Number system

1. When Sum and Diff of two numbers (X and Y) are given, then

X = (sum + diff)/2
Y = (sum - diff)/2
2. Diff between two digits of two digit number is =

(Diff in original and interchanged number)/9
3. Sum of first n odd numbers i= n^2
4. Sum of first n even numbers= n(n+1)
5. Sum of squares of first n natural no's is = n(n+1)(2n+1)/6
6. Sum of cubes of first n natural numbers is = [n(n+1)/2]^2
7. If the sum of squares of two numbers is x and the square of their diff is y, then the product of the two numbers is [(x-y)/2]

Algebra

1. (a+b)^2 = a^2 + 2ab + b^2
2. (a-b)^2 = a^2 - 2ab + b^2
3. (a+b)^2 = (a-b)^2 + 4ab
4. (a-b)^2 = (a+b)^2 - 4ab
5. (a+b)^3 = a^3+b^3+3ab(a+b)
6. (a-b)^3 = a^3- b^3-3ab(a-b)
7. a^3+b^3 =(a+b) ^3 - 3ab(a+b)
8. a^3- b^3 =(a-b) ^3 + 3ab(a-b)
9. a^2 -b^2 = (a-b)(a+b)
10. a^3 +b^3 = (a+b)(a^2-ab+b^2)
11. a^3 - b^3 = (a-b)(a^2+ab+b^2)
12. a^m x a^n = a^(m+n)
13. a^m / a^n = a^ (m – n)
14. (a/b)^(m / n) =(b/a)^(-m / n)
15. a^m / b^(– n) = a^m x b^n

Ratio and Proportion

1. If four quantities are in proportion, then Product of Means = Product of Extremes.

In the proportion a:b::c:d, we have bc = ad

2. If a:b::c:x, x is called the fourth proportional of a, b, c.
a/b = c/x or, x = bc/a.

3. If two numbers are in a:b ratio and the sum of these numbers is x, then numbers will be ax/ (a+b) and bx/(a+b) respectively

4. If three numbers are in the ratio a:b:c and the sum of these numbers is x, then these numbers will be ax/(a+b+c) , bx/(a+b+c) and cx/(a+b+c) respectively

5. The ratio of two numbers is a : b. If n is added to each of these numbers, the ratio becomes c : d. The two numbers will be given as an(c-d)/(ad-bc) and bn(c-d)/(ad-bc) respectively

6. The ratio of two numbers is a : b. If n is subtracted from each of these numbers, the ratio becomes c : d. The two numbers
are given as an(d-c)/(ad-bc) and bn(d-c)/(ad- bc) respectively

7. If the ratio of two numbers is a: b, then the numbers that should be added to each of the numbers in order to make this ratio c:d is given by (ad-bc)/(c-d)

8. If the ratio of two numbers is a:b, then the number that should be subtracted from each of the numbers in order to make this ratio c:d is given by (bc-ad)/(c-d)

9. The CP of the item that is cheaper is CPcheaper and the CP of the item that is costlier (dearer) is CPDearer. The CP of unit quantity of the final mixture is called the Mean Price and is given by

$$CPmean\ price = CPcheaper - CPmean\ price\ CPmean\ price - CPcheaper$$

Percentage

1. a % of b = a x b/100

2. If A is x% more than B, then B is less than A by
[x /(100+x) * 100]%

3. If A is x% less than B, then B is more than A by
[x /(100-x) * 100]%

4. If A is x% of C and B is y% of C, then A = x/y * B

5. If two numbers are respectively x% and y% more than a third number, then
first number is [(100+x)/(100+y)*100]% of the second number
and
the second number is [(100+y)/(100+x)*100]% of the first number

6. If two numbers are respectively x% and y% less than a third number, then
the first number is [(100-x)/(100-y)*100]% of the second number
and
the second number is [(100-y)/(100-x)*100]% of the first number

7. If the price of a commodity decreases by P %, then the increase in consumption so that the expenditure remains same is [P/(100-P)*100]%

8. If the price of a commodity increases by P%, then the reduction in consumption so that the expenditure remains same is [P/(100+P)*100]%

9. If a number is changed (increased/decreased) successively by x% and y%, then net% change is given by [x+y+(xy/100)]%, which represents increase or decrease in value according as the sign is positive or negative

10. If two parameters A and B are multiplied to get a product and if A is changed by x% and another parameter B is changed by y%, then the net% change in the product (A * B) is given [x+y+(xy/100)]%

11. In an examination, the minimum pass percentage is x%. If a student secures y marks and fails by z marks, then the maximum marks in the examination is 100(y+z)/x

12. If the present population of a town (or value of an item) be P and the population (or value of item) changes at r% per annum, then population (or value of item) after n years = P(1+r/100)^n

and the Population (or value of item) n years ago = P/(1+r/100)^n

13. If a number A is increased successively by x% followed by y% and then by z%, then the final value of A will be
A(1+x/100) (1+y/100) (1+z/100)

