

Ratio and proportion important formulas concepts health essay

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Four numbers are in a proportion if the product of extremes = product of means. E. g. if $a : b :: c : d$, then $ad = bc$. If the ratio of first and second equals to the ratio of second and third (with three or more quantities), they are said to be in continued proportion. E. g. if $a/b = b/c$, then a, b and c are in a continued proportion. If a number, say Z , is divided into three parts, whose ratio is $a : b : c$, then: First part = Second part = Third part = Illustration 1: The ratio of number of ladies to gents in a party was 1: 2, but when 2 ladies and 2 gents left, the ratio became 1: 3. How many people were originally present at the party? 48

12

16Solution: Let the number of ladies be x & the number of gents be $2x$
 $3x - 6 = 2x - 2$
 Total number of persons at the party = $3x = 3 \times 4 = 12$
 Illustration 2: The sum of the present ages of A, B and C is 30 years. Six year ago, their ages were in the ratio 1: 2: 3. What is the present age of C? 36

42

5024Solution: Sum of the ages of A, B, C six years ago = $90 - 3 \times 6 = 72$
 years
 Now, Six years ago, the ages of A, B & C were in ratio 1: 2: 3
 Age of C six years ago = 36 years
 Present age of C = $36 + 6 = 42$ years
 Illustration 3: If $bc : ac : ab = 1 : 2 : 3$, find $a : b : c$

4 : 1

Solution: $a : b = 4 : 1$

Also $bc : ac = 1 : 2$

=

: = = 2 = Illustration 4: The sum of the squares of three numbers is 532 and the ratio of the first to the second as also of the second to the third is 3: 2.

What is the second number?

12

181521

Solution: = , =

$A = B$ & $C = B$ Now, $A^2 + B^2 + C^2 = 532$
 $B^2 + B^2 + B^2 = 532$
 $3B^2 = 532$

$\times 36B = 12$ Illustration 5: A person distributes his pens among four friends A,

B, C and D in the ratio 1/3: 1/4: 1/5: 1/6. What is the minimum number of pens that the person should have to perform this exercise? 60

57

4852 Solution: LCM of 3, 4, 5, 6 = 60 So, the pens are distributed among A, B,

C & D in the ratio 15 : 12 : 10 Total number of pens = $20x + 15x + 12x +$

$10x$ To gauge the minimum number of pens, the value of x should be taken

as $1 = 20 + 15 + 12 + 10 = 57$

Practice Exercise

If half of one number is equal to 0.07 of another, the ratio of the numbers is:

50: 75: 7

7: 50

1: 14 Solution: $x = 0.07$ $y = 0.07 \times 2 = x \times 2 = 7/50$ If = 2: 3 then =?

4/94/316/9

4/27

Solution: = {given} = $2x$ = A man divides his property so that ratio of his son's share to his wife's share and the ratio of the wife's share to his daughter's share are both 3: 1. If the daughter gets Rs. 10, 000 less than the son, then the total worth of his property is: 25, 000

16, 250

65, 000
27, 350
Solution: Son : Wife = 3 : 1 & Wife : Daughter = 3 : 1
Son : Wife : Daughter = 9 : 3 : 1
Now, Son's share - Daughter's share = 10, 000
 $9x - x = 10, 000$
 $8x = 10, 000$
 $x = 1250$
Total property = $13x = 13 \times 1250 = 16, 250$
The incomes of A & B is are in the ratio 3: 2 and their expenditures are in the ratio 5: 3. If each one of them saves Rs. 1000, then, A's income can be:
Rs. 3000
Rs. 4000

Rs. 6000

Rs. 9000
Solution: Let the income of A & B be $3x$ and $2x$ & the total expenditures of A & B be $5y$ & $3y$
 $3x - 5y = 1000$ (I)
 $2x - 3y = 1000$ (II)
Solving (I) & (II)
 $x = 2000$
 $y = 1000$
A's income = $3x = 3 \times 2000 = 6000$
If Rs. 58 is divided among 150 children such that each girl and each boy gets 25 p and 50 p respectively, then how many girls are there in total? 72

68

50
110
Solution: Let the number of boys & girls be x & y respectively
 $x + y = 150$ (I)
 $x + y = 58$
 $2x + y = 232$ (II)
Solving (I) & (II)
 $y = 68$
60 kg of an alloy A is mixed with 100 kg of alloy B. If alloy A has lead and tin in the

ratio 3: 2 and alloy B has tin and copper in the ratio 1: 4, then the amount of tin in the new alloy is: 36 kg

44 kg

53 kg 80 kg Solution: Tin in Alloy ' A' = = 24 kg Tin in Alloy ' B' = = 20 kg Tin in new Alloy C = 24 + 20 = 44 kg 15 liters of mixture contains 20% alcohol and the rest water. If 3 liters of water is mixed with it, the percentage of alcohol in the new mixture would be: 15% 17 % 18 Solution: Amount of alcohol in mixture = 20 % \times 15 = = 3 liters Percentage of alcohol after adding 3 liters water

=

= %

The speeds of the three cars are in the ratio 5: 4: 6. The ratio between the time taken by them to travel the same distance is: 5: 4: 6 6: 4: 5 10: 12: 15

12: 15: 10

Solution: Speeds are in ratio of 5: 4: 6 For same distance time will be in ratio: : LCM (5, 4, 6) = 60 Required ratio = : : : 60 = 12 : 15 : 10 Seats for Mechanical, Civil and Electrical branch in an engineering college are in the ratio of 5: 7: 8. There is a proposal to increase these seats by 40%, 50% & 75% respectively. What will be the ratio of increased seats?

2: 3: 4

6: 7: 8 6: 8: 9 None of these Given ratio 5: 7: 8 After increment 5×140 : 7×150 : 8×175 700: 1050: 1400 = 2 : 3 : 4 Hence, the answer is (a) The sides of the

triangles are in the ratio of : : and its perimeter is 104 cm. The length of the longest side is: 52 cm

48 cm

32 cm 26 cm Solution: Let the sides be , and
 $x + 4x + 3x = 104$
 $8x = 104$
 $x = 13$
 Longest side = $\frac{1}{2} x = 13 \times 96 = 48$

Simple Interest/Compound Interest

Important Formulas/Concepts

Simple Interest = From the above-mentioned formula, the following formulas can be derived: P = R = T = Let P = Principal, R = R% per annum, Time = T years and number of times the interest is compounded in a fixed interval = N, then (Compound Interest): Amount = $P \times T$ To find number of years it will take for money to double (in case of compound interest): Number of years = E. g. If rate = 18%, then number of years for money to double = 4 years
 Illustration 1: A man invests Rs. 3000 at the rate of 5% per annum. How much more should he invest at the rate of 8%, so that he can earn a total of 6% per annum? Rs. 1200 Rs. 1300

Rs. 1500

Rs. 2000 Solution: $30,000x + (3000 + x) \times 15000 + 8x = 18000 + 6x$ Thus, $x = 1500$
 Illustration 2: A sum of money lent out at simple interest amounts to Rs. 720 after 2 years and to Rs. 900 after a further period of 5 years. The sum and the rate % are: 500, 10%

600, 10%

500, 15% 600, 15% Solution: $A - P = 720 - P = \dots$ (i) Similarly, $900 - p = \dots$

(ii) Dividing (i) by (ii)

=

$5(720 - P) = 2(900 - P)$
 $3600 - 5P = 1800 - 2P$
 $3P = 600$
 Now, Rate% $720 - 600 =$

R
 $10\% = R$
 Illustration 3: Out of a certain sum, $1/3$ rd is invested at 3%, $1/6$ th at 6% and the rest at 8%. If the simple interest for 2 years from all these investments amount to Rs. 600, then the original sum is: Rs. 3000 Rs. 4500

Rs. 5000

Rs. 6000 Solution: Let the initial amount be x Now,

+

$12x = 60,000$ Thus, $x = 5000$ Illustration 4: If Rs. 85 amounts to Rs. 95 in

3 years, what Rs. 102 will amount to in 5 years at the same rate %? 117

122

132142 Solution: $A - P = 95 - 85 = \dots$ (I) Similarly, $A - 102 = \dots$ (II) Dividing

equation (I) by (II) = $85/102 \cdot 3/5$ Thus, $A = 122$ Illustration 5: If simple interest on a certain sum is 16 over 25 of the sum, then the rate percent and time, if both are equal, are: 567

8

Solution: Simple Interest = Given, Simple Interest = $16/25P$ & $R = T$
 $16/25P =$

$64 = R$
 $2R = T = 8$
 $R = 8$

Practice Exercise

If the difference between the Compound Interest and Simple Interest on a certain sum of money is Rs. 72 at 12 percent per annum for 2 years, then the amount is: Rs. 6000

Rs. 5000

Rs. 6500Rs. 5500Solution: Compound Interest - Simple Interest = 72
 $tP - P = 72$
 $2P = 72$
 $P = 36$
 Thus, P = 5000
 A sum of money placed at a compound interest doubles itself in 3 years. In how many years will it amount to 8 times of itself?

