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Quantitative Aptitude Shortcut Tricks

Dear Aspirants,

We Are Presenting You QUANTITATIVE APTITUDE SHORTCUT TRICKS Book to remember All Important FORMULAS & SHORTTRICKS ,This QUANTITATIVE APTITUDE SHORTCUT TRICKS Complete Book is important for all government competitive exams like IBPSPO, SBI PO, RBI, BANK PO, SSC, CGL, SBI PO 2019, SBI PO VACANCY, CLERK, RAILWAYS, LIC, IBPS CLERK, RBI, RBI ASSISTANT, RBI EXECUTIVE etc.

Hello Dear Aspirants,

Welcome to Online **QUANTITATIVE APTITUDE** section in **www.Dreambiginstitution.com** We Have Created **FORMULAS and SHORTCUT TRICKS E-Book** of Quantitative Aptitude Which will Help You In Your Upcoming Examination

By – Deepali Jadhav

TIME & WORK FORMULAS

Work

Relations between work, time and person: -

- Work & Person: Directly proportional i.e. more work, more person required.
- Time & Person: Inversely proportional i.e. more people, less time required.
- Work & time: Directly proportional i.e. more work, more time required.

Note: Work done is always considered to be equal to 1.

Rules: -

- If a person can do a piece of work in 'n' days/ hours then that person's one day's/ hour's work = $^1/_n$
- If a person's one day's/ hour's work = $^1/_n$, then he will complete then he will complete the work in 'n' days/ hours.
- If first person is 'n' times efficient than second person then work done by first person : second person = n : 1
- If the ratio of number of men required to complete a work is m : n then the ratio of time taken by them will be n : m.

Formulas Including Short Tricks:

1.

If persons can do W_1 work in D_1 days working T_1 hours in a day and M_2 Persons can do W_2 work in D_2 days working T_2 hours in a day then the relationship between them is

$$\frac{M_1 * D_1 * T_1}{W_1} = \frac{M_2 * D_2 * T_2}{W_2}$$

 # 2.

If A can do a piece of work in days and B can do the same work in days then (A + B)'s one day work-

$$\frac{1}{x}+\frac{1}{y}=\frac{x+y}{xy}$$

Time taken by (A + B) to complete the work –

$$\frac{xy}{x+y}$$

If 'n' persons (more than two) are there then their one day's work =

$$\frac{1}{x_1}+\frac{1}{x_2}+\frac{1}{x_3}+\ldots\ldots\ldots\ldots+\frac{1}{x_n}$$

Where x_1,x_2, x_3 …… represents the number of days taken by them to complete the work.

 # 3.

If A & B can complete a work in days and A alone can finish that work in days then number of days required by B to complete the work–

$$\frac{xy}{y-x}$$

 # 4.

If A & B can do a piece of work in days, B & C can the same work in days and A & C can do it in days, then working together A,B & C can do that work in–

$$\frac{2xyz}{xy+yz+zx}\ days$$

 # 5.

If A can do a work in days and B can do faster than A, then B will complete the work in -

$$\frac{100 * x}{100 + y} \; days$$

 # 6.

If A takes days more to complete a work than the time taken by (A + B) to do the same work and B takes y days more than the time taken by (A + B) to do the same work then (A + B) do the work in √xy days –

 # 7.

If A & B each alone can do a piece of work in days respectively. Both begin together but –

I. A leaves the work 'n' days before its completion, then total time taken for completion of work :

$$\mathbf{T} = \frac{(\boldsymbol{x} + \mathbf{n}) * \boldsymbol{y}}{\boldsymbol{x} + \boldsymbol{y}}$$

II. B leaves the work 'n' days before its completion, then total time taken for completion of work :

$$\mathbf{T} = \frac{(\mathbf{y} + \mathbf{n}) * \boldsymbol{x}}{\boldsymbol{x} + \boldsymbol{y}}$$

 # 8.

If A & B do a piece of work in days respectively. Both begin together but after some days, A leaves off & the remaining work is completed by B in 'n' days. Then

$$\mathbf{T} = \frac{(\mathbf{y} - \mathbf{n}) * \boldsymbol{x}}{\boldsymbol{x} + \boldsymbol{y}}$$

the time after which A left, is given by

TIME, SPEED & DISTANCE FORMULAS & TRICKS

Speed: - The rate at which an object travels to cover a certain distance. [Unit - km/hr, m/sec]
Time: - The duration spent to cover a certain distance. [Unit - hr, min, sec]
Distance: - The length of the path travelled by an object between two places. [Unit – km, m]

Relationship between Speed, Time & Distance

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

Note: -

1) Unit of speed, time and distance should be in the same metric system.
2) $1\ ^{\text{km}}/_{\text{hr}} = ^{\text{5m}}/_{\text{18s}}$

Formulas Including Short Tricks:

Trick 1.

Calculation of Speed when units are not belong to same metric system –
Speed= $^{\text{Distance}}/_{\text{Time}}$

Trick 2.

Calculation of distance if speed is constant –

$^{D1}/_{T1} = {}^{D2}/_{T2}$

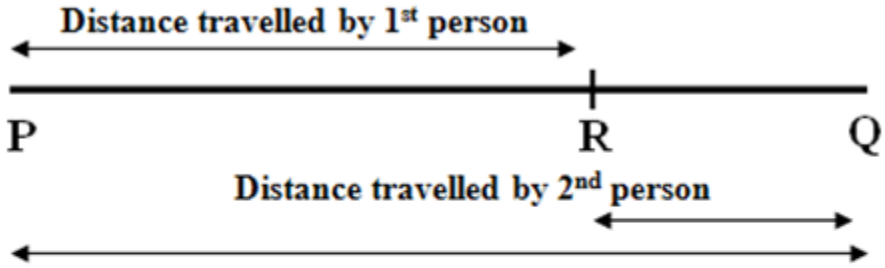
Trick 3.

Calculation of average speed if certain distance is covered at speed A & same distance is covered at distance B –

Avg. Speed= $^{2AB}/_{A+B}$

Trick 4.

Calculation of distance if two persons travels from point P to Q (having distance D) with given different speeds and second person reaches point Q first, returns immediately and meet first person at R –



Distance travelled by first person (PR) =

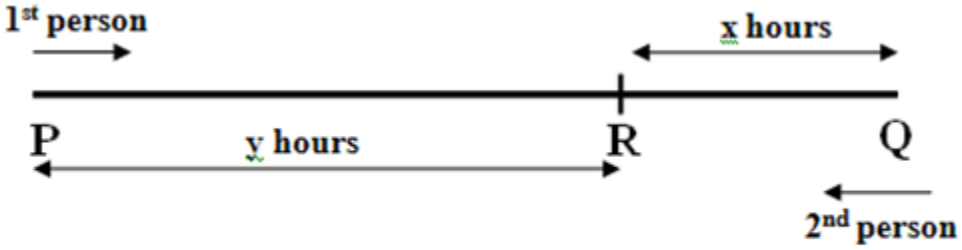
$$2 * D * \frac{\text{Speed of 1st person}}{\text{sum of speeds}}$$

Distance travelled by second person (PQ + QR) =

$$2 * D * \frac{\text{Speed of 2nd person}}{\text{sum of speeds}}$$

Trick 5.

