Speed mathematics

First rule of the mathematics:

The easier the method you use to solve a problem, the faster you will solve it with less chance of making a mistakes.

Why mathematics is important?????

- People equate mathematical ability with general intelligence.
- If you are good at maths, you are generally regarded as highly intelligent.
- High achieving maths students are treated differently by their teachers and colleagues.
- Mental calculations improves concentration, develops memory, and enhances the ability to retain several ideas at once
- Mathematical knowledge boosts your confidence and self-esteem.
- These methods will give you confidence in your mental faculties, intelligence and problem-solving abilities.

1. **MULTIPLYING NUMBERS UP TO 10:**

We will begin by learning how to multiply numbers up to 10x10

E.g. 1   7X8=????

Solution- 7 x 8 =

$$3 \quad x \quad 2$$

- ➤ Go to the first number 7. How many more do you need to make 10? The answer is 3.
- ➤ Go to the next number 8. How many more do you need to make 10? The answer is 2
- ➤ Then subtract diagonally. Take either one of the number. (7-2 =5 8-3= 5)
- ➤ 7 x 8 =5(3   x   2)(put 5 on the left side and next to tat 5 put the multiplication of 3 and 2) and we get
- ➤ 7 x 8 =56.

2. **MULTIPLYING NUMBERS GREATER THAN 10. (MULTIPLYING WITH A REFERENCE NUMBER)**

Using 100 as a reference number.

100   96 x 97 = 9300   (96-100= -4, 97-100=-3,), (97-4= 93 (diagonally sub))

-4   -3   + 12   93x100=9300 (multiply with 100), (-4x-3=+12)

9312   => 9300+12=9312

Steps involved:

- ➤ Just take an example of multiplying 96 X 97

- ➢ Take 100 as a reference number.
- ➢ Just subtract 96-100 = -4 and 97-100 = -3
- ➢ Then subtract diagonally and take either of the number, we will get 93 and it was multiplied by 100.
- ➢ You will get 9300 and -4 X-3 gives you +12. Add this 12 with 9300 we will get 9312.

3. MULTIPLYING NUMBERS ABOVE 100:

100   106 x 104 = 11000   (106-100= +6, 104-100=-4,), (106+4=110 (diagonally add))

+6   +4   + 24   110x100=11000 (multiply with 100), (6x4=24)

       11,024   =>11000+24=11024

- ➢ It's similar to the previous technique.
- ➢ Take 100 as reference number, 106-100 = +6, 104-100 = 4.
- ➢ This time just add diagonally. We will get 110 and it was multiplied by 100 we get 11000.
- ➢ Then multiply +6 and +4 we get 24 and it was added to 11024.

4. COMBINATIONAL METHOD:

100   92 x 93 = 8500

10   -8 -7   + 56

   -2 -3   8556

- ➢ Suppose on subtracting the given numbers with the reference number we getting higher number, we need to do the same procedure for the number (which we will get on subtracting the main number from the reference number.

5. MULTIPLYING NUMBERS ABOVE AND BELOW THE REFERENCE NUMBERS:

100   98 x 135 = 13300

   -2 +35   -70

        13230

- ➢ The same principle is to be followed.
- ➢ Here 98 is lower than 100 and 135 is more than 100.
- ➢ Just subtract the multiplying number with the reference number. We will get -2 and +35.
- ➢ Then just follow the previous technique we will get 13300,
- ➢ Then multiply -2 and +35 we get -70.
- ➢ Then just add 13300-70 we will get 13230.

6. MULTIPLICATION BY FACTORS:

➢ It's easy to multiply by 20, as 20 are 2 times 10. And it is simple to multiply by 10 and by 2. This is called multiplication by factors, as 10 and 2 are factors of 20.

20   23 x 31 =   680   (23+11=31+3=34,   )

         +3   +11   33   (34 x 20=> 34x 10=340, 340x 2= 680)-> multiplication by factors

                713

➢ Just do the same procedure.
➢ (23+11=31+3=34,   )
➢ (34 x 20=> 34x 10=340, 440x 2= 680)-> multiplication by factors
➢ 3*11 gives 33 and 680+33 gives you 713 tats the answer.

7. MULTIPLYING BELOW 20

20 19 x 16 =   300   (19-4=16-1=15,)

        -1   -4   04   (15X2X10=30x10=300   )-> multiplication by factors

               364

➢ Here the only difference we need to take 20 as reference number.
➢ And follow the same procedure.

