oliveboard

IMPORTANT MATHS SHORT TRICKS/ FORMULAS

For Bank, SSC, Railway and Insurance Exams

NUMBER SYSTEM

Method to multiply 2-digit number.

1. AB × CD = AC {AD + BC} BD
   63*46 = 24 {36 + 12} 18
   Add the middle term = 24 {48} 18
   Keep first term intact, form the middle term by adding 2 numbers also keep the last term same, which means
   2 (4+4) (8+1) 8 = **2898**

Divisibility

Numbers	IF A Number
Divisible by 2	End with 0,2,4,6,8 are divisible by 2
Divisible by 3	Sum of its digits is divisible by 3
Divisible by 4	Last two digit divisible by 4
Divisible by 5	Ends with 0 or 5
Divisible by 6	Divides by Both 2 & 3
Divisible by 8	Last 3 digit divide by 8
Divisible by 10	End with 0
Divisible by 11	[Sum of its digit in odd places-Sum of its digits in even places] = 0 or multiple of 11
Divisible by 12	[The number must be divisible by 3 and 4]
Divisible by 13	[Multiply last digit with 4 and add it to remaining number in given number, result must be divisible by 13]
Divisible by 14	[The number must be divisible by 2 and 7. Because 2 and 7 are prime factors of 14.]
Divisible by 15	[The number should be divisible by 3 and 5. Because 3 and 5 are prime factors of 15.]

Divisible by 16	[The number formed by last four digits in given number must be divisible by 16.]
Divisible by 17	[Multiply last digit with 5 and subtract it from remaining number in given number, result must be divisible by 17]
Divisible by 18	[The number should be divisible by 2 and 9]
Divisible by 19	[Multiply last digit with 2 and add it to remaining number in given number, result must be divisible by 19]
Divisible by 20	[The number formed by last two digits in given number must be divisible by 20.]

Division & Remainder Rules

A very basic formula for division rules is:

dividend = (divisor ✗ quotient) + remainder

or

divisor= [(dividend)-(remainder] / quotient

This could be mathematically written in another way:

⇨ **x = kq + r where (x = dividend, k = divisor, q = quotient, r = remainder).**

Sum Rules:

- Sum of first n natural numbers= n(n+1)/2
- Sum of square of first n natural numbers= n(n+1)(2n+1)/6
- Sum of cubes of first n natural numbers= (n(n+1)/2)^2
- Sum of first n odd numbers= n^2
- Sum of first n even numbers= n(n+1)

Number of divisors:

(i) If N is any no. and N = $a^n \times b^m \times c^p \times \ldots$ where a, b, c is prime no.

(ii) No. of divisors of N = (n + 1) (m + 1) (p + 1) ....

ALGEBRA:

(i) $(a + b)^2 + (a - b)^2 = 2(a^2 + b^2)$

(ii) $(a + b)^2 - (a - b)^2 = 4ab$

(iii) $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

(iv) $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

(v) $a^4 + a^2 + 1 = (a^2 + a + 1)(a^2 - a + 1)$

(vi) If $a + b + c = 0$, then $a^3 + b^3 + c^3 = 3abc$

(vii) $\frac{(a+b)^2-(a-b)^2}{ab} = 4$

(viii) $\frac{(a+b)^2+(a-b)^2}{a^2+b^2} = 2$

(ix) If $a_1x + b_1y = c_1$ and $a_2x + b_2y = c_2$, then

(a) $a_1/a_2 \neq b_1/b_2$, one solution

(b) $a_1/a_2 = b_1/b_2 = c_1/c_2$, infinitely many solution

(c) $a_1/a_2 = b_1/b_2 \neq c_1/c_2$, No Solution

Arithmetic Progression:

If a, a + d, a + 2d, ... are in A.P., then, nth term of A.P. an = a + (n – 1) d
Sum of n terms of this A.P = Sn = n/2 [2a + (n-1) d]
Where: a = first term
d = common difference

Geometric Progression:
(i) G.P. = a, ar, ar^2, ...
Then, nth term of G.P. $a_n = ar^{n-1}$

Sum of n numbers Sn = a (r^n-1)/r-1, For r>1

= a (1 - r^n)/ 1-r, for r<1

AVERAGE:

(i) Average of first n natural no. = (n=1)/2
(ii) Average of first n even no. = (n + 1)
(iii) Average of first n odd no. = n
(iv) Average of sum of square of first n natural no. = (n+1)(2n+1)/6
(v) Average of sum of square of first n even no. = 2 (n+1)(2n+1)/3
(vi) Average of sum of square of first odd no = (4n2 - 1)/3
(vii) If average of some observations is x and a is added in each observation, then new average is (x + a).
(viii) If average of some observations is x and a is subtracted in each observation, then new average is (x – a).
(ix) If average of some observations is x and each observation multiply by a, then new average is ax.
(x) If average of some observations is x and each observation is divided by a, then new average is x/a

RATIO & PROPORTION:

(i) A/k1 = b/K2 = c/K3 ….. then (a+b+c+….)/c = (K1+K2+K3+…)/K3

(ii) A number added or subtracted from a, b, c & d, so that they are in proportion = $\frac{ad-bc}{(a+d)-(b+c)}$

TIME & WORK:

(i) A can-do a/b part of work in t1 days and c/d part of work in t2 days, then $\frac{t_1}{a/b} = \frac{t_2}{c/d}$

(a) If A is K times efficient than B, Then $T(K + 1) = Kt_B$

(b) If A is K times efficient than B and takes t days less than B, then **$T = t/(k-1)$** & **$tb = t/k-1 = Kt_A$**

