

FORMULA SHEET

Math Topics

- Age problems
- Work hours problems
- Clock angles and Sector area
- Algebraic expressions
- Speed distance problems
- Fractions & Percentages
- Range, mean, Mod, Median
- Simple Geometry problems
- Basic Arithmetic
- Probability
- Ratios
- Profit, Discount problems
- Equation solving for Variables
- Basic Calculations
- Square, Marble Size
- Bridge Length
- Fraction Based Gain, Loss
- Finding Share

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

1. Mean

The mean average is not always a whole number.

The mean is the **total** of the numbers **divided** by how many numbers there are.

To work out the mean:

- Add up all the numbers.
 $7 + 9 + 11 + 6 + 13 + 6 + 6 + 3 + 11 = 72$
- Divide the answer by how many numbers there are.
 There are 9 numbers.
 $72 \div 9 = 8$
So the mean value is 8.

2: Mode

The mode is the value that appears the **most**.

7 9 11 6 13 6 6 3 11

To work out the mode:

- Put the numbers in order:
 3 **6 6 6** 7 9 11 11 13
- Look for the number that appears the most.
 6 appears more than any other number.
So the mode value is 6.

3. Median

The median is the **middle** value.

To work out the median:

1. Put the numbers in order:
3 6 6 6 **7** 9 11 11 13
2. The number in the middle of the list is the median.
So the median value is 7.

If there are two middle values, the median is **halfway** between them. Work out the median for this set of numbers:

3 6 6 6 **7 8** 9 11 11 13

There are two middle values, 7 and 8.
The median is **halfway** between 7 and 8, so the median is

4. Range

The range is the **difference** between the biggest and the smallest number.

To work out the range:

1. Put the numbers in order:
3 6 6 6 7 9 11 11 13
2. Subtract the smallest number from the biggest number:
 $13 - 3 = 10$
So the range of this set of numbers is 10.

5. Sum of Series

$$\text{Sum of an series} = \left(\frac{\text{First Term} + \text{Last Term}}{2} \right) * \text{Number of Terms}$$

Exp. what is the avg of first 20 multiples of 7?

7, 14, 21, 41

$$\text{Sum} = ((7 + 41) / 2) * 20$$

$$\text{Sum} = 73.5 * 20$$

We have to find avg so

$$\text{Avg} = 73.5 \times 20 / 20 = 73.5 \text{ ans}$$

6. Probability

Ten coins are tossed simultaneously. In how many of the outcomes will the third coin turn up a head?

- A. 2^{10}
- B. 2^9
- C. 3×2^8
- D. 3×2^9
- E. None of these

The correct choice is (B) and the correct answer is 2^9 .

If two dice are thrown what is the probability of soming a sum of 9.

(4,5)...(5,4)...(3,6).....(6,3) Total 4 ways to become 9

So $4/36 = 1/9$ ans

Factorial:

$$N! = N \cdot (N-1) \cdot (N-2) \cdot \dots \cdot 2 \cdot 1$$

7: PERMUTATION

If here are 5 student , in how many ways they can sit?

$$5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$$

8: COMBINATION

$$5 \text{ combination } 2 = \frac{5!}{2!(5-2)!} = \frac{5!}{2! \cdot 3!} = \frac{5 \times 4 \times 3 \times 2 \times 1}{2 \times 1 \times 3 \times 2 \times 1} = 10$$

Exp. How many different 4-person teams can b made from a group of 9 players?

$$= \frac{9!}{5!(9-5)!} = 126$$

9: MARBLE SIZE

Marble size is 20cm*30cm. How many marbles are required to cover a square with side 3m?

$$3\text{m}=300\text{cm}$$

$$\text{Area}=300*300$$

No of marbles=Area/Marble size

$$=300*300/20*30=150$$

12: LENGTH OF BRIDGE

If a man running at 15kmph passed a bridge in 9 seconds, what is the length of the bridge?

Length or Dist=speed * Time

$$15\text{km}=15000\text{m}$$

$$15000\text{mpr}=15000/3600 \text{ mps}$$

$$\text{So Length}=15000*9/3600=37.5\text{m}$$

12: EQU MAKING

What is the number 3 more than the double of specific value of x..?

$$2x-3$$

Similarly....

What is the number 3 less than the double of specific value of x..?

$$2x+3$$

13:LOG PROPERTIES

$$\text{Log}(x.y)=\log x+\log y$$

$$\text{Log}(x/y)=\log x-\log y$$

$$\ln e=1$$

$$\ln x^2=2\ln x$$

14: Clock Angles

Angle traced by hour hand in 12 hrs = 360° .

Angle traced by minute hand in 60 min. = 360° .

5:35 .. express hour hand in degree?