8. MULTIPLYING USING DOUBLE REFERENCE NUMBER:

8 X 37=????

(10 x 4)   8 x 37   = 290

         -2   -3   6

        -8   296

➢ In this problem we have two reference nos. , for 8, the reference no is 10 and for 37, the reference no is 40.
➢ Its shows the reference no of 8 is four times the reference number of the 37.
➢ Just subtract the no from its reference no. (8 - 10= -2,   37- 40= -3)
➢ Then multiply the first difference (2) by 4 (the multiplies of the reference no 10) , -> -2 x 4 = -8,
➢ Then -8+37 = 29 , and multiply by the main reference no 10., 29x10 = 290.
➢ Then -2 x -3 = 6, 290+6 = 296.
➢ The answer is 296.

EASY MULTIPLICATION BY 9

9X486 = ?

(10 x 49)   9   x   486 = 4370

        -1   -4   +4
                         ————
     -49   4374

- The reference no for 9 is 10, and for 486 is 490,
- And the second reference no is 49 times the first reference no.
- Just the subtract the respective no from their reference no.
- We will get 9-10 = -1, 486-490= -4
- Multiply the difference of first reference no (10) by the multiple of the second reference no. => -1 x 49 = -49.
- Subtract -49 from 486, => 486-50+1 = 437 and multiply by the first reference no. we will get -4370.
- Then -1 x -4 we will get 4 and it was added to 4370 we will get 4374... That's the answer.

SHORTCUT FOR SUBTRACTION

- What is the easiest way to take 90 from a number?
  Take 100 and give back 10
- What is the easiest way to take 80 from a number?
  Take 100 and give back 20
- What is the easiest way to take 70 from a number?
  Take 100 and give back 30

100   98x135 = 13300-70 = 13230

      -2   35   30

- How do we take 70 from 13,330?
- Take away 100 and give back 30

CHECKING THE ANSWERS BY USING SUBSTITUTE NUMBER:

- 13 x 14 = 182
- The first number is 13. Add its digits together to get the substitute (1+3=4: four becomes our substitute for 13)
- The next number we are working with is 14. The substitute is (1+4=5)
- Then multiply the substitute numbers (4 x 5=20: twenty is a two digit number so we add its digits together to get our check answer : 2+0=2).
- Do the same principle in the RHS Side too (1+8+2=11, 1+1= 2)

➢ So both LHS and RHS are equal. Hence our answer is correct.

DOUBLING AND HALVING NUMBERS
To use 20 and 50 as reference numbers, we need to be able to double and halve numbers easily.

➢ To halve 78, 78 = (80-2). and half of (80-2) is 40-1 = 39
➢ To double 78, do it the reverse manner. (80-2). Double of (80-2) is 160-4 = 156

MULTIPLYING THE DECIMALS:

1.3 X 1.4 =?
➢ Ignore the decimal point in the calculation.

1. 10   13   14   =   170

    +3   +4   12
                   ─────────
               182

➢ In order to put the decimal points, count the number of digits after the decimal point in the given question.
➢ Here two digits after the decimal points. Hence place the decimal point after two digits (1.82 is the answer)

2. 8 x 68 =?
    Let take 8.0 x 68   =?.
   100   80 x 68 = 4800

        -20   -32   640
                    ─────
              5440

    ➢ Let same principle for multiplying we got the answer 5440
    ➢ Let count the no of digits, its 1
    ➢ Then answer is 544.0.
    ➢ Lets try 9 x 83 = , 9 x 67 =

MULTIPLICATION BY 11

➢ To multiply a two digit number by 11, simply add the two digits together and insert the result in between.
➢ For example, to multiply (23 x 11), add (2+3= 5), and insert the 5 in between 2 and 3, the answer is 235.

MULTIPLYING MULTIPLES OF 11.

EG: 330 x 12 = ?

➢ 330 = 3 x 10 x 11 (ignore the zero now)
➢ 3 x 11 x 12 = 11 x 36 = 396

➢ Now keep the zero now. We will get 3960.

CONVERTION OF KILOGRAMS INTO POUNDS:

➢ DOUBLE THE NUMBER, MULTIPLY BY 11, AND DIVIDE BY TEN TO ACCOUNT FOR THE DECIMAL PLACE. (TO CONVERT KG TO POUNDS YOU MULTIPLY BY 2.2)
   1. 80 KG TO POUNDS = ?
➢ 80 kg = (80 x 2.2) = 160x 11/10 = 176 pounds.