9 years

8 years27 years7 yearsSolution: Given $A = 2P$
 $A = Pn$
 $2 = 3 \dots \dots \dots$

(i) Similarly $8P = Pn$
 $8 = n3 = n \dots \dots \dots$ (ii) From (i) & (ii) $(\frac{2}{3})^3 = n$
 Thus, n =

9
 If x is the simple interest on y and y is the simple interest on z, what is the relation between x, y and z, the rate % and the time being the same in both cases? $x^2 = yz$

$y^2 = xz$

$x = \frac{y^2}{z}$
 $x = \frac{y^2}{z}$
 Solution: $x = \frac{y^2}{z}$ (I)
 $y = \frac{xz}{z}$ (II)
 Dividing (I) & (II)

=

$xz = y^2$
 A sum of money invested triples itself in 8 years at simple interest.

Find in how many years will it become 8 times itself at the same rate? 24 years

28 years

30 years 21 years
 Solution: $2P = \dots\dots(i)$
 $7P = (\dots\dots)(ii)$
 Dividing (I) by (II)
 Thus, $T = 28$ years
 Find the compound interest at the rate of 10% for 3 years on the principle which in 3 years at the rate of 10% per annum gives Rs. 300 as simple interest.

331

310330333
 Solution: Simple Interest = 300 = Thus, $P = 1000$
 Now, Compound Interest = $P [(1 + \frac{r}{100})^n - 1]$
 $= 1000 [(1 + \frac{10}{100})^3 - 1] = 331$
 A man wants to invest Rs. 1, 50, 000 among two schemes at the rate of 5% and 10% to earn interest at Rs. 10, 000 in 1 year. Thus, the amount invested in 5% and 10% schemes respectively is:

1, 00, 000 & 50, 000

50, 000 & 1, 00, 000
 75, 000 & 75, 000
 1, 25, 000 & 25, 000
 Solution: Let amount invested in 5% scheme be x
 Thus, $100000 \cdot 5x + 1500000 - 10x = 1000000$
 $500000 = 5x$
 $x = 100000$
 If Rs. 1100 is obtained after lending out same amount at 5% per annum for 2 years and Rs. 1800 is obtained after lending the remaining amount at 10% per annum for 2 years, then the total amount lent out is:

2500

300020002200
 Solution: $A_1 = P_1 + I_1$
 $I_1 = P_1 \times 1100 = P_1 = 1000$
 Similarly, $1800 - P_2$
 $P_2 = 1500$
 Total principle $P = P_1 + P_2 = 1000 + 1500 = 2500$
 Shamit invested Rs 6000 in a company at a compound interest compounded semi-annually. He receives Rs 7986 after 18 months from the company. Find the rate of interest per annum. 10%

20%

5%12. 5%Solution: $7986 = 6000 (1 +)^{3/2} \times 2R = 10\%$ Yearly rate = $2 \times 10\%$
 = 20%A sum was invested at a simple interest at a certain interest for 2
 years. It would have fetched Rs 60 more had it been invested at 2% higher
 rate. What was the sum?

1500

130025001000Solution: Condition..... (I) $I = P \times R \times 2 / 100$ Condition

(II) $I + 60 = 1500 = PA$ sum of Rs. 3, 800 is lent out in two parts in such a way
 that the interest on one part at 8% for 5 years is equal to that on the another
 part at $\frac{1}{2}\%$ for 15 years. Find the sum lent out at 8%. 500400

600

700Solution: Let the amount invested at 8% be x

= x

$16x = 11400 - 3x$
 $19x = 11400$
 $x = 600$

Time and Work / Pipes and Cisterns**Important Formulas/Concepts**

Work = Working units Time
 If A can do a piece of work in b days, then his one
 day's work = $\frac{1}{b}$
 Illustration 1: Varun can do a piece of work in 20 days. Tarun is
 25% more efficient than Varun. The number of days taken by Tarun to do the
 same piece of work is: 15

16

1825Solution: Amount of work done by Varun in one day = Amount of work

done by Tarun in one day = $125\% \times \frac{1}{20} = \frac{1}{16}$ = Tarun will complete the same piece
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of work in 16 days
 Illustration 2: Sam can do a piece of work in 40 days. He works on it for 8 days and then John finished it in 16 days. How long will they take to complete the work together?

days

15 days 20 days 56 days
 Solution: Amount of work completed by Sam in 8 days $8 \times =$ Work left to be completed by John $= 1 - =$ Let the amount of work completed by John in one day $=$ Using work equation Amount of work they can complete in one day $= =$ Required time $=$ days
 Illustration 3:

Mukesh, Anil and Sumit are three civil engineers. Mukesh can design a plan alone of a multistoried apartment in 5 hours and Anil in 4 hours. They together can do it in 2 hours. In what time can Sumit do it alone? 7 hours 15 hours

20 hours

18 hours Solution: Using work equation,

$= -$

$= =$

Sumit can design the plan alone in 20 hours. Illustration 4: If $\frac{4}{7}$ th of a piece of work is completed in $\frac{7}{4}$ th days, in how many days can rest of the work be completed? $\frac{7}{3}$ $\frac{7}{7}$

21/16

$\frac{16}{21}$ Solution: of a work is completed in days Total work is completed in $=$ days Work remaining to be completed $= 1 - =$ Time taken to complete work $= =$ days
 Illustration 5: One man can paint a house in ' r ' days and another man

can do it in ' t ' hours. If they can together do it in ' d ' days, then ' d ' is given by: Solution: Work completed by a man in one day = $\frac{1}{r}$ Work completed by another man in one day = $\frac{24}{t}$ Using work equation,

=

d =

Practice Exercise

Mary has ' m ' minutes of home work in each of her ' s ' subjects. In one hour, she completes what part of her homework? $\frac{1}{ms}$

$\frac{60}{ms}$

$\frac{m}{sm}/60s$ Solution: Mary completes home work in each of the subjects in ' m ' minutes And there are in total ' s ' subjects Total homework of Mary is completed in ms minutes. i. e. $\frac{ms}{60}$ hours Hence, in one hour, Mary completed $\frac{60}{ms}$ work Federer can do a job in 40 days. He worked on it for 5 days and then Paes finished it in 21 days. In how many days Federer and Paes can finish the work together? 10

15

2012 Solution: Work completed by Federer in 5 days = = Work remaining to be completed = $1 - \frac{5}{40} = \frac{35}{40}$ Paes completed the remaining work in 21 days. Let the work completed by Paes in one day be x Using work equation, Amount of work completed by both of them together in one day = Thus, together they will take 15 days. Rohit can copy 80 pages in 20 hours. Rohit and Rahul can copy 135 pages in 27 hours. How many pages Rahul can copy in 20 hours?

20

275535Solution: Pages copied by Rohit in 1 hour = 4 pages
 Pages copied by Rohit and Rahul in 1 hour = 5 pages
 Number of pages Rahul can copy in an hour = $5 - 4 = 1$ page
 Hence, pages completed by Rahul in 20 hours = $20 \times 1 = 20$ pages
 A and B can do a piece of work in 12 days, B and C in 15 days, C and A in 20 days. How long would each take separately to do the same amount of work? 30, 60, 20

30, 20, 60

20, 15, 30
 15, 20, 35
 Solution: (I).....
 (II).....(III) Adding (I), (II) & (III) $2 =$ (IV) Solving (I), (II), (III) & (IV)
 Time taken by A = 30 days
 Time taken by B = 20 days
 Time taken by C = 60 days
 Pipes P & Q can fill up a tank in 4 hours & 8 hours respectively and pipe R can empty it in 12 hours. If all the three pipes are opened together, then the tank will be filled in: 10 hours, 7 hours, $16/7$ hours

24/7 hours

Solution: Using time and work equation: Thus, $T = 24/7$ hours
 Three taps A, B & C can fill a tank in 12, 15 & 20 hours respectively. If A is open all the time, B and C are open for one hour each alternately, the tank will be full in: 6 hours, 6 hours, 5 hours

7 hours

Solution: Work completed by A & B in 1 hour = Work completed by A & C in 1 hour = Work completed in 2 consecutive hours = Work completed in 6 hours = Remaining work = 1
 Now A & B can complete the remaining work in 1 hour
 Total work is completed in $6 + 1 = 7$ hours
 12 buckets of water fill a tank

when the capacity of each bucket is 13.5 litres. How many buckets will be needed to fill the same tank, if the capacity of each tank is 9 litres?

