MATHEMATICAL LITERACY:
PRACTICE BOOK FOR STUDENTS

A Little Mathemagic

Practice book for students
Enhancing Critical and Creative Thinking

2020

भारत का संविधान

उद्देशिका

हम, भारत के लोग, भारत को एक सम्पूर्ण [1]प्रभुत्व-संपन्न समाजवादी पंथनिरपेक्ष लोकतंत्रात्मक गणराज्य बनाने के लिए, तथा उसके समस्त नागरिकों को:

सामाजिक, आर्थिक और राजनैतिक न्याय,

विचार, अभिव्यक्ति, विश्वास, धर्म

और उपासना की स्वतंत्रता,

प्रतिष्ठा और अवसर की समता

प्राप्त कराने के लिए

तथा उन सब में व्यक्ति की गरिमा

[2]और राष्ट्र की एकता और अखंडता

सुनिश्चित करने वाली बंधुता बढ़ाने के लिए

दृढ़संकल्प होकर अपनी इस संविधान में आज तारीख 26 नवम्बर, 1949 ई॰ को एतद्द्वारा इस संविधान को अंगीकृत, अधिनियमित और आत्मार्पित करते हैं।

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1. संविधान (बयालीसवां संशोधन) अधिनियम, 1976 को धारा 2 द्वारा (3.1.1977) से "प्रभुत्व-संपन्न लोकतंत्रातक गणराज्य" के स्थान पर प्रतिस्थापित।

2. संविधान (बयालीसवां संशोधन) अधिनियम, 1976 को धारा 2 द्वारा (3.1.1977) से "राष्ट्र की एकता" के स्थान पर प्रतिस्थापित।

भाग 4 क

मूल कर्त्तव्य

51 क. मूल कर्त्तव्य—भारत के प्रत्येक नागरिक का यह कर्त्तव्य होगा कि वह—

(क) संविधान का पालन करे और उसके आदर्शों, संस्थाओं, राष्ट्र ध्वज और राष्ट्रगान का आदर करें;

(ख) स्वतंत्रता के लिए हमारे राष्ट्रीय आंदोलन को प्रेरित करने वाल उच्च आदर्शों को हृदय में संजोए रखे और उनका पालन करे:

(ग) भारत की प्रभुता, एकता और अखंडता की रक्षा करे और उसे अक्षुण्ण रखे;

(घ) देश की रक्षा करे और आह्वान किए जाने पर राष्ट्र की सेवा करे;

(ङ) भारत के सभी लोगों में समरसता और समान भ्रातृत्व की भावना का निर्माण करे जो धर्म, भाषा और प्रदेश या वर्ग पर आधारित सभी भेदभाव से परे हों, ऐसी प्रथाओं का त्याग करे जो स्त्रियों के सम्मान के विरुद्ध हैं;

(च) हमारी सामाजिक संस्कृति की गौरवशाली परंपरा का महत्त्व समझे और उसका परिरक्षण करे;

(छ) प्राकृतिक पर्यावरण की जिसके अंतर्गत वन, झील, नदी, और वन्य जीव हैं, रक्षा करे और उसका संवर्धन करे तथा प्राणी मात्र के प्रति दयाभाव रखे;

(ज) वैज्ञानिक दृष्टिकोण, मानववाद और ज्ञानार्जन तथा सुधार की भावना का विकास करे;

(झ) सार्वजनिक संपत्ति को सुरक्षित रखे और हिंसा से दूर रहे;

(ञ) व्यक्तिगत और सामूहिक गतिविधियों से सभी क्षेत्रों में उत्कर्ष की ओर बढ़ने का सतत प्रयास करे जिससे राष्ट्र निरंतर बढ़ते हुए प्रयत्न और उपलब्धि की नई उंचाईयों को छू ले;

[1](ट) यदि माता-पिता या संरक्षक है, छह वर्ष से चौदह वर्ष तक की आयु वाले अपने, यथास्थिति, बालक या प्रतिपाल्य के लिए शिक्षा के अवसर प्रदान करे।

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1. संविधान (छयासीवां संशोधन) अधिनियम, 2002 की धारा 4 द्वारा प्रतिस्थापित

THE CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolve to constitute India into a [1]SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC and to secure to all its citizens :

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the [2]unity and integrity of the Nation;

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949, do HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.