MULTIPLYING LARGER NUMBERS BY 11:

   2. 12345 X 11 = ?
➢ Write zero in front of the number we are multiplying. (012345 x 11)
➢ Beginning with the units digit, add each digit to the digit on its immediate right. In this case add 5 to the digit on its right. There is no digit on its right, so add nothing
➢ 5+0=5, (write 5 as the last digit of your answer)

$$\underline{012345 \times 11}$$
$$5$$

➢ Now go to the 4. Five is the digit on the right of the 4: (4+5 =9)
➢ 012345 x 11, (continue the same procedure)
➢   95
➢ 3+4 =7
➢ 2+3=5
➢ 1+2=3
➢ 0+1=1
➢ The answer is 135795

CHECKING YOUR ANSWERS:

   1. $\underline{012345 \times 11}$
      1 3 5 7 9 5

   ➢ Write a cross under every second digit of the answer, beginning from the right hand end of the number. The calculation will now look like
   ➢ $\underline{012345 \times 11}$
      1 3 5 7 9 5
      X   X   X
      ➢ Now add the digits with the cross under them (1+5+9 = 15)
      ➢ Add the digits without the cross (3+7+5 = 15)
      ➢ We are getting both the answers are equal hence our answer is correct.
   2. 0217475 x 11
      2 3 9 2 2 2 5
       X   X   X
               ➢ Add the digits in the cross(3+2+2 = 7)
               ➢ Add the digits in the without cross (2+9+2+5 = 18)

➢ The difference between two answers is 11.
➢ If the difference is 0,11,22,33,44,55,66 etc., then the answer is correct.

MULTIPLICATION BY 9 :

➢ There is an easy shortcut for multiplication by 11 because 11 is one more than 10, so there is an easy shortcut for multiplication by 9 because 9 is one less than 10.
➢ Instead of adding each digit to the digit on the right, we subtract each digit from the digit on the right.
➢ Because subtraction involves borrowing and carrying, we can make the following short cut..
➢ We subtract the units digit from 10, then subtract each successive digit from 9 and add the neighbor. We subtract 1 from the first digit of the number for the first digit of the answer.

ADDITION

The basic rule for mental addition:

To add 9, add 10 and subtract 1: to add 8, add 10 and subtract 2; to add 7 add 10 and subtract 3, and so on.

➢ If you wanted to add 47, you would add 50 and subtract 3,
➢ To add 196, add 200 and subtract 4.
➢ To add 38 to a number, add 40 and subtract 2,

TWO DIGIT MENTAL ADDITIONS:

If the units digit is high, round off to the next ten and then subtract the difference. If the units' digit is low, add the tens then the units.

➢ With two digit mental addition you add the tens digit of each number first, then the units. If the unit's digit is high, round off the number upwards and then subtract the difference. If you are adding47, add 50, and then subtract 3.
➢ To add 35, 67, and 43 together you would begin with 34, add 70 to get 105, subtract 3 to get 102, add 10 to get 142 then the 3 to get your answer of 145.

ADDING THREE DIGIT NUMBERS:

355+752+694 =?

➢ 355+700 = 1055
➢ 1055+50+2 = 1107
➢ 1107+700-6 = 1807-6 = 1801
OR
  ➢ You may prefer to add from left to right; adding the hundreds first, then the tens and then the units.

ADDITING LARGER NUMBERS:

8461

$+5678$

> ➢ We begin with the thousands column.8+5 = 13, since we are dealing with thousands, our answer is 13 thousand.
> ➢ Observe that the numbers in the hundreds column conveniently add to 10, so that gives us another thousand. Then answer is 14000.
> ➢ Then add 61 to 14000, we getting 14061.
> ➢ Add 80 to and subtract 2. To add 80 add 100 and subtract 20, (14061+100-20-2) = 14161-20-2=14141-2=14139 is the answer.
> ➢ An easy rule is: when adding a column of numbers add pairs of digits to make tens first, then add the other digits.

SUBTRACTION:

To subtract mentally, try and round off the number you are subtracting and then correct the answer.