18

15106Solution: Using concept of variation: $12 \times 13.5 = x \times 9$
 $x = 18$
 A cistern is filled in 9 hours but it takes 10 hours when there is a leak in its bottom. If the cistern is full, in what time shall the leak empty it?

90 hours

94 hours92 hours91 hoursSolution: Let the time take by leak to empty the tank be x hours. Using work equation
 $\frac{1}{9} - \frac{1}{x} = \frac{1}{90}$
 From a leaking tap 'a' drop comes out in 'b' minutes. If there are 'c' drops in a litre, then in how many hours one litre of water will be wasted? Solution: Given 'a' drop falls in $\frac{b}{60}$ hours
 1 drop falls in $\frac{b}{60}$ hours
 Hence, C drops will fall in $\frac{C \times b}{60}$ hours
 If a tanker is normally filled by a tap in 8 hours, but suddenly a leak develops and it empties the full tanker in 24 hours, the cistern will be filled (with a leak) in: 10 hours

12 hours

15 hours18 hoursSolution: Using time equation,

=

$t = 12$ hours

Speed and Distance

Important Formulas/Concepts

Speed = Time = Distance = Speed \times Time
 If ratio of speeds of A and B is $x :$

y , then ratio of time taken by them to cover the same distance = :

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Illustration 1: Walking at $\frac{5}{7}$ th of his usual rate, a boy reaches his school 6 minutes late. Find his usual time to reach the school. 6 minutes 8 minutes 12 minutes

15 minutes

Solution: Let the usual speed of the boy be x , then his slower speed = $\frac{5}{7}x$. Also let the school be at a distance of D . Now using SDT equation, $\frac{D}{\frac{5}{7}x} = \frac{D}{x} + 6$

$\frac{7D}{5x} = \frac{D}{x} + 6$
Usual time to reach the school = 15 minutes

Illustration 2: A train completes a journey without stopping in 8 hours. If it had travelled 5 km an hour faster, it would have completed the journey in 6 hours 40 minutes.

What is its slower speed? 23 km/hr 30 km/hr

25 km/hr

42 km/hr Solution: Using distance relation for equal travel
Slow speed \times More time = Fast speed \times Less time
 $\frac{D}{x} \times 8 = \frac{D}{x+5} \times 6\frac{2}{3}$
Thus $x = 25$ km/hr.

Illustration 3: Without stoppages, a train travels certain distance with an average speed of 80 km/hr, and with stoppages; it covers the same distance with an average speed of 60 km/hr. How many minutes per hour does the train stop? 20 minutes/hours

15 minutes/hours

12 minutes/hours 8 minutes/hours Solution: Using the formula, Stoppage

time/hours = hours - hours = 15 minutes
Illustration 4: If a car moves from A to B at a speed of 60 km/hr, and comes back from B to A at a speed of 40 km/hr, then its average speed is: 46 km/hr 50 km/hr 56 km/hr

48 km/hr

Solution: Average speed = 48 km/hr
 Illustration 5: A car during its journey travels 30 minutes at a speed of 40 km/hr, and another 45 minutes at a speed of 60 km/hr, and another 2 hours at a speed of 70 km/hr. Find its average speed. 65 km/hr 56 km/hr 48 km/hr

63 km/hr

Solution: Average speed =

=

= 63 km/hr

Practice Exercise

Two friends X and Y walk from A to B, a distance of 39 km, at 3 km/hour and $3\frac{1}{2}$ km/hour respectively. Y reaches B, returns immediately and meets X at C. Find the distance from A to C. 35 km

36 km

28 km 32 km
 Solution: Let the distance of C from B be x
 For same time, equation will be: $2x = 3(39 - x)$ (i)
 On solving equation (i) $x = 3$
 Thus, distance A to C = $39 - x = 39 - 3 = 36$ km
 A long distance runner runs 9 laps of a 400 meters track every day. His timings for four consecutive days are 88, 96, 89 and 87 respectively. On an average how many meters/minutes does the runner cover? 36 meters/minute 12 meters/minute

40 meters/minute

48 meters/minute
 Solution: = 40 meters/minute
 Average speed = 40

m/min
 A thief runs away with a car at a speed of 40 km/hr. The theft was

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discovered after half an hour and the owner sets off in another car at 50 km/hr. When will the owner overtake the thief from the time of theft? 2 hours

hours

3 hours 1 1/2 hours Solution: Let the time taken by owner be t Both thief and owner cover equal distances $50t = (t + 1/2)40$ Thus, $T = 2$ hours He will be caught after 2 1/2 hours The speed of the boat in still water is 12 km/hr and the speed of the stream is 3 km/hr. A distance of 27 km, going upstream, will be covered in:

3 hours

5 hours 4/3 hours 3/2 hours Solution: Time taken to row upstream = 3 hours A boat rows 20 km upstream and 30 km downstream in 5 hours each. The velocity of the stream is: 3 km/hr 2 km/hr

1 km/hr

4 km/hr Solution: Let the velocity of the stream be y & velocity of the boat be x For upstream = 5, $5x - y = 4$ (I) $x + y = 6$(II) Solving (I) & (II) $y = 1$ km/hr. A 270 meter long train running at the speed of 120 km/hr crosses another train running in opposite direction at the speed of 80 km/hr in 9 seconds. What is the length of the other train? 230 meters 240 meters 260 meters 320 meters Solution: Relative speed of train = $(120 + 80)$ km/hr 200 km/hr = $200 \times 500/9$ m/s Length of the train Thus, $x = 230$ A train of length 150 meters takes 40.5 seconds to cross a tunnel of length 300 meters. What is the speed of the train in km/hr.? 13. 33 26. 67

40

66. 67Solution: Speed = 40 km/hours
A farmer travelled a distance of 61 km in 9 hours. He travelled partly on foot at 4 km/hr and partly on bicycle at the rate of 9 km/hr. The distance travelled on foot is: 14 km 15 km

16 km

17 kmSolution: Let the distance travelled on foot be 'x' km
Using time equation, $9x + 4(61 - x) = 9 \times 369x + 244 - 4x = 3245x = 80x = 16$
km
Thus, distance travelled by farmer on foot is 16km
Two cars P & Q start at the same time from A & B which are 120 km apart. If the two cars travel in opposite directions, they meet after 1 hour and if they travel in the same direction, then P meets Q after 6 hours. What is the speed of the car P? 60 km/hr

70 km/hr

100 km/hr 120 km/hrSolution: Let the speed of car P be 'x' & speed of car Q be 'y'
Then, the two equations will be: $x + y = 120 \dots (I)$
 $6x - 6y = 120 \dots (II)$
Solving (I) & (II) $x = 70$ km/hr.
A bus while moving at an average speed of 40 km/hr reaches its destination on time. When its average speed becomes 35 km/hr, then it reaches 15 minutes late. Find the length of Journey. 30 km 40 km

70 km

80 kmSolution: Using time equation, $x = x = 70$ km

Number System

Important Formulas/Concepts

$(a + b)^2 = a^2 + 2ab + b^2$
 $a^2 + b^2 = (a + b)^2 - 2ab$
 $(a - b)^2 = a^2 - 2ab + b^2$
 $a^2 - b^2 = (a + b)(a - b)$
 $(a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$
 $(a + b)^3 = a^3 + b^3 + 3ab(a + b)$
 $(a - b)^3 = a^3 - b^3 - 3ab(a - b)$
 $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$
 $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

2

Its unit digit is any of 0, 2, 4, 6, 8

3

The sum of its digits is divisible by 3

4

The sum of its last two digits is divisible by 4

5

Its unit digit is either 5 or 0

6

It is divisible by both 2 and 3

8

The number formed by its last 3 digits is divisible by 8

9

The sum of its digits is divisible by 9

10

Its unit digit is 0

11

The difference of the sum of its digits at odd places and that at even places is either 0 or a number divisible by 11. Illustration 1: The sum of two numbers is 25 and their product is 114. What is the sum of the reciprocals of these numbers? $\frac{5}{19} + \frac{19}{5} = \frac{114}{25}$

