CSAT Formula and Methods

Contents

Comprehension

Highlight keywords for fast reading
Find extreme words in passage: options are framed from these.
Read all the options first, and passage later
Use **elimination technique** in all the passages.
Answer must be based only on the passage. Do not use GS knowledge.
Use **two colour pen or use one highlighter**

Number System

Face value face value of a digit is equal tom the digit itself.

In 3452, face value of '4' is 'four'

Place value (or local value) the place value of the digit is multiplied by the place.

In 3876, place value of 8 is 8 x 100 = 800.

Type of Numbers

1. Natural numbers (*N*) If N is the set of natural numbers, then $N = \{1, 2, 3, 4, 5, 6, ...\}$. The smallest natural number is 1. **Zero not included.**

2. Whole numbers (*W*) If we include 0 among the natural numbers, $0, 1, 2, 3, ...$ i.e. W = {0, 1, 2, 3, 4, 5,...}.

Integers (I): If I is the set of integers, then I = {-3, -2, -1, 0, 1, 2, 3, ...}

Rational Numbers: Any number which **can be expressed in fractions** or in the form of p/q, where p and q are both integers and q # 0. **Eg. integers, fractions.**

Irrational Numbers: number which cannot be expressed in fractions. Eg. $\sqrt{3}$, π.

Any number added to an irrational number will remain irrational.

Real numbers: these include both rational and irrational numbers.

Sum of first n natural numbers i.e $1+2+3+4+....+n = \frac{n(n+1)}{2}$

Sum of the squares of first n natural numbers i.e $1^2+2^2+3^2+4^2+....+n^2 = \frac{n(n+1)(2n+1)}{6}$

Sum of the squares of first n natural numbers i.e $1^3+2^3+3^3+....+n^3 = \left[\frac{n(n+1)}{2}\right]^2$

Prime number: Number which are divisible by one and itself only are called prime numbers.

The primes from 1 to 100 are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97.

(i) All Prime numbers are positive.
(ii) Zero is not a prime number.
(iii) 1 is not a Prime number, as it has only one factor itself.
(iv) 2 is the only even prime number

Test for a number (P) whether it is Prime or not

(a) Find a whole numbers x such that $x > \sqrt{P}$.
(b) Take all the prime numbers less than or equal to x.
(c) If none of these divides p exactly then P is prime, otherwise P is not prime.

e.g. find whether 193 is a prime number or not.

$14 > \sqrt{193}$ Prime number upto 14 are 2,3,5,7,11, 13. None of these divides 193. Hence, 193 is a Prime number.

Which of the following number completely divides $(15^{14} - 1)$?

(a) 12 (b) 13 (c) 14 (d) 15

When 2^{256} is divided by 17, the remainder would be

(a) 1 (b) 14 (c) 16 (d) none of these

$\because (2^4)^{64} = (16)^{64}$

Finding the Unit's Place Digit in the Product of Numbers

If there is a ten's place digit in the product, then take only unit's place digit of that number and continue the process of multiplication.

e.g. Unit's place digit in $54\times18\times145\times339$ = Unit's place digit in $4\times8\times5\times9$ = Unit's place digit in 32×45 = Unit place digit in 2×5 = Unit's place digit in $10=0$

Unit's Place of a Number in Index Form

• The **unit's place digit to exponential** $0, 1, 5, 6$ **are** $0, 1, 5$ **and** 6, respectively.

Eg. $(3046596)^{243}$, unit's place digit $=6$.

• The **Unit's place digit of exponential 4 and 9 are 4 and 9,** respectively for odd powers and 6 and 1, respectively for even powers.

Like $(404969)^{241}$, unit's place digit is 9, as 241 is odd.

• The **unit's place digit of exponential of numbers** $2, 3, 7$ **and** 8 are calculated by **dividing the powers by 4 and taking remainder as new power.**

Like $(134967)^{550} \Rightarrow 550\div4$ remainder $=2$.   Then, $(134967)^{2} \Rightarrow (7)^{2}=49$

So, unit's place digit is 9.