Calculation of speed if two persons start running at the same time in opposite direction (P & Q) between two points and after passing each other (R), they complete their journey in x and y hr respectively –



$$\frac{\text{Speed of 1st person}}{\text{Speed of 2nd person}} = \frac{\sqrt{y}}{\sqrt{x}}$$

Trick 6.

Calculation of time if a person changes his speed (in fraction such has times) of his original speed and reaches either late or early by t minutes –

$$\text{Required time} = \frac{t * x}{x - y} \quad \text{if } x > y$$

Or

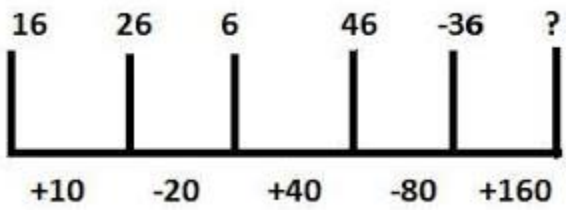
$$\text{Required time} = \frac{t * x}{y - x} \quad \text{if } y > x$$

NUMBER SERIES RULES, TRICKS SHORTCUTS

Number Series

In Number series questions, you need to find the pattern of series.

Let's take an example : **16, 26, 6, 46, -34, ?**



There is a pattern in the difference between the numbers in the series.

Every consecutive difference is multiplied by -2.

Similar questions are asked in the exams.

Rules on Counting Numbers

I. Sum of all the first n natural numbers = $\frac{n(n+1)}{2}$

Example: $1 + 2 + 3 \ldots\ldots\ldots\ldots + 105 = \frac{105(105+1)}{2} = 5565$

II. Sum of first n odd numbers = n^2

Example: $1 + 3 + 5 + 7 = 4^2 = 16$ (as there are four odd numbers)

Example: $1 + 3 + 5 + \ldots\ldots\ldots\ldots + 20^{th}$ odd number (i.e.$20 \times 2 - 1 = 39$) $= 20^2 = 400$

III. Sum of first n even numbers = n (n + 1)

Example: $2 + 4 + 6 + 8 \ldots\ldots\ldots\ldots\ldots + 100$ (or 50^{th} even natural number)

$50 \times (50 + 1) = 2550$

IV. Sum of square of first n natural numbers = $\frac{n(n+1(2n+1)}{6}$

Example: $1^2 + 2^2 + 3^2 + \ldots\ldots\ldots\ldots + 10^2 = \frac{10(10+1)(2\times10+1)}{6} = \frac{10\times11\times21}{6} = 385$

V. Sum of cubes of first n natural numbers = $\left[\frac{n(n+1)}{2}\right]^2$

Example: $13 + 23 + \ldots\ldots\ldots\ldots\ldots + 63 = \left[\frac{6\times(6+1)}{2}\right]^2 = (21)^2 = 441$

In the first n counting numbers, there are n/2 odd and n/2 even numbers provided n, the number of numbers, is even. If n, the number of numbers, is odd, then there are 1/2(n + 1) odd numbers and 1/ 2 (n – 1) even numbers.

For example: from 1 to 50, there are 50/2= 25 odd numbers and 50/2 = 25 even numbers. And from 1 to 51, there are (51+1)/2 = 26 odd numbers and(51-1)/2= 25 even numbers.

The difference between the squares of two consecutive numbers is always an odd numbers.

For example: Difference between $(26)^2$ and $(25)^2 = 51$ (an odd number)

The difference between the square of two consecutive numbers is the sum of the two consecutive numbers.

For example: $(26)^2 - (25)^2 = 26 + 25 = 51$

Reasoning: $a^2 - b^2 = (a + b)(a - b) = (a + b)$ since, $a - b = 1$

POWER & INDEX TRICKS & SHORTCUTS

If a number 'p' is multiplied by itself n times, the product is called nth power of 'p' and is written as p^n. In p^n, p is called the base and n is called the index of the power.

Rule no. 1.

For Odd Numbers

When there is an odd digit in the unit place (except 5), multiply the number by itself until you get 1 in the unit place.

$(\ldots\ldots\ldots\ldots 1)^n = (\ldots\ldots\ldots\ldots 1)$

$(\ldots\ldots\ldots 3)^{4n} = (\ldots\ldots\ldots 1)$

$(\ldots\ldots\ldots 7)^{4n} = (\ldots\ldots\ldots 1)$

Where n = 1, 2, 3,…….

Rule no.2

When there is an even digit in the unit place of the given number, then after any times of its multiplication, it will have the same digit in the unit place i.e.

$(\ldots\ldots\ldots\ldots 1)^n = (\ldots\ldots\ldots\ldots\ldots 1)$

$(\ldots\ldots\ldots 5)^n = (\ldots\ldots\ldots 5)$

$(\ldots\ldots\ldots 6)^n = (\ldots\ldots\ldots 6)$

SQUARING TRICKS & SHORTCUTS

Squaring

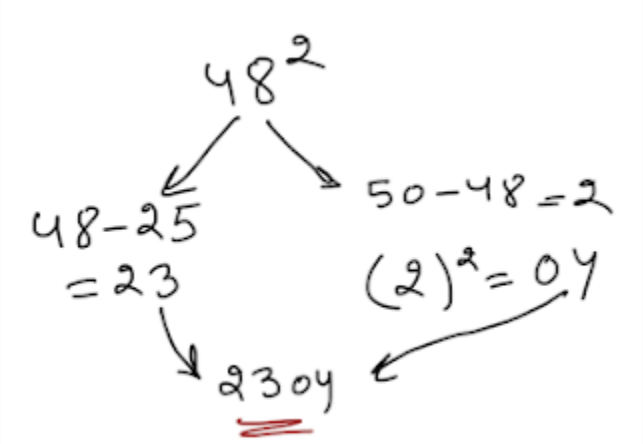
In this simple trick, we need to modify the equation and make the units digit zero. After all, it is easy to multiply when units digit is zero.

