $L_2 = 300$

$S_1 \sim S_2 = 66 - 30 = 36$ kmph $= 10$ mps

Substitute the values in the above equation, we get

T = (200+300)/(10)

= 50 seconds

Train crossing a man sitting on another train travelling in opposite direction.

$$\text{Time taken to cross} = \frac{L_1}{S_1 + S_2}$$

L_1 – Length of the train which is crossing the man

S_1 – Speed of the train 1; $\qquad$ S_2 – Speed of train 2

Question:

Two trains A and B of length 300m and 400 are travelling at a speed of 72kmph and 36kmph respectively in opposite directions. How long will train A take to cross a man travelling in train B?

300 m long $\qquad$ 72 kmph speed

400 m long $\qquad$ 36 kmph speed

Answer:

$L_1 = 300$, (Length of train crossing the man)

$S_1 + S_2 = 72 + 36 = 108$ kmph $= 30$ mps

Substitute the values in the above equation, we get

$T = (300)/(30)$

$= 10$ seconds

Train crossing a man sitting on another train travelling in same direction.
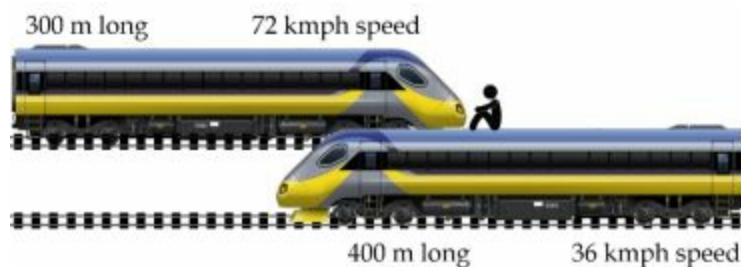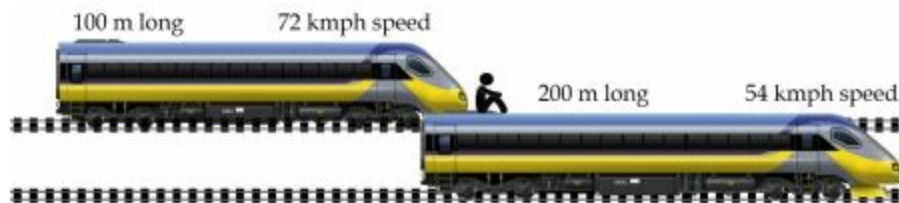
$$\text{Time taken to cross} = \frac{L_1}{S_1 \sim S_2}$$

L_1 – Length of the train which is crossing the man

S_1 – Speed of the train 1; S_2 – Speed of train 2

Question:

Two trains A and B of length 100m and 200 are travelling at a speed of 72kmph and 54kmph respectively in same directions. How long will train A take to cross a man travelling in train B?

Answer:

$L_T = 100$, (Length of train crossing the man)

$S_1 = 72\text{kmph} = 72(5/18)$ mps $= 20$mps

$S_2 =$ speed of the man travelling in train B

$S_2 = 54\text{kmph} = 36(5/18)$ mps $= 10$mps

Substitute the values in the above formula, we get

$T = (100)/(20\text{-}10)$

$= 10$ seconds

Time taken to row upstream.

$$\text{Time taken to row upstream} = \frac{D_{us}}{S_b - S_r}$$

D_{us} – Distance travelled upstream.

S_b – Speed of the boat in still water.

S_r – Speed of the river flow (or) stream (or) current.

Question:

The speed of boat in still water is 40kmph. How long will the boat take to row 175 km upstream in a river of speed 5kmph?

Answer:

D = 175km

S_b = 40kmph, (speed of boat in still water)

S_r = 5kmph, (speed of river water)

$S_b - S_r$ = 35kmph, (Upstream speed of boat)

Substitute the values in the above formula, we get

T = 175/35

= 5 hours

Time taken to row downstream.

$$\text{Time taken to row downstream} = \frac{D_{ds}}{S_b + S_r}$$

D_{ds} – Distance travelled downstream.

S_b – Speed of the boat in still water.

S_r – Speed of the river flow (or) stream (or) current.

Question:

The speed of boat in still water is 30kmph. How long will the boat take to row 96 km downstream in a river of speed 2kmph?

Answer:

D = 96km

S_b = 30kmph, (speed of boat in still water)

S_r = 2kmph, (speed of river water)

S_b + S_r = 32kmph, (Downstream speed of boat)

Substitute the values in the above formula, we get

T = 96/32

= 3 hours

Finding speed of the boat when upstream and downstream speed are known.

$$\text{Speed of the boat, } S_b = \frac{S_{ds} + S_{us}}{2}$$

S_b – Speed of the boat in still water.

S_{us} - Upstream speed.

S_{ds} – Downstream speed.

Question:

Time taken by a boat to row 40km upstream in 4 hours. It took 2 hours to return back to the starting point. Find the speed of the boat.

Answer:

Step 1: Find the speed upstream and downstream.

$S_{us} = 40/4 = 10$kmph

$S_{ds} = 40/2 = 20$kmph

Step 2: Find the speed of boat.

$S_b = (10 + 20)/2 = 15$kmph

Shortcut # 49 – Boats
Finding speed of the river when upstream and downstream speed are known.

$$\text{Speed of the boat, } S_b = \frac{S_{ds} - S_{us}}{2}$$
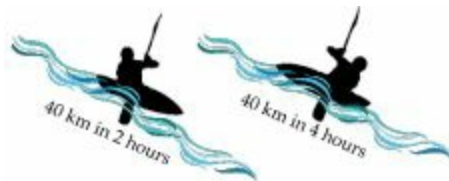
S_b – Speed of the boat in still water.
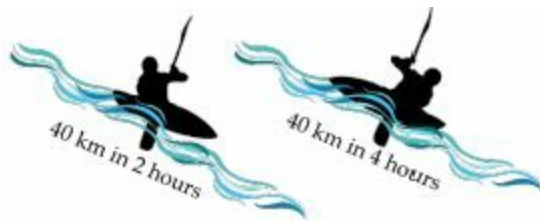
S_{us} - Upstream speed.

S_{ds} – Downstream speed.

Question:

Time taken by a boat to row 40km upstream in 4 hours. It took 2 hours to return back to the starting point. Find the speed the river.

Answer:

Step 1: Find the speed upstream and downstream

$S_{us} = 40/4 = 10$kmph

$S_{ds} = 40/2 = 20$kmph

Step 2: Find the speed of the river

$S_r = (20 - 10)/2 = 5$kmph

Work is directly proportional to time.

$$\frac{W_1}{W_2} = \frac{T_1}{T_2}$$

W_1 – Work done in first case.
T_1 – Time taken in first case.
W_2 – Work done in second case.
T_2 – Time taken in second case.

Question:

It took 40 days to build 10 buildings. How long will it take to build 50 buildings using same number of employees?

Answer:

$W_1 = 10$; $W_2 = 50$

$T_1 = 40$; $T_2 = ?$

Substitute the values in the above formula, we get

$10/50 = 40/T_2$

$T_2 = 200$ days

Shortcut # 51 – Time and Work
Work is directly proportional to Resource.

$$\frac{W_1}{W_2} = \frac{R_1}{R_2}$$

Question:

40 men are required to complete 20 buildings. How many men are required to build 50 buildings in the same time?

Answer:

$R_1 = 40$; $R_2 = ?$

$W_1 = 20$; $W_2 = 50$

Substitute the values in the above formula, we get

$40/R_2 = 20/50$

$R_2 = 100$

Shortcut # 52 – Time and Work
Time is inversely proportional to Resource.

$$\frac{T_1}{T_2} = \frac{R_2}{R_1}$$

Question:

If 20 men can do the work in 40 days, how many men are required to do the same work in 10 days?

Answer:

$R_1 = 20$; $R_2 = ?$

$T_1 = 40$; $T_2 = 10$

Substitute the values in the above formula, we get

$20/R_2 = 10/40$

$R_2 = 80$

Shortcut # 53 – Time and Work
Comparison of Time, Work and Resource.

$$\frac{W_1}{W_2} = \frac{R_1 T_1}{R_2 T_2}$$

Question:

If 10 men can cut 40 trees in 4 days, how many trees can be cut by 40 men 6 days?