25/114

Solution: Given- $x + y = 25$ & $xy = 114$ Required answer = = Illustration 2:

Which of the following is not the perfect square? 1, 99, 8091, 41, 3766, 59, 344

17, 82, 362

Solution: Since the square of natural number never ends with 2, 3, 7, 8, 17, 82, 362 is not a perfect square, as it ends with 2. Illustration 3: If the number $812x74$ is completely divisible by 11, then smallest whole number in place of x will be:

1

357 Solution: Divisibility of 11 = (Sum of number at odd place) - (Sum of number at even place) Thus, it should be either 0 or a number divisible by 11 = $(8+2+7) - (1+x+4) = (12-x)$ Hence, minimum value of x should be 1 so as to make the number divisible by 11. Illustration 4: The difference between place values of both 6s in the numerical 376982604 is: 44404

59, 99, 400

5, 99, 400 Solution: Place values of two 6s are 6000000 & 600000
 Difference = 6,000,000 - 600 = 5999400. Illustration 5: If the number $78x$ is divisible by 6, then the value of x is: 45

6

7 Solution: For any number to be divisible by 6, it must be divisible by both 2 and 3. 6 is the correct answer. Since, 786 is divisible by: 2 (the last digit is even) and 3 ($7+8+6 = 21$ which is divisible by 3)

Practice Exercise

How many prime numbers are less than 30? 8

10

1214 Solution: Prime numbers below 30 are '2, 3, 5, 7, 11, 13, 17, 19, 23, 29'. Thus, 10 is the correct answer.

=

1

105

10 - 5 = 5
 10 - 12 = -2

Solution:

$10^6 + 5 - 7 = 10^4 = 10^5$ The value of $10^2 \times 98$ is: 996986

9996

9986 Solution: $(100+2)(100-2) = 100^2 - 2^2 = 10000 - 4 = 9996$

=

Solution: = =If $f(x) = x^2 - 6x - 5$, then $f(2) - f(-2) = 2448$ **-24**-48Solution: $f(x) = x^2 - 6x - 5$
 $f(2) = 2^2 - 6(2) - 5 = 4 - 12 - 5 = -13$
 $f(-2) = (-2)^2 - 6(-2) - 5 = 4 + 12 - 5 = 11$
 $f(2) - f(-2) = -13 - 11 = -24$ Which of the following fractions has a non-terminating repeating decimal?
 $\frac{33}{50}$ $\frac{17}{625}$ $\frac{171}{800}$ **17/90**

Solution: To get a non-terminating repeating decimal expansion:

Denominator $2^m 5^n$
 $50 = 2 \times 5^2$, $625 = 5^4$, $800 = 2^5 \times 5^3$, $90 = 2 \times 3^2 \times 5$

Therefore, the answer is Rational form of 0. is:

2/3 $\frac{3}{5}$ $\frac{33}{50}$ $\frac{33}{500}$
Solution: Let $x = 0.\dots\dots(i)$
 $x = 0.6\dots\dots(ii)$ Multiplying equation (ii) by 10
 $10x = 6.\dots\dots(iii)$ Subtracting (iii) from (i)
 $9x = 6$
 $x = \frac{6}{9} = \frac{2}{3}$
is: An integer
A rational number**An irrational number**

None of these

Solution: = =

Here, 2 is a rational number & 3 is irrational. Now, we know that Rational

 \times Irrational = Irrational
Hence, is an irrational number. Rational form of 2.4 is: $\frac{12}{5}$

22/9

11/76/5 Solution: Let, $x = 2$ (i) $x = 2$. 4..... (ii) On multiplying equation (ii) by 10 $10x = 24$ (iii) Now, subtract (i) from (iii) $9x = 22$ $x = \frac{22}{9}$ = The decimal expansion of the number $\frac{27683}{625}$ will terminate after: One decimal places
Two decimal places
Three decimal places

Four decimal places**Solution:** =

=

=

The correct answer is (d) as the number ends after four decimal expressions.

Average**Important Formulas/Concepts**

Average = Let average age of existing A people be x , and the number of new people be n , and increase in average age be y years. Then,

If n new people join,

If n people join and the average age increases, the average age of n people

= $x +$ If n people join and the average age decreases, the average age of n people = $x -$

If n people leave,

If n people leave and average age increases, then average age of n people =

$x +$ If n people leave and average age decreases, then average age of n

people = $x -$ Illustration 1: If the mean of $x, x + 3, x + 5, x + 7$ & $x + 10$ is 9,

then the mean of last three observations is: 10

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11

11Solution: Average of 5 numbers = 9
Thus, $x = 4$
Hence, the last 3 numbers are $(4+5)$, $(4+7)$ and $(4+10)$
Average $(9, 11, 14) =$

=

= 11 . Illustration 2: If the mean of five observations is 4, then the mean of same observations after increasing 5 is: 68

9

10Solution: Original sum of five observations = $(x_1+x_2+x_3+x_4+x_5) = 5 \times 4 = 20$
Increase in sum after adding 5 to each observation = $(x_1+5) + (x_2+5) + (x_3+5) + (x_4+5) + (x_5+5) = (x_1+x_2+x_3+x_4+x_5) + (5 \times 5) = 20 + 25 = 45$
New mean = 9

Illustration 3: The mean of the marks scored by 50 students was found to be 39. Later on it was discovered that a score of 43 was misread as 23. The corrected mean is: 38. 6

39. 4

39. 839. 2Solution: Wrong sum of 50 observations = $50 \times \text{wrong mean} = 50 \times 39 = 1950$
Corrected sum = wrong sum - wrong reading + correct

reading = $1950 - 23 + 43 = 1970$
Corrected mean = 39. 4
Illustration 4: The mean of five numbers is 30. If one number is excluded, their mean becomes 28. The excluded number is: 2634

38

46Solution: Sum of five numbers = $5 \times \text{mean} = 5 \times 30 = 150$
Sum of remaining four numbers = $4 \times \text{New mean} = 4 \times 28 = 112$
The excluded number = sum of five observations - sum of four observations = $150 - 112 = 38$
Illustration 5: The

mean of 31 results is 60. If the mean of first 16 results is 58 and that of the last 16 results is 62, the 16th result is:

60

403530Solution: Sum of first sixteen results = $16 \times \text{mean} = 16 \times 58 =$

928Sum of last sixteen results = $16 \times \text{mean} = 16 \times 62 = 992$ Sum of all thirty

one results = $31 \times \text{mean} = 31 \times 60 = 1860$ Sixteenth observation = $(928 +$

$992 - 1860) = 60$

Practice Exercise

The average cost of 5 jeans & 7 shirts is Rs. 600 and the average cost of 5 jeans is Rs. 740 , then the average cost of 7 shirts is:

500

560450480Solution: Total cost of 5 jeans & 7 shirts = Average (5J, 7S) $\times 12 =$

$600 \times 12 = 7200$ Total cost of 5 jeans = Average (5J) $\times 5 = 740 \times 5 = 3700$ Total

cost of 7 shirts = $7200 - 3700 = 3500$ Thus, average cost of 7 shirts = $3500 / 7 = 500$ At

a shop ' book A' was priced thrice as ' book B' and ' book B' was priced 9

more than twice the price of ' book C'. If average price of the three books is

Rs. 360, the price of ' book C' is: 310312256

116

Solution: Let the prices of books A, B and C be x, y and z respectively $x = 3y$

$y = 9 + 2z$ According to given condition $= 360y = 241z = Z = (y-9)/2 = (241-$

$9) / 2 = 116$ Thus, the cost of book C = 116Three years ago, the average age

of Marsh & Mathew was 16. With Steve joining them now, the average age

becomes 20. The present age of Steve is: 16

22

1820Solution: Sum of ages of Marsh and Mathew presently = $16 \times 2 + 3 \times 2 = 38$
 Sum of ages of Marsh, Mathew and Steve = $20 \times 3 = 60$ Therefore, Steve's age = $60 - 38 = 22$ years
 A cricketer whose bowling average is 12. 4 runs per wicket takes 5 wickets for 26 runs and thereby decreases his average by 0. 4.
 The number of wickets taken by him till the last match was: 6575