As 12 Sectors on clock = 360 degree

$$5 \times 30 + 30 \times \frac{35}{60} = 150 + 17.5 = 167.5$$

14: WORK SHARE

Amount of Work/Time = Output(Rate)

A can do a piece of work in 4 hours; B and C together can do it in 3 hours, while A and C together can do it in 2 hours. How long will B alone take to do it?

$$A = \frac{1}{4}$$

$$B + C = \frac{1}{3}$$

$$A + C = \frac{1}{2}$$

$$C = \frac{1}{2} - \frac{1}{4} = \frac{1}{4}$$

$$B = \frac{1}{3} - \frac{1}{4} = \frac{1}{12}$$

So B alone will do in 12 hours

15: AREA & CIRCUMFERENCE OF CIRCLE

$$\text{Area} = \pi r^2$$

$$C = 2\pi r$$

16: AREA OF SQUARE, triangle, rectangle

$$\text{Area of square} = s^2$$

$$\text{Perimeter} = 4s$$

Area of triangle = $b \cdot h / 2$

Perimeter = sum of all sides

Area of Equilateral triangle = $\frac{\sqrt{3}}{4} s^2$

Perimeter = $3s$

Area of rectangle = $L \cdot W$

Perimeter = $2(L + W)$

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

Volume of cube = a^3

Area of a rectangle = (Length \times Breadth).

Perimeter of a rectangle = $2(\text{Length} + \text{Breadth})$.

Area of a square = $(\text{side})^2 = \frac{1}{2} (\text{diagonal})^2$

Area of 4 walls of a room = $2 (\text{Length} + \text{Breadth}) \times$
Height.

Area of a triangle = $\frac{1}{2} \times \text{Base} \times \text{Height}$.

I). Area of a triangle = $\sqrt{s(s-a)(s-b)(s-c)}$ where a, b, c are
the sides of the triangle and $s = \frac{1}{2} (a + b + c)$

II). Area of parallelogram = (Base \times Height).

Area of a rhombus = $\frac{1}{2}$ (Product of diagonals).

III). Area of a trapezium = $\frac{1}{2}$ (sum of parallel sides) \times
distance between them.

IV). Area of a circle = πR^2 , where R is the radius.

Circumference of a circle = $2\pi R$.

I). Circumference of a semi-circle = πR .

II). Area of semi-circle = $\frac{\pi R^2}{2}$.

Cube :

Let each edge of a cube be of length a. Then,

1. Volume = a^3 cubic units.

2. Surface area = $6a^2$ sq. units.

3. Diagonal = $\sqrt{3}a$ units.

Cylinder :

Let radius of base = r and Height (or length) = h . Then,

1. Volume = $(\pi r^2 h)$ cubic units.
2. Curved surface area = $(2\pi rh)$ sq. units.
3. Total surface area = $2\pi r(h + r)$ sq. units.

17: i values

$i = \text{sqrt of } -1$

$$i^2 = -1$$

$$i^4 = 1$$

18:**Average formula:**

Let $a_1, a_2, a_3, \dots, a_n$ be a set of numbers, average = $(a_1 + a_2 + a_3 + \dots + a_n)/n$

Average = sum of elements / no of elements

19: RATIO

$$3:b=x:c$$

$$X=?$$

$$3c=bx$$

$$X=3c/b$$

20: Algebra

$$a^n \cdot a^m = a^{m+n}$$

$$a^n / a^m = a^{n-m}$$

19:

If Given Data is

Passed in 1st sub=x%.....Pass in 2nd sub=y%.....failed in both sub=z%

Then we can find % of passing students in both sub by this formula

passed in both %= passed in 1st sub+passed in 2nd sub+failed in both-100%.

Similarly

If given data is

Failed in 1st sub=x%.....Failed in 2nd sub=y%....Passed in both sub=z%

Then we can find % of students failed in both sub by this formula

Failed in both %=failed in 1st sub+failed in 2nd sub+Passed in both-100%.

Through these formulas you can find % of failed or passed students in only one subject or both subjects

20:

If it is Sunday , what will be after 100 days?

$$12 \cdot 8 = 96 = \text{Sunday so } +4 = \text{Thursday}$$

After 100 days it will be Friday

20:AGE PROBLEM

If father is double the age of his son. 20 years ago he was 12 times that of son. What is the age of father now?

$$F = 2S$$

$$F - 20 = 12(S - 20)$$

$$2S - 20 = 12S - 240$$

$$10S = 220$$

$$S=22$$

$$F=2S=44$$

21: % SHARE

A company sell three types of mobiles worth 100, 125, and 225. It sold equal no. of all mobiles. What is the percent share of cheapest mobile?

$$\text{Total}=100+125+225=450$$

$$225=50\%$$

$$100+125=225=50\%$$

$$100*50/225=22.22\%$$

Simple Interest (S.I.) :

If the interest on a sum borrowed for certain period is reckoned uniformly, then it is called **simple interest**.

