STEP BY STEP

MATHS FOR ALL

Start

Think

Analyse

Plan

Do

Do again

Keep on doing

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STEP – 2

ABOUT THE BOOK

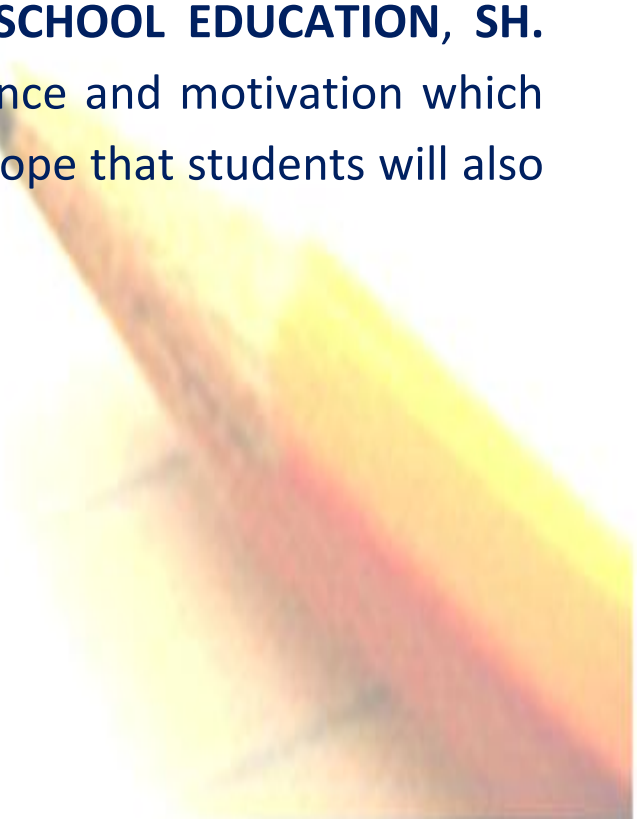
Everything around us can be understood better with Mathematics as it can help children to think about many aspects of their world through its connection with them.

For students, learning usually happens in the best way when they can relate it to real life situations. With each higher class, it becomes more advanced and challenging. Many students find it difficult to understand the abstract mathematical concepts and have to work harder and practice longer for this.

However, by infusing real life examples with mathematical concepts, teachers can help students view mathematics from an entirely different point of view.

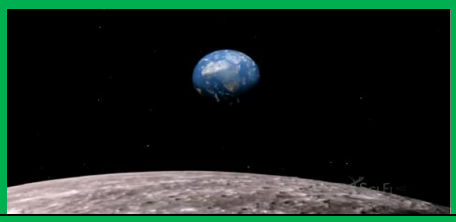
The booklet **''STEP BY STEP"** fulfils the objective that concepts in Mathematics can be learnt in a joyful manner. It will also enhance the CCT skill of learning.

We are thankful to the **DIRECTOR OF SCHOOL EDUCATION**, **SH. RUBINDERJIT SINGH BRAR** for his guidance and motivation which helped us to complete this task and we hope that students will also get benefit from this booklet.



Hello everyone!

Today I will tell you some interesting facts

	The distance between Earth and Moon = 384,000,000 m.
	In a galaxy there are on and average = 100,000,000,000 stars.
	The diameter of Sun = 1,400,000,000 meter.
	The speed of light in vacuum is 300,000,000 m/s.

OMG! How we can learn these large numbers. So many zeros.....!

Yes these are very large numbers, Let us ask our teacher is there any other way to remember these numbers.

Don't be afraid from these large numbers.

I will explain you how to write these numbers in other form which can be easily remembered, which is called **STANDARD FORM.**

	Standard Form
The distance between Earth and Moon = 384,000,000 m.	3.84×10^{8}
In a galaxy there are on and average = 100,000,000,000 stars.	1.0×10^{11} stars.
The diameter of Sun = 1,400,000,000 meter.	Standard form = 1.4×10^{9}
The speed of light in vacuum is 300,000,000 m/s.	Standard form = 3.0×10^{8} m/s.

Oh so easy, now we can easily remember them.

What are these forms called?

Baccho!

See in all above examples how we are using exponents to express the larger number in easy way.

Now I will tell you about it's uses in day to day life

Wow! It is going to be very interesting

Yes, It is interesting.