85

95Solution: Let the number of wickets till the last match be ' x'
 New average after 5 more wickets for 26 runs is decreases by 0. 4= 12
 The average of 5 subjects increased by 5, when marks in English were increased in rechecking. If the marks in English before rechecking were 45, then the marks after rechecking in English are: 60

70

7585Solution: Total increase in marks after rechecking = $5 \times 5 = 25$
 Therefore, corrected marks in English = $45 + 25 = 70$
 If the average of three numbers a, b and c is A, then the average of a, b, c and A is: $2A/4$

A

Solution: Given, Thus, $a + b + c = 3A$
 Average of a, b, c & A =

=

= = A
 The total production of 10 tea estates is 550 tonnes. By opening two new tea estates the average increases by 3 tonnes. The average cash production of these two new tea estates (in tonnes) is: 573570

568

564Solution: Total production of 10 tea estates = $550 \times 10 = 5500$

tonnesTotal production of 12 tea estates = $553 \times 12 = 6636$ tonnesProduction

by 2 new estates = $6636 - 5500 = 1136$ Average production by each new

estate == 568Find the average increase rate if increase in the population in

the first year is 30% and that in the second year is 40%. 35%38%40%

41%

Solution: Population initially = 100%Population after 1 year =

130%Population after 2 years = $130\% + 40\%$ (of 130%)= 182%Thus, increase

in population in 2 years = 82%Average increase = $82\% / 2 = 41\%$ A person

travels three equal distances at a speed of x km/hr, y km/hr and z km/hr

respectively. What was his average speed during the whole journey? $xyz /$

$(xy+yz+zx)(xy+yz+zx) / xyz$

 $3xyz / (xy+yz+zx)$

None of theseSolution: Let, the equal distance be ' D' kmsNow, Average

speed =

=

=

=

=

The average salary of the entire staff in an office is Rs. 3200 per month. The

average salary of officers is Rs. 6800 and that of non-officers is Rs. 2000. If

the number of officers is 5, then find the number of non-officers in the office.

812

15

5Solution: Let the number of non-officers in the office be x Now, average salary, $3200 = \frac{3200(x+5)}{x+5} = \frac{3400+2000x}{x+5}$ Thus, $x = 15$

HCF/LCM

Important Formulas/Concepts

Product of 2 numbers = HCF of 2 numbers \times LCM of 2 (same) numbers

HCF of fractions = LCM of fractions = Illustration 1: If the HCF of 27 and 63 is of the form $(63 - 27m)$, then value of m is: 1

2

34Solution: HCF $[27, 63] = 9$ Also, HCF $[27, 63] = 63 - 27m$ (given) $63 - 27m = 9$ Thus, $m = 2$ Illustration 2: What is the largest number that divides 70, 97, 125, leaving remainder 5, 6, & 8 respectively? 369

13

Solution: H C F $[70-5, 97-6, 125-8]$ H C F $[65, 91, 117] = 13$ Illustration 3: If r & s are positive integer such that $r = a^3 b^2$ & $s = a^2 b^3$, then their LCM is: $a^2 b^2$

$a^3 b^3$

$a^6 b^6$ Solution: L C M $[r, s] = \text{L C M } [a^3 b^2, a^2 b^3] = a^3 b^3$ Illustration 4:

Which among the following is a pair of co-primes? (14, 21)

(18, 25)

(31, 62)(32, 62)Solution: We know that, co-primes have their H C F= 1(18, 25) is pair of co-prime because its H C F= 1Illustration 5: What is the least number that is divisible by all prime numbers from 1 to 6? 30

60

90120Solution: LCM [1, 2, 3, 4, 5, 6]LCM [1, 2, 3, 2 = 1 = 60

Practice Exercise

Three measuring rods are 30, 45 & 60 cm in length. Find the least length of cloth that can be measured an exact number of times, using any one of the rods.

180

240360540Solution: L C M [30, 45, 60] is the least length of cloth that can be measured exact number of timesL C M [30, 45, 60] = $[2 \times 3 \times 5, 3 \times 3 \times 5, 2 \times 2 \times 3 \times 5] = 2 \times 3 \times 5 \times 3 \times 2 = 180\text{cm}$ The HCF & LCM of two numbers is 16 & 2304. If one number is 256 then other number is: 169

144

12596Solution: We know that: Product of numbers = H C F \times L C MThus, $256 \times x = 16 \times 2304$ Thus, $x = 144$ By what number should 162 be divided to get 10 as a quotient and 12 as a remainder? 6912

15

Solution: Let the divisor be ' x'It is known that: Dividend = Divisor \times Quotient + Remainder $162 = x \times 10 + 12$ Thus, $x = 15$ The least number of four digits which is exactly divisible by 12, 15 & 18 is: 11201060

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1080

1180Solution: L C M [12, 15, 18] = $[2 \times 2 \times 3, 3 \times 5, 2 \times 3 \times 3] 2 \times 2 \times 3 \times 3 \times 5 =$

180Now, least four digits number is 1000, when divided by 180 gives

remainder as 100Least four digit number divisible by 12, 15, 18 is $(1000$

$+180-100) = 1080$ What is the least number which when doubled will be

exactly divisible by 6, 9, 12 and 15? 304560

90

Solution: Let the number be xL C M [6, 9, 12, 15] = $[2 \times 3, 3 \times 3, 2 \times 2 \times 3,$

$3 \times 5] = 2 \times 2 \times 3 \times 3 \times 5 = 180$ Now $2x = 180x = 90$ The HCF of $(23 \times 33 \times 52),$

$(22 \times 33 \times 52)$ & $(24 \times 3 \times 53 \times 7)$ is: 304860

300

Solution: HCF of $(23 \times 33 \times 52), (22 \times 33 \times 52)$ & $(24 \times 3 \times 53 \times 7) = 22 \times 3 \times 52 =$

$4 \times 3 \times 25 = 12 \times 25 = 300$ Richard takes 18 minutes to complete a circular track

while John takes 12 minutes to complete the same track. If both start

together in same direction, they both will meet again after: 12 minutes18

minutes24 minutes

36 minutes

Solution: Richard and John will meet at the L C M (18, 12) minutesL C M (18,

12) = $2 \times 2 \times 3 \times 3 = 36$ minutesThe numbers nearest to 10, 000 but greater

than 10, 000 which is exactly divisible by 5, 6, & 8 is: 100201040

10080

1025Solution: We know that: L C M (5, 6, 8) = $2 \times 2 \times 2 \times 3 \times 5 = 120$ Now, to

obtain the number nearest but greater than 10, 000 divisible exactly by 5, 6,

& 8, We will divide 10, 000 by L C M (5, 6, 8)= $10000/120 =$ Required number = $120 \times 84 = 10, 080$ The smallest fraction, which each of $\frac{2}{7}$, $\frac{3}{5}$, $\frac{4}{21}$ will exactly divide is:

12/7

$\frac{6}{14}$ $\frac{3}{6}$ $\frac{7}{24}$ $\frac{1}{14}$ Solution: To obtain a number that is divisible by $\frac{2}{7}$, $\frac{3}{14}$ & $\frac{4}{21} := \frac{12}{7}$ The maximum number of students among whom 960 books and 720 copies can be distributed under " Sarv Shiksha Abhiyan" government scheme in such a way that each student gets the same number of books and copies is: 120

240

360 420 Solution: For distribution of equal number of books and copies, We will have to take out the H C F of 960 and 720. = 240

Percentage

Important Formulas/Concepts

Percentage equivalents of oft-appearing fractions: $\frac{1}{10} 10\%$ $\frac{1}{9} 11.11\%$ $\frac{1}{8} 12.5\%$ $\frac{1}{7} 14.28\%$ $\frac{1}{6} 16.66\%$ $\frac{1}{5} 20\%$ $\frac{1}{4} 25\%$ $\frac{1}{3} 33.33\%$ $\frac{1}{2} 50\%$ $\frac{2}{3} 66.66\%$

$\frac{3}{4}$

75% If P is the current population of a town, and it increases by R% per annum, then population after n years: $P \times (1 + \frac{R}{100})^n$ If P is the current population of a town, and it increases by R% per annum, then population n years ago: $\frac{P}{(1 + \frac{R}{100})^n}$ If A is R% more than B, then B is less than A by: $\frac{R}{100 + R} \times 100$ If A is R% less than B, then B is more than A by: $\frac{R}{100 - R} \times 100$ Illustration 1: 30% of a number subtracted from 91, gives the number itself. Find the number. 60 kg 65 kg