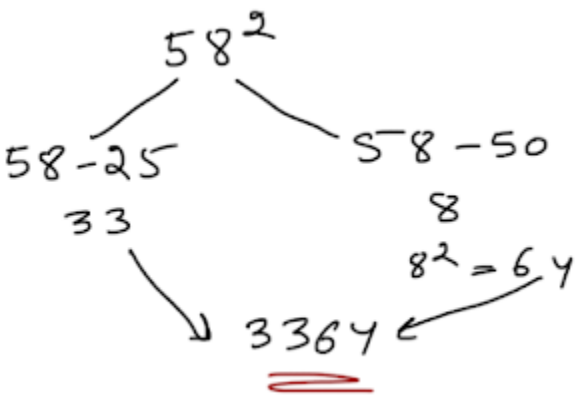
For example - Find square of 43

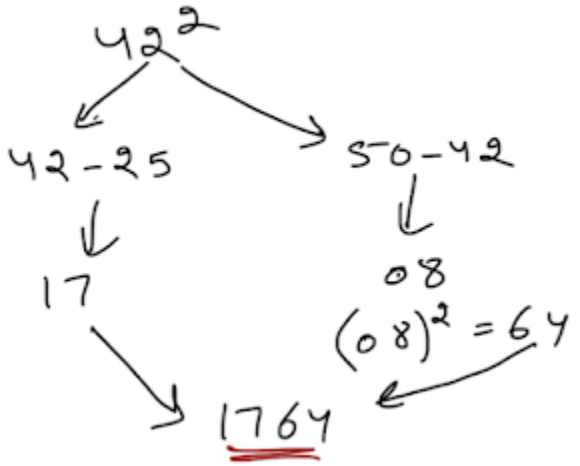
= (43+3) × (43-3) + (3×3)
=(46×40) + 9
= (460×4) + 9
= 1840 + 9 = 1849

Finding Square of Any No. From 1 to 100

Pick Any No. Just like this:







SQUARE ROOT TRICKS & SHORTCUTS

To Find Square Root of a Number:

Square root of 4096:

Here the one's digit is having 6, so we will find square of which numbers from 1 to 9 are having 6 in the ones digit place which will be 4 and 6. So either 4 or 6 will

form the one's digit of the square root of 4096.
⇒ Now we will find square of which number from 1 to 9 is the closest to the last two digits of 4096 i.e. 40 which will be 62 = 36. So either 64 or 66 can be the square root of 4096.
⇒ Now multiply this 6 with its next number 7 which will come as 42. As 40 is smaller than 42, hence the smaller number 64 will be the desired square root.

CUBE ROOT TRICKS & SHORTCUTS

To Find Cube Root of a Number:

Cube Root of 19683:

⇒ Here the one's digit is having 3, so we will find cube of which numbers from 1 to 9 are having 3 in the ones digit place which will be 7. So 7 will form the one's digit of the cube root of 19683.

⇒ Now 19 falls between the cube of 2 and 3, so the smaller number between 2 and 3 i.e. 2 will form the tens digit of the cube root.

⇒ Hence, the cube root of 19683 will be 27.

MULTIPLICATION TRICKS & SHORTCUTS

Example of Multiplying Numbers Close to 100 or 1000 with Each Other

What is the answer for-

(i) 98 x 93 (ii) 104 x 112

A. 9882, 11178

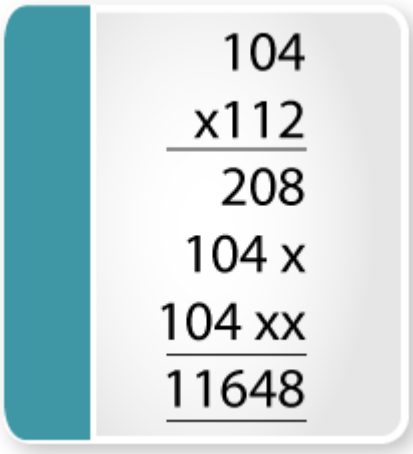
B. 8992, 11148

C. 9052, 11168

D. 9114, 11648

Conventional Method of Multiplying Numbers close to 100 without Multiplication Ticks

What is your usual reflex on reading numbers like this that have to be multiplied, assuming you know no calculation ticks for bank exams? You quickly start scribbling in some corner of a paper. You start by multiplying 3 with 8, then 3 with 9 followed by 9 with 8 and 9, add them and then get the answer. You follow the similar process for multiplying 104 and 112.



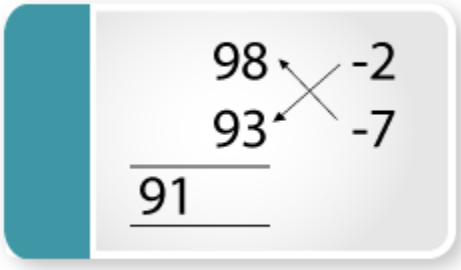
Smart Method of Multiplying Numbers using Multiplication Tricks

Multiplication tricks make these calculations really easy. We start with taking **100 as the base and the difference of the numbers from 100 or 1000 depending on the number.**

Step 1:

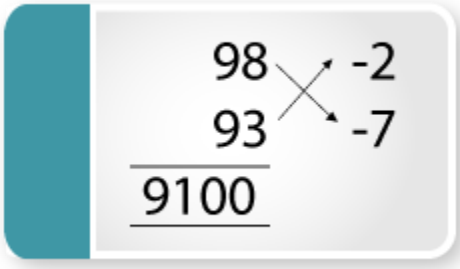
98 – 100 = -2

93 – 100 = -7



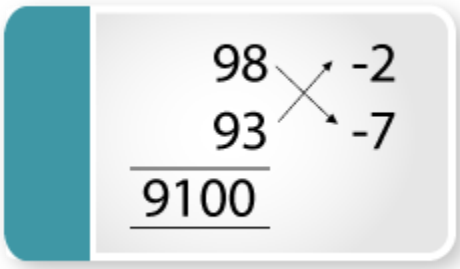
Step 2:

Now you have to take **the cross difference between the numbers and the differences,** so here we will take '98-7' or '93-2' which is equal to '91' and write it.



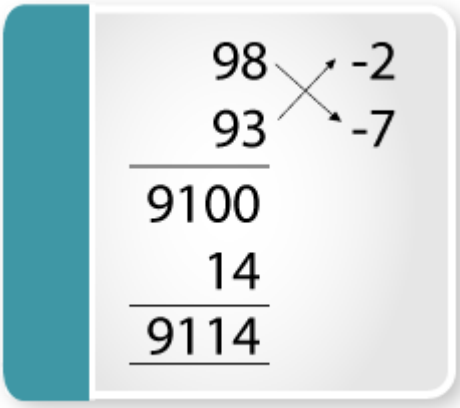
Step 3:

Now write 2 zeros after '91' making it '9100'. **The number of zeros written depends on the base**, which is hundred in this case, therefore 2 zeros.



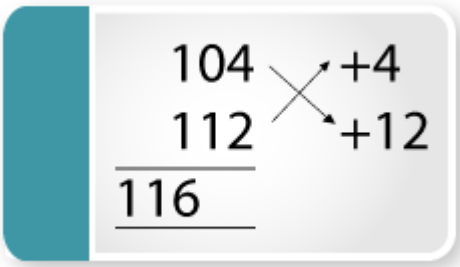
Step 4:

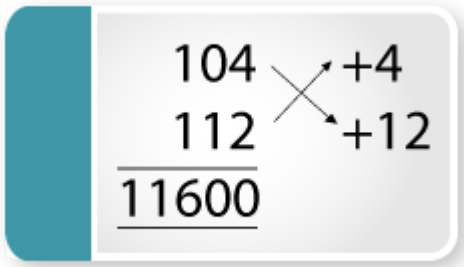
Find the product of the 2 numbers that indicate the difference from 100 and add it to 9100 in this case. Remember to **take the signs into consideration while finding the product**.