Answer:

$R_1 = 10$; $R_2 = 40$

$T_1 = 4$; $T_2 = 6$

$W_1 = 40$; $W_2 = ?$

Substitute the values in the above formula, we get

$40/W_2 = (10 \times 4)/(40 \times 6)$

$W_2 = 240$ trees

When the number of working hours per day is included in the question.

$$\frac{W_1}{W_2} = \frac{R_1 T_1 H_1}{R_2 T_2 H_2}$$

Question:

30 men working 6 hours day for 50 days can make 2000 toys. How many hours per day should 40 men work for 60 days to make 3000 toys?

Answer:

$R_1 = 30$; $R_2 = 40$, (Resources in each case)

$T_1 = 50$; $T_2 = 60$, (Days in each case)

$W_1 = 2000$; $W_2 = 3000$, (Work in each case)

$H_1 = 6$; $H_2 = ?$, (Hours per day in each case)

Substitute the values in the above formula, we get

2000/3000 = (30 x 50 x 6)/(40 x 60 x H_2)

$H_2 = 5(5/8)$ hours = 5 hours 32 minutes 30 seconds

Shortcut # 55 – Time and Work
Two resources working together.

$$T = \frac{AB}{A + B} \quad \text{or} \quad \frac{1}{T} = \frac{1}{A} + \frac{1}{B}$$

Question:

A can complete a work in 40 days. B can complete the same work in 60 days. How long will they take to complete the work if they are working together?

40 days   60 days

Answer:

A = 40

B = 60

Substitute the values in the above formula, we get

Time taken together = (40 x 60)/(40 + 60)

= 24 days

Shortcut # 56 – Time and Work
Three resources working together.

$$T = \frac{ABC}{AB + BC + AC} \quad \text{or} \quad \frac{1}{T} = \frac{1}{A} + \frac{1}{B} + \frac{1}{C}$$

Question:

A can do a work in 40 days, B in 50 days and C in 60 days. If they work together, how long will they take to complete the work?

40 days   50 days   60 days

Answer:

A = 40

B = 50

C = 60

Substitute the values in the above formula, we get

Time taken together = (40 x 50 x 60)/(40 + 50 + 60)

= 16.21 days

Shortcut # 57 – Time and Work
Work done.

Work done per day = 1/Time taken to do complete work

Work done = Number of days worked x Work done per day

Question:

A can do a piece of work in 40 days. What is the fraction of work done by him in 25 days?

Answer:

Per day work of A = 1/40

Number of days for which A worked = 25

Work done = (1/40) x 25

$= \dfrac{5}{8}$

Question:

A can do a piece of work in 30 days. What is the fraction of work done by him in 45 days?

Answer:

Per day work of A = 1/30

Number of days for which A worked = 45

Work done = (1/30) x 45

$= 1\dfrac{1}{2}$

Remaining work.

Remaining Work = 1 – Work Done

Question:

A can do a work in 30 days, B in 40 days. A works for 9 days and the remaining work is done by B. What is the fraction of work done by B?

Answer:

Remaining work for B = 1 – Work done by A

Work done by A = (1/30) x 9 = 3/10

Remaining work for B = 1 – (3/10) = 7/10

Question:

A can do a work in 40 days, B in 60 days. A works for 24 days and the remaining work is done by B. What is the fraction of work done by B?

Answer:

Remaining work for B = 1 – Work done by A

Work done by A = (1/40) x 24 = 6/10

Remaining work for B = 1 – (6/10) = 4/10

= 2/5

Shortcut # 59 – Time and Work
Time taken to do the remaining work.

Time taken to do remaining Work

= Remaining work x Time taken to do full work

Question:

A can do a work in 30 days, B in 40 days. A works for 9 days and the remaining work is done by B. What is the total number of days to complete the work?

Answer:

Time taken to complete the work

= Remaining work x time to finish full work

Remaining work for B = 1 – Work done by A

Work done by A = (1/30) x 9 = 3/10

Remaining work for B = 1 – 3/10 = 7/10

Time taken by B to complete the remaining work

= 7/10 x 40

= 28 days

Total time taken
= 28 + 9
= 37 days

Salary ratio of resources working together.

Salary of a resource is directly proportional to the per day work.

$$S_A : S_B = \frac{1}{A} : \frac{1}{B}$$

$$S_A : S_B : S_C = \frac{1}{A} : \frac{1}{B} : \frac{1}{C}$$

Question:

A can do a work in 20 days and B can do the same work in 40 days. They both work together and get a combined salary of Rs. 3000. What is the salary of A?

Answer:

S_A = Salary of A; S_B = Salary of B

A = 20; B = 40

$S_A : S_B = 40 : 20 = 2 : 1$

$S_A = [2/(2+1)] \times 3000 = 2000$

Question:

A can do a work in 30 days B in 40 days and C in 50 days. If they all work together, what will the ratio between their salaries?

Answer:

A = 30;   B = 40;   C = 50

$S_A : S_B : S_C = (1/30) : (1/40) : (1/50) = 20 : 15 : 12$

One pipe fills the tank and the other empties the tank.

$$\frac{1}{T} = \frac{1}{A} - \frac{1}{B}$$

The pipe which empties the tank is doing negative work. So we have to assign '-'symbol for the work done by that pipe.
T – Total time taken to fill the tank.

Question:

Pipe A can fill a tank in 4 hours and pipe B can empty the tank in 5 hours. If both pipes are opened together, how long will they take to fill a complete tank?
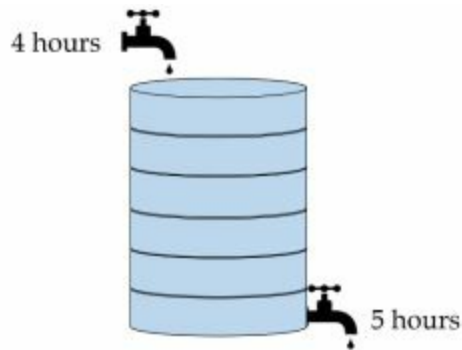
Answer:

A = 4;   B = 5

Substitute the values in the above equation, we get

Time taken to fill the tank = (4 x 5)/(-4 + 5)

= 20 hours

Shortcut # 62 – Pipes and Cisterns
Two pipes fill a tank and another pipes empties the tank.

$$\frac{1}{T} = \frac{1}{A} + \frac{1}{B} - \frac{1}{C}$$

Question:

Pipes A and B can fill a tank in 10 hours and 12 hours respectively. Pipe C can empty a tank in 20 hours. If all the pipes are opened together, how long will they take to fill a complete tank?
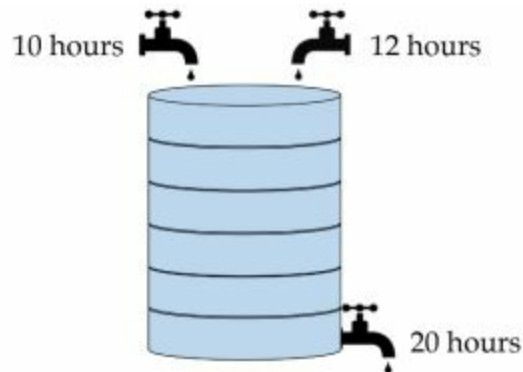
Answer:

A = 10; B = 12; C = 20

Substitute the values in the above equation, we get

Time taken to fill the tank

= (10 x 12 x 20)/[(-10 x 12) + (12 x 20) + (10 x 20)]

= 7. 5 hours = 7 hours 30 minutes

Simple Interest

$$\text{Simple Interest} = \frac{PNR}{100}$$

P = Principle amount invested or borrowed

R = Rate of interest per term

N = Number of terms

Term = duration for which interest is calculated

Question:

A man invested Rs. 10000 at 4% per annum simple interest.

1. What is the interest he will get at the end of 3 years?
2. What is the total amount earned after 3 years?

Answer:

P = 10000; N = 3; R = 4

Substitute the values in the above equation, we get

SI = 10000 x 3 x 4/100

= 1200

Amount = Principle + Interest

Amount = 10000 + 1200 = 11200

Shortcut # 64 – Interest – Simple and Compound
Compound Interest.

$$\text{Amount after } n^{th} \text{ term} = \frac{100 + R}{100} \text{ Amount after } (n-1)^{th} \text{ term}$$

Question:

What is the compound interest obtained for Rs. 16000 at 2% per annum for three years?