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1. Subs, by the Constitution (Forty-Second Amendment) Act. 1976, sec. 2 for "Sovereign Democratic Republic" (w.e.f. 3.1.1977)
2. Subs, by the Constitution (Forty-Second Amendment) Act. 1976, sec. 2 for "unity of the Nation" (w.e.f. 3.1.1977)

THE CONSTITUTION OF INDIA

Chapter IV A

FUNDAMENTAL DUTIES

ARTICLE 51A

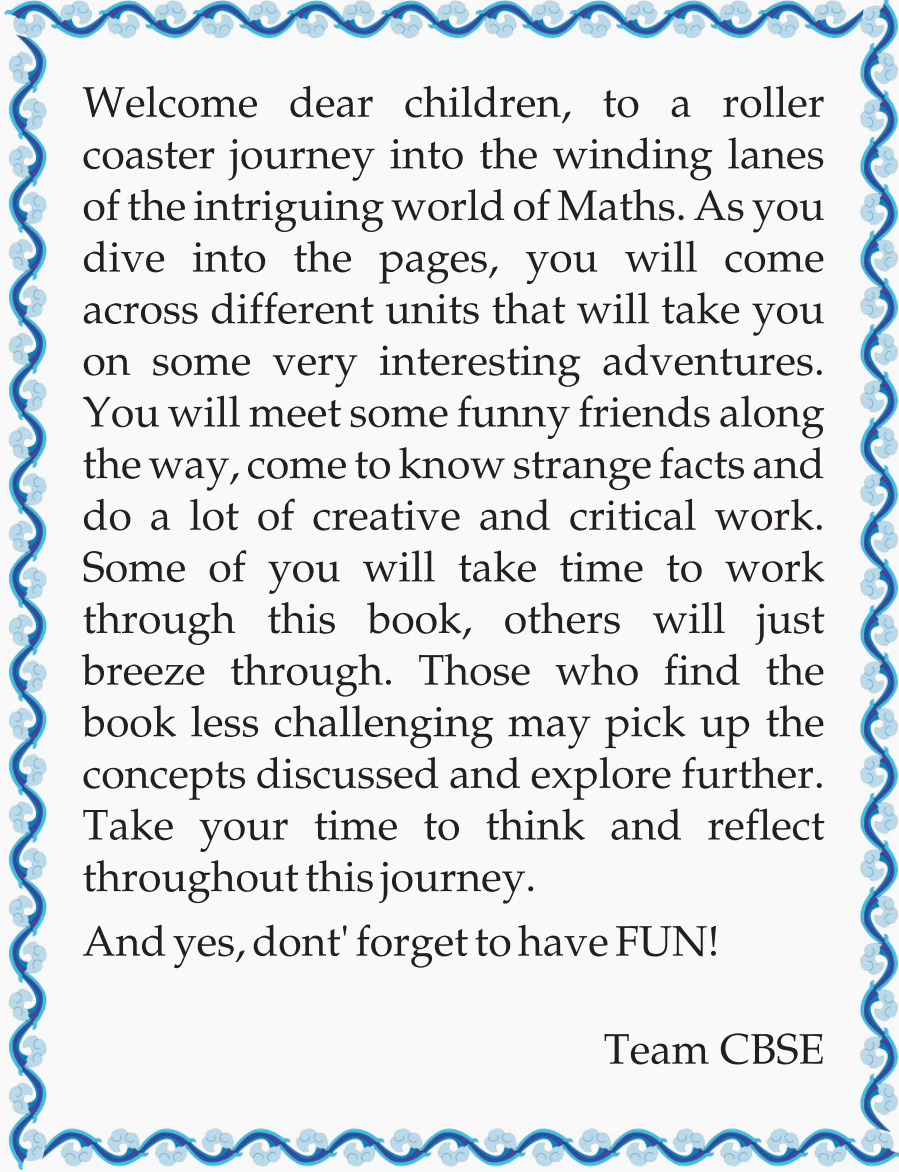Fundamental Duties - It shall be the duty of every citizen of India-

(a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;

(b) to cherish and follow the noble ideals which inspired our national struggle for freedom;