To subtract 9, take 10 and add 1: to subtract 8, take 10 and add 2; to subtract 7, take 10 and add 3,

1. Eg: 56-9 =

    -1

(To take 9 from 56 in your head, the easiest and fastest method is to subtract 10, (46) and add1 we get 47.)

2. 54-38 = 16
       +2
> ➢ 44-40, plus 2 makes 16

3. 436-87 =
       +13
> ➢ Take 100 to get 336. Add 13 and we will get 349 easy.
> ➢ **SUBTRACTING ONE NUMBER BELOW A HUNDREDS VALUE FROM ANOTHER WHICH IS JUST ABOVE THE SAME HUNDREDS NUMBERS.**

THREE DIGIT SUBTRACTIONS:

1. 461 -275 =
      25
   161+25 = 160+20+5+1 = 186
2. 834 – 286 =
         14
   534+14 = 530+10+4+4 = 540+8 = 548

SUBTRACTION METHOD ONE:
1. 7254-3897 =

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      6  1  '4
      V  2̶  5̶'4

      3  3  9  7
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3 3 5 7

> Subtract 7 from 4. We can't, so we borrow 1 from the tens column.
> Cross out the 5 and write 4.
> Don't say 7 from 14, we have to say 7 from 10 and add 4 we getting 3+4 = 7 (the first digit of the answer)
> Nine from 4 won't go, so borrow again. Nine from 10 is 1, plus 4, the next digit answer.
> Eight from 1 won't go, so borrow again. Eight from 10 is 2, plus 1 is 3, three from 6 is 3, the final digit of the answer.

SUBTRACTION METHOD TWO:

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   7'2'5'4

 _ ,3 ,8,9  7

   3  3  5  7
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> Subtract 7 from 4. We can't, so we borrow 1 from the tens column. Put a 1 in front of the 4 to make 14 and write a small 1 alongside the 9 in the tens column. Don't say 7 from 14, but 7 from 10, add 4 on top gives 7, the first digit of the number.
> Ten (9+1) from 5 won't go so borrow again in a similar fashion. Ten from 15 is 5 or 10 is zero, plus 5 is 5.
> Nine from 2 won't go, so borrow again. Nine from 10 is 1 plus 2 is 3.
> Four from 7 is 3. You have your answer.

SUBTRACTION FROM A POWER OF 10:

The rule is : SUBTRACT THE UNITS DIGIT FROM 10, THEN EACH SUCCESSIVE DIGIT FROM 9, THEN SUBTRACT 1 FROM THE DIGIT ON THE LEFT.

1. 1000
    -574
    _____

> 10-4=6,
> 9 - 7 = 2,
> 9 - 5 = 4,
> 1 - 1 = 0
> The answer is 0426

SUBTRACTING SMALLER NUMBERS:

If the number we are subtracting has fewer digits than the one you are subtracting from, then add zeros before the number (at least, mentally) to make the calculation:

For instance:

23 000 – 46 =

23 000

  0 046
_____

22 954

Use the same principle as subtraction method 2.

SQUARING THE NUMBERS:

1. Squaring the numbers ending with 5.
    $35^2 =$

    ➢ Separate the 5 from the digits in front. in this case there is only a 3 in front of the 5. Add 1 to 3 get 4 (3+1= 4)
    ➢ Multiply these numbers together: 3 x 4 = 12
    ➢ Write the square of 5 (25) after 12. We will get 1225.

$135^2 = ??$

➢ Take 13, add 1 to it we will get 14.
➢ Then 13 x 14 = 182
➢ Add the square of 5 next to it. We will get 18225.

SQUARING THE NUMBERS NEAR TO 50:

1. $46^2 =$

    ➢ Forty six squared means 46 x 46. Rounding upwards, 50 x 50 = 2500.
    ➢ Take 50 and 2500 as our reference points.

    50 46^2
        - 4

    46 = 50-4, so 4 is a minus number.
    ➢ So we take 4 from the 25 hundreds.
    ➢ (25-4) x 100= 2100
    ➢ To get the rest of the answer, we square the number in the minus. (4^2= 16)
    ➢ Add 2100 and 16 we will get 2116 is the answer.

$56^2 =$

➢ Fifty six squared means 56 x 56. Rounding upwards, 50 x 50 = 2500.
➢ Take 50 and 2500 as our reference points.

50   56^2

　　+6

56 = 50+4, so 6 is a positive number.