• If **remainder is zero, then take 4 as the new exponential power** of the number instead of zero.

Like $(134647)^{552} \Rightarrow 552\div4 \Rightarrow$ remainder $=0$

Then, $(134647)^{0} \equiv (134647)^{4} \equiv (7)^{4} = 2401$. So, unit's place digit is 1.

unit's place digit in $(a)^4$, = unit's place digit in $(a)^{4n}$.

unit's place digit in $(3)^4$, = unit's place digit in $(3)^{4n}=1$.

Q. unit's place digit in $(3)^{65}$ = … ?

Rules of Divisibility

By 2 - last digit to be divisible by 2

By 3 - Sum of digits divisible by 3

By 4 - Last two digits divisible by 4.

By 5 - 0, 5

By 6 - divisible by both 2 and 3

By 7: multiplied the last digit by 2. Subtracted with the rest of the number leaving the last digit. If the difference is 0 or a multiple of 7, then it is divisible by 7.

Eg. 658. → 65 – 8*2 = 65 – 16 = 49

By 8 - Last three digits divisible by 8.

By 9 - Sum of digits divisible by 9

By 11 - even odd rule. Eg 30415

Fractions

The fractions in which the number in numerator is less than that of denominator, are called **proper fractions.**

If the number in numerator is greater than that of denominator, then the fractions are called **improper fractions.**

Terminating and Non-Terminating Recurring Decimals Fractions

If decimal expression of the fraction is terminated, then fraction is called terminating.

As, $\frac{5}{16} = 0.3125$

Now, if we take example 33/26 then

$\because \frac{33}{26} = 1.2692307692307$ ....

$\because \frac{33}{26} = 1.2\overline{692307}$.

The fraction is non-terminating.

Convert Non- terminating Recurring Decimals into Simple Fractions

To convert it into simple fraction we will put as many 9 in denominator as in decimal. $0.3 = \frac{3}{9} = \frac{1}{3}$

(a) $2.00\overline{72} = 2 + 0.00\overline{72} = 2 + \frac{72-00}{9900} = 2 + \frac{72}{990} = 2 + \frac{2}{275} = 2\frac{2}{275}$

If one digit recurring, find 10x – x
If two digits recurring, find 100x – x

LCM and HCF

Factors

Any composite number N, which can be expressed as $N = x^a X y^b X z^c X$…

Where x, y and z are different Prime Factors of N and a, b, c are positive integers.

Least Common Multiple (LCM)

The least common multiple of given numbers is the least number which is exactly divisible by each one of them. E.g. 42 is the least common multiple of 2, 3 and 7.

Methods of finding LCM: By factorisation, By division method

Applications of LCM

(i) If some **bells ring after different time interval,** then time after which they will ring together = LCM of the different time interval.

(ii) If some **people run around a circular path taking different time,** then time after which they meet at a point = LCM of different time taken by them.

Highest Common Factor (HCF)

The highest common factor of two or more numbers is the greatest number which divides each of them exactly.

e.g. HCF of the number 18 and 24 is 6.

It is also Known as Greatest Common Divisor (GCD).

Methods of Finding HCF: By Long Division Method, By Prime Factorisation

Properties of LCM and HCF

The least number which is exactly divisible by a, b and c is the LCM of a, b and c.

Product of two numbers = LCM * HCF

HCF of given numbers must be a factor of their LCM.

(i) HCF of a fraction = HCF of numerator / LCM of denominators

(ii) LCM of a fraction = LCM of numerator / HCF of denominators

Average

The average is a measure is of the central tendency of a set of numbers.

Let $x_1, x_2, x_3, \ldots, x_n$ be the set of n observations, then Averages = $x_1, x_2, x_3, \ldots, x_n$ / n

Ratio: A to B ratio is a:b or a/b. First term is **antecedent. Second term is consequent.**

Proportion??