Answer:

Amount at the end of 1st year $= \dfrac{102}{100}$ x 16000 = 16320

Amount at the end of 2nd year $= \dfrac{102}{100}$ x 16320 = 16646.4

Amount at the end of 3rd year $= \dfrac{102}{100}$ x 16646.4 = 16979.328

Interest obtained at the end of three years:

Interest = Amount – Principle

Interest = 16979.328 – 16000 = 979.328

Note:
In simple interest, the interest is calculated only for the principle. In compound interest, the interest is calculated for the principle as well as the interest obtained till the last term.

Divisibility.

Divisible by	Rule
2	Last digit of a number should be 0, 2, 4, 6 or 8
3	Sum of the digits should be divisible by 3
4	Last two digits of a number should be divisible by 4
5	Last digit of a number should be 0 or 5
6	Number should be divisible by 2 and 3
8	Last three digits of a number should be divisible by 8
9	Sum of the digits should be divisible by 9
10	Last digit of a number should be 0
11	Difference between sum of digits in odd places and sum of digits in even places should be o or 11

Divisibility rule for composite numbers:

If a number is a multiple of 'x' and 'y', then it is divisible by LCM of (x, y). 30 is the LCM of (2, 3 and 5). So all the multiples of 30 are divisible by 2, 3 and 5.

Question:

Which of the following numbers is divisible by both 5 and 9?

1115, 11115, 111115, 1111115

Answer:

11115 – It is divisible by 5 and 9.

Shortcut # 66 – Number Systems
Finding largest four digit number that is divisible by certain numbers.

Step 1: LCM of the divisors
Step 2: Remainder of 10000/LCM
Step 3: 10000 – Remainder = Answer

Question:

Find the largest number that leaves
1. Remainder 0 when divided by 12, 15 and 20.
2. Remainder 2 when divided by 12, 15 and 20.
3. Remainder 9, 12 and 17 when divided by 12, 15 and 20 respectively.

Answer:

1. Remainder 0:
LCM(12, 15, 20) = 60
Remainder(10000/60) = 40
10000 – 40 = 9960.
The largest number that leaves remainder 0 = 9960

2. Remainder 2:
9960 + 2 = 9962 is the largest 4 digit number that leaves remainder 2 when divided by 12, 15 and 20.

3. Remainder 9, 12 and 17:
Difference between divisor and remainder = 3.
9960 – 3 = 9957 is the largest 4 digit number that leaves remainder 9, 12 and 17 when divided by 12, 15 and 20.

Shortcut # 67 – Number Systems
Finding unit digit of a number with certain power.

The expression will be in the form $X^Y = Z$

Unit digit of X	Unit digit of Z
0	0
1	1
5	5
6	6

Power value

	Odd	Even
4	4	6
9	9	1

Unit place of X

Unit place of Z

Remainder when power value is divided by 4

	1	2	3	0
2	2	4	8	6
3	3	9	7	1
7	7	9	3	1
8	8	4	2	6

Unit place of X

Unit place of Z

Shortcut # 68 – Number Systems
Remainder Concept.

$$\text{Remainder}\left(\frac{A \times B \times C}{K}\right) = R\left(\frac{A}{K}\right) \times R\left(\frac{B}{K}\right) \times R\left(\frac{C}{K}\right)$$

This concept is also applicable if the numbers in the numerator are added or subtracted.

Question:

Find the remainder when 212 x 313 x 414 is divided by 5.

Answer:

Using the above concept we can find the remainder for each term and then we can multiply.

R(212/5) = 2

R(313/5) = 3

R(414/5) = 4

2 x 3 x 4 = 24

The value we got is still greater than 5, so again divide it and find the remainder.

R(24/5) = 4

The remainder of the expression is = 4

Finding both HCF and LCM using single L-Division.

While doing the L-Division method, initially divide only using the prime numbers which are common factors for all the numbers, then divide using the prime numbers which are not common.

Question:

Find LCM, and HCF for the numbers 240, 450 and 570.

2	240, 450, 570
5	120, 225, 285
3	24, 45, 57
19	8, 15, 19
5	8, 15, 1
3	8, 3, 1
2	8, 1, 1
2	4, 1 , 1
2	2, 1, 1
	1, 1, 1

The common factors for the three numbers are 2, 3 and 5.
Variation between common factors and the others is shown by using different font.

       Multiply only the common factors to get the HCF
HCF = 2 x 3 x 5 = 30
       Multiply all the factors to get LCM
LCM   = 2 x 3 x 5 x 19 x 5 x 3 x 2 x 2 x 2
        = 2^4 x 3^2 x 5^2 x 19^1
        = 68400

Application problem using HCF.

There will be different sets of elements with different quantities in each. They have to be arranged based on the following conditions.
1.   Every group should have equal number of elements.
2.   Every group should have same kind of elements.
Under these conditions one must find out:
1. The maximum number of elements per group.
2. The minimum number of groups required.

HCF of the numbers of elements in all the groups will give the maximum number of elements per group.

Total number of elements divided by HCF will give the minimum number of groups required.

Question:

There are 40 apples and 32 oranges. They have to be packed in boxes such that each box will have one kind of fruit and every box will have equal number of fruits. Under this condition, what is the:
1.   Maximum number of fruits per box?
2.   Minimum number of boxes required?

Answer:
Maximum number of fruits per box = HCF(40, 32) = 8
Minimum number of boxes required = (40 + 32)/8 = 9

Shortcut # 71 – HCF and LCM
Application problem using HCF.

For three or more numbers, the HCF of the difference between the successive numbers arranged in ascending order is the largest number that can divide the given numbers and leave same remainder.

Question:

What is the largest number that can divide 212, 254, 310 and 338 and leave the same remainder?

Answer:
The difference between the numbers = 42, 56 and 28.
HCF (42, 56, 28) = 14
Remainder (212/14) = 2
Remainder (254/14) = 2
Remainder (310/14) = 2
Remainder (338/14) = 2
14 is the largest number that can divide the given numbers and leave the same remainder.

Question:

What is the largest number that can divide 34, 52 and 88 and leave the same remainder?

Answer:
Difference between the numbers = 18 and 36
HCF (18, 36) = 18

18 is the largest number that can divide 34, 52 and 88 and leave same remainder.

Shortcut # 72 – HCF and LCM
Application problem using LCM.

When different events occur in different intervals of their own and if all the events are started at the same time, at some point of time all the events will again occur together. To find the duration between two common occurrences, LCM of the intervals of each event has to be calculated.

Question:

There are three different bells. The first bell rings every 4 hour, the second bell rings every 6 hours and the third bell rings every 15 hours. If all the three bells are rung at same time, how long will it take for them to ring together again at the same time?

Answer:

Take LCM of 4, 6, 15

LCM (4,6,15) = 60

All the three bells will ring after 60 hours.

Question:

There are three different alarms. The first alarm rings every 2 minutes, the second alarm rings every 3 minutes and the third alarm rings every 5 minutes. If all the three alarms are rung at 6 am together, at what time the three alarms will ring together for the next time?

Answer:
LCM (2, 3, 5) = 30. After 30 minutes = 06:30 am.

Solution using tan ϴ .

ϴ	0	30	45	60	90
tan	0	$\dfrac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞

Question:

Jack Sparrow from a boat saw a lighthouse of height 100m at an angle of elevation, 60°. What is the distance between Jack Sparrow and the tower?

Answer:

$\tan \Theta = \dfrac{\text{opposite side}}{\text{adjacent side}}$

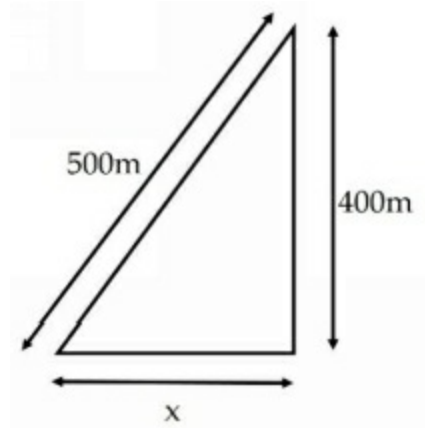$\tan 60° = \dfrac{100}{X} = \qquad \sqrt{3} = \dfrac{100}{X} = \qquad x = 57.7 \text{ m}$

Shortcut # 74 – Heights and Distances
Solution using Pythagoras theorem.