70 kg

75 kg Solution: Let x be the number According to given condition, $91 - 30\% x$

$= x$
 $91 - x = x$
 $91 = x + x$
 $91 = 2x$
 $x = \frac{91}{2} = 45.5$
 Illustration 2: Stuti spends 20% of her monthly income on her household expenditures, 15% of the rest on books, 30% of the rest on clothes and saves the rest. On counting, she came to know that she finally saved Rs. 9520. Find her monthly income. 10, 000 25, 000

20, 000

12, 000 Solution: Let her total income be x $x - 20\% x = 9520$
 $9520 = 9520$

9520 Illustration 3: 30% of x is 150% of y is 150% of y is 150% of z . Which of the following is z ? 0. 25 x 1. 2 x 5/6 y

0. 2 x

Solution: $30\% \times x = 150\% \times y$
 $0.3x = 1.5y$
 $x = 5y$
 Illustration 4: Two years ago, Ravi used to purchase 2 mangoes more than today which he can afford at Rs. 40. If the price is raised by 20%, then what is the cost of a dozen mangoes today? 54 62

32

45 Solution: Let the cost of a mango 2 years ago be ' x ' Then, the cost of a mango presently after 20%: Price rise will be $1.2x$
 According to given condition, $2 - 2 = 0$
 $3 = 3x = Rs.$ Cost of a mango today will be $1.2x$
 Cost of a dozen mangos = $12 \times 1.2x = 14.4x$
 Illustration 5: Two numbers are less than the third number by 25% and 40% respectively. How much percent is the second number less than the first? 15%

20%

25%40%Solution: Let the third number be ' x', then the first number = 75%
 xSecond number = 60% xDifference in the first & second number = 15%
 xRequired percentage = $\frac{15}{75} \times 100 = 20\%$

Practice Exercise

5% of income of A is equal to 15% income of B and 10% of income of B is equal to 20% of income of C. if C's income is Rs. 2000, then the total income of A, B & C is:

18, 000

16, 00010, 0008000Solution: 5 % A = 15% B..... (I)10% B = 20% C.....

(II)From (II)B = $\frac{10}{20} \times 2000$ B = 4000From (I)A = $\frac{15}{5} \times 4000 = 12,$

000Therefore total income of A, B, C = 12000 + 4000 + 2000 = 18, 000A

building worth Rs. 12, 16, 700 is constructed on a land worth Rs. 4, 91, 300.

After how many years will the values of both will be the same if the land appreciates at 15% per annum and the building depreciates at 15% per annum? 1 year1 ½ years2 ½ years

3 years

Solution: According to the given condition, $4, 91, 300 \times n = 12, 16, 700 \times n$
 $\times 3n = 3$ If the price of petrol is increased by 20%, by how much percent a car owner must reduce his consumption in order to maintain the same budget?

16 %

33 %40%23%Solution: We know that: Decrease in consumption = $\frac{1}{3} \times 100$

=

37 ½% of the candidates in examination were girls, 75% of the boys and 62 ½% of the girls passed and 342 girls failed. The total number of boys failed were: 350360370

380

Solution: Let the total population of the class be x , Number of girls failed: $37.5\% \times x = 342$
 $(37.5/100) \times x = 342$
 $x = 2432$
 Number of boys who failed: $= 380$
 If the price of a cricket bat is first decreased by 15% and then increased by 25%, then the net change in price of bat will be: 5%

6. 25%

7. 5%10%
 Solution: Let the original price of the bat be Rs 1000
 Price after decrement of 15% = $85\% \times 1000 = \text{Rs } 850$
 Further, price after increment of 25%: $= 125\% \times 850 = 1062.5$
 Net change in price = The difference between one fifth of 1000 and one fifth percent of 1000 is: 0998

198

800= 198
 If price of sugar is increased by 7%, then by how much percent should a housewife reduce her consumption of sugar so as to incur no extra expenditure? 7%93%

6

12%
 Solution: Decrease in consumption:

%=
 =

The daily wage is increased by 15% and a person now gets Rs. 23 per day.

What was his daily wage before the increase? 1518

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20

Solution: Original daily wage = $\times 100 = \text{Rs. } 20$ The ratio of salary of a worker in July to that in June was. By what % was the salary of July more than salary of June? 10% 76% Solution: $\times 100 \times 100 = 11$ The population of a village is 1,00,000. The rate of increase is 10% per annum. Find the population increase in the third year?

12, 100

10,000 $33,100$ $21,000$ Solution: Population after 2nd year = $100000 \times 2 = 100000 \times = 121000$ Population after 3rd year = $100000 \times 3 = 133100$ Increase in population: $= 133100 - 121000 = 12,100$

Profit, Loss and Discount**Important Formulas/Concepts**

Profit = Selling Price - Cost Price
Loss = Cost Price - Selling Price
Profit % =

Loss % = $\frac{\text{Selling Price} - \text{Cost Price}}{\text{Selling Price}} \times 100$
Selling Price = $\frac{\text{Cost Price}}{\text{Cost Price} - \text{Loss}}$

Selling Price = $\frac{\text{Cost Price}}{\text{Cost Price} - \text{Loss}}$
Discount = Marked Price - Selling Price

Price
Rate of discount = $\frac{\text{Discount}}{\text{Marked Price}} \times 100$

Illustration 1: A man purchased two watches for Rs. 560. He sold one at a 15% profit and the other at a 10% loss, and thus he neither gains nor loses. Find the cost price of each watch. $320, 240$ $240, 320$

224, 336

336, 224 Solution: $CP1 \times 0.15 = CP2 \times 0.10$ $CP1/CP2 = 2/3$(I)
 $CP1 + CP2 = 560$(II)
On comparing (I) & (II) $CP1 = 224$ $CP2 = 336$
Illustration 2: A man buys 10 pencils for Rs. 3 and sold 8 of them for Rs 3. His gain percent is: 20%

25%

30%27%Solution: CP of 1 pencil = 3/10SP of 1 pencil = 3/8Gain% = $\frac{3}{8} \times 100 =$

$\times 100 = 25\%$ Illustration 3: A radio costing Rs. 500 is available on 10%

discount on cash purchase. The shopkeeper gives sequential discounts. Asha paid Rs 427. 50 for the radio. Find the rate of the discount on cash price.

20%15%10%

5%

Solution: Price after 1st discount of 10% = 90% = 450If final cash price is Rs

427. 50Discount % = 5%Illustration 4: A person marks his goods 20%

higher than cost price and allows a discount of 5%. His percentage profit is:

15%20%5%

14%

Solution: Let the cost price be 100, Marked Price = 120% Cost Price = \times

100 = 120Selling Price = 95% of Marked Price

=

= 19 = 114

=

= 14%Illustration 5: A fruit seller has 24 kg of apples. He sells a part of these

at a gain of 20% and the remaining at a loss of 5%. If on the whole he earns

a profit of 10%, the amount of apples sold at a loss is: 4. 6 kgs6 kgs

9. 6 kgs

11. 4 kgs
 Solution: Let the number of apples sold at a loss be x and the cost price of an apple be Rs 1.
 $1 \times (24-x) \times 120\% - 1 \times x \times 95\% = 1 \times 24 \times 110\% - (24-x) \times 6/5 - x \times 19/20 = 24 \times 11/10$
 Thus, $x = 9.6$ kgs

Practice Exercise

A retailer buys 30 articles from a wholesaler at the price of 27. If he sells them at their marked price the gain percent in the transactions is: 90%

11

16
 Solution: Let the marked price of one article be Rs. 1.
 C P of 30 articles = 27 & S P / M P of 30 articles = 30
 Profit % = $3/27 \times 100 = 100/9$

=%

A dishonest shopkeeper professes to sell potatoes at the cost price, but he weighs 875 grams instead of one kg. What is his percentage of profit? 6.5%

12. 5%

18. 75%
 15. 25%
 Solution: Profit% = 12.5%
 A man sold his book for Rs. 891, thereby gaining 1/10th of its cost price. The cost price is: 850

810

851840
 Solution: Selling Price = Cost Price + 1/10th Cost Price
 $891 = \text{Cost Price}$
 Cost Price = 810
 A shopkeeper increased the price of a product by 50% and later on reduced the price by 50%. The shopkeeper's loss was: 2.5%

25%

10%Solution: Let the actual price of the article be Rs. 100
 Price after increasing 50% = $150\% \times 100 = 150$
 Price after reducing 50% = $50\% \times 150 = 75$
 Loss % = $\frac{100 - 75}{100} \times 100 = 25\%$
 A CD music system when sold at a certain price gives a gain of 20%. If sold for thrice that price, the gain percent will be:
 260%