Percentage

1. Percentage increase = $\frac{\text{increase}}{Original\ value} x\ 100$
2. Percentage decrease = $\frac{\text{decrease}}{Original\ value} x\ 100$
3. If the price of the commodity increases by r% then the reduction in consumption so as not to increase the expenditure is $\left[\frac{r}{100+r} x\ 100\right]\%$
4. If the price of the commodity decreases by r% then the reduction in consumption so as not to increase the expenditure is $\left[\frac{r}{100-r} x\ 100\right]\%$
5. If A's income is r% more than B's income then B's income is less than A's income by $\left[\frac{r}{100+r} x\ 100\right]\%$
6. If A's in income is r% less than B's income then B's Income is more than A's income by $\left[\frac{r}{100-r} x\ 100\right]\%$

Profit and Loss

CP = Cost Prices, SP = Selling Price.

Profit and loss formulas	
Gain = SP - CP	CP = 100 * SP / (100 + Gain %)
Loss = CP - SP	CP = 100 * SP / (100 - Loss %)
Gain % = Gain * 100 / CP	SP = Market price - Discount
Loss % = Loss * 100 / CP	Discount % = Discount * 100 / Market Price
SP = (100 + Gain %) / 100 * CP	
SP = (100 - Loss %) / 100 * CP	

Time and work

If A can do a piece of work in n days, then work done by A in 1 day is 1/n.

[or a pipe fills a cistern or reservoir in n days]

If A's 1 day's work = 1/n, then A can finish the whole work in n days.

If A is thrice **efficient** as a workman then B, then ratio of work done by A and B = 3 : 1.

If two persons A and B can individually do some work in a and b days respectively, then A and B together can complete the same work in ab (a + b) days.

Speed, Time and Distance

Distance = Speed x Time

To convert speed of an object **from m/s to km/h: multiply the speed by 18/5**

Average speed = Total distance covered / Total time of journeys

Average Speed

If a certain distance is covered at a speed of x km/h and the same distance is covered at a speed of y km/h then average speed during the entire journey is $\left(\frac{2xy}{x+y}\right)$ km/h

If a person or a motor car covers three equal distances at the speed of x km/h, y km/h and z km/h respectively, then for the entire journey average speed of the person or motor car is $\left(\frac{3xyz}{xy+yz+zx}\right)$ km/h.

Relative Speed

When two objects are moving in the same directions with x km/h and y km/h respectively then

Relative Speed = (x - y) km/h

When two objects are moving in the opposite directions with x km/h and y km/h respectively then

Relative Speed = (x + y) km/h

Boats and Streams

Downstream and upstream speed Let the speed of the boat in still water be x km/h and speed of the stream be y km/h. Then,

Speed of Boat with stream = Downstream speed = (x + y) km/h

Speed of Boat against stream = upstream speed = (x – y) km/h

Problems of trains

Train vs Stationary object of no length

Speed of the train = length of the train / time taken to cross the stationary object

Train vs Stationary object of certain length

Speed of the train = (length of the train + length of the stationary object) / Time taken to cross the stationary object

Simple and Compound Interest

Simple interest SI = (P x R x T) / 100

Amount after T years = A = P + SI = P $\left(1+\frac{RT}{100}\right)$

Compound interest

Amount after T years = A = P + CI = $P\ \left(1+\frac{R}{100}\right)^T$

CI = $P\ \left(1+\frac{R}{100}\right)^T - P\ =\ P\left[\left(1+\frac{R}{100}\right)^T - 1\right]$

If interest rates are different for different years (R1, R2, R3)

$$A = P\left(1+\frac{R_1}{100}\right)\left(1+\frac{R_2}{100}\right)\left(1+\frac{R_3}{100}\right)$$

When time period T is given in fraction i.e., $T =\ N\frac{a}{b}yr$, then compound interest is calculated as

A = P $\left(1+\frac{R}{100}\right)^n.\left(1+\frac{a}{b}.\frac{R}{100}\right)$

For half yearly, R → R/2, and T → 2T and so on.