- ➢ So we add 6 to 25 hundreds.
- ➢ (25+6) x 100= 3100
- ➢ To get the rest of the answer, we square the number in the minus. (6^2= 36)
- ➢ Add 3100 and 36 we will get 3136 is the answer.

SQUARING NUMBERS NEAR TO 500:

- ➢ This is similar to our strategy for squaring numbers near 50.
- ➢ Five hundred times 500 is 250000, we take 500 and 250000 as our reference number.
  1. 506^2 =
     500   506^2

     　　+6

     500^2 = 250000
     - ➢ Five hundred and six is greater than 500,
     - ➢ Square of 500 is 250000
     - ➢ The number 6 is added to the thousands
     - ➢ (250+6) x1000 = 256000
     - ➢ Square 6 is 36.
     - ➢ 256000+36 =256036 is the answer.

Square the number ends with 1:

1. 31^2 =
   - ➢ First, subtract 1 from the number. The number now ends in zero and should be easy to square. (30^2 = 3 x 3 x 10 x 10) = 900
   - ➢ Add 30 and its next number 31 (30+31). We will get 61)
   - ➢ Add (900 + 61) = 961.
2. 351^2=?
   - ➢ 350^2 = 122500
   - ➢ 350 +351 = 701
   - ➢ 122500 +701 = 123201

WE CAN ALSO USE THE METHOD FOR SQUARING NUMBERS ENDING IN 1 FOR THOSE ENDING IN 6.

3. 86^2 =
   - ➢ 85^2 =7225
   - ➢ 85+86 = 171
   - ➢ 7225+171 = 7396

Squaring numbers ending with 9

1. $29^2 =$
   - Add 1 to the number. The number now ends in zero and is easy to square.
   - $30^2 = 900$
   - Now add 30 with given number 29 (30+29 =59)
   - Then **sub** (900 - 59 = 841)

2. $349^2 =$
   - $350^2 = 122500$
   - 350+349 = 699
   - Sub (122500 - 699 = 121801)

MULTIPLYING NUMBERS WHEN THE UNITS DIGITS ADD TO 10 AND THE TENS DIGITS DIFFER BY 1.

THERE IS RULE IN MATHEMATICS THAT IF YOU MULTIPLY TWO NUMBERS THAT DIFFER ABOVE AND BELOW A SQUARE BY THE SAME AMOUNT, THE ANSWER WILL BE THAT NUMBER SQUARED LESS THE DIFFERENCE SQUARED.

1. 67 x 73 =
   - 67 = 70 - 3
   - 73 = 70 + 3
   - 67 x 73 = $70^2 - 3^2$
   - = 4900 − 9 = 4891

MULTIPLYING NUMBERS NEAR 50

1. 54 x 58 =

   50   54   x   58

        4   8

   - Add 4 + 8 = 12
   - Halve the answer 12/2 = 6
   - Add that answer to 25 , we will get 25+6 = 31 (31 hundreds)
   - Multiply (4 x 8 = 32)
   - Add (3100 + 32 = 3132)

2. 46 x 48 =
   50   46   x   48
        -4   -2
   - Add (-4 -2 = -6)
   - Halve the answer (-6/2 = -3)

- ➢ Subtract (25 – 3 = 22) (22 hundreds)
- ➢ 4 x 2 = 8
- ➢ Add (2200 + 8 = 2208)

TEMPERATURE CONVERSION:

To change Fahrenheit to Celsius, subtract 30 degree and then halve.

To change Celsius to Fahrenheit, double and then add 30.

- ➢ Then answer you will get using this formula will not be exact, but its close enough for practical purposes.
- ➢ If you are told the temperature will be 8 ^{o} C, double it and add 30. We will get 46 ^{o} F. but the actual temperature would be 46.4^{o}F
- ➢ Easy temperature conversion formulas : (^{o}C x 2) +30 = ^{o}F, (^{o}F -30) / 2 = ^{o}C,
- ➢ Exact temperature conversion formulas : (^{o}C x 9/5) +32 = ^{o}F, (^{o}F -32) x 5/9 = ^{o}C,

TIME AND DISTANCES:

1. A common ruler is 30 cm. thirty divided by 12 gives approximately 2 ½. (2.5 cm is equal to 1 inch)
2. 100 km = 60 miles.

POUNDS TO KILOGRAMS

1. 1 KG = 2.2 POUNDS
   65 kg = 65 x 11 x 2/10
       =143 pounds