LET US DISCUSS USES OF EXPONENTS IN DAY TO DAY LIFE

Exponents and Viral Marketing

If One Person , tells another 10 people, and then each of these 10 people tell another 10 people, and so on, we get rapid spreading of a message, video, photo, news item, or product across the Internet.

Level	0		1		2		3		4	etc
Spread	1	+	10	+	100	+	1000	+	10 000	
Powers	10^0		10^1		10^2		10^3		10^4	

Spread = 10^{Level}

Image Source: http://m5.paperblog.com

See how fake news can spread from one person to 10,000 persons with in second through social media.

An earthquake is the result of a sudden release of stored energy in the Earth's crust that creates seismic waves. In its most generic sense, the word earthquake is used to describe any seismic event—whether a natural phenomenon or an event caused by humans—that generates seismic waves

Exponents and Earthquakes

The "Richter Scale" quantifies the amount of seismic energy, (as the Indexes of Powers of 10), that is released by an earthquake.

Richter Scale of Earthquake Energy:

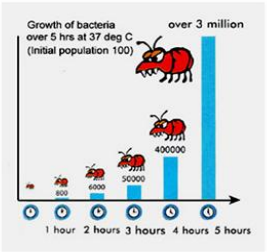
Each level is 10 time stronger than the previous level

	Description	Occurrence	In Population	Movement
1	Small	Daily	Every minute	Small
2	Small	Daily	Every hour	Small
3	Small	Daily	Every day	Small
4	Small	Daily	Every week	Moderate sudden
5	Moderate	Monthly	Every 10 years	Strong Sudden
6	Moderate	Monthly	Every 30 years	Strong Sudden
7	Major	Monthly	Every 50 years	Severe Sudden
8	Great	Yearly	Every 100 years	Very Severe
9	Great	Yearly	Every 300 years	Very Severe
10	Super	Rarely	Every 1,000 years	Extreme

Exponents are also part of Food Technology and Microbiology.

Bacteria Exponential Growth

Once Bacteria and Mould start growing on food that is not refrigerated, it reaches harmful levels very quickly.



Do you know why cooked food decay so fast when it is not refrigerated. It's because of exponential growth of bacteria.

Now you see, why we should not share any fake news on social media without knowing it.

Wow it is very simple and amazing, I can easily understand the uses of exponents in daily life. That is why my tiffin smells if I forgot it in bags after school. Because bacteria grows so fast they decay the food.

Very good Students,

Now I will tell you about some basic exponent rules.

HOW TO LEARN EXPONENT RULES?

Product Rule

$$a^x \times a^y = a^{x+y}$$

$$a^2 \times a^3 = a^5$$

Quotient Rule

$$a^x \div a^y = a^{x-y}$$

$$a^7 \div a^3 = a^4$$

Power Rule

$$(a^x)^y = a^{xy}$$

$$(a^7)^2 = a^{14}$$

Negative Rule

$$a^{-x} = \frac{1}{a^x}$$

$$a^{-4} = \frac{1}{a^4}$$

Zero Rule

$$a^0 = 1$$

Sameer, Can you write 8 NINE TIMES.

8*8*8*8*8*8*8*8*8

Really Sameer, you don't know how to write this in a simple way.

Ye theek to hai.

In simple way we write it as

$8*8*8*8*8*8*8*8*8 = 8^9$

Oh sorry, I forget our teacher explained it very well.

This is known as exponential form, in which base is 8 and exponent is 9.

DIVISIBILITY

Sameer, Kya tumhe pata hai ki without actual division we can tell that a given number is divisible by other number. It's a MAGIC!!!!

Really, Mujhe bhi sikhna hai ye MAGIC.

Chalo fir Teacher se hi puchte hai.

Haan Bacho,

It's a MAGIC.

Let me explain you, how it works.

THESE ARE THE FEW DIVISIBILITY RULES.

A Number is DIVISIBLE by	
2	If the last digit is an even number.
3	If the sum of the digits is divisible by 3. Eg 321 3+2+1=6 6/3=2 therefore 321 is divisible by 3.
4	If the last two digits are divisible by 4. Eg 1932 32/4=8 therefore 1932 is divisible by 4.
5	If the last digit is 0 or 5.
6	If it is even and the sum of its digits is divisible by 3. Eg 936 is even and 9+3+6=18 which is divisible by 3.
7	Double the last digit then subtract it from the rest of the number. Repeat if needed. The difference should be divisible by 7
8	If the last 3 digits are divisible by 8. Eg 14248 248/8=31 therefore 14248 is divisible by 8.
9	If the sum of its digits is divisible by 9 eg. 7236 7+2+3+6=18 therefore 7236 is divisible by 9.
10	If the last digit is zero.