Hypotenuse² = Oppsoite² + Adjacent²

Question:

A man looks at the top of a tower which is 400m height. The minimum distance between him and top of the tower is 500m. What is the distance between him and the base of the tower?

Answer:

$hyp^2 = opp^2 + adj^2$

$500^2 = 400^2 + x^2$

$x^2 = 90000$

$x = 300$ m

Finding nth term of an Arithmetic Progression.

$$t_n = a + (n - 1)d$$

Parameters:

a   - first term of the series.

d   - common difference between successive terms. $a_2 - a_1$

n   - the number position of the term.

t_n - the term that has to found out.

Question:

What is the 100th term of the series?
1.   2, 7, 12, 17, 22, …
2.   501, 497, 493, 489, 485, …

Answer:

1.   a = 2;   d = 5;   n = 100
            $t_n = 2 + (100 - 1)5$
            $t_n = 2 + 495 = 497$
            $t_{100} = 497$

2.   a = 501;   d = - 4;   n = 100
            $t_n = 501 + (100 - 1)(- 4)$
            $t_n = 105$
            $t_{100} = 105$

Shortcut # 76 – Arithmetic Progression
Number of terms in an Arithmetic Progression.

$$n = \frac{(l - a)}{d} + 1$$

l   - Last term of the series.

Question:

Find the number of terms in the series:
1.   2, 7, 12, 17, 22, ... 382
2.   501, 497, 493, 489, 485, ... 201

Answer:

1. $n = \dfrac{(382 - 2)}{5} + 1$

       $n = 77$

2. $n = \dfrac{(201 - 501)}{-4} + 1$

       $n = 76$

Shortcut # 77 – Arithmetic Progression
Sum of the terms in an Arithmetic Progression.

$$S_n = (a + l)\, \frac{n}{2}$$

l   - Last term of the arithmetic series.

Question:

Find the sum of the series:
1.   2, 7, 12, 17, 22, … 497
2.   501, 497, 493, 489, 485, … 105

Answer:

1.   Number of terms, n = $\dfrac{(497 - 2)}{5}$ + 1

   n = 100

   Sum   = (2 + 497)(100/2)
   S   = 24950

3.   Number of terms, n = $\dfrac{(105 - 501)}{-4}$ + 1

   n = 100

   Sum   = (501 + 105)(100/2)
   S   = 30300

Finding nth term of a Geometric Progression.

$$t_n = ar^{n-1}$$

t_n - n^{th} term.

a   - first term of the series.

r   - common ratio between the successive terms. (a_2/a_1)

n   - number position of the term in the series.

Question:

Find 8th term of the series 3, 6, 12, …

Answer:

n = 8;   a = 3;   r = (6/3) = 2

$t_8 = 3(2)^{8-1}$

$t_8 = 3(128) = 384$

Question:

Find 6th term of the series 400, 200, 100, …

Answer:

n = 6;   a = 400;   r = (200/400) = 01/2

$t_6 = 400(1/2)^{6-1}$

$t_6 = 400(1/32) = 12.5$

Shortcut # 79 – Geometric Progression
Sum of the terms of a finite series where r > 1.

$$S_n = \frac{a(r^n - 1)}{r - 1}$$

S_n - Sum of n terms of the series.

Question:

Find the sum of the series 3, 6, 12, 24, … up to 10 terms.

Answer:

a   = 3
n   = 10
r   = (6/3) = 2;   here r > 1.

Sn $= \dfrac{3(2^{10} - 1)}{2 - 1}$ = 3069

Question:

Find the sum of the series 10, 30, 90, 270, … up to 8 terms.

Answer:

a   = 10
n   = 8
r   = (30/10) = 3;   here r > 1.

Sn $= \dfrac{10(3^8 - 1)}{3 - 1}$ = 32800

Shortcut # 80 – Geometric Progression
Sum of the terms of a finite series where r < 1.

$$S_n = \frac{a(1-r^n)}{1-r}$$

Question:

Find the sum of the series 600, 300, 150, ... up to 6 terms.

Answer:

a = 600
n = 6
r = (300/600) = 1/2;   here r < 1

$$S_n = \frac{600(1 - \frac{1}{2}^6)}{1 - \frac{1}{2}} = 1181.25$$

Question:

Find the sum of the series 128, 64, 32, ... up to 10 terms.

Answer:

a = 128;   n = 10;   r = 64/128 = ½   (r < 1)

$$S_n = \frac{128(1 - \frac{1}{2}^{10})}{1 - \frac{1}{2}} = 255.75$$

Shortcut # 81 – Geometric Progression
Sum of the terms of an infinite series where r < 1.

$$S_n = \frac{a}{1-r}$$

Question:

A ball is thrown up in the air for 400 m. every time the ball hits the ground it will bounce back one third of the height it went the last time. The ball repeats this bounce as long as it rests in the ground. What is the total distance covered by the ball?

Answer:

Distance travelled in the first throw = 450 + 450 = 900.
(450 + 450 is because the total distance is both up and down distance covered).

Distance covered in the first bounce = (1/3)900 = 300
Distance covered in second bounce = (1/3)300 = 100
The series is 900, 300, 100, … infinite terms.
Sum = 900/[1 – (1/3)]
Sum = 1350 m

Finding day of a date using a reference day.

Question:

Find the day of birth of MS Dhoni (7 July, 1981), if 31 Dec 1999 is Friday

Answer:

Step 1: Number of days after 7/7/1981 in 1981   = 177

Step 2: Number of years between 1981 and 1999   = 17

Step 3: Number of leap years between 1981 and 1999   = 4

Step 4: Number of days in 1999 till Dec 31   = 365

Step 5:   177 + 17 + 4 + 365   = 563

Step 6:   Remainder of (563/7)   = 3

Our reference day is Friday and the remainder is 3.

Step 7: 3 days before Friday is Tuesday.

MSD was born on Tuesday.

Note:
If there are no years in between the day in the question and reference day, step 2 and step 3 will be = 0
If a date in the future is asked, remainder number of days after the reference day will be the answer.
If remainder is 0, the day to be found out is the same day as the reference day.

Angle between the hour hand and the minute hand.

$$Angle = \left(30H + \frac{M}{2}\right) \sim 6M$$

H   - Hour value
M   - Minute value

Question:

What is the angle between minute hand and hour hand at 05:40?

Answer:

H = 5
M = 40
Angle   = [30(5) + (40/2)] ~ 6(40)
          = 170 ~ 240
          = 70`

Note:
If the value is above 180`, subtract it from 360 to get refract angle.

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Shortcut # 84 – Clocks
Time at which the two hands overlap.

$$\text{Time} = \frac{12}{11}\, 5H$$

</div>

H   - Least hour between 'H' and 'H+1' hour

Question:

At what time between 3 o' clock and 4 o' clock the two hands of the clock will overlap?

Answer:

Time   = [12/11][5(3)]
      = 180/11 minutes past 3 'o' clock
      = 16.36 minutes past 3 'o' clock
      = 16 minutes 22 seconds past 3
      = 03 : 16 : 22

Question:

At what time between 10 o' clock and 11 o' clock the two hands of the clock will overlap?

Answer:

Time   = [12/11][5(10)]
      = 600/11 minutes past 10 'o' clock
      = 54.54 minutes past 10 'o' clock
      = 54 minutes 32 seconds past 10
      = 10 : 54 : 32

Time at which the two hands face opposite directions.

Case 1: H < 6

$$Time = \frac{12}{11} [5H + 30]$$

Question:
At what time between 1 o' clock and 2 o' clock the two hands will be facing opposite direction?
Answer:
Time   = 12/11[5(1) + (180/6)]
       = 12/11[5(1) + 30]
       = 420/11 minutes past 1 'o' clock
       = 38.18 minutes past 1 'o' clock
       = 38 minutes 11 seconds past 1
       = 01 : 38 : 11

Case 2: H > 6

$$Time = \frac{12}{11} [5H - 30]$$

Question:
At what time between 9 o' clock and 10 o' clock the two hands will be facing opposite directions?
Answer:
Time   = 12/11[5(9) - (180/6)]
       = 12/11[5(9) - 30]
       = 180/11 minutes past 9 'o' clock
       = 16.36 minutes past 9 'o' clock
       = 16 minutes 22 seconds past 9
       = 09 : 16 : 22

Time at which the two hands will be certain angle apart.

$$\text{Time} = \frac{12}{11}\left[5H \pm \frac{\theta}{6}\right]$$

There are two different time at which the hands will be certain degrees apart. T_1 and T_2.