Permutation and Combination

Permutation and combination are way for the arrangement or selection of a group of persons / objects / numbers etc.

Permutation is an act of rearranging all the members of a set into same sequence or order. It is one of the different arrangements of a group of items where **order / sequence / way matters.**

Combinations is a way of selecting members from the group such that the **order of selection doesn't matter.**

Fundamental Principle of Multiplication

In two jobs, if one can be completed in **m ways;** and second job can be completed in **n ways**

Then the **two jobs in succession can be completed in m x n ways.**

e.g If there are 4 ways in which a person can go from X to Y and 7 ways in which he can go from Y to Z, then possible ways to go from X to Z = 4 x 7 = 28 ways.

Fundamental Principle of Addition

If there are **two jobs such that they can be performed independently in m and n ways** respectively then either of the two jobs can be **performed in (m + n) ways.**

Permutation

By Permutation we mean an arrangement of objects in a particular order. e.g. If there are three are three objects a, b and c, then permutation of these objects, taking two at a time are 6 i.e. ab, bc, ac, ba, cb and ca. These six arrangements are called permutations of three things taken two at a time.

Types of Permutation

1. Linear Permutation

If the things are arranged in a line, then a Permutation is called **linear Permutation, or simply permutation.**

Number of Permutations of n dissimilar things taken r at a time is ^nP_r.

$^nP_r = n\,(n-1)\,(n-2)\,\ldots\,(n-r-1) = \frac{n!}{(n-r)!}$

where n! is the product of the first n natural numbers and called ' n- factorial ' or 'factorial n' denoted by n! or $\lfloor n$.

e.g. 5! = 5 x 4 x 3 x 2 x 1 = 120

n! is defined only for positive integers. We define 0! = 1 n! = n. (n - 1)!

• Numbers of permutations of n dissimilar things taken all at a time is ^np_n.

$$^np_n = \frac{n!}{(n-n)} = n!$$

e.g. The number of permutations of 3 dissimilar things taken all at a time is $^3p_3 = \frac{3!}{(3-3)!} = 3! = 3\times2\times1 = 6$

• Number of permutations of n different things, taken r at a time, when a particular thing is to be always included in each arrangement thing is to be always included in each arrangement $= r\cdot{}^{n-1}P_{r-1}$

e.g. A team of 3 players is to be formed from 8 boys in which one boy is always included, then possible arrangement is

$$3\cdot{}^{8-1}P_{3-1} = 3\times{}^7P_2$$
$$= 3\times7\times6 = 126$$

• Number of permutations of n different things taken all at a time, when m specified things always come together is $m!\times(n-m+1)!$.

e.g. the total ways in which the letters of word 'DISCOVER' can be arranged in which all vowels are always together is $3!\times(8-3+1)!$ i.e. $3!\times6!$ (because there are 3 vowels)

• The number of arrangement that can be formed using n things out of which p are identical and of one using n things out of which p are identical and of one kind q are identical are of another kind, r of them are allke and of third kind and rest are all different, is given by $\frac{n!}{p!q!r!}$ e.g. The number of permutations that can be made using all the letters of the word 'MANORAMA' is $\frac{\lfloor 8}{\lfloor 2\cdot\lfloor 3}$. (since, the given word contains 8 letters of which there are 2M's, 3A's and three different letters.)

Without repetition

The number of permutations of n different things taken r at a time is denoted by ^nP_r or P (n, r)

Where $^nP_r = \frac{n!}{(n-r)!}\,(1 \le r \le n)$

2. Circular Permutation

If the things are arranged around a circle.

In circular Permutation, there is no first or last place of an object.