Sameer, see what I have written about the divisibility rules.

 # symbolizes NUMBER

I'm #2 and I'll be your friend.
As long as an even #'s on the end.
#3 will work for me, you see.
If the sum is divisible by 3.
The #4 won't be such a chore.
If the last 2 are divisible by 4.
The #5 is my biggest hero.
He has to end in 5 in 0.
The #6 will always go into me.
As long as so does 2 and 3.
#9 will go into me just fine.
If the sum is divisible by 9.
I'm #10 and this you should know.
I always end in a big fat 0!

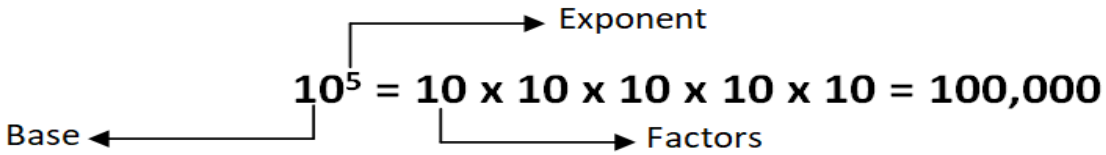
Wow Siya!!! Wonderful, ye to ek Gaana bana diya tumne. We can learn it very easily.

Please clap for Siya

DRILL ON EXPONENTS

A **power** is the product of multiplying a number by itself. It is represented on a **base number** and an **exponent**.

The **base number** indicates what number is being multiplied, and the **exponent** indicates how many times the base number is to be multiplied.



Write the factors, then find the value.					
A.	$5^2=$	$7^2=$	$9^2=$	$3^4=$	$2^2=$
	5 X 5 = 25				
B.	$10^2=$	$10^2=$	$5^2=$	$6^2=$	$3^3=$
Write the value.					
C.	$7^2=49$	$9^3=$	$4^4=$	$2^3=$	$1^4=$
D.	$8^2=$	$3^2=$	$2^2=$	$3^4=$	$8^2=$

Write the value using exponents.				
E.	5x5x5x5x5=	10x10x10x10=	6x6x6x6=	2x2=
F.	4x4x4x4=	7x7x7=	2x2x2x2x2x2=	3x3x3=
G.	10x10x10=	5x5=	8x8x8=	10x10=

Fill in the missing numbers.			
	Product	Number to Given Power	Standard Notation
H.	8x8x8	8^3	512
I.	5x5		
J.	12x12x12		
K.	2x2x2x2x2		

Sameer & Siya, Ab tumhe DIVISIBILITY RULE & EXPONENTS samjh aa gaye to kuch challenges ho jaye.

CHALLENGE: 1

Number sort

Divisibility Rules for 2, 5 and 10

If the number is divisibility by 2: Color it orange

if the number is divisible by 5: Draw a yellow star on it

If the number is divisibility by 10: Mark it with a cross (X)

80
85
9000
300
1101
3325
45
449
88
342
545
64
195
16
77
108
449
190
24
121
5571
12
8890
62
67
140
13
36
895
1
1276
5773
464
35
9987
73
782
6625
58

What symbol is hidden here?

CHALLENGE: 2

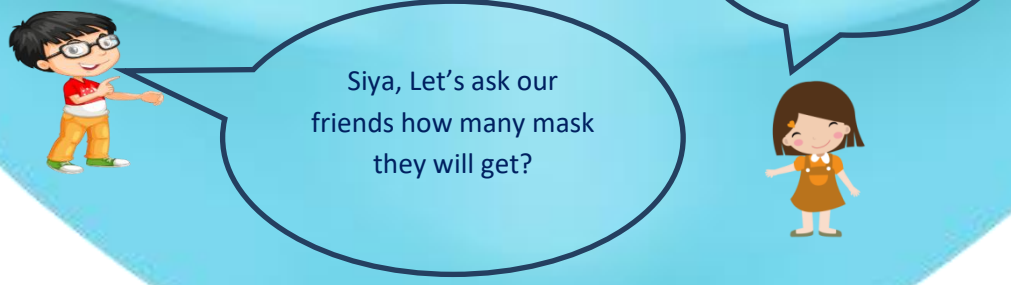
Anshika was ordering mask online. The website is giving out three free masks if your area postal code is divisible by 3 and an additional one free mask if your birthday digits were divisible by 9 when arranged in as specific way: month, day, and year.