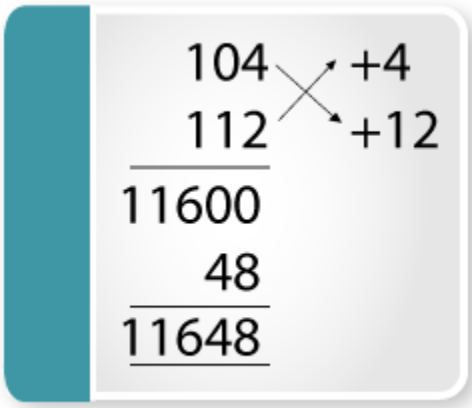


And this is the answer!! Simple and Quick!!

Now try multiplying the second set of numbers using multiplication tricks!







MIXTURE TRICKS & SHORTCUTS

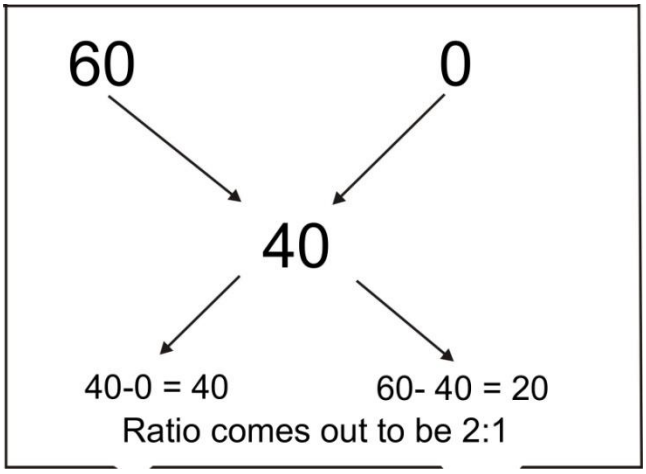
Mixture

Questions related to mixtures can be easily solved by alligation method. By using alligation we can wide arrange of maths questions. Let me explain this with a simple example

Example

The price of wine of $60 per litre. If Samuel is adding water with and selling the

mixture for $40 per litre. Profit margin remains same. What is the ratio of water and wine in the mixture?



COMPOUND INTEREST TRICKS & SHORTCUTS

Computing Compound Interest:

a) C.I. for 2 years, $CI_2 = R_2\% \times$ Principal where, $R_2 = 2r|r^2$

Example: Principal = 10,000; Rate = 12%; Time = 2years

Here, R2 = 2×12|12×12 = 24|144 = 25. 44

⇒ CI2 = 25.44% × 10000 = 2544

b) C.I. for 3 years, $CI3 = R_3\% \times$ Principal where, $R_3 = 3r|3r^2|r^3$

Example: Principal = 25,000; Rate = 12%; Time = 3years

Here, R3 = 3×12|3×12×12|123 = 36|432|1728 = 40.4928

⇒ CI3 = 40.4928% × 25000 = 10123.20

PROFIT & LOSS (FORMULA) TRICKS & SHORTCUTS

Profit and Loss

Profit/loss = Sales price - Cost price

In case of profit
25% of Cost Price (1/4 of CP) = 20% of Selling Price (1/5 of SP)
Similarly, 1/3 of CP = 1/2 of SP

In case of loss
25% of Selling Price (1/4 of SP) = 20% of Cost Price (1/5 of CP)
Similarly, 1/3 of SP = 1/2 of CP

Profit and loss problems involve various terms like Cost price, Selling price, Marked price and Discount etc. Basically, it is a difference between selling price and cost price.

Cost price is the price paid to purchase an article or a product or we can say it is a cost incurred in manufacturing an article.

Selling price is the price at which a product is sold.

Commonly used Profit and loss Formulas :

1) Calculation of Profit:

Profit or gain = Selling price(S.P) - Cost price(C.P)
in other ,
⇒ Selling Price = Cost Price + Profit

2) Calculation of Loss

Loss = Cost price - Selling price

3) Calculation of Gain percentage(%)

$$\frac{Gain}{CP} \times 100$$

4) Calculation of Loss percentage(%)

$$\frac{Loss}{CP} \times 100$$

5) Finding relationship between selling price and cost price:

$$S.P = \frac{100+Gain\ percentage}{100} \text{ x C.P (In Case of gain)}$$

$$S.P = \frac{100-Loss\ percentage}{100} \text{ x C.P (In Case of loss)}$$

6) Finding Combined Profit/Loss on sale of Two products

If a person sells two commodities at same prices. On one he gains x% and loses x% on another, then as a whole he will be in loss and the loss percentage will be equal to:

$$\frac{(Common\ Gain\ or\ loss\ Percentage)^2}{100} = \frac{x^2}{10}$$

ESTIMATION TRICKS & SHORTCUTS

Estimation

That's the most important technique. This is not a secret that every successful candidate is using this technique during exams.

Example - 112 × 92
Simply 112 × 9 = 1008
⇒ Add a zero 10080 and then add 224 to 10080.
⇒ Answer is 10304

You need to do all the calculations in your brain. Don't use paper. You need to divide complex calculations into parts and solve it in your brain without paper. That's how toppers do complex calculations during exams.

Right now it will be difficult for you to use this method but with practice, you will be able to do any complicated calculation within seconds.

Rule of 72, 114 and 142

The rule of 72 is a shortcut technique to estimate the number of years it will take for your money to double with compounding interest.

For example: If you are invested Rs. 100, then how much time it will take to double your money, If the rate of interest is 6%?

So, according to rule of 72:
72 ÷ 6 i.e. 12 years.