(c) to uphold and protect the sovereignty, unity and integrity of India;

(d) to defend the country and render national service when called upon to do so;

(e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;

(f) to value and preserve the rich heritage of our composite culture;

(g) to protect and improve the natural environment including forests, lakes, rivers, wild life and to have compassion for living creatures;

(h) to develop the scientific temper, humanism and the spirit of inquiry and reform;

(i) to safeguard public property and to abjure violence;

(j) to strive towards excellence in all spheres of individual and collective activity so that the national constantly rises to higher levels of endeavour and achievement;

[1](k) who is parent or guardian to provide opportunities for education to his/her child or, as the case may be, ward between age 6 and 14 years.

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1. Subs. by the Constitution (Eighty–Sixty Amendment) Act, 2002

In the words of Albert Einstein, 'Pure Mathematics is, in its own way, the poetry of logical ideas.'

Welcome dear children, to a roller coaster journey into the winding lanes of the intriguing world of Maths. As you dive into the pages, you will come across different units that will take you on some very interesting adventures. You will meet some funny friends along the way, come to know strange facts and do a lot of creative and critical work. Some of you will take time to work through this book, others will just breeze through. Those who find the book less challenging may pick up the concepts discussed and explore further. Take your time to think and reflect throughout this journey.

And yes, dont' forget to have FUN!

Team CBSE

ACKNOWLEDGEMENTS

Table of Contents

Unit 1 : Messy Integers

Surabhi has been studying Integers in class. She even had a restless night trying to sort integers in her dreams.

1.1 Can you help her sort the integers?

−7 +2 −3 +5
+11
+8 −9 28
−11 13
0

There is one integer in her dream which is bothering her the most. Can you point out that number?
Hint : The troubling number goes neither in column A nor in column B, but, in the circle in between.

Column A	Column B
Positive Integers	Negative Integers

1.2 Decode the secret message.

If **RISE** is coded as 6 8 2 1, **TEAR** is coded 9 1 4 6 and **REACH** is coded as 6 1 4 7 3. What will be the code for **TEACHER?**

_____

Did you know?

We forget 50% of our dreams within 5 minutes of waking up and 100% within 10 minutes.

And, not everyone dreams in colour. 14% people dream in black and white!

Unit 2 : Rainbow Integers

2.1 Solve the questions in the image below. Next, identify the integers and then colour all sections with positive integers yellow, and all sections with negative integers as red.