Anshika looked at her area postal code:

160035

Anshika looked at her birthday: January 13, 2002. She wrote out her birthday like this: 01 13 2002.

I. How many mask Anshika will get?



CHALLENGE: 3

A genie offers you a choice:

He will give you Rs. 3500/- right now

OR

He will give you 1 penny today, 2^2 tomorrow,

3^3 the next day and so on for 5 days.

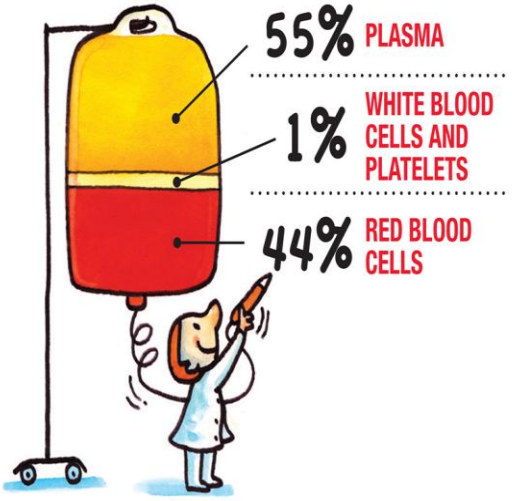
Which do you choose?

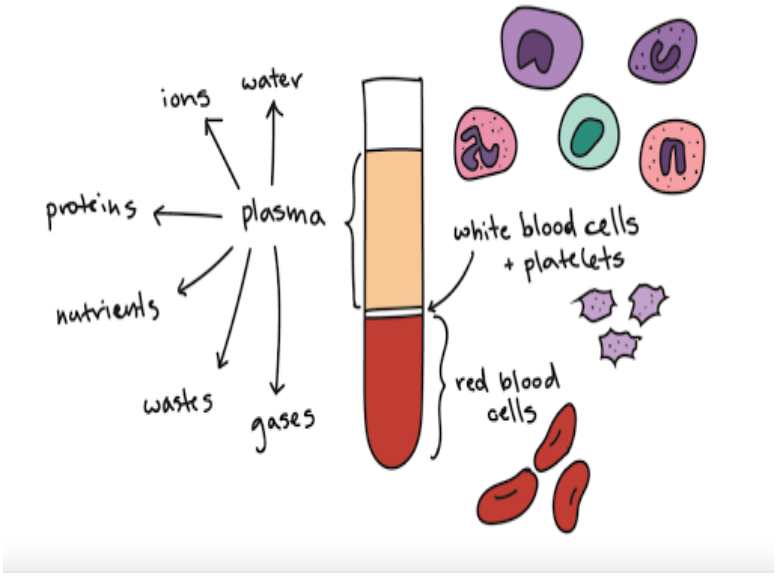
Show calculation also.

CHALLENGE: 4

Life Science Application

The major components of human blood are red blood cells. White blood cells, platelets and plasma. A typical red blood cell has a diameter of approximately 7 X 10^{-6}metres. A typical platelet has a diameter of approximately 2.33 X 10^{-6}metre.





A. Which has a greater diameter and by how much, a red blood cell or a platelet?

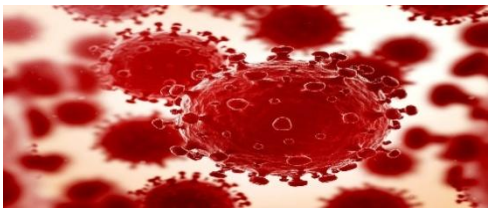
CHALLENGE: 5

See my number $\frac{3^5}{9^5}$
It's greater than your number.

No, No, No…
See my number $\frac{5^5}{15^5}$
Mine is greater than yours.