Rule of 72

Investment Rate x Number of Years Invested = 72

Rule of 72

$$\text{Number of Years Invested} = \frac{72}{\text{Annual Investment Rate}}$$

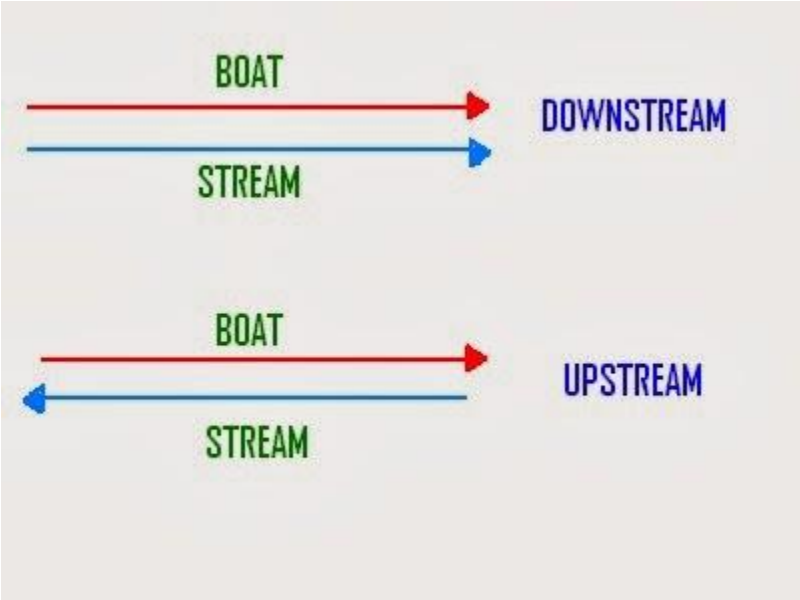
Rule of 72

$$\text{Investment Rate} = \frac{72}{\text{Number of Years Invested}}$$

BOATS & STREAM TRICKS & SHORTCUTS

The two most important and only elements in this type of problems is a BOAT and a STREAM. A stream is nothing but the moving water, which is sometimes also called CURRENT.
In the question, by speed of the boat (or swimmer), we mean the speed of the boat (or swimmer) in still water.
Upstream: When the boat (or swimmer) moves against i.e. in the opposite direction of the stream.

Downstream: when the boat (or swimmer) moves in the same direction as that of the stream.



Now, if the speed of the boat is B km/hr while the speed of the stream is S km/hr, then
Upstream speed U = (B – S) km/hr
Downstream speed D = (B + S) km/hr

If in the question, you are provided with the upstream and the downstream speed U and D respectively, to determine the speed of boat and stream the formula goes like
Speed of boat B = (D + U) / 2
Speed of stream S = (D - U) / 2
Also, always have with you the basic speed formula,

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

Formula 1:

If the ratio of downstream and upstream speeds is D: U, then ratio of time taken will be U : D.

Formula 2:

When a boat's speed in still water is B km/h and stream is flowing with a speed of S km/h and T is the time taken to row to a place and back, then the distance between the two places

$$\text{Distance} = \frac{(B^2 - S^2)T}{2B}$$

Formula 3:

A man rows a certain distance downstream in X hrs and returns the same distance in Y hrs. If the stream flows at the rate of Z km/hr then the speed of the boat in still water is

$$\text{Speed in still water} = \frac{Z\,(X+Y)}{Y-X}$$

Formula 4:

A man rows a certain distance downstream in X hrs and returns the same distance in Y hrs. If the speed of the man in still water is Z km/hr then the speed of the stream will be

$$\text{Speed of the stream} = \frac{Z\,(Y-X)}{X+Y}$$

TRAINS TRICKS & SHORTCUTRS

Introduction

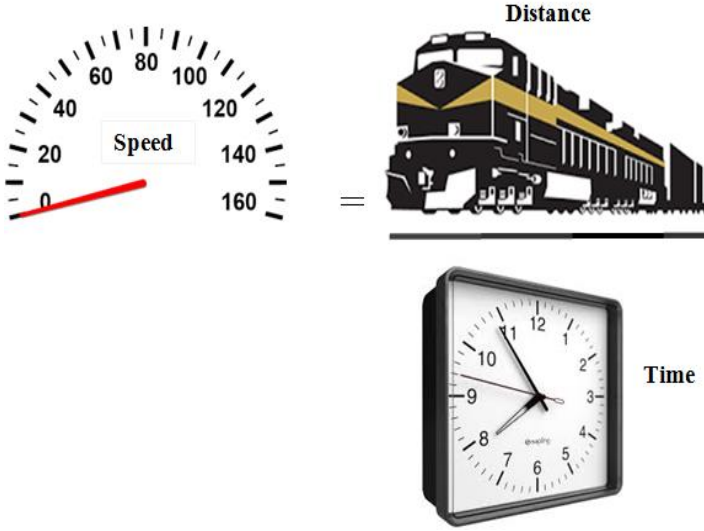
$$\text{Speed} = \frac{Distance}{Time}$$

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

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

A train is said to have crossed an object (stationary or moving) only when the last coach (end) of the train crosses the said object completely. It implies that the total length of the train has crossed the total length of the object.

In case of Train, The Distance covered by the Train = Length of Train + Length of Object You have to keep in mind some Formulae which are given below:



Conversion of km/hr into meter/sec

Following formula is used in this case

$$x\ \text{Km/hr} = \{x \times \frac{5}{18}\}\ \text{m/sec}$$

Conversion of meter/sec into km/h

The formula is:

$$x\ \text{m/sec} = \{x \times \frac{18}{5}\}\ \text{km/hr}$$

We can find the basic formula for the time required for a train to cross different type of objects.

Time to Cross an object moving in the direction of Train

$$= \frac{\textbf{Length of Train} + \textbf{Length of Object}}{\textbf{Speed of Train} - \textbf{Speed of Object}}$$

Length of Train	L_t
Length of Object	l
Speed of Train	V_t
Speed of Object	V
Basic formula can be represented as: $T = \frac{L_t + L}{V_t - V}$	

Different types of Objects

On the basis of various types of objects that a train has to cross, we find the following different cases:

Case	Types of Objects	Formulae of Time to cross*
1	Object is stationary and is of negligible length. e.g. Train crosses pole, lamp post, standing man etc.	$t = \frac{\text{Length of Train}}{\text{Speed of Train}}$
2	Object is stationary and is of some length. e.g. bridge, platform, tunnel, another train etc.	$t = \frac{\text{Length of (Train+Object)}}{\text{Speed of Train}}$
3	Object is moving and is of negligible length. e.g. running car, running man etc.	$t = \frac{\text{Length of Train}}{\text{Speed of (Train}-\text{Object)}}$
4	Object is moving and has some length. e.g. train crosses another running train.	$t = \frac{\text{Length of (Train+Object)}}{\text{Speed of (Train}-\text{Object)}}$
5	If the Object is moving in opposite direction	$t = \frac{\text{Length of (Train+Object)}}{\text{Speed of (Train+Object)}}$

AVERAGE TRICKS & SHORTCUTS

An average, or more accurately an arithmetic mean is, in crude terms, the sum of n different data divided by n.

For example, if a batsman scores 35, 45 and 37 runs in first, second and third innings respectively, then his average runs in 3 innings is equal to (35+45+37)/3 = 39 runs.

Therefore, the two mostly used formulas are:

$$\text{Average} = \frac{Total\ of\ data}{No.of\ data}$$

And, Total = Average × No. of data

RATIO & PROPORTION TRICKS & SHORTCUTS

Ratio and Proportions is another important topic from banking exam point of view; it can come as an individual question and it can also come as a part of data interpretation.

RPs (short for Ratio and Proportions) are easy enough if we could just get the hang of the basic concept. Today my effort will be to revise the basic premise of RPs and tackle some short cut concepts too.

Basic Concepts

1. Ratio

When two numbers are represented in the form of another; this is done by expressing one number as a fraction of another.