The **number of circular permutations** of **n different things** taken all at a time around a circle in **(n – 1)!**

Combination

Each of the groups or selections that can be made by taking some or all of the things **without considering the arrangement** is called a **combination.**

e.g. the different **combinations** formed of **three letters A, B, C taken two at a time are AB, AC, BC.**

Without repetition the number of combinations of **n dissimilar things taken r at a time is ^nC_r.**

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

e.g. The number of selection of 6 dissimilar things taken 4 at a time is $^6C_4 = \frac{6!}{4!\,2!}$

Probability

Probability is just the chance of happening of an event. Likelihood of a given event's occurrence is expressed as a number between 1 and 0.

$$\therefore \text{Probability of happening of an event} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

Important Terms

- **Experiment** An action which results in some well-defined outcomes.
- **Random experiment** A random experiment is an experiment or a process for which the outcome cannot be predicted with certainty.

e.g. When a die is thrown, it is trial, getting a number 1 or 2 or 3 or 4 or 5 or 6 is an event.

- **Sample space** A sample space (S) of an experiment is the set of all possible outcomes of that experiment.

e.g. If we throw a die, then sample space, $S = \{1, 2, 3, 4, 5, 6\}$

- **Event** It is a single result of an experiment.
- **Equally likely events** e.g When a die is thrown any number 1 or 2 or 3 or 4 or 5 or 6 may occur. The six events are equally likely.
- **Exhaustive events** A set of events is said to be exhaustive, if one of them must necessarily happen every time the experiment is performed.

e.g. When a die is thrown, there are six exhaustive events.

- **Mutually exclusive events** If the occurrence of anyone of the events in a trial prevents the occurrence of others,

e.g. When a die is thrown, the event of getting faces numbered 1 to 6 are mutually exclusive events.

Classical Definition of Probability

If in random experiment, there are n mutually exclusive and equally likely elementary events in which m elementary events are favourable to a particular event E, then the probability of the event E is defined as

$$P(E) = \frac{\text{Favourable events}}{\text{Total number of events}} = \frac{n(E)}{n(S)} = \frac{m}{n}$$

What is the probability of getting an even number in single throw of a die?

Sol. (b) Total outcome that can arise in a throw of a single die $= 1, 2, 3, 4, 5, 6$

$n(S) = 6$

Now, total outcomes in which the number appeared on face is even = 2, 4, 6

$n(E) = 3$

$\therefore$ Required probability $P(E)\frac{n(E)}{n(S)}=\frac{3}{6}=\frac{1}{2}$

3 digits are chosen at random from 1, 2, 3, 4, 5, 6, 7, 8, and 9 without repeating any digit. What is the probability that their product is add?

Sol. (c) Every digit must be odd, if their product is odd. The ways of selecting 3 odd digits out of 5. $^5C_3=\frac{5\times4\times3}{2}$

The ways of selecting 3 odd digit out of 9. $^9C_3=\frac{9\times8\times7}{2}$

$\therefore$ Probability $=\frac{5\times4\times3}{9\times8\times7}=\frac{5}{42}$

Complement of an Event

(Non-occurrence of an Event)

The complement of an event A is the set of all outcomes in the sample space that are not included in the outcomes of event, the complement of an event A is represented by A.

i.e. $P(\bar{A})=1-P(A)\Rightarrow P(A)+P(\bar{A})=1$

e.g. Probability of getting an odd number in a throw of die is ½.

The complement of it i.e. probability of not getting an odd number is 1 – ½ = ½

Addition Rule of Probability

When two events A and B are mutually exclusive, the probability that A or B will occur, is the sum of the probability of each event.

$$P(A \text{ or } B) = P(A) + P(B)$$

$$P(A \cup B) = P(A) + P(B)$$

But when two events A and B are non-mutually exclusive, then the probability that A or B will occur, is

$$P(A \text{ or } B) = P(A) + P(B)-P(A \,\text{or}\, B)$$

$$P(A \cup B) = P(A) + P(B)-P(A\cap B)$$

Odds of an Events

Suppose, there are m outcomes favourable to a certain event and n outcomes unfavourable to the event in a sample space, then Odds in favour of the event.