Question:

At what time between 4 o' clock and 5 o' clock the two hands of the clock will be 60 degrees apart?

Answer:

T_1 $= 12/11[5(4) + (60/6)]$

     $= 360/11$ minutes past 4 'o' clock

     $= 32.72$ minutes past 4 'o' clock

     $= 32$ minutes 44 seconds past 4

     $= 04 : 32 : 44$

T_2 $= 12/11[5(4) – (60/6)]$

     $= 120/11$ minutes past 4 'o' clock

     $= 10.9$ minutes past 4 'o' clock

     $= 10$ minutes 54 seconds past 4

     $= 04 : 10 : 54$

Shortcut # 87 – Clocks
Time at which the two hands will be certain minute spaces apart.

$$\text{Time} = \frac{12}{11}[5H \pm M]$$

There are two different time at which the hands will be certain degrees apart. T_1 and T_2.

Question:

At what time between 7 o' clock and 8 o' clock the two hands of the clock will be 15 minutes apart?

Answer:

T_1 = 12/11[5(7) + 15]

      = 600/11 minutes past 7 'o' clock

      = 54.54 minutes past 7 'o' clock

      = 54 minutes 33 seconds past 7

      = 07 : 54 : 33

T_2 = 12/11[5(7) – 15]

      = 240/11 minutes past 7 'o' clock

      = 21.81 minutes past 7 'o' clock

      = 21 minutes 48 seconds past 7

      = 07 : 21 : 48

Dependent and Independent Events.

Dependent events – Multiplication;   Key word – AND
Independent events   - Addition;   Key word – OR

Question:

There 3 busses from city A to city B and there are 5 busses from city B to city C. In how many ways a person can travel from city A to C through B?

Answer:

Choosing a bus from city B depends on choosing a bus from city A.

Number of ways = 3 x 5 = 15

Question:

There 3 busses from city A to city B and there are 5 busses from city A to city C. In how many ways a person can travel from city A to C or B?

Answer:

Choosing a bus to city B or C are not dependent.

Number of ways = 3 + 5 = 8

Permutation – Arrangement with repetition.

n^n

Question:

In how many ways the letters of the word "ORANGE" can be arranged with repetition?

Answer:

n = 6   (n = total number of elements)

Since all the elements are taken,

Number of arrangements = 6^6

---

n^r

Question:

In how many ways three letters from the word "ORANGE" can be arranged with repetition?

Answer:

n = 6; r = 3   (r = number of elements taken for arrangement)

Number of arrangements = $6^3 = 216$

Permutation – Arrangement without repetition.

n!

Question:

In how many ways the letters of the word "MANGO" can be arranged without repetition?

Answer:

n = 5

Since all the elements are taken for arrangement,

Number of elements = n! = 5! = 120

$$nP_r = \frac{n!}{(n - r)!}$$

Question:

In how many ways any three letters of the word 'MANGO" can be arranged without repetition?

Answer:

n= 5; r = 3

$nP_r = 5!/(5 - 3)! = 120/2 = 60$ ways

Permutation – Elements occurring together.

If two elements occur together
2!(n − 1)!
If three elements occurtogther
3!(n − 2)!
If four elements occur together
4!(n − 3)!
and so on

Question:

In how many ways letters of the word "ORANGE" arranged so that the vowels will always occur together?

Answer:

n = 6

Three letters 'O, A and E' should occur together.

Since three letters occur together

3! x (6 − 2)! = 6 x 24 = 144

Note:

If there are 4 letters occurring together, the answer is

4!(6 − 3)!

If there are 5 letters occurring together, the answer is

5!(6 − 4)!

Permutation – When similar kind of elements occur.

$$\frac{n!}{a! \times b!}$$

Question:

In how many ways the letters of the word "ENVIRONMENT" can be arranged?

Answer:

n = 11
Let, a = 2 (E is repeated twice)
Let, b = 3 (N is repeated thrice)
Number of arrangements = 11!/(2! x 3!)
= 277200

Question:

In how many ways the letters of the word "PIIZZZAAAA" can be rearranged?

Answer:

n = 10
a = 2 (I is repeated twice)
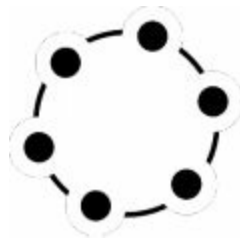b = 3 (Z is repeated thrice)
c = 4 (A is repeated four times)
Number of arrangements = 10!/(2! x 3! x 4!)
= 12600

Permutation – Circular arrangement.

(n – 1)!

Question:

In how many ways 6 persons can be arranged in a circle?

Answer:

n = 6

Number of arrangements = (6 – 1)! = 5! = 120

___

Question:

In how many ways 8 persons can be arranged in a circle?

Answer:

n = 8

Number of arrangements = (8 – 1)! = 7! = 5040

Shortcut # 94 - Permutation Combination and Probability
Permutation – Elements occurring together in a circle.

If two elements occur together
2!(n – 2)!
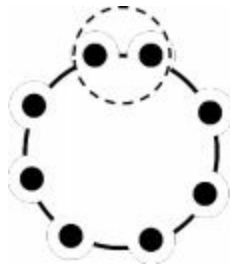If three elements occur together
3!(n – 3)!
If four elements occur together
4!(n – 4)!
and so on

Question:

In how many ways 8 persons can be seated around a circular table with two persons always sitting together?

Answer:

2! x (8 – 2)! = 2 x 720 = 1440

Note:

If three persons are sitting together, the answer is

3! x (8 – 3)!

If four persons are sitting together, the answer is

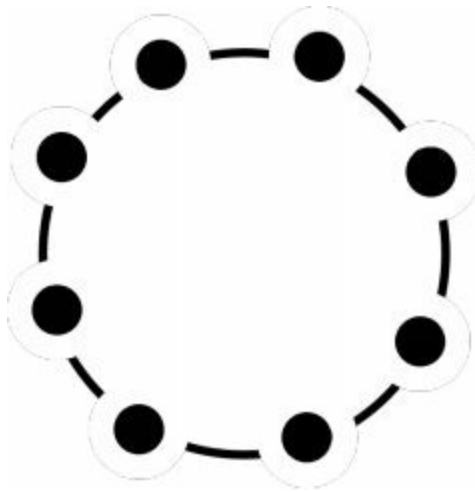4! x (8 – 4)!

Permutation – Arrangement of Necklace.

(n – 1)!/2

Question:

In how many ways a necklace with 8 different colored beads can be arranged?

Answer:

n = 8

Number of arrangements = (8 – 1)!/2 = 2520

Combination

$$nC_r = \frac{n!}{r!(n-r)!}$$

Question:

In how many ways 2 shirts and 3 pants can be selected from 5 shirts and 7 pants?

Answer:

Selecting 2 shirts out of 5 = $^5C_2$ = 5!/[2!(5 − 2)!]   = 10

Selecting 3 shirts out of 7 = $^7C_3$ = 7!/[3!(7 − 3)!]   = 35

Since the two events are dependent,

Total ways of selecting = 10 x 35 = 350

Question:

In how many ways 2 shirts or 3 pants can be selected from 5 shirts and 7 pants?

Answer:

Selecting 2 shirts out of 5 = $^5C_2$ = 5!/[2!(5 − 2)!]   = 10

Selecting 3 shirts out of 7 = $^7C_3$ = 7!/[3!(7 − 3)!]   = 35

Since the two events are independent,

Total ways of selecting = 10 + 35 = 45

Probability.

Probability = $\dfrac{\text{Expecting number of results}}{\text{Total number of results}}$

Question:

What is the probability of selecting 2 spades from a pack of 52 cards?

Answer:

Total number of ways of selecting 2 cards from $52 = {}^{52}C_2 = 1275$

Total ways of selecting 2 spades from 13 spades $= {}^{13}C_2 = 78$

Probability $= 78/1275$

Question:

What is the probability of selecting 2 students from a class of 10 boys and 8 girls, where both the selected students are boys?