Thus, we have **a:b**; where **a** is the **antecedent**, and **b** is the **consequent** (a little general knowledge doesn't hurt even in math!)
Thus when we write 4:16,
it can be re-written as 2:8 and further simplifying it can be said to be 1:4.

Which actually means, the number '4' is 4 times to get the figure 16.
And all of you know, that 1:4 can also be written as ¼.

2. Ratios to percentages:

This 1/4 ratio can be denoted as a percentage too! It's 25% How?

Well, 1/4 x 100 = 25% [$1/4^{th}$ is also known as one quarter, that is one part out of 4 parts.]

2/4 = 1/2 =50%

3/4 = 75%

and, 4/4 = 100%

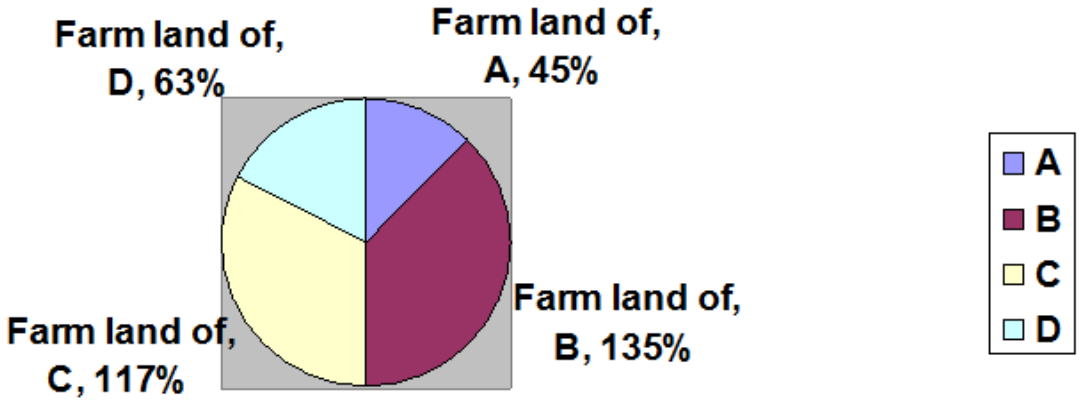
3. Ratios to Degrees:

Supposing, we have A:B:C:D, being four farmers, who have contributed Rs. 25,000, Rs. 75,000, Rs. 65,000 and Rs. 35,000 respectively.

Using all their contributions, they have purchased a land, which surprisingly is circular! (C'mon Math need not be boring!)

They decided that they would all receive a part of the circular land based on their contribution; how will they divide the circular land? So one of them who had completed his class 12, suggested they divide the land on a pie chart model!

Total contribution = Rs. 2,00,000 (25000+75000+65000+35000)
Ratio of contribution = 25000:75000:65000:35000
= 25:75:65:35 (always cancel off the 000s first!)
= 5:15:13:7 (this is our last stage, where no more common factors are possible, where total of the ratios is 40)



We know, if we need A's share, then A's ratio = 5/40,
B's = 15/40,
C's = 13/40 and D's = 7/40.
Total area = 360°, then A's share of the total area/ share of 360° = 360 x 5/40 = 45°
B's share = 360 x 15/40 = 135°
C's share = 360 x 13/40 = 117° and D's = 360x7/40 = 63°

4. Comparing two ratios or fractions:

If you are give two fractions, say 5/3 and 7/8, and we need to find out which fraction is greater than the other what do we do?

We can either calculate their percentages, 5/3x100 = 167% and 7/8x100 = 88% (approx values)
So we know, that 5/3 is the greater fraction!

Another method can be to compare the two fractions. And to compare we have to make their denominators equal.

To make their denominators equal, for the first fraction, we multiply 8 to both the numerator and denominator. Therefore the first fraction = 40/24.

The second fraction, by multiplying 3 to make the second fraction = 21/24.

Obviously 40 is greater than 21!

Hence, 40/24 or 5/3 is greater than 21/24 or 7/8!

5. Proportions

Proportions is where two ratios are compared and equated.

Where **a:b** is a ratio and **c:d** is another ratio, and if they are equal,
then, they can be re-written as **a:b :: c:d**. { the '**::**' sign means 'equal to'}

Therefore, **a:b = c:d**

1:2 :: 7:14 , try out the simplifications!

'a' and 'd' are called extremes as they are in the extreme ends! And 'b' and 'c' are called means as they are in the middle!

6. Properties of proportions

(i) **a:b = c:d**
can be written as a/b = c/d

which implies, axd = bxc, or, ad = bc
this property helps in solving many questions

(ii) if **a:b = b:c**, which means this proportions between three numbers is in the form of

'continued proportions', as all three numbers are having a connection.

so, a/b=b/c or,
ac=bxb or,
$ac=b^2$

PERCENTAGE TRICKS & SHORTCUTS

Playing with Percentages

Technique 1

If out of the total apples 60% are bad, i.e., 100% - 60% = 40% is good.
So, when we are asked the number of good apples, simply do the mental calc (short form of calculation!) and get the figure of 40%, the multiply with the total number of apples say 600, which is :

40 x 600 / 100 = 240 apples

Technique 2

You already know that the '00s in 600 and '00s in 100 get cancelled, then why waste time writing down the entire figure?

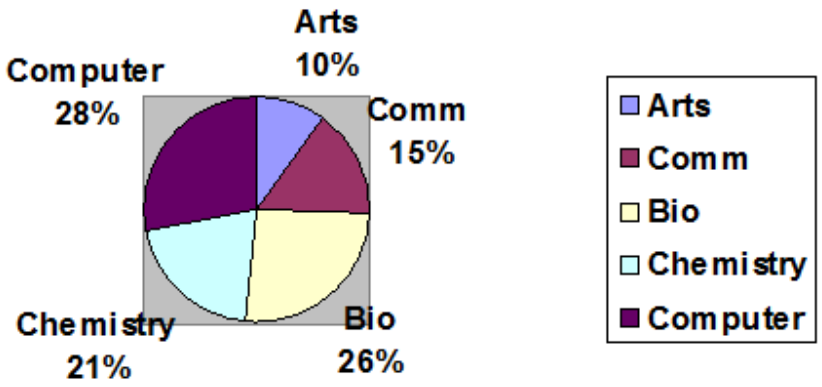
Simply multiply 40 x 6 = 240!

Technique 3

Also, 40% can be written as 0.4 or simply .4 – how?
40/100 is 0.4!

So you can multiply 600 with 0.4 and put the decimal point to get 240!

When I say multiply with 0.4, you should actually multiply with 4, (i.e. 600 x 4), which gives us 2400 and then put a decimal. Gives you 240.



Technique 4

In DI Where the total number of students is given as 1950, and you are asked to find the total of Computer and Bio students, what do you do?

You add up their respective percentages and then find the total figure.

28 + 26 = 54%

54/100 * 1950 = 1053 (I'm showing the complete calculations, but you are to always use the shortcuts!)