$$=\frac{\text{Number of favourable outcomes}}{\text{Number of unfavourable outcomes}}=\frac{m}{n}$$

and odds against the events

$$=\frac{\text{Number of unfavourable outcomes}}{\text{Number of favourable outcomes}}=\frac{n}{m}$$

Also, probability of happening of an event $=\frac{m}{m+n}$

and probability of not happening of an event $=\frac{m}{m+n}$

Sets and functions

Venn diagram

Calendar

Odd Days: The number of days more than the complete weeks for a given period called odd days.

Ordinary Year: An ordinary year has 365 days and an ordinary year is not a leap year. It has one odd day.

Leap Year: Divisible by 4 and 400 rule.

1 ordinary year = 365 days = (52 weeks + 1 day) *p* 1 ordinary year = 1 odd day

1 leap year 366 days = (52 weeks + 2 days) = 1 leap year = 2 odd days

100 yr = 76 ordinary years + 24 leap years = (76 x 1 + 24 x 2) odd days = 124 odd days = (17 weeks + 5 days) = S odd days

200 yr = (5 x 2) = 10 odd days = (1 week + 3 days) = 3 odd day

300 yr = (5 x 3) = 15 odd days = (2 weeks + 1 day) = 1 odd days

400 yr = (5 x 4 + 1) = 21 odd days = (3 weeks + 0 day) 0 odd days

Today's Day

29 September 2020

19 - 4 leap year 15 normal = 23 odd days

31+29+31+30+31+30+31+31+29

273/7= 0 odd days

Overall - 23/7 =2 odd days

0 - Sunday

2 - Tuesday

Clock and Calendar

Clock

The clock has two hands, the hour hand and the minute hand.

Some facts about clock

• In one hour, both the hands coincide once.

• In one hour, the hands are straight (point in opposite directions) once i.e. they make angle of 180°.

• In one hour, the hands are twice perpendicular to each other.

• In 60 min, the minute hand covers 360°. Thus, in 1 min the minute hand covers = 6°.

• In 12h, the hour hand covers 360° and in 1h, the hour hand covers 30°.

• When the two hands are at right angles, then they are15 min spaces apart.

• When the two hands are in opposite directions, then they are 30 min spaces apart.

• Tn 60 min, the minute hand gains 55 min on the hour hand.

• The minute hand moves 12 times as fast as the hour hand.

Faulty clock

The minute hand of a clock overtakes the hour hand at intervals of M min of correct time. The clock gains or loses in a day by $\left(\frac{720}{11}-M\right)\left(\frac{60\times24}{65}\right)$ min.

e.g. If the minute hand of a clock overtakes the hour hand at intervals of 65 min. The time gained or lost by clock is given by

$$\left(\frac{720}{11}-M\right)\left(\frac{60\times24}{65}\right)$$

$$=\left(\frac{720}{11}-65\right)\left(\frac{60\times24}{65}\right)=10\frac{10}{143}\text{min}$$

Since, the sign is (+ ve), then clock gains by $10\frac{10}{143}$ min

Calendar

Ordinary

A year having 365 days is called an ordinary year (52 complete weeks + 1 extra day = 365 days)

Leap Year

A leap year has 366 days (the extra day is 29th of February) (52 complete weeks + 2 extra days = 366 days.)

A leap year is divisible by 4 except for a century. For a century to be a leap year it must be divisible by 400. e.g.

Odd Days

Extra days, apart from the complete weeks in a given period are called odd days. An ordinary year has 1 odd day while a leap year has 2 odd days.

• Number of days in a century (100 yr) = 76 ordinary years + 24 leap years

$76\times1+24\times2=124$

$=17\times7+5=17$ week + 5 odd days

$\therefore$ 100 yr has 5 odd days.