$(-1) -1$

$(-5) + 4$

50

24

$(-6) \times (-2)$

$(-2) + 3$

-12

-10
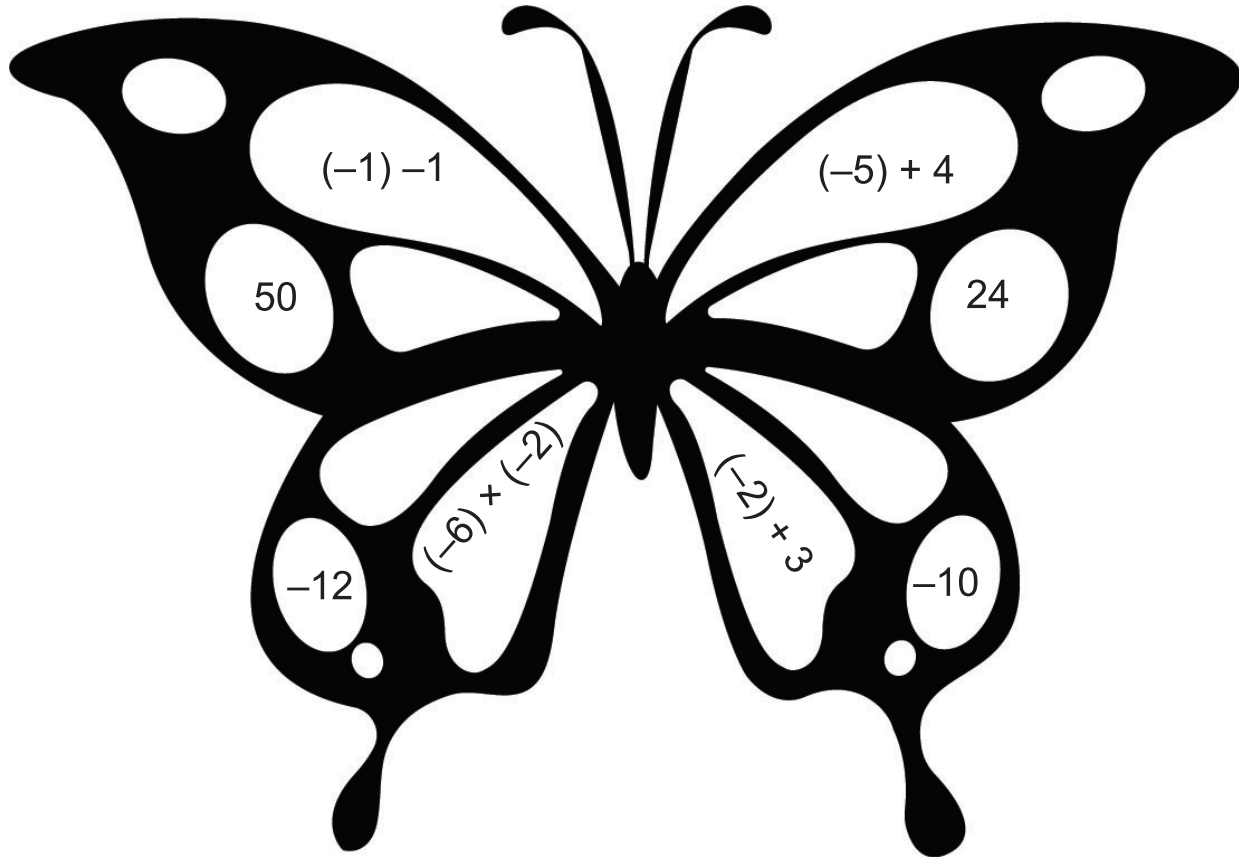
2.2 Adwaita a tortorise in Alipore Zoo in Kolkatta has the longest recorded life span in the world. She lived for more than 200 years.

I am Tapu, the tortoise. Although I am not as old as Adwaita was, can you guess my age with the help of clues given below :
(a) Both my digits are odd.
(b) One of my digits is 3
(c) My ten's place is three times the digit at one's place.
(d) I am more than 50 years old, but less than 100 years.

years
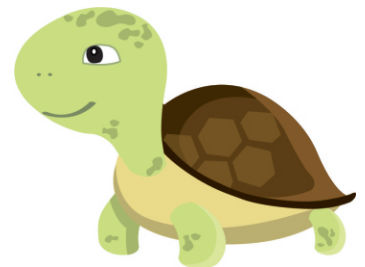
Butterflies use ants as babysitters? Really?

Yes! Many members of a butterfly family Lycaenids depend on ants to take care of their babies. In some species, like the Alcon blue, ants carry the babies back to their nest, and heartily protect them from parasites too!

How's that for insect solidarity!

Unit 3 : Magic Squares

A Magic Square is a square with a special arrangement of numbers such that the numbers in each row, each column and the diagonals adds up to the same number.

For example:

A 3×3 Magic Square of numbers 1 to 9, can be arranged as following.

2	7	6	➜15
9	5	1	➜15
4	3	8	➜15

15   15 15 15   15

Now, look at the arrangement of the numbers carefully.

If you arrange the given numbers in an ascending order, you get

1, 2, 3, 4, 5, 6, 7, 8, 9 where 5 is the number that lies exactly in the middle.

In the above magic square notice that 5 is right in the middle of the square.

Let us now look at the diagonals 2, 5, 8

$$5-2=3; \ 8-5=3$$

Similarly, the other diagonal: 6, 5, 4

$$6-5=1; \ 5-4=1$$

And, the second row

$$9-5=4; \ 5-1=4$$

Do you see a pattern?

Also, the sum in each case is 15, which is called the **Magic Constant.** And in this case it is $5 \times 3 = 15$

But why is it called a Magic Square?

It seems that since ancient times, squares have been connected to the supernatural and the magical world.

3.1   Complete the Magic Square, using numbers from 7 to 21, given that the Magic Constant $= 14 \times 3 = 42$.

10	?	?
?	14	?
11	?	18

3.2 The magic square, given below uses all integers from 7 to 15. The sum of the numbers in each row, column and the two main diagonals are the same. Which number would replace ✳ in the given square, once completed?