Let the principal = P, Rate = R% per annum (p.a) and Time = T years. Then ,

$$1. S.I. = (P \times R \times T / 100)$$

$$2. P = (100 \times S.I. / R \times T)$$

$$3. R = (100 \times S.I. / P \times T)$$

$$4. T = (100 \times S.I. / P \times R).$$

22: SIMPLE EQU TO FIND VALUE OV VARIABLE

If $a=3$ find $(a^2)^3-a=?$

$$a^6-a=3^6-3=726$$

23: square root, perfect square

Find the square root of 2809.

- 1) The last digit is '9'...so the last digit of the answer is either '3' or '7'.
- 2) Out of the perfect squares in the list, which ones straddle '28'? In this case, '25' and '36'.
- 3) Choose '25' since its the lower one. The square root of '25' is '5'. '5' is the first digit of our answer.
- 4) Which number is '28' closer to...'25' or '36'? It's closer to '25' in this case, so we choose the smaller of our choices for the second digit. Our choices are '3' and '7'; so we choose '3'.

Answer: The square root of 2809 is 53.

Try for 6084.... Ans 78

24:

How much speed of train must be increased if time is reduced by 20% ...

$S=vt$suppose $s=100$, $t=10$

$$V=100/10=10$$

20% less time= $10-2=8$

$$V=100/8=12.5$$

$12.5-10=2.5$ hence 25%

25:

Largest of 13 consecutive integers whose sum is 0 ? -6 to 6

Largest =6

Least no. of among three digits whose sum is 18 = 5..bcz

$$X+X+1+X+2=18 \dots\dots\dots 3X=15 \quad X=5 \dots\dots\dots 5+6+7=18$$

26: Sum Of Series:

$$S_n = n(a_1 + a_n)/2$$

Example. Sum of numbers from 1,2,3.....100

$$a_1 = 1;$$

$$a_n = 100$$

$$n = 100$$

$$S_n = 100(1+100)/2 = 5050$$

27: Gain, Loss

$$\text{Loss} = (\text{C.P.}) - (\text{S.P.}).$$

Gain Percentage: (Gain %)

$$\text{Gain \%} = (\text{Gain} \times 100 / \text{C.P})$$

Loss Percentage: (Loss %)

$$\text{Loss \%} = (\text{Loss} \times 100 / \text{C.P})$$

28: Percentage:

Concept of Percentage :

By a certain percent, we mean that many hundredths. Thus, x percent means x hundredths, written as x%.

I. To express x% as a fraction: We have, $x\% = x / 100$.

Thus, $48\% = 48 / 100 = 12 / 25$.

II. To express a / b as a percent :

We have $a / b = (a / b \times 100)\%$.

Percent to fraction: $x\% = x/100$

Percentage formula: $\text{Rate}/100 = \text{Percentage}/\text{base}$

Word problems

- To solve word problems, first translate the problem from English to Algebra. While translating, use variables to represent unknowns. Once translated, it is easy to solve them using the techniques you have learned in previous sections.
- Following English to Algebra dictionary will be helpful in translating word problems to algebraic expressions.

English words	Mathematical meaning	Symbol
Is, was, will be, had, has, will have, is equal to, is the same as	Equals	=
Plus, more than, sum, increased by, added to, exceeds, received, got, older than, farther than, greater than	Addition	+
Minus, fewer, less than, difference, decreased by, subtracted from, younger than, gave, lost	Subtraction	-
Times, of, product, multiplied by	Multiplication	x
Divided by, quotient, per, for	Division	+ or $\frac{a}{b}$
More than, greater than	Inequality	>
At least	Inequality	≥
Fewer than, less than	Inequality	<
At most	Inequality	≤
What, how many, etc.	Unknown quantity	x (Some variable)

Properties of Logarithms :

1. $\log_a(xy) = \log_a x + \log_a y$
2. $\log_a(x / y) = \log_a x - \log_a y$
3. $\log_x x = 1$
4. $\log_a 1 = 0$
5. $\log_a (x^p) = p(\log_a x)$
6. $\log_a x = 1 / \log_x a$

Some Important Formulae :

- I. $(1 + 2 + 3 + \dots + n) = n(n + 1) / 2$
- II. $(1^2 + 2^2 + 3^2 + \dots + n^2) = n(n + 1)(2n + 1) / 6$
- III. $(1^3 + 2^3 + 3^3 + \dots + n^3) = n^2(n + 1)^2 / 4$

Fractions formulas:

Adding Formula: $\frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd}$

Subtracting formula: $\frac{a}{b} - \frac{c}{d} = \frac{ad - bc}{bd}$

Multiplying fractions: $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$

Dividing fractions: $\frac{\frac{a}{b}}{\frac{c}{d}} = \frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$

Consumer math formulas:

Discount = list price \times discount rate

Sale price = list price - discount

Discount rate = discount \div list price

Sales tax = price of item \times tax rate

Interest = principal \times rate of interest \times time

Tips = cost of meals \times tip rate

Commission = cost of service \times commission rate

Good Luck 😊