If they ask the difference between the number of students in Chemistry and Commerce…then 21 – 15 = 6% and 1950 x 6% =117 students.

If they ask the difference between the number of students studying computer and commerce and chemistry and arts…

We add up the % figures of computer and commerce = 43%,
and of chemistry and arts which is = 31%, and then get their difference = 43-31= 12 %, thus, 12% of 1950 = 234 students.

Please Note: This method can only work when only percentages are given; where ratios are also given the method of calculation will be different. We'll discuss that when doing Ratio's chapter.

Technique 5

Price of commodity! Bank PO's favorite question!

The short cut in these questions is the formulae which is printed in every quantitative aptitude book!

Suppose if the Price of Oranges increases by 5%, then the reduction required in the consumption so as to maintain the original expenditure will be = 5/(100+5) x 100 = 4.76%. Here, reduction can only be calculated in % form as absolute figure is not given, i.e., number of oranges is not given. [formula is R/(100+R) * 100]

Similarly, if the price of oranges decreases by 5%, then the % increase in the consumption so as to maintain the original expenditure = 5/(100-95) x 100 = 5.26% [formula is R/(100+R) *100)
If you are having a problem remembering the formula, then do it this way – the

numerator will always be the percentage number, in our case '5'.

If the price is increasing by '5'%, then in the denominator we add 5 to 100, i.e., 105.
If the price is decreasing by '5'%, then in the denominator we subtract 5 from 100, i.e., 95.

Technique 6

% and Population! Another one of the PO googlies!

Here, just remember one thing…population increase is exactly the same as compound interest! Use the same concept here too…

If the population of a town is, say 20,000 people as of today, and if population

increases at 6% p.a., then what will be the population after 3 year?

Do you see the similarity between this question and a compound interest question?

Except for the semi-annually or quarterly compounding part, every other information can be seen in a similar fashion and that is why their formulae are same too!

Population after 3 years = 20,000 x (1 + 6/100)3 = 23820 approx
Formula being – Population x (1 +R/100)n
where, n is the number of years.

If population is decreasing, we simply remove the '+' sign and put a '–' instead, i.e., Population x (1 – R/100)n

Population increase or decrease in future is called calculation of a 'future value' and hence this formulae, where we multiply with the present population holds true.

But when calculating a past value, we will need to divide the present population by the % increase/decrease for the required number of years.

Thus our formula is, P/ (1+ R/100)n or P/ (1- R/100)n
or increase or decrease in population respectively!

Technique 7

The above mentioned formulae and concepts hold true for depreciation sums as well. Depreciation means, the decrease in an assets value due to wear and tear or usage.

When you purchase a mobile, Nokia Lumia or Samsung Galaxy, and suppose it costs you Rs.15,000 today. You use it for a year, and then you want to sell it, how much will you ask for? Rs.15000? How much will you get? Rs.15000? Surely not!

Why not? The value goes down from 15000, but why?

Because you and the buyer both know that once any asset has been used, it most probably will have some defects (scratched screen, weak battery, and phone getting way too warm).

So, why will you pay the same amount for a defective piece, which you pay for the new phone! But what is the value of the old phone? How to get the proper value of the old phone?

This is where the concept and formula of depreciation (which is similar to the population formulae)

QUADRATIC EQUATION TRICKS & SHORTCUTS

An equation in which the highest power of the variable is 2 is called a quadratic equation.For example, the equation of the type $ax^2+bx+c=0$ denotes a quadratic equation.

There are many ways for solving a quadratic equations but while in exams we need a quick answer
so there is a shortcut method which used for solving a quadratic equations in less time but before let me tell you the most basic and accurate method which is used for it.

Solving Quadratic Equations

When we solved a quadratic expression or equation, it will always gives two values of variable. these values are called **roots of the equation or expression**.

1. By taking square roots or Factor Method
2. By Quadratic Formula

1. Factorization of Quadratic Equation

$$x^2 - 4 = 0$$

$$(x-2)(x+2) = 0$$

$$x - 2 = 0 \quad \text{or} \quad x + 2 = 0$$

$$x = 2 \qquad x = -2$$

Condition for Factorization of a quadratic Equation

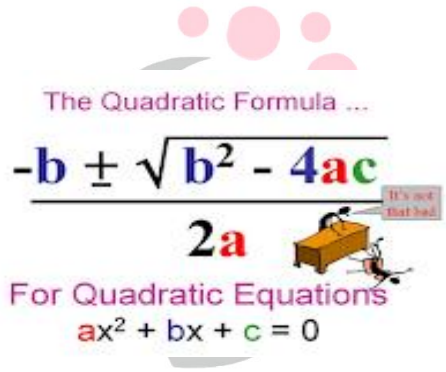
1. If $b^2 - 4ac > 0$, then the quadratic equation can be factorized.
2. If $b^2 - 4ac < 0$, then the quadratic equation cannot be factorized.

some basic formulas which used in while solving through factorization method.

Factoring Formulas

- $a^2 - b^2 = (a-b)(a+b)$
- $a^3 - b^3 = (a-b)(a^2+ab+b^2)$
- $a^3 + b^3 = (a+b)(a^2-ab+b^2)$
- ✔ $a^4 - b^4 = (a-b)(a+b)(a^2+b^2)$
- $a^5 - b^5 = (a-b)(a^4+a^3b+a^2b^2+a$

2. Quadratic Formula



Discriminant of $ax^2+bx+c = 0$ is $D = b^2 - 4ac$ and the two values of x obtained from a quadratic equation are called roots of the equation which denoted by α and β sign.

For a quadratic equations $ax^2+bx+c = 0$

If α,β are the roots of $ax^2 + bx + c = 0$ then

$\alpha = (- b + \sqrt{b^2 - 4ac}) /2a$

$\beta = (- b - \sqrt{b^2 - 4ac}) /2a$.

1. When D = 0 ,Both the roots will be real an equal (a = b) and rational.
2. When D > 0 but not perfect square then the roots will be irrational, unequal and real .
3. When D > 0 and perfect square then the roots will be rational, unequal and real .

4. When D < 0 imaginary roots

Example:

$x^2 - 4x + 3 = 0$; a = 1, b= -4, c = 3

$D = b^2 - 4ac = (-4)2 - 4\times1\times3 = 16-12 = 4 > 0$ and also a perfect square. So, the roots will be distinct rational numbers.

$$\frac{-b \pm \sqrt{D}}{2a} = \frac{-(-4)\pm\sqrt{4}}{2\times1} = \frac{4\pm2}{2} = 2 \pm 1$$

= 3 and 1

(these are distinct rational numbers.)

Formulating a Quadratic Equation

when you have the roots and you need to make a quadratic equation from that roots then formula that is used = x^2 - x (sum of the roots)+product of the roots = 0
Now let you have roots 2 and 3 then the quadratic equation will be using formula(x^2-x(sum of the roots)+product of the roots = 0) is : $x^2 - (2+3)\times x + (3\times2) = 0$; x^2-5x+6 = 0 .