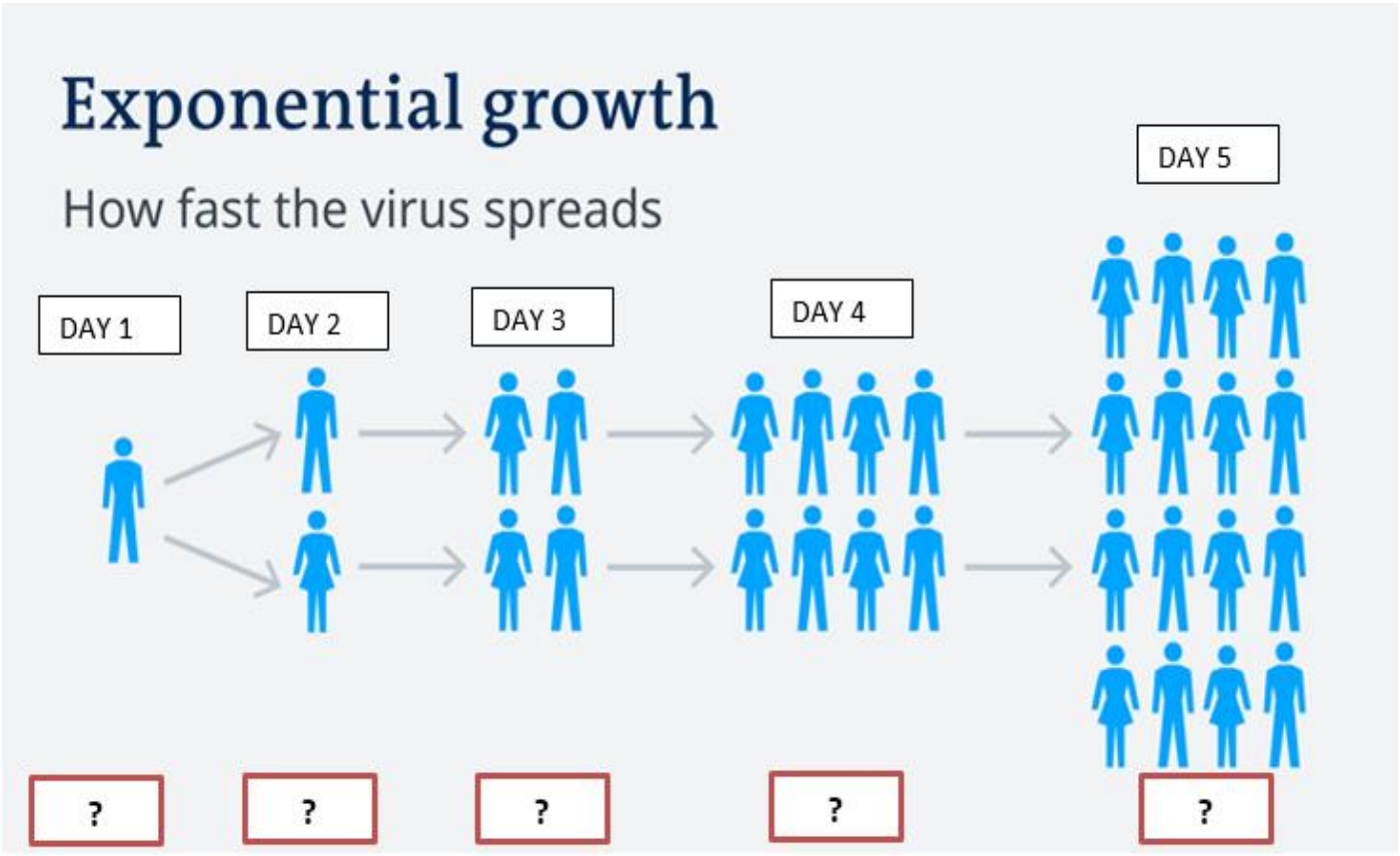
Oh, Don't jump to the conclusion
Stop fighting, first both of you calculate your number and then decide.
What do you observe?

CHALLENGE: 6



CORONA VIRUS:- The COVID-19 pandemic in India is part of the worldwide pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus. The first case of COVID-19 in India, which originated from China, was reported on 30 January 2020. India currently has the largest number of confirmed cases in Asia,and has the second-highest number of confirmed cases in the world after the United States,with more than 9 million reported cases of COVID-19 infection and more than 100 thousand deaths. By mid of 2020, India had approached in position of conducting highest number of daily tests in the world which subsequently translated to a high number of positive cases.The per day cases peaked mid-September in India with over 90,000 cases reported per day and have since come down to below 40,000 in December.