✳		
		7
		14

Creative Corner

Choose 9 consecutive numbers of your choice and create a Magic Square by following these steps.

- (a) Write the consecutive numbers choosen by you.
- (b) What is the middle most number chosen by you?
- (c) What is your Magic Constant (the sum of the numbers rows, columns or the diagonals)?
  (Magic Constant = Middle most number × 3)

  [Hint: Start with putting the middle most number at its right place]

'Square' isn't just for Maths, is it?   Let's explore. A square is . . .

- an open, four-sided, area surrounded by buildings in a village, town, or city. (e.g. Meet me at the market-square.)
- an L-shaped or T-shaped instrument used for obtaining or testing right angles. (e.g. The carpenter misplaced the square.)
- a person considered to be old fashioned. (e.g. He's such a square!)
- being upright and honest. (e.g. I'm trusting you to be square with your decision.)
- paying or settling (an account): (e.g. Please square up the bill before you leave.)

  So, now you can go ahead and make many sentences with 'square'!

Unit 4 : Climatic Diversity of India

The world is divided into a number of climatic zones. The climate of India is described as 'Monsoon' type. There is a lot of variation in temperature across India. In Summer, the mercury occasionally touches 50° C in some parts of the Rajasthan desert, whereas it may be around 20° C in Pahalgam in Jammu and Kashmir. On a winter night, temperature at Drass in Jammu and Kashmir may be as low as –45 ° C on the other hand, Churu in Rajasthan may have a temperature of 22° C.

The average monthly temperatures of Drass and Churu were recorded. The table given below shows this information from January to June.

	January	February	March	April	May	June
Average Temperature in Drass (°C)	–32	–20	–6	2	14	21
Average Temperature in Churu (°C)	22	25	32	35	40	44

4.1 Show the increase in temperature in Drass from March to April on the number line below.
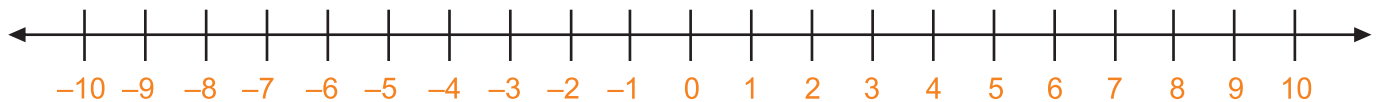
4.2 Find the difference in temperature between Churu and Drass in January.

_____

_____

Let's get to know about some weather-measuring instruments.

The instrument that . . .

- measures the water vapor content of air or the humidity -Hygrometer.
- indicates wind direction and relative wind speed - Wind Cock.
- measures weather conditions higher up in the atmosphere - Wind Balloon.
- measures the height of the base of clouds (called the ceiling) above the ground- Ceiling Projector/ Ceilometer.

Unit 5 : Hit the Boundary

The word Perimeter is used either to indicate path or length. This word comes from two Greek words **'Peri'** (which means around) and **'Meter'** (which means measure).