Answer:

Total number of ways of selecting 2 students from 18

$= {}^{18}C_2 = 153$

Total ways of selecting 2 boys from 10 boys

$= {}^{10}C_2 = 45$

Probability $= 45/153$

Shortcut # 98 - Permutation Combination and Probability
Probability – Coin based problems.

Probability = $\dfrac{\text{Expecting number of results}}{\text{Total number of results}}$

Question:

What is the probability of getting 4 heads when 7 coins are tossed?

Answer:

Total number of results = 2 x 2 x 2 x 2 x 2 x 2 x 2 = 2^8 = 128

When the required results need 4 heads, the remaining three will be tails. The results will be the different arrangement of the following:

" H H H H T T T "

The number of ways in which the above can be arranged is
= 7!/(4! x 3!)

= 5040/144

= 35

Probability = 35/128

Shortcut # 99 – Permutation Combination and Probability
Probability – Dice based problems.

$$Probability = \frac{Expecting\ number\ of\ results}{Total\ number\ of\ results}$$

Question:

What is the probability of getting a sum which is equal to prime number from the results obtained by throwing two dice with six faces numbered 1 to 6 on the faces?

Answer:

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

The above table shows the different sums obtained from different results.
Total number of results = 36.
Expecting result = 15. (Highlighted with the shade).

Probability = 15/36

Shortcut # 100 – Permutation Combination and Probability
Probability – Selection based problems.

$$\text{Probability} = \frac{\text{Expecting number of results}}{\text{Total number of results}}$$

Question:

What is the probability of selecting 4 balls from a bag that has 5 red balls and 6 black balls where the selection has at least 1 red ball?

Answer:

The different cases are:

1 red and 3 black	$= {}^5C_1 \times {}^6C_3$	$= 100$
2 red and 2 black	$= {}^5C_2 \times {}^6C_2$	$= 150$
3 red and 1 black	$= {}^5C_3 \times {}^6C_1$	$= 60$
4 red	$= {}^5C_4$	$= 5$

Number of ways of selecting 4 balls with at least 1 red ball:
$= 100 + 150 + 60 + 5 = 315$

Total ways of selecting 4 balls without any condition:
$= {}^{11}C_4 = 330$
Probability $= 315/330$

Alternate method:

Probability $= 1 -$ probability of selecting no red balls
$= 1 -$ probability of selecting 4 black balls
Probability $= 1 - ({}^6C_4 / {}^{11}C_4)$
$= 1 - (15/330)$
$= 315/330$

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4. Profit and Loss
5. Simple Interest and Compound Interest
6. Ratio and Proportion
7. Time and Work
8. Time Speed and Distance

#1 SIMPLIFICATION

Q1.

$8^{12} \div 16^2$ of $32^3 \times \sqrt{256} = 2^?$

Sol :
$(2^3)^{12} \div (2^4)^2$ of $(2^5)^3 \times 16 = 2$
$2^{36} \div 2^8$ of $2^{15} \times 2^4 = 2^?$
$2^{17} = 2^?$
$? = 17$

Q2.

$108 \div 36$ of $^1/_4 + {}^2/_5 \times 3^1/_4 = ?$
Sol :
$108 \div 9 + {}^2/_5 \times {}^{13}/_4 = ?$
$12 + {}^{13}/_{10}$
$? = 13^3/_{10}$

Q3.

$33^1/_3\%$ of $633 + 129 = 66^2/_3\%$ of $= ?$
Sol :
$^1/_3 \times 633 + 129 = {}^2/_3 \times ?$
$(211+129) \times {}^3/_2 = ?$
$? = 340 \times {}^3/_2 = 170 \times 3 = 510$

More Tricks on Simplification and Download PDF : Click Here

#2 NUMBER SERIES

Basic Concept Starts From Here : Click Here

Q1.

In each series only one number is wrong. Find out the Wrong number.
- 5531, 5506, 5425, 5304, 5135, 4910, 4621 **(IBPS PO 2012)**

Hint: -7^2, -9^2, -11^2

- 1, 3, 10, 36, 152, 760, 4632 **(IBPS PO 2012)**

Hint : $\times 1+2$, $\times 2+4$, $\times 3+6$ …

- 4, 3, 9, 34, 96, 219, 435 **(IBPS PO 2012)**

Hint : $+1^3 -2$, $+2^3 -2$, $+3^3 -2$, …

- 5, 7, 16, 57, 244, 1245, 7506 **(Allahabad Bank PO 2010)**

Hint : $\times 1+1^2$, $\times 2+2^2$
- 2.5, 3.5, 6.5, 15.5, 41.25, 126.75 **(Allahabad Bank PO 2010)**

Hint : $\times 1/2 + 1/2$, $\times 1+1$, $\times 3/2 + 3/2$ ….

#3 PERCENTAGE

Basic Concepts Starts Here : Click Here

Q1.

If the income of Ram is 10% more than that of Shayam's income. How much % Shyam's income is less than that of Ram's income ?
Method I.
By using formula
less% = r/100+r ×100 = 10/100+10 × 100
= 10/110 ×100 = 9 1/11%
Method II.

Since 10% more $\left\langle \begin{array}{l} 100\% \\ 110\% \end{array} \right\rangle$ Two tools

Less% = $10 \times \dfrac{100}{110}$ .... (To decrease any number, we multiply with small number and divide with large number)

= $9\dfrac{1}{11}\%$

Q2.

A man spends 40% on food, 20% on house rent, 12% on travel and 10% on education. After all these expenditure he saved Rs. 7200. Find the amount spent on travel ?

Method I.
Let total income x
total expenditure
= x × (40%+20%+12%+10%)
= x × 82%
Total saving = x - x × 82%
= x × 18%
Then x × 18% = 7200
x = 7200/18×100 = 40,000
Expenditure on travel = 12%
x × 12% = 40,000×12/100 = Rs. 4800

Method II.
Total income = 100% - represent total

Total Exp $\left\langle \begin{array}{l} 40\% - \text{Total} \\ 20\% - \text{House Rent} \\ 12\% - \text{Travel} \\ 10\% - \text{Education} \end{array} \right.$

100% -82% = 18% (saving)
Expenditure on Travel = 7200/18×12
= 4800

Q3.

When numerator of a fraction is increased by 10% and denominator decreased by 20% the resultant fraction becomes 5/8. Find the original fraction ?

Method I.

Let the original fraction be x/y then -

$$\frac{x+\frac{x\times10}{100}}{y-\frac{y\times20}{100}}=\frac{5}{8}$$

$$\frac{\frac{x\times110}{100}}{\frac{y\times80}{100}}=\frac{5}{8}$$

$$\frac{x}{y}=\frac{5}{8}\times\frac{80}{110}=\frac{5}{11}$$

Method II.

Given Fraction = 5/8

Original fraction = 5/8×80/110

= 5/11 Ans.

Q4.

If the length of a rectangle is increased by 20% and breath is decreased by 10%. Find the net% change in the area of that rectangle.

Sol:

net% change = x+y+ x×y/100

(+20)×(-10)/100

= +10-2

=8

Increase % = 8% Ans.

Q5.

A reduction of 10% in the price of tea would enable and purchase to obtain 3 Kg. more for 2700 Rs. Find the reduced rate (new rate) of tea ?

Sol :

10% 2700 = Rs. 270

Rs. 270 is the rate of 3 kg. of tea

1 kg of tea = Rs. 90/- kg,

#4 PROFIT AND LOSS

Basic Concept Starts Here : Click Here

Statement www.BankExamsToday.com

A purchase an article at Rs 40 Rs. and sells it to B at rs. 50 and B sells its to C at Rs. 30

CP of A = Rs. 40
SP of A = Rs. 50

CP of B = Rs. 50
SP of B = Rs. 30
CP of C = Rs.30

For A, Profit = 50-40 = 10
For B, Loss = 50 -30 = 20

For A, P =SP-CP
For B, L= CP-SP

For A, Percent Profit = Profit of A/CP of A×100
For B, Percent loss = Loss of B/CP of B×100
For A, 10/40×100 = 25%
For B, 20/50×100 = 40%
P% = P/CP×100
L% = L/CP×100

Q1.

A person purchased an article for Rs. 80 and sold it for Rs. 100.Find his % profit.
Sol:
CP of the article = Rs. 80
SP of the article = Rs. 100
Profit of the person = 100-80 = Rs. 20
% Profit of the person = Profit /CP×100
%P = 20/80×100
%P = 25%

Trick:
%P = 20/80×100 = 25%

Q2.