200%

360%300%Solution: Let the selling price of CD music system be x
 Cost Price = $\frac{x}{3}$
 If the new Selling Price is thrice that of Cost Price, then = 3
 =

Profit % = $\frac{3x - \frac{x}{3}}{\frac{x}{3}} \times 100 = 200\%$
 A shopkeeper earns a profit of 15% on selling a book at 10% discount on the printed price. The ratio of the cost price and the printed price of the book is. 23: 18

18: 23

3: 22: 3Solution: Let the Selling Price be x
 Then CP = $\frac{3x}{4}$ & Marked Price = $\frac{3x}{2}$
 = =

The cost price of a shirt and a pair of trousers is Rs. 371. If the shirt costs 12% more than the trousers, then the cost price of the trousers is: Rs. 125Rs.
 150

Rs. 175

Rs. 200Solution: Let the Cost Price of the trousers be x
 Then, $x + 12\% x = 371$
 $1.12x = 371$, $100x = 371 \times 100$, $x = 331.25$
 The cost of manufacturing an article is made up

of material, labour and overheads in the ratio 4: 3: 2. If the cost of laborers is Rs. 45, find the profit percent if the article is sold for Rs. 180. 50%33. 33%

25%

20%Solution: Let the total cost of manufacturing be x Then labour cost, $x =$

$45x = 135$ Selling Price = 180 (given) Gain% = $\frac{x}{100} = 25\%$ A trader

purchases apples at Rs. 60 per hundred. He spends 15% on the

transportation. What should be the selling price per dozen to earn a profit of

20%? Rs. 8. 21

Rs. 9. 936

Rs. 10. 2Rs. 3. 362Solution: Total Cost Price of 100 Apples = 60 = 69of 100

apples earning profit 20% = Selling Price of 1 dozen apples = = 9. 936A

shopkeeper purchases 10 kg of rice at Rs. 600 and sells at a loss as much as the selling price of 2 kg of rice. Find the sale of rice purchases/kg.

Rs. 5

Rs. 10Rs. 12. 5Rs. 15Solution: Let the Selling Price be Rs. x / kg Loss = Cost

Price -Selling Price $2x = 600 - 10 x x = Rs. 5/ kg$

Square Roots and Cube Roots

Illustration 1: If $\sqrt{x} = 15$ then $x = 15^2 = 225$

17

18

Solution: =

On squaring both sides - 1+-1Thus, $x = 17$ Illustration 2: If $x + 1/x = 5$, then the value of $x^2 + 1/x^2 = 21$

23

2527Solution: $x + = 5$ On squaring both sides, we get: $(x+) ^ 2 = 5^2$
 $x^2 + + 2 = 25$
 $x^2 + = 23$ Illustration 3: $1+1. 7321. 414$

2

None of these (Take = $1. 414, = 1. 732, = 2$) Solution: $1 + + +1 - (1 -2) - (2 - 3) - (3 - 4)1 - 1 + 2 - 2+ 3 - 3 + 4= 4= 2$ Illustration 4: If $(x-7)^2 + (y-5)^2 +(z - 3)^2 = 0$, then value of x, y & z are respectively. $\sqrt{7}, \sqrt{5}, \sqrt{349}, 25, 9$

7, 5, 3

Can't be determined Solution: Since, $x - 7 = 0 = x = 7$ Also, $y - 5 = 0 = y = 5$
 $z - 3 = 0 = z = 3$

Illustration 5:**- 0. 4472**

+ 0. 4472- 0. 5773+0. 5773 (Take = $1. 732, = 2. 236$)

Solution: +

=

= = $-2. 236 / 5 = - 0. 4472$

Practice Exercise

The greatest four digit perfect square is: 99629921

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9801

9726Solution: $999\ 99999\ 81181\ 189917011989999 - 198 = 9801$ The smallest three digit perfect square is:

100

120125144Solution: $100 = 10^2$ 100 is the smallest perfect square if x then values of x are: 2, 3

-2, 3

-5, 15, 1Solution: $x = x = x^2 = 6 + x^2 - x - 6 = 0$ $x^2 - x - 6 = 0$ $x^2 - 3x + 2 = 0$ $(x - 3)(x - 2) = 0$ $x = 2, 3$ The cube root of 0.000000729 is: 0.00270.0270.0009

0.009**Solution:**

3

=

= 0.009If $x = 5 - 2\sqrt{6}$, then $x^2 - 1/x^2 = 36\sqrt{6} - 27\sqrt{6}$

-40√6

72√6Solution: $x = 5 - 2\sqrt{6}$ $x^2 = 25 + 24 - 20\sqrt{6} = 49 - 20\sqrt{6}$ $1/x^2 = 1/(49 - 20\sqrt{6}) = (49 + 20\sqrt{6})/(49^2 - (20\sqrt{6})^2) = (49 + 20\sqrt{6})/(-49 - 20\sqrt{6}) = -40\sqrt{6}/363$ The value of is not equal to: $366\sqrt{363}\sqrt{144}$

18√12

Solution: $= = 36 = 6 = 318$ What is the least number which must be multiplied in 4851 to form a perfect square? 7

11

1213Solution: Factor of 4851 = $3 \times 3 \times 7 \times 7 \times 11$ So, 11 must be multiplied in 4851 to get a perfect square. What is the least number that must be divided in 864 to form a perfect square? 23

6

9Solution: Factor of 864 = $2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3$ So, 6 must be divided in 864 to get a perfect square.

:

Solution:

If $a = 13$, $b = 5$, find value of 31896

1728

343216Solution: $3^3 = 3^3 = 3^3 = 3^3 = 1728$

Partnership

Illustration 1: A, B and C enter into partnership with a total of Rs. 8200. A's capital is Rs. 1000 more than B's capital and Rs. 2000 less than C's capital.

What is B's share of the year's profit of Rs. 2460? 560920820

420

Solution: $A + B + C = 8200$(i)
 $A = 1000 + B \Rightarrow B = A - 1000$
 $A = C - 2000 \Rightarrow C = A + 2000$

Substituting in equation (i)
 $A + A - 1000 + A + 2000 = 8200$

$3A = 7200 \Rightarrow A = 2400$
 $B = 1400$
 B's share = 420

Illustration 2: What amount of money is divided between Atul, Mradul, & Ishaan, if Mradul & Ishaan together get Rs. 3000 and Atul gets five times as much as Mradul while

Ishaan and Atul together get Rs 6000? 875080007500

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6750

Solution: $M + I = 3000$ (i) $A = 5M$ (ii) $I + A = 6000$

(iii) Substitute equation (ii) in (iii) $5M + I = 6000$ (iv) Solving (i) & (iv) M

$= 750$ $I = 2250$ $A = 3750$ Hence, total money shared between the three is

$(750 + 2250 + 3750) = 6750$

Practice Exercise

A, B & C enter into a partnership. A contributes Rs. 320 for 4 months, B contributes Rs. 510 for 3 months, and C contributes Rs. 270 for 5 months. If the total profit is Rs. 208, find the profit share of the partners. 78, 98, 32

64, 76. 50, 67. 50

90, 48, 7084, 45, 79 Solution: $320 \times 4 : 510 \times 3 : 270 \times 5$ $128 : 153 : 135$ A's

share $\times 208 = 64$ B's share $\times 208 = 76.50$ C's share $\times 208 = 67.50$ A began

a business with Rs. 1,250 and was joined afterwards by B with Rs. 3,750.

When did B join if the profits at the end of the year are divided equally? After 6 months

After 8 months

After 4 months After 7 months Solution: Say B joined the business after 'x'

months If the profits are shared equally, $1250 \times 12 = 3750 \times (12 - x) = 3(12 -$

$x) \times x = 8$ The cost of a music system and an LCD TV are in the ratio of 3: 8 and

total price of both is Rs. 20,900. The difference in their price is: 7,600 6,050

9, 500

8, 100 Solution: The ratio of the price is 3: 8 Let the cost of the music system

be $3x$ and the cost of LCD TV be $8x$ Difference in their prices $= x \times 20,900$

20, 900 = 9500 Four milkmen rented a pasture. 'A' grazed 24 cows for 3 months; 'B' grazed 10 cows for 5 months; C grazed 35 cows for 4 months and D grazed 21 cows for 3 months. If A's share of rent is Rs. 720, find the total rent of the field.