Perimeter is the total length of the boundary of a closed figure.
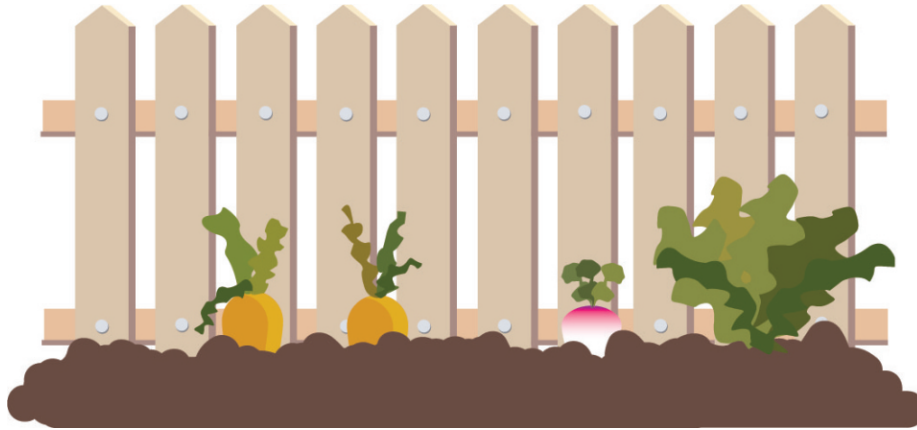
The perimeter of a simple closed figure is the sum of the measures of line-segments, binding the figure.
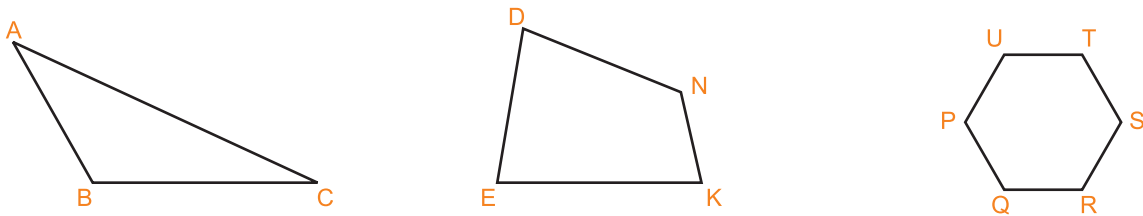
Perimeter of △ ABC = length (AB + BC + CA)

Perimeter of the quadrilateral DEKN = length (DE + EK + KN + ND)

Perimeter of the hexagon PQRSTU = length (PQ + QR + RS + ST + TU + UP)

5.1 Calculate the perimeters of the figures given below:

(a)

9m

4m   4m

9m

Perimeter = ...

(b)

4 ft

7 ft   7 ft

7 ft
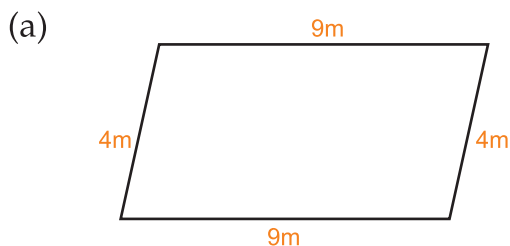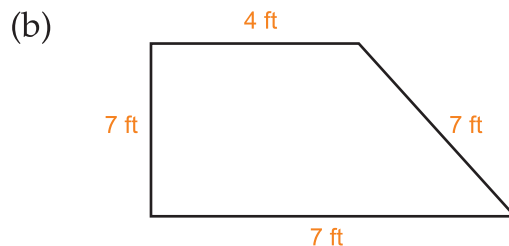
Perimeter = ...

Perimeter can also be found by counting the outer sides of a grid. But remember you must know which sides to take!

5.2   What are the perimeters of the figures given below?

(a)
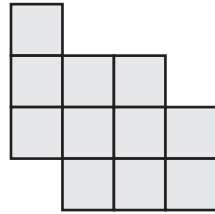
Perimeter = [........................] unit

(b)
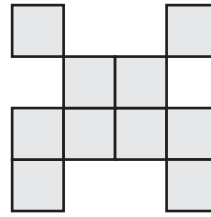
Perimeter = [........................] unit

Creative Corner

Create your own figures of the given perimeters and colour them according to your choice.

(a) Draw a closed shape with a perimeter of = 24 units.
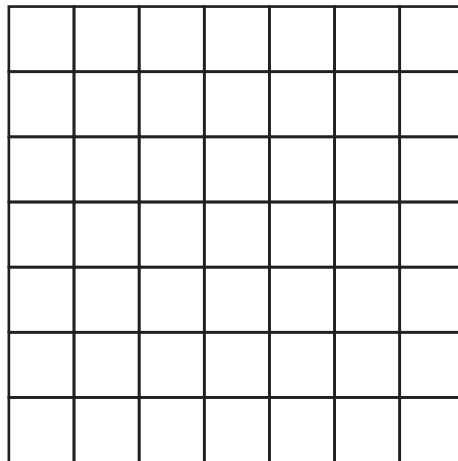
(b) Draw three different closed shapes with a perimeter of 18 units.
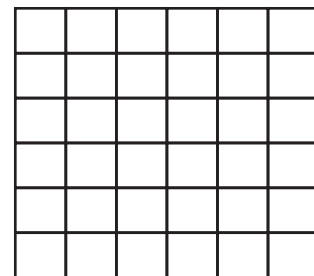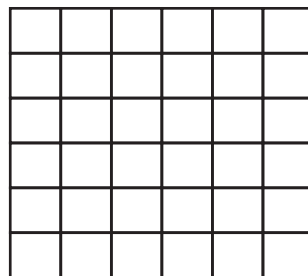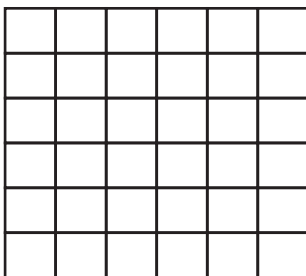
The Peri in 'perimeter' is special!