Exponential growth of Corona virus in a City. The following figure shows how fast this virus spreads.



A. **Write an expression for the above figure as exponent of 2 in the boxes.**

B. **Write in exponent form the growth of Virus on day 15^{th}.**

C. **Find the total number of infected persons on Day 6?**

CHALLENGE: 7

A) CHRISTMAS MESSAGE DECODER A

What did Sameer say to the Siya?

N	2^3
Y	10^2
V	3^4

H	4^3
I	11^2
E	5^3

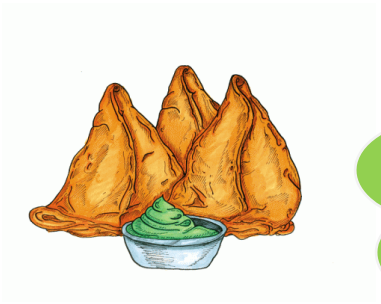
C	2^5
D	7^2
A	3^3

Solve each problem and write the matching letter on the blank above the answer.

_____	_____	_____	_____	_____	_____
64	27	81	125	27	8
_____	_____	_____	_____	_____	_____
121	32	125	49	27	100

B) MESSAGE DECODER

Solve each problem and write the matching letter on the blank above the answer.



Siya can you guess

what I want to say about this Samosa?

E	2^3
T	10^2
U	3^4

A	4^3
D	11^2
S	5^3

I	2^2
M	7^2
F	3^3

____	____	____	____	____	____	____	____	____	____
4	64	49	125	100	81	27	27	8	121

CHALLENGE: 8

One day in the ancient kingdom of **Mughals**, a peasant saved the life of the king's daughter. The king was so grateful he told the peasant he could have any reward he desired. The peasant—who was also the kingdom's chess champion—made an unusual request: "I would like you to place 1 Takka on the first square of my chessboard, 2 Takka on the second square, 4 on the third square, 8 on the fourth square, and so on, until you have covered all64 squares. Each square should have twice as many Takka as the previous square."The king replied, "Takka are the least valuable coin in the kingdom. Surely you can think of a better reward." But the peasant insisted, so the king agreed to his request.

Square Number	Takkas
1	1
2	2
3	4
4	8
5	
6	
7	
8	
9	
10	

A. Did the peasant make a wise choice? Yes or No.
B. Make a table showing the number of Takka the king will place on squares 1 through 10 of the chessboard.
C. How does the number of Takkas change from one square to the next?
D. How many Takka will be on square 20? On square 30? On square 64? Write all these in exponential form.

CHALLENGE: 9

ANCESTRAL MATHEMATICS

In order to be born, you needed:

You

4 grand parents

- 16 second great grandparents

64 fourth great grandparents

.....

.....

.....

- 256 sixth great grandparents

1024 eighth great grandparents

For you to be born today from 12 previous generation you needed a total of 4094 ancestral over the last 400 years.

i. Now write all these expression in Exponential form.

ii. Write in exponential form the expression for 20^{th} generation.

iii. Write total number of males upto seventh generation.

CHALLENGE: 10

FUN WITH MATHS

Did you know that it it possible to estimate how tall you will be when you are an adult?

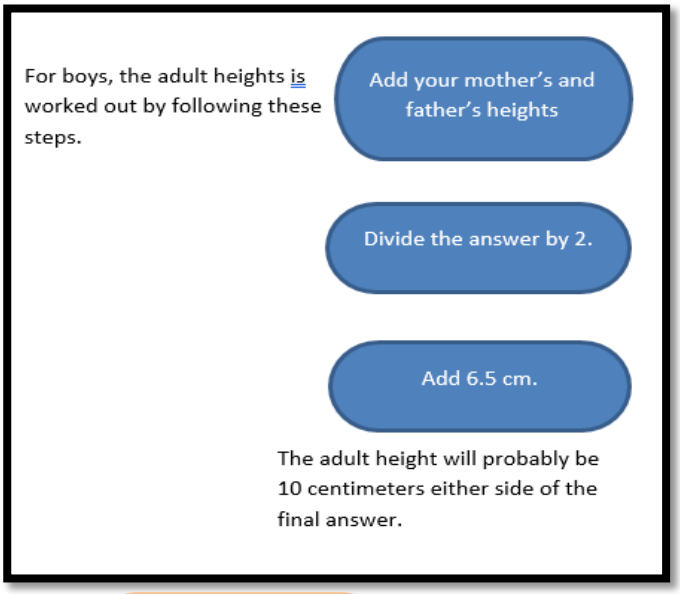
To do this, you need to know the heigthts of your mother and father or your height when you were a toddler. (if you cant find out either of these, you will just have to wait untill you grow up!)