A dishonest shopkeeper sells goods at his cost price but uses a weight of 900 gm for a kg. weight. Find his gain percent.
Sol:
The Cp of Shopkeeper = 900 gm
The Sp of Shopkeeper
= 1000 gm (1kg = 1000 gm)
The profit of shopkeeper
= 1000 -900 = 100 gm
% profit shopkeeper
= $^{\text{Profit of shopkeeper}}/_{\text{CP of shopkeeper}}$×100
%P = $^{100}/_{900}$×100 = 11$^1/_9$%

Q3.

A person got 5% loss by selling an article for Rs. 1045. At what price should the article be sold to earn 5% profit ?
Sol:
Trick :
New SP = 1045/95×105 = 1155

Q4.

A person sold an article at profit of 12%. If he had sold it Rs. 3.60 more, he would have gain 18%. What is the cost price ?
Sol:
Trick :
CP = 3.60/6×100 = Rs. 60

Q5.

If the CP of 12 articles is equal to the SP of 9 articles. Find the gain or loss.
Sol : Let the CP of each article be Rs. 1
Then CP of 9 articles = Rs. 9
SP of 9 articles = Rs. 12
Gain % = $^3/_9$×100 = 33$^1/_3$%

5 SIMPLE AND COMPOUND INTEREST

Basic Concept Starts From Here : Click Here

Q1.

At what rate of interest per annum will a sum double itself in 8 years ?
Sol:
Trick :

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

$$= \frac{2-1}{8} \times 100$$

$$= 12.5\%$$

Q2.

A sum of money double itself at compound interest in 15 years. In how many years will it become eight times.
Trick :

$$n_2 = (n_1)^{\frac{t_2}{t_1}}$$

$$n = \text{no. of times}$$

$$t = \text{number of years}$$

$$8 = (2)^{\frac{t_2}{15}}$$

$$2^3 = (2)^{\frac{t_2}{15}}$$

$$\frac{t_2}{15} = \frac{3}{1}$$

t_2 = 45 years

#6 Ratio and Proportion

Q1.

The ratio between the length and the breadth of a rectabgular field is 5:4 respectively. If the perimeter of that field is 360 meters. what is the breadth of that field in meters ?
Sol :
Perimeter = 2(5+4) = 18
Mean value of 18 = 360
Breadth = $\frac{360}{18}$ × 4 = 80 meters

Q2.

A bag contains 50 P, 25 P and 10 P coins in the ratio 5:9:4 amounting to Rs. 206. Find the number of coins of each type.
Sol:
Let the number of 50P,25P and 10P coins be 5x,9x and 4x respectively
5x/2+9x/4+4x/10 = 206
50x + 45x + 8x = 4120
103x = 4120
x = 40
No. of 50 P coins = 5×40 = 200
No. of 25 P coins = 4×40 = 160
No. of 10 P coins = 9×40 = 360

Q3.

A mixture contains alcohol and water in the ratio of 4:3. If 5 liters of water is added to the mixture the ratio becomes 4:5. Find the quantities of alcohol in the given mixture.
Sol:
Let the quantity of alcohal and water be 4x liters and 3x liters respectively.
4x/₃ₓ₊₅ = 4/5
8x =20
x = 2.5

Q4.

A:B = 5:9 and B:C = 4:7 Find A:B:C.
Sol:

$$A : B = 5 : 9$$
$$B : C = 4 : 7$$
$$A:B:C = 20:36:63$$

#7 TIME AND WORK

Q1.

A and B together can complete a piece of work in 4 days. If A alone can complete the same work in 12 days, in how many days can B alone complete that work ?**(S.S.C.2003)**

Sol:

Q2.

X and Y can do a piece of work in 20 days and 12 days respectively. X started the work alone and then after 4 days Y joined him till the completion of the work. How long did the work last ?

(Bank PO,2004)

Sol:

$$X \quad 20 \quad 3$$
$$\overset{60}{}$$
$$Y \quad 12 \quad 5$$

$$4 \times 3 = 12$$

$$60 - 12 = 48$$

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

$$6 + 4 = 10 \text{ ans}$$

Q3.

A is thrice as good a workman as B and together is able to finish a job in 60 days less than B. Working together, they can do it in ?

Sol :

$$A \qquad\qquad 2$$
$$\qquad\qquad 12$$
$$B \quad 12 \qquad \frac{1}{3}$$

$$12/3 = 4$$

#8 TIME, SPEED AND DISTANCE

CONCEPTS

1) There is a relationship between speed, distance and time:

Speed = Distance / Time OR

Distance = Speed* Time

2) Average Speed = 2xy / x+y

where x km/hr is a speed for certain distance and y km/hr is a speed at for same distance covered.

**** Remember that average speed is not just an average of two speeds i.e. x+y/2. It is equal to 2xy / x+y

3) Always remember that during solving questions units must be same. Units can be km/hr, m/sec etc.

**** Conversion of km/ hr to m/ sec and m/ sec to km/ hr

x km/ hr = (x* 5/18) m/sec i.e. u just need to multiply 5/18

Similarly, x m/sec = (x*18/5) km/sec

4) As we know, Speed = Distance/ Time. Now, if in questions Distance is constant then speed will be inversely proportional to time i.e. if speed increases ,time taken will decrease and vice versa.

TIME AND DISTANCE PROBLEMS

Problem 1: A man covers a distance of 600m in 2min 30sec. What will be the speed in km/hr?

Solution: Speed =Distance / Time
⇒ Distance covered = 600m, Time taken = 2min 30sec = 150sec
Therefore, Speed= 600 / 150 = 4 m/sec
⇒ 4m/sec = (4*18/5) km/hr = 14.4 km/ hr.

Problem 2: A boy travelling from his home to school at 25 km/hr and came back at 4 km/hr. If whole journey took 5 hours 48 min. Find the distance of home and school.

Solution: In this question, distance for both speed is constant.

⇒ Average speed = (2xy/ x+y) km/hr, where x and y are speeds

⇒ Average speed = (2*25*4)/ 25+4 =200/29 km/hr

Time = 5hours 48min= 29/5 hours

Now, Distance travelled = Average speed * Time

⇒ Distance Travelled = (200/29)*(29/5) = 40 km

Therefore distance of school from home = 40/2 = 20km.

Problem 3: Two men start from opposite ends A and B of a linear track respectively and meet at point 60m from A. If AB= 100m. What will be the ratio of speed of both men?

Solution: According to this question, time is constant. Therefore, speed is directly proportional to distance.

Speed∝Distance
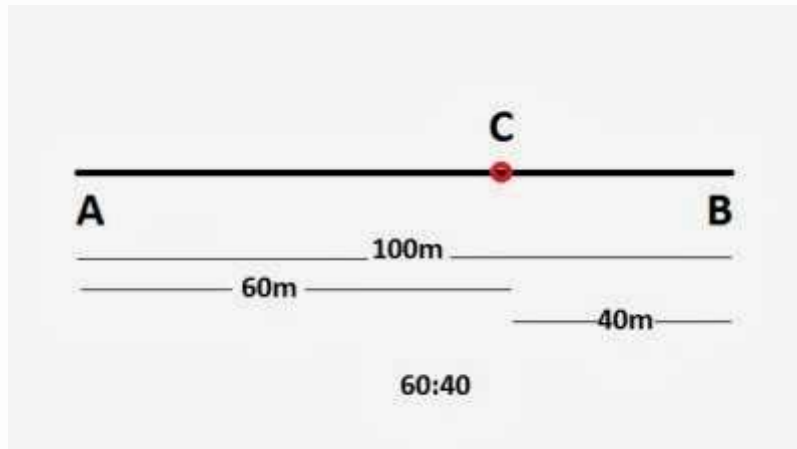
⇒ Ratio of distance covered by both men = 60:40 = 3:2

⇒ Therefore, Ratio of speeds of both men = 3:2

Problem 4: A car travels along four sides of a square at speeds of 200, 400, 600 and 800 km/hr. Find average speed.

Solution: Let x km be the side of square and y km/hr be average speed

Using basic formula, Time = Total Distance / Average Speed

x/200 + x/400 + x/600 + x/800 = 4x/y ⇒ 25x/ 2400 = 4x/ y⇒ y= 384

⇒ Average speed = 384 km/hr

Quantitative Aptitude Formulas & Shortcut Tricks for IBPS PO Prelims 2015

Percentage

Percent is derived from a phrase in latin "per centum" which means per hundred. It is a ratio with base (denominator) 100. It evolved as a concept so that there can be a uniform platform for comparing different values.