This is because Peri is a prefix that means "about", "around", "enclosing" or "surrounding".

There is a rich beauty of words starting with peri-

● Peri + meter

● Peri + scope

● Peripheral

Unit 6 : Double Trouble

6.1 Can you figure out where the other five numbers 1,2,4,5 and 6 go in this arrangement?

$$\boxed{}\ \boxed{8}\ \times\ \boxed{3}\ =\ \boxed{}\ \boxed{7}\ \boxed{}\ =\ \boxed{}\ \boxed{9}\ \times\ \boxed{}$$

It is possible to place the numbers 1-9 in the nine boxes so that both sets of multiplications in the sequence are correct.

The numbers 3, 7, 8 and 9 are already placed for you.

6.2 Find the value for each icon using box method given that the sum of all four boxes is 117.

3

$100 \div 2$	🍌
40	🥭

🍊 — 1

Fruit	Value
orange	
mango	
banana	
apple	

'*Double Trouble*' is a song performed in the Harry Potter film -The Prisoner of Azkaban.

It was performed at the Hogwarts school of Witchcraft and Wizardry Welcoming Feast (Welcoming students to the new term) and the Choir held toads and ravens while singing. The lyrics are also magical . . .

Double, double, toil and trouble

Fire burn and cauldron bubble.

Double, double, foil and trouble.

Something wicked this way comes!

Unit 7 : Magical Maths

Read the following conversation between two friends

I will show you a magic trick. Are you ready?

Yes! It is going to be real fun.

Think of a number and don't tell me.

Let me take 5 as it is my lucky number

Now, double it and add 10

$2 \times 5 + 10 = 20$

Now halve it and subtract the original number you had thought
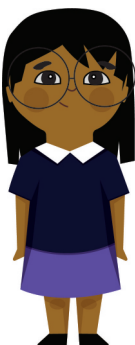
$10 - 5 = 5$
I am sure that you can't guess my answer.

Abra ka Dabra!
The number in
your mind is 5

Correct! But how
did you do it?
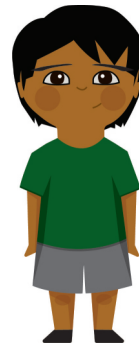
Let's try to figure out this 'trick'.

1. x
2. 2x
3. 2x + 10
4. (2x + 10) / 2
5. x + 5
6. x + 5 − x
7. 5

7.1 Now another puzzle for you . . .

STEP 1 : Think of a number
STEP 2 : Multiply it by 3
STEP 3 : Add 6
STEP 4 : Divide by 3
STEP 5 : Subtract the number chosen in STEP 1, from the number of STEP 4 AND the answer is . . .

2

Can you explain the above steps algebraically, as done in the first puzzle?
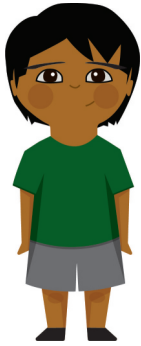
Explanation:

1. x

2. ....

3. ....

4. ....

5. ....

7.2 Can you create a similar puzzle for Chintu and Mintu to solve?

Puzzle:

1. x

2. ....

3. ....

4. ....

5. ....

And now, we certify you as an accomplished Math-E-Magician!

A Bonus trick   **Example**

- Write down a three digit number whose digits are in a decreasing order.   321

- Now, just reverse the digits to create a new number.   123

- Subtract the new number from the original number.   198

- The last step whew! Reverse the digits of the last obtained number and   891 + 198
  add it to its reverse.   =   1089

And you get your Magic Number 1089!

Try this trick with another number.