(iii) If a cistern takes X min to be filled by a pipe but due to a leak, it takes Y extra minutes to be filled, then the time taken by leak to empty the cistern
= $(X^2 + XY)/Y$ min

(iv) If a leak empties a cistern in X hours. A pipe which admits Y litres per hour water into the cistern and now cistern is emptied in Z hours, then capacity of cistern is = (X+Y+Z)/ (Z-X)

(v) If t1 and t2 time taken to travel from A to B and B to A, with speed *a* km/h and *b* km/h, then distance from A to B is

$$d = (t_1 + t_2)\left(\frac{ab}{a+b}\right) \quad \text{or} \quad d = (t_1 - t_2)\left(\frac{ab}{a-b}\right)$$

$$d = (a - b)\left(\frac{t_1 t_2}{t_1 - t_2}\right)$$

PERCENTAGE:

Simple Fraction	Percentage
1	100%
1/2	50%
1/3	33.3%
1/4	25%
1/5	20%
1/6	16.67%
1/7	14.28%
1/8	12.50%
1/9	11.11%
1/10	10.00%
1/11	9.09%
1/12	8.33%

(i) If A is (x% = a/b) more than B, then B is $\frac{a}{a+b}\%$ less than A.

(ii) If A is (x% = a/b) more than B, then B is $\frac{a}{a-b}\%$ more than A.

if a > b, we take a – b

if b > a, we take b – a.

(iii) If price of a article increase from Rs 'a' to Rs 'b', then its expenses decrease by $\left(\frac{b-a}{b} \times 100\right)\%$ that expenditure will be same.

(iv) Due to increase/decrease the price x%, A man purchase *a* kg more in ` y, then Per kg increase or decrease = (XY/100*a)

For 2 Articles, If price:

Ist	IInd	Overall
Increase (x%)	Increase (y%)	Increase $\left(x+y+\frac{xy}{100}\right)\%$
Increase (x%)	Decrease (y%)	$\left(x-y-\frac{xy}{100}\right)\%$ if +ve (increase) if -ve (decrease)
Decrease (x%)	Decrease (y%)	Decrease $\left(x+y-\frac{xy}{100}\right)\%$
Increase (x%)	Decrease (x%)	Decrease ($X^2/100$) %

(v) If the side of a square or radius of a circle is x% increase/decrease, then its area increase/decrease = **$(2X \pm X^2/100)$ %**

(vi) If the side of a square, x% increase/decrease then x% its perimeter and diagonal increase/decrease.

(vii) If population P increase/decrease at r% rate, then after t years population $\boldsymbol{P\left\{\frac{100\pm R}{100}\right\}^t}$

(viii) If a man spends **x%** of this income on food, **y%** of remaining on rent and **z%** of remaining on cloths. If he has ` P remaining, then total income of man is = $\frac{P\times 100^3}{(100-x)(100-y)(100-2)}$

SIMPLE & COMPOUND INTEREST:

If P = Principal, R = Rate per annum, T = Time in years, SI = Simple interest, A = Amount

(i) Simple Interest = PRT/100

(ii) Amount = Principle + Simple Interest = P[1+RT/100]

(iii) If P = Principal, A = Amount in n years, R = rate of interest per annum. Then
A= P $[1+ R/100]^n$, interest payable annually.
For Half-yearly interest R = r/2
For Quarterly interest R = r/4

(iv) CI = Amount – Principal = P $[(1+R/100)^n -1]$

(v) When Rates are different for different years, say R1, R2, R3% for 1st, 2nd & 3rd years respectively, then,
Amount = $P[1+R_1/100] [1+R_2/100] [1+R_3/100]$

Few Tricks for Faster Math Calculations:

1. **Finding square of numbers having 5 unit digit-** Suppose a number 55 is given to you, all you need to do is square the 5 at units place and multiply the number at 10's place with its succeeding number, in this case 6.

   So it makes $(55)^2$ = (5*6)25 = **3025**
   Example**:** (75)2 = (7*8)25 = **5625**

2. **Multiplying a number by 11-** If you must multiply a number by 11, here are few very basic steps that will reduce your calculations to your fingers.

   Example: 23*11 = Take the number 23, put 2&3 at 100's and unit place, 2()3. In the blank in between put the total of units and 100s place, which makes it 2(2+3)3 = **253** which is the answer.

   There is one exception to this condition, when the total of mid term exceeds 10, add the 1 from 10 in the first digit.

Example: 59*11 = 5(5+9)9 = 5(14)9 = (5+1)49 = 649

3. **Division by 5:** If a number is given to be divided by 5, all you need to do is just double the given number and move the decimal point to 1 place left.

   Example – 350/5, multiply 350 by 2 which makes it 700, now move the decimal to 1 place left. Therefore, answer **is 70**

4. **Multiplying a number by 5:** To multiply a number by, it may seem easy for smaller number but when it comes to 3- or 4-digit number you might feel the pain. Don't worry here is a super trick to approach. If you must multiply a number by 5, just divide the given number by 2 and add 0 at the end, in case of decimal move it one step right.

   Example: 124*5. Divide 124 by 2, which makes it 62, now add a zero at the end, which makes **it 620**, and that is your answer.

5. **Multiplying a number by 9:** Suppose you wish to multiply a number by 9. Let take an example, 72*9. All you need to do is add 0 at the end of number other than 9 here it is 72, which makes it 720. Now subtract the original number from 720. The answer becomes **648.**

These are few faster solving techniques and formulas that will help you increase your confidence and efficiency and will reduce your time consumptions.

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