• Number of odd days in 400 yr $=(5\times4\times1)$ days $=21$ days

= 3 weeks

= 0 odd days

January 3, 2007 was Friday. What day of the week fell on January 3, 2008?

(a) Friday

(b) Saturday

(c) Tuesday

(d) Thursday

Sol. (b) The year 2007 is an ordinary year, if 3rd January 2007, is a Friday, then 3rd January 3, 2008 will be one day ahead of Friday i.e. Saturday.

Day Gain/Loss

Ordinary Year ($\pm$ 1 day)

When we proceed forward by 1 yr, then 1 day is gained. e.g. 9th August 2013 is Friday, then 9th August 2014 has to be Friday + 1 = Saturday.

When we move backward by 1 yr, then 1 day is lost.

Leap Year ($\pm$ 2 day)

When we proceed forward by 1 leap year, then 2 days are gained.

If 5th January, 1991 and 4th March, 1992 was Saturday, what day of the week was it on 4th March, 1992?

(a) Wednesday

(b) Friday

(c) Sunday

(d) Tuesday

Sol. (a) Number of days between 5th January, 1991 and 4th March, 1992 = (365−5) days of year 1991 + 31 days of January 1992 + 29 days of February 1992 + 4 days March 1992

[as 1992 is completely divisible by 4, hence it is a leap year]

$$= 360 + 31 + 29 + 4 = 424 = 60\,\text{weeks} + 4\,\text{days}$$

Area and Perimeter

Scalene Tringle

• Area of the triangle $= \left(\frac{1}{2} \times \text{Base} \times \text{Height}\right) = \frac{1}{2}\text{bh}$

• Area of the triangle, $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$

Where, $s = \frac{1}{2}(a+b+c)$

• Perimeter of the triangle $= a + b + c \text{ or } 2s$

• Radius of incircle of a triangle = Δ/s

Right Angled Triangle

• Area = ½ bh

• Hypotenuse, $d = \sqrt{b^2 + h^2}$ (by Pythagoras theorem)

• Perimeter $= b + d + h$

Square

• Area $=(\text{Side})^2=a^2=\frac{1}{2}\times(\text{Diagonal})^2=\frac{(\text{Perimeter})^2}{16}$

• Diagonal $=\sqrt{2}\,(\text{Side})=\sqrt{2}a$

• Perimeter $=4a=\sqrt{16\times \text{Area}}$

Rectangle

• Area = Length × Breadth = $l\times b$

• Diagonal $=\sqrt{l^2+b^2}$

• Perimeter $=2(l+b)$

• Area of 4 walls $=2(l+b)\times h$

Circle

• Area $=\pi r^2$

• Circumference $=2\pi r^2$

Volume and surface areas

Cuboid

Volume = lbh cu units

• The length of diagonal of the cuboid is $\sqrt{l^2+b^2+h^2}$ units.

Cube

Lateral surface area $=4x\times x=4x^2$ sq Units

Total surface area $=4x^2+2\left(x^2\right)=6x^2$ sq units and

Volume $=x^2\times x=x^3$ cu units

Cylinder

Curved surface area $=2\pi rh$ sq units

Total surface area $= 2\pi rh + 2\pi r^2 = 2\pi r(r+h)$ sq units

Volume of cylinder $= \pi r^2 h$ cu units

Sphere

Let r be the radius of sphere.

Then, surface area $= 4\pi r^2$ sq units

Volume $= \dfrac{4}{3}\pi r^3$ cu units

Hemisphere

Curved surface area $= 2\pi r^2$ sq units

Total surface area $= 2\pi r^3 + \pi r^2 = 3\pi r^2$ sq units

And volume $= \dfrac{2}{3}\pi r^3$ cu units

Cone

Slant height, $l = \sqrt{h^2 + r^2}$ units Curved surface area $= \pi rl$ sq units

Total surface area $= \pi rl + \pi r^2 = \pi r(l+r)$ sq units and the volume $= \dfrac{1}{3}\pi r^2 h$ cu units