The logic behind this trick is that if we denote the three digits as a, b , c then the 3 digit number would be 100a +10b+c. Now work the next few steps.

Unit 8 : Restaurant Menu

Ashu decided to clean his cupboard. While cleaning he found an old restaurant bill. Seeing the bill, he remembered that he and Suresh had shared a plate of Crispy Cheese Fries as an appetizer. For quick bites, Suresh had chosen Paneer Tikka Sandwich and he had chosen Paneer Rolls. The food was accompanied by drinks like lassi for himself and Iced Tea for Suresh. In the end, they had shared a Brownie for dessert.

SAFARI RESTURANT

Appetizers:
Roaring Rava Idli Rs.18
Loaded Nachos Rs.34
Crispy Cheese Fries Rs.42

Quick Bites:
Paneer Rolls Rs. 85
Spicy Safari Pasta Rs. 70
Aloo Tikki Burger Rs. 85
Paneer Tikka Sandwich Rs. 65

Drinks:
Lazeej Lassi Rs.25
Mint Iced Tea Rs 35
Magical Milkshake Rs.40

Desserts:
Chocolate Cake Rs. 60
Cake with Ice Cream Rs. 75
Brownie Bites Rs. 55

With the passage of time the numbers on the bill had become blurred.

8.1 Can you help Ashu to complete his old bill?

Selection	Price
Crispy Cheese Fries	
Paneer Rolls	
Paneer Tikka Sandwich	
Lazeej Lassi	25
Mint Iced Tea	
Brownie Bites	
TOTAL Amount	
GST @ 18%	
Net Amount inclusive of GST	

(a) The total amount of the bill for the selections made at the Safari Restaurant was Rs _____.

(b) If the GST(Goods Service Tax) on this meal was 18% of the total bill amount. Then, the final bill including this tax was_____.

(c) What would be the total bill amount (including GST) if both of them skipped the dessert?

_____

_____

_____

_____

(d) Ashu notices that a milkshake is less expensive than a dessert. He decides that next time, instead of ordering dessert, he will treat himself and his friend to milkshakes. Find the cost of REPLACING his drinks in the original order with milkshakes and skipping the dessert. How much money will he save on the total bill?

_____

_____

_____

_____

The first restaurant!

Texts say that the first restaurant proprietor was a soup vendor, in Paris in the year 1765 - A. Boulanger. He put a sign above the door advertising restoratives (or restaurants), which meant soups and broths that were available within.

It was from there that the name 'restaurant' became popular and began to mean a public eating place.

Unit 9 : Time and Again

In her chemistry lab class, Reena heated a liquid until it boiled. After a while she measured the temperature of the liquid as it cooled down. The following table shows its temperature, in **c** (degree Celsius), in **t** (minutes after it boiled).

t (minutes)	0	4	8	12	16	20
c (°C)	105	96.04	87.08	78.12	69.16	60.2

Reena believes that the relation between **c** and **t** is modelled by a linear equation.

$$c = -2.24t + 105, \ 0 \le t \le 20$$

The teacher observed Reena and was impressed with her work and efforts.

To test Reena on the basis of her understanding and thoroughness of her work, the teacher asked her the following questions.

Can you help Reena with her answers?

9.1   In your opinion, what are the independent and dependent variables in this scenario?

_____

9.2   What is the boiling temperature of the liquid?

_____

9.3   If the liquid freezes at 26.6°C, then at what time will it freeze assuming that Reena started the experiment at 10.00 am.

_____

Let's learn how experiments work

- A variable/quantity is anything that can change or be changed. So, in an experimental set up, it would mean anything that may be controlled, manipulated or measured.
- The variable that we deliberately change or manipulate in an experiment is the independent variable.
- The dependent variable is the one that is restricted. In simple words, it is what you observe or measure to figure out what is happening, when you change your independent variable.

Unit 10 : Circle Pies

A bar graph is a graphical display of data using bars of different lengths.

For example, ICY Treats Ice Cream company conducted a telephonic survey to find out favourite ice cream flavours of 200 students. The data so obtained is represented using a bar graph as shown below.

Favourite flavour	Number of students
Butterscotch	45
Vanilla	15
Strawberry	30
Chocolate	35
Mango	55
Orange	20

Favourite