Note:

- A quadratic equation $ax^2 + bx + c = 0$ will have reciprocal roots, if a =c .
- When a quadratic equation $ax^2 + bx + c = 0$ has one root equal to zero, then c = 0.
- When both the roots are equal to zero, b = 0 and c =0.
- When the roots of the quadratic equation ax^2+bx = c are negative reciprocals of each other, then c = -a .
- If they have both the roots common, then $a/a_1 + b/b_1 + c/c_1$.
- The square root of any negative number will be an imaginary number like $\sqrt{-25} = \sqrt{(-1)\times 25} = \sqrt{-1}\times\sqrt{25} = 5i$

Example :

Forming a quadratic equation whose roots are 3 and 5 and verifying them.
the equation will be

x^2 - sum of the roots × x + products of the roots = 0
x^2 - { 3+ (-5)}×x + 3×(-5) = 0
x^2 - (-2)x+(-15) = 0 or x^2 + 2x - 15 = 0
Verification : D = 4+ 60 = 64

$$\text{The roots are } \frac{-2 \pm \sqrt{64}}{2 \times 1} = \frac{-2 \pm 8}{2}$$

$$= -1 \pm 4 = 3 \text{ and } -5$$

AGES TRICKS & SHORTCUTS

The important thing in any kind of Age Problem, is to decide which age – present or past or future – to be taken as 'x'!

- Let us make a **simple rule** for ourselves – the **'x' should be the present age**always.
- In most cases, taking the present age as 'x', i.e., the base year works just fine. Past will become, say (x-5) years, and future can be denoted as (x+5).
- But sometimes, 'present age' is not directly given in words. Then, **take 'x' to be the age you are supposed to find**.
- You can also try putting yourself in someone's place and try to calculate the age!
- Also, sometimes – when nothing works and you're stuck on an age question in the last 4 minutes of the exam – just look at the options and solve it through back calculations! Works just fine!

PERMUTATION & COMBINATION TRICKS & SHORTCUTS

Permutation implies arrangement where order of things is important and includes word formation, number formation, circular permutation etc. **Combination** means selection where order is not important and it involves selection of team, forming geometrical figures, distribution of things etc.

Factorial = Factorial are defined for natural numbers, not for negative numbers.

n! = n.(n-1).(n-2).....3.2.1

For example: 1) 4! = 4.3.2.1 = 24

2) 6!/ 4! = (6.5.4!)/ 4! = 6.5 = 30

3) 0! = 1

PERMUTATION	COMBINATION
Implies Arrangement	Implies Selection
Order of things is important	Order of things is NOT important
Permutation of three things a, b and c taking two at a time are ab, ba, ac, ca,bc and cb (Order is important).	Combination of three things a,b and c taking two at a time are ab, ca and cb (Order is not important).
nPr = n!/ (n-r)!	nCr = n!/ (n-r)! r!

nPn = n!	nCn = 1
nP0 = 1	nC0 = 1

Example of Word Formation:

Example: How many new words can be formed with the word "PATNA"?
Solution: In word "PATNA", P,T,N occurs once and A occurs twice.
****Always remember in word formation, if word repeats, number of repetition will be on denominator.
So, total number of words that can be formed = 5!/ 2! = 60
Therefore, except PATNA there are 59 new words (60-1).

Example: How many words can be formed from the letters of the word "EXAMINATION"?
Solution: E, X, M, T, O : Occurs ONCE
A, I, N : Twice
So, total number of words = 11! / 2! 2! 2!
(Total number of letters=11 and 3 letters are occurring twice)

PROBABILITY TRICKS & SHORTCUTS

1. What is probability?

Probability is the chance of the happening or non-happening of event; denoted by 'P'.

2. What are events and sample space?

Sample space is the total number of occurrences that can happen.

Event is the occurrence of 'something' which we are concerned with.

For example: Jai and Veeru did that coin toss to gamble away their lives – awesome – but it has got an important lesson of probability too.

One coin – what are the possible out comes? – Two, as there can be a Head or a Tail.

Therefore, our **sample space (S)** = 2 = **total number of possible outcomes** (either head or tail).

Say, Veeru wanted Heads – **how many heads is possible in one coin?** – One.
Thus 1 is our **Event (E)!**

3. How to find Probability

Probability is the chance of the occurrence of an event; **[P = E/S]**

Thus, with E = 1, and S = 2,

Probability of Veeru going to die = E/S = ½ = 0.5! [But it was different in the film - I know, I know!]

4. Hold on now! If the chances of Veeru's death is 0.5; what could be the chance of Jai being the one dying?

Again, ½ =0.5! [Think the film makers calculated only this probability!]

5. The 'Non – event'.

Every event has its corresponding **'non-event'**; which can be **denoted as E'**. If the 'event' is happening, then non-event will not happen and vice versa.

If Veeru is going to die (E), then Jai won't (E'); if Jai's (E) going to die then Veeru (E') won't!

Thus, **P(E) + P(E') = 1**

In words, probability of event and probability of a non-event add up to 1.

Therefore, **1- P(E) = P(E'),**
1- P(E') = P(E).

6. AND 'n' OR:

First off – AND is multiplying.
OR is for addition.

If a question is worded like this – 'if the probability of A hitting the target is 1/3 and B hitting the target is ½, what is the probability of **A and B**, **both**, hitting the target if a shot is taken by both.'

which means, P(A) **AND** P(B) = P(A **and** B hitting the target); **P(A) x P(B)**

P(A) x P(B) = 1/6.

Now, if the question was worded - 'if the probability of A hitting the target is 1/3 and B hitting the target is ½, what is the probability of **A or B** hitting the target?'

which means, P(A) **OR** P(B) = P(A **or** B hitting the target); **P(A)** + **P(B)**

P(A) + P(B) = 5/6.

7. Some common sample space(s)!

For Coins	One Coin	Two Coins	Three Coins
Sample Space (S) =	2	2 x 2 = 4	2 x 2 x 2 = 8 and so on…
For Dice	One Dice	Two Die	Three Die
(S) =	6	6 x 6 = 36	6 x 6 x 6 = 216

			and so on…
For Cards	Cards in one suit (Either Spade, Clubs, Hearts or Diamonds)	One Pack of Cards/ Deck = Total number of cards	Face Cards (King, Queen, Jack and Ace) of all the fours suits together
(S)	13	13 x 4 = 52	4 x 4 = 16

8. Concept of Odds:

Sometimes probability is viewed in terms of 'odds for' or 'odds against' an event.

Odds in favour of an event = P(E)/P(E')

Odds against an event,
or,
Odds in favour of the non-event = P(E')/P(E)

… fairly simple, right? All you got to do is calculate the P(E) and the P(E'); then use the above formulae, **if and only if the word 'odds'** is in the question! Otherwise we calculate the normal probabilities as asked in the question.

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