To express x% as a fraction, divide it by 100 ⇒ **x% = x/100**

To express a fraction as %, multiply it by 100 ⇒ x/y = **[(x/y) × 100] %**

x% of y is given by (y × x/100)

Point to remember for faster Calculation

1 = 100%

1 /2= 50%

1 /3= 33.33%

1/4 = 25%

1/5 = 20%

1 /6= 16.66%

1/7 = 14.28%

1/8 = 12.5%

1/9 = 11.11%

1/10 = 10%

1/11 = 9.09%

1/12 = 8.33%

Shortcuts

If X's income is a% more than Y's income, the Y's income is less than X's income by

[a / (100+a)] * 100%

If 'M' is x% of 'N' and 'P' is y% of 'N' then

'M' is **(x/y) * 100%** of 'P'.

If the sides of the triangle, rectangle, square, circle, rhombus etc is

(i) Increased by a%. Its area is increased by

2a+(a²/100)

(ii)If decreased b%. Its areas is decreased by,

-2b+(b²/100)

The population of a town is 'P'. It increased by x% during 1ˢᵗ year, increased by y% during 2ⁿᵈ year and again increased by z% during 3ʳᵈ year. The population after 3 years will be,

P *[(100+x)/100] * [(100+y)/100] * [(100+z)/100]

SIMPLE AND COMPOUND INTEREST

Principal: - The money borrowed or lent out for certain period is called the principal or the Sum.

Interest: - Extra money paid for using other money is called interest

The cost of borrowing money is defined as Simple Interest. It is of two types – simple interest or compound interest. Simple interest(SI) is calculated only on the principal (P) whereas Compound interest(CI) is calculated on the principal and also on the accumulated interest of previous periods i.e. "interest on interest." This compounding effect makes a big difference in the amount of interest payable on the principal.

Simple interest is:

Simple Interest = Principal x Interest Rate x Term of the loan(Time of Loan)

SI = P x i x n/100 when interest rate is taken in percent.

Compound Interest

$CI = P\left[(1 + i)^n - 1\right]$

where P = Principal, i = annual interest rate in percentage terms, and n = number of compounding periods.

Compounding periods : When calculating compound interest, the number of compounding periods makes a significant difference. The basic rule is that the higher the number of compounding periods, the greater the amount of compound interest. So for every INR 100 principal over a certain period of time, the amount of interest accrued at 10% annually will be lower than interest accrued at 5% semi-annually, which will in turn be lower than interest accrued at 2.5% quarterly.

In the formula for calculating compound interest, the variables "i" and "n" have to be adjusted if the number of compounding periods is more than once a year. That is, "i" has to be divided by the number of compounding periods per year, and "n" has to be multiplied by the number of compounding periods. Therefore, for a 10-year loan at 10%, where interest is compounded semi-annually (number of compounding periods = 2), i = 5% (i.e. 10% / 2) and n = 20 (i.e.10 x 2).

The following table demonstrates the difference that the number of compounding periods can make over time for a INR 10,000 loan taken for a 10-year period.

Shortcut Trick: Rule of 72

The Rule of 72 calculates the approximate time over which an investment will double at a given rate of return or interest "i", and is given by (72 / i). It can only be used for annual compounding.

For example, an investment that has a 6% annual rate of return will double in 12 years.

An investment with an 9% rate of return will double in 8 years.

PROFIT & LOSS

Cost Price-The price at which an article is purchased is known as cost price (C.P.)

Selling Price-The price at which the article is sold is known as selling price (S.P.)

These questions deals with Selling Price(P), And Cost price(CP). When selling price is greater than cost price then profit And when cost price is greater than selling price then loss.

Profit = SP-CP (SP>CP)

Loss = CP-SP (CP>SP)

Profit and loss questions are very easy to solve. Following formulae should be kept in mind while solving profit loss questions in bank exams.

Profit % = (Profit x 100)/CP

CP= {100 /(100+profit%)} x SP

CP={100/(100-loss%)} x SP

If there is a Profit of x% and loss of y % in a transaction, then the resultant profit or loss% is given by

[x – y - (x × y/100)]

Note- For profit use sign + in previous formula and for loss use – sign.

if resultant is positive then overall its profit. However, if it is negative then overall we have a loss.

If a cost price of m articles is equal to the selling Price of n articles,

(**C.P of m article = S.P. of n article**) then Profit percentage

 (m - n)/n×100%

If m parts are sold at x% profit , n parts are sold at y % profit and p parts are sold at z% profit Rs. 'R' are earned as overall profit then the value of total consignment

 R ×100 / (mx +ny +pz)

A man purchases a certain no. of article at m rupee and the same no. at n a rupee. He mixes them together and sells them at p a rupee then his gain or loss

[{2mn/(m+n)p} -1]× 100

Marked price = Cost price + Markup

Always Remember: Markup is extra price on Cost Price. So, Markup is always calculated on CP

And

%Markup = [Markup/CP]*100

Discount (if SP < MP) = MP - SP i.e. **SP = MP - Discount**

Always Remember: Discount is deducted from Marked Price. So, Discount is always calculated on MP and

%Discount = [Discount/MP]*100

AVERAGES

Suppose there are N numbers, then their average is their sum divided by that is,

Average=(sum / N)

Weighted Average: The average between two sets of numbers is closer to the set with more numbers.
if 3 batsmen scored 25 runs and 2 batsmen scored 35 runs the average of the team won't be 30. Rather it will be
= (25×3 + 35×2)/5 = 29 . This is nearer to 25 since more batsmen scored 25 runs.

Average =total of data/No. of data

If the value of each item is increase by x, then the average of the group will also increase by x.

If the value of each item is decreased by y, then the average of the group of items will also decrease by y.

If the value of each item is multiplied by the same value m, then the average of the group or items will also get multiplied by m.

If the value of each item is multiplied by the same value n, then the average of the group or items will also get divided by n.

If we know only the average of the two groups individually, we cannot find out the average of the combined group of items.

Average of x natural no's = (x+1)/2

Average of even No's = (x+1)

Average of odd No's = x

Change in the value of a Quantity and its effect on the Average

When one/more than one quantity are **removed** but **replaced** with same no. of quantities of different value,

Change in the no. of quantities and its effect on Average

+ = if quantities are Added, - = if quantities are removed

RATIO AND PROPORTION

Ratio is a fraction of two values. It can be represented in any of the following ways:

=> x/y, x : y , x÷y

- In ratio of the form x : y, x is called as the antecedent/first term and y is the consequent/second term.
- Generally, ratio is a handy way to compare two terms.
- For example : $4 / \pi > 1$, it is clear that $4 > \pi$
- One thing that has to be remembered while comparing two numbers in a ratio is that they should be represented in same units. For example, if x is in meters and y in litres they cannot be compared by using ratio as they are expressed in different units – meters vs litres.

A proportion is the equality of two ratios/ fractions.

- If x : y = a : b, it can be written as x : y :: a : b and it is said that x, y, a, b are in proportion.
- Here x and b are called extremes, while y and a are called mean terms.
- Product of means=Product of extremes
  Thus,
  x :y :: a : b => (y* a)=(x* b)
- If x : y=a : b

b is called the fourth proportional to x, y and a.

a is called the third proportional to x and y.

- Sub-duplicate: Sub-duplicate ratio of (a:b) is $(a^{1/2}: b^{1/2})$
- Duplicate ratio of (a:b) is $(a^2:b^2)$
- Triplicate Ratio:Triplicate ratio of (a:b) is $(a^3:b^3)$
- Sub-triplicate Ratio: Sub-triplicate ratio of (a:b) is $(a^{1/3}:b^{1/3})$

- If a/b=c/d then, a+b/a−b=c+d/c−d This is known as Componendo and Dividendo.
- We say that x is directly proportional to y, if x=ky for some constant k and we write, x∝y
- We say that x is inversely proportional to y, if xy=k for some constant k and we write, x∝1y

Ages

Problems on Ages are asked in majority of bank and competitive examinations.

They are generally simple to attempt if you have done practice and remember the formulae. Important formulae to remember are :

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