Averages and Mixtures

1. Average = Sum of quantities/ Number of quantities
2. Sum of quantities = Average * Number of quantities
3. The average of first n natural numbers is (n +1)/2
4. The average of the squares of first n natural numbers is (n +1)(2n+1)/6
5. The average of cubes of first n natural numbers is n(n +1)^2/4
6. The average of first n odd numbers is given by (last odd number +1)/2
7. The average of first n even numbers is given by (last even number + 2)/2
8. The average of first n consecutive odd numbers is n
9. The average of squares of first n consecutive even numbers is 2(n+1)(2n+1)/3
10. The average of squares of consecutive even numbers till n is (n+1)(n+2)/3
11. The average of squares of squares of consecutive odd numbers till n is n(n+2)/ 3.
12. If the average of n consecutive numbers is m, then the difference between the smallest and the largest number is 2(m-1)

13. If the number of quantities in two groups be n1 and n2 and their average is x and y respectively, the combined average is (n1x +n2y)/(n1 + n2)

14. The average of n quantities is equal to x. When a quantity is removed, the average becomes y. The value of the removed quantity is n(x-y) + y

15. The average of n quantities is equal to x. When a quantity is added, the average becomes y. The value of the new quantity is n(y-x) + y

Profit and Loss

1. Gain = SP- CP
2. Loss = CP- SP
3. Gain on Rs. 100 is Gain per cent
4. Gain% = (Gain * 100)/CP
5. Loss on Rs. 100 is Loss per cent
6. Loss% = (Loss * 100)/CP
7. When the Cost Price and Gain per cent are given:
SP = [(100+Gain %)/100] x CP

8. When the Cost Price and Loss per cent are given:
SP = [(100-Loss %)/100] x CP

9. When the Selling Price and Gain per cent are given:
CP = [100/(100+Gain %)] x SP

10. When the Selling Price and Loss per cent are given:
CP = [100/(100-Loss %)] x SP

11. When p articles are sold at the cost of q similar articles, the Profit/Loss % = [(q-p)/p]x100

12. If two articles are sold at the same price with a profit of x % on one and a loss of x % on the other, the net loss % = (x^2/100)%

13. If two articles bought at the same price are sold with a profit of x % on one and a loss of x % on the other, then overall there will be No Profit No Loss

Simple and Compound Interest

1. Simple Interest, SI = PTR/100
2. Principal, P = 100 * SI/RT
3. Rate, R = 100 * SI/PT
4. Time, T = 100 * SI/RP
5. Amount, A = P + SI = P + (PTR)/100
6. If a certain sum of money becomes n times itself at R% p.a. simple interest in T years, then T = [(n-1)/R] * 100 years

7. If a certain sum of money becomes n times itself in T years at a simple interest, then the time t in which it will become m times itself is given by t = (m-1/n-1) * T years

8. If a certain sum of money P lent out at SI amounts to A1 in T1 years and to A2 in T2 years, then
P = (A1*T2-A2*T1)/(T2-T1)
R = (A1 – A2)/(A1*T2 - A2*T1) * 100%

9. If a certain sum of money P lent out for a certain time T amounts to A1 at R1% per annum and to A2 at R2% per annum, then
P = (A2*R1-A1*R2)/(R1-R2)
T = (A1-A2)/(A2*R1-A1*R2)* 100 years

10. Compound Interest, CI = $P\ (1+ R/100)\text{^}\ n - P$
= $P\ [(1+ R/100)\text{^}\ n - 1]$

11. Amount, A = $P\ (1+ R/100)\text{^}\ n$,
if interest is payable annually

12. Amount, A = $P\ (1+ R'/100)\text{^}\ n'$,
R'= R/2, n' = 2n; if interest is payable half-yearly

13. Amount, A =$P\ (1+ R''/100)\text{^}\ n''$,
R''= R/4, n'' = 4n; if interest is payable quarterly

14. When time is fraction of a year, say 4 $3/4$ years, then Amount,
A = $P\ (1+ R100)\text{^}\ 4\times\ (1+ (3/4)\ *R/100\ )$

15. When Rates are different for different years, say, R1, R2, R3 for
1st , 2nd & 3rd years respectively, then, Amount =
$P\ (1+ R1/100)\ (1+ R2/100)\ (1+ R3/100\ )$

16. In general, interest is considered to be Simple unless otherwise stated.

Time and Work

1. If 1/n of a work is done by A in one day, then A will take n days to complete the full work.

2. If A can do a piece do a piece of work in X days and B can do the same work in Y days, then both of them working together will do the same work in XY/(X+Y) days

3. If A, B and C, while working alone, can complete a work in X, Y and Z days respectively, then they will together complete the work in XYZ/(XY+YZ+ZX) days

4. If A does 1/nth of a work in m hours, then to complete the full work A will take n/m hours.

5. If A and B can together finish a piece of work in X days, B and C in Y days and C and A in Z days, then
a) A, B and C working together will finish the job in (2XYZ/XY+YZ+ZX) days.
b) A alone will finish the job in (2XYZ/XY+YZ- ZX) days.
c) B alone will finish the job in (2XYZ/ZX+XY- YZ) days.
d) C alone will finish the job in (2XYZ/ZX+YZ- XY) days.