3250

267045002750 Solution: Let the total rent be 'x' Ratio of rent shared by four milkmen is A B C D $24 \times 3 : 10 \times 5 : 35 \times 4 : 21 \times 3$ $72 : 50 : 140 : 63$ A's share of rent = Rs. 720 (given) $\frac{72}{3250} \times x = 720$ Thus, $x = 3250$ Hrithik and Ravish entered into partnership with capitals in the ratio 4: 5. After 3 months, Hrithik withdrew $\frac{1}{4}$ of his capital and Ravish withdrew $\frac{1}{5}$ th of his capital. If the gain at the end of 10 months was Rs. 760, Ravish's share in this profit is: Rs.

330 Rs. 360 Rs. 380

Rs. 430

Solution: Let initially the sum invested by Hrithik and Ravish be $4x$ & $5x$ Ratio of their profit share is $4x \times 3 + 4x \times 7 : 5x \times 3 + 5x \times 7$ $12x + 28x : 15x + 35x$ $40x : 50x$ $4 : 5$ Ravish share in profit $\frac{5}{9} \times 760 = 430$ A workman earned Rs. 180 in a certain number of days. If his daily wages had been Rs. 2. he would take one more day to earn the same amount, find how many days he worked at the higher rate. 18 days

9 days

6 days 12 days Let the no of days initially be x Using many equation, $2 = \frac{180}{x}$ $2x = 180$ $x = 90$ $2(x + 10) = 180$ $2x + 20 = 180$ $2x = 160$ $x = 80$ days Ayush, Sujoy & Kartik hired a taxi for Rs. 780 and used it for 17, 8 & 14 hours respectively. The charges paid by Karthik are: 320

280

460300Solution: Kartik's share = = Rs. 280In a partnership A invested $\frac{1}{6}$ th of the capital for $\frac{1}{6}$ th of the time, B invest $\frac{1}{3}$ rd of the capital for $\frac{1}{3}$ rd of the time and C, the rest of the capital for the whole time. Out of a profit of Rs. 4600, B's share is: 650

800

9601000Solution: Let x be the total amount & y be the total time period investmentRatio of the profit for A, B, & C is $x \times 1 : y : 18$ Profit share of B = 4600 $x = 800$ Adil & Akram invest in a grocery business in the ratio 4: 3. If 9% of the total profit goes to certain taxes and Akram's share is Rs. 35, 100, the total profit is: 1, 15, 0001, 09, 000

90, 000

68, 000Solution: Net profit after paying all taxes = 91% xGiven ratio 4: 3 $91\% x = 35, 100x = x = 90, 000$ A and B are partners in a business. A contributes $\frac{1}{4}$ of the capital for 15 months and B received $\frac{2}{3}$ rd of the profit. For how long B' money was used? 6 months9 months

10 months

1 yearSolution: The invested ratio is 1: 3& the profit ratio is 1: 2Equally born,
=
 $y = 10$ months

Probability

Important Formulas/Concepts

Probability = Illustration 1: If two dices are thrown at random, probability of getting a sum more than 9 is:

$$\frac{1}{6}$$

$$\frac{5}{62/3}$$

$$\frac{1}{2}$$

Solution: Favorable outcomes - (5, 5) (4, 6) (6, 4) (5, 6) (6, 5) (6, 6) Also, total outcomes = 36
Probability = $\frac{6}{36} = \frac{1}{6}$
Illustration 2: Probability of getting a black face card, when a card is drawn randomly from a 52 card deck is: $\frac{3}{52}$

$$\frac{3}{26}$$

$\frac{1}{132/13}$
Solution: Favorable outcomes = 6
Total number of outcomes = 52
Probability = Illustration 3: Find the probability of getting a prime number on throwing a dice.

$$\frac{1}{4}$$

$$\frac{1}{3}$$

$$\frac{1}{2}$$

1
Solution: Favorable outcomes = 3; {2, 3, 5}
Total number of outcomes = 6
Probability = $\frac{3}{6} = \frac{1}{2}$
Illustration 4: Find the probability of getting a composite number on throwing a dice.

1/3 $\frac{1}{2}$

2/31 Solution: Favorable outcomes = 2 ; { 4, 6 } Total number of outcomes =

6 Probability = $\frac{2}{6} = \frac{1}{3}$ Illustration 5: The probability of getting atleast 2 heads, on tossing a coin three times is:

 $\frac{1}{2}$ $\frac{3}{8}$ $\frac{3}{4}$ $\frac{1}{4}$

Solution: The various possibilities (of getting at least 2 heads) are: H HHH H
TH T HH T TT H HT H TT T HT TTT Thus, total number of favorable outcomes =
4 Total number of outcomes = 8 Thus, probability = $\frac{4}{8} = \frac{1}{2}$

Practice Exercise

The probability of getting a doublet on throwing a pair of dice is: $\frac{1}{21/3}$

1/6

5/6 Solution: Favorable outcomes = 6; {(1, 1),(2, 2),(3, 3),(4, 4),(5, 5),(6,
6)} Total number of outcomes = 36 Probability = = The probability of getting
53 Sundays in a leap year is: $\frac{1}{7}$

2/7

3/74/7 Solution: Total complete weeks in a leap year = 52 Also, remaining
days in a leap year = 2 days Now, favorable outcomes = {(sat, sun), (sun,

mon)} Thus, $\frac{2}{7}$ is the correct answer. The probability of getting 53 Mondays in a non-leap year is:

$\frac{1}{7}$

$\frac{2}{7}$ Solution: Total number of complete weeks in a non-leap year =

52 Also, remaining days in a leap year = 1 Number of favorable outcomes =

1 Total number of outcomes = 7 Hence, probability =

Among a group of 9

males & 6 females, a President & a Vice-President is to be appointed. Find

the probability of occupying either both places by a female or one each by a male and a female. $\frac{12}{105}$

$\frac{54}{105}$

Solution:

=

=

A class consists of 12 boys and 8 girls. If a panel of 3 students is to be made, then the probability of choosing two girls and one boy is:

$\frac{28}{95}$

$\frac{7}{20}$ Solution: Number of ways of choosing 2 girls and 1 boys =

${}^{12}C_1 \times {}^8C_2$ Total number of ways to choose = ${}^{20}C_3$ To select 3 such students:

Required probability =

=

=

A lady wardrobe consists of five black pants, three brown pants and six white tops and four red tops. The probability of choosing a black pant with a red top for a party is: $\frac{4}{51/5}$

 $\frac{1}{4}$

$\frac{2}{5}$ Solution: Number of ways of choosing a black pant = $5C_1$ Number of ways of choosing a red top = $4C_1$ Total number of ways of choosing a pant and a top = $8C_1 \times 10C_1$ Required probability =

=

=

If two dices are thrown at random, find the probability of getting an odd number on both faces. $\frac{1}{21/3}$

 $\frac{1}{4}$

$\frac{1}{6}$ Solution: Number of favorable cases = $\{(1, 1) (3, 3) (5, 5), (1, 3) (3, 1)(5, 3), (1, 5)(3, 5)(5, 1)\} = 9$ Total number of cases = 36 Required probability = =

If three coins are tossed simultaneously, find the probability of getting at most one tail.

 $\frac{1}{2}$ $\frac{3}{8}$

$\frac{1}{4}$

$\frac{5}{8}$ Solution: Number of favorable cases = 4 ; {(H, H, H),(H, T, H)(H, H, T)(T, H, H)} Total number of outcomes = 8 Required probability = $\frac{4}{8} = \frac{1}{2}$ From the deck of 52 cards, if a card is drawn at random, find the probability of getting either a Black jack or a Red king. $\frac{1}{26}$ $\frac{3}{26}$

$\frac{1}{13}$

$\frac{2}{13}$ Solution: Number of ways of getting a black jack = 2C_1 Number of ways of getting a red king = 2C_1 Total number of ways of getting a card = ${}^{52}C_1$ Required probability = = If out of a sample of 40 pens, 12 are defective, find the probability of choosing a defective and a perfect pen. $\frac{12}{30}$

$\frac{84}{195}$

$\frac{2}{197}$ / $\frac{40}{40}$ Solution: Number of ways to select a defective pen = ${}^{12}C_1$ Number of ways to select a correct/perfect pen = ${}^{28}C_1$ Total number of ways of selecting two pens = ${}^{40}C_2$ Required probability == $\frac{84}{195}$