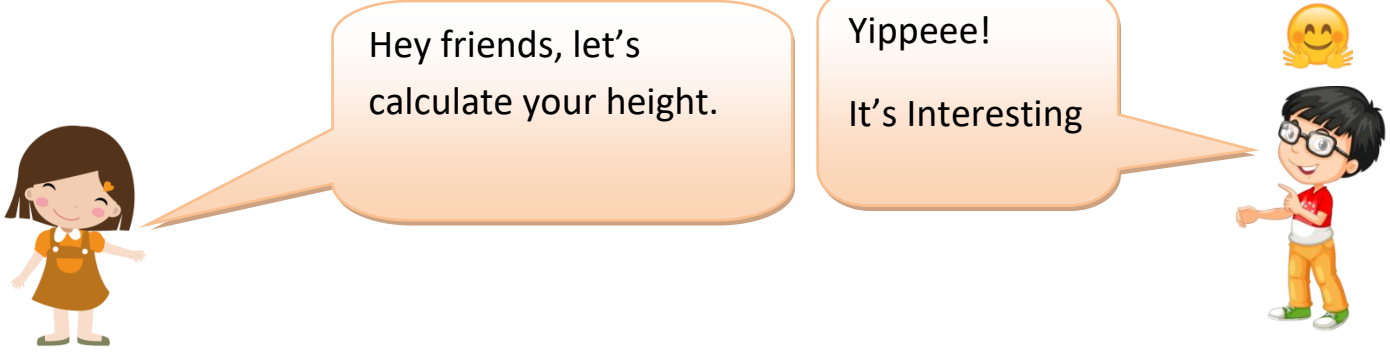
Tania knows that her mother is 164 centimetres tall and her father is 186 centimetres tall.

To estimate her adult height, she followed these steps.

Add your mother's and father's heights.	→	Divide the answer by 2.	→	Subtract 6.5 cm
164 + 186 = 350		350 / 2 = 175		175-6.5 = 168.5 cm

The estimate of Tanya's adult height is 10 centimetres either side of 168.5 centimetres. So, tanya's height will be somewhere in the range of 158.5 to 178.5





THINKING ABOUT THE ANSWERS, TRYING TO SOLVE IT

KYA TUMHE QUESTIONS SAMJH AAYE?

Mujhe sab samajh aa gya. These questions were very easy. Anyone can solve them if their basics are clear

Siya, hopefully you can solve all these questions now

Keep on doing Bacho.

I will share the answers next time.

LEARNING OUTCOMES ACHIEVED

CLASS 6

- Applied the rules of divisibility and find the factors of a number quickly

CLASS 7

- Uses exponential form of numbers to simplify problems involving multiplication and division of large number.

CLASS 8

- Simply power with negative exponents and calculate the multiplicative inverse of a number.
- Apply the laws of exponent and simplify a given expression.

CLASS 9

- Extend the laws of exponents and simplify a given expression.

CLASS 10

- Laws of exponents studied earlier to solve problems related to real life context.

STEP 1
(ANSWER KEY)

Match you IQ with my answers of our previous book.

CHALLENGE 1

100

CHALLENGE 2

FUN WITH MATH

Turn upside down

87

CHALLENGE 3 & 4

-1 +2 -3

6 -1 7

7 13 -6

-44 -1 -43

and so on.

CHALLENGE 5

44

CHALLENGE 6

47

CHALLENGE 7

Profit Rs 2000/-

CHALLENGE 8

150 cm

CHALLENGE 9

i. Rs. 230/-
ii. Rs. 90/-
iii. Rs. 85/-

CHALLENGE 10

i. 60
ii. 25
iii. 22
iv. 16
v. Dev –21,Ajay – 21, Vijay - 21

CHALLENGE 11

i. 27
ii. 33
iii. 37
iv. Zero, as Post office is closed on Sunday. So, no customer will visit on Sunday.
v. 64

DESIGNED SUPPORT: MR. BALJIT SINGH, JR. COMPUTER INSTRUCTOR