6. If A can finish a work in X days and B is k times efficient than A, then the time taken by both A and B working together to complete the work is X/(1+k).

7. If A and B working together can finish a work in X days and B is k times efficient than A, then the time taken by A working alone to complete the work is (k+1)X and B working alone to complete the work is (k+1/k)X.

Time and Distance

1. 1 Kmph = (5/18) m/s
2. 1 m/s = (18/5) Kmph
3. Speed(S) = Distance(d)/Time(t)
4. Average Speed = Total distance/Total Time = (d1+d2)/(t1+t2)
5. When d1 = d2 , Average speed = 2*S1*S2/(S1+S2), where S1 and S2 are the speeds for covering d1 and d2 respectively
6. When t1 = t2 , Average speed = (S1+S2)/2, where S1 and S2 are the speeds during t1 and t2 respectively
7. Relative speed when moving in opposite direction is S1 +S2

8. Relative speed when moving in same direction is S1 - S2

9. A person goes certain distance (A to B) at a speed of S1 kmph and returns back (B to A) at a speed of S2 kmph. If he takes T hours in all, the distance between A and B is T(S1*S2/S1+S2)

10. When two trains of lengths l1 and l2 respectively travelling at the speeds of s1 and s2 respectively cross each other in time t, then the equation is given as
s1+s2 = (l1+l2)/t

11. When a train of lengths l1 travelling at a speed s1 overtakes another train of length l2 travelling at speed s2 in time t, then the equation is given as
s1 - s2 = (l1+l2)/t

12. When a train of lengths l1 travelling at a speed s1 crosses a platform/bridge/tunnel of length l2 in time t, then the equation is given as
s1 = (l1+l2)/t

13. When a train of lengths l travelling at a speed s crosses a pole/pillar/flag post in time t, then the equation is given as s = l/t

14. If two persons A and B start at the same time from two points P and Q towards each other and after crossing they take T1 and T2 hours in reaching Q and P respectively, then
(A's speed)/(B's speed) =(T2/ T1)^0.5

Mensuration

Circle:

1. Diameter, D = 2R
2. Area = π*R^2 sq. units
3. Circumference = 2 π R units

Square:

4. Area = a^2 sq. units
5. Perimeter = 4a units
6. Diagonal, d = 2 a units

Rectangle:

7. Area = L * B sq. units
8. Perimeter = 2(L+B) units
9. Diagonal, d = $(L\text{^}2 + B\text{^}2)\text{^}0.5$ units

Scalene Triangle:

10. Area = $[s\ (s - a)\ (s - b)\ (s - c)]\text{^}0.5$ sq. units ; s=a+b+c/2
11. Perimeter = (a+b+c) units

Isosceles Triangle:

12. Area = $b/4\ (4a\text{^}2 - b\text{^}2)\text{^}0.5$ sq units
13. Perimeter = 2a + b units

b = base length; a = equal side length

Equilateral Triangle:

14. Area = ¾ $a\text{^}2$ sq. units
15. Perimeter = 3a units ;a = side of the triangle

Right-angled triangle:

16. Area = (½)bxh sq. units
17. Perimeter = b + h + hypotenuse
18. Hypotenuse = $(b\text{^}2 + h\text{^}2)\text{^}0.5$ units

Cuboid:

19. Volume = (Cross section area * height) = L * B * H cubic units
20. Lateral Surface Area (LSA) = 2[(L+B)H] sq. units
21. Total surface area (TSA) = 2(LB+BH+HL) sq. units
22. Length of the diagonals = (L^2+B^2+H^2)^0.5

Cube:

23. Volume = a^3 cubic units
24. Lateral Surface Area (LSA) = 4 a^2 sq. units
25. Total Surface Area (TSA) = 6a^2 sq. units
26. Length of diagonal = a √ 3 units

Sphere:

27. Volume = (4/3) π R^3 cubic units
28. Surface Area = 4 π R^2 sq. units
29. If R and r are the external and internal radii of a spherical shell, then its Volume = 4/3[R^3-r^3] cubic units

Hemisphere:

30. Volume = (2/3)π R^3 cubic units
31. TSA = 3 π R^2 sq. units

Cylinder:

32. Volume = π *R^2 *h cubic units
33. Curved surface Area (CSA) (excludes the areas of the top and bottom circular regions) = 2 π Rh sq. units
34. TSA = Curved Surface Area + Areas of the top and bottom circular regions = 2 π R*H + 2 π R^2=2 π R[R+h] sq. units

Cone:

35. Volume = (1/3) π R^2*h cubic Units)
36. Slant Height of cone
L = (R^2+H^2) ^0.5
37. CSA = π RL sq. units
38. TSA = π R(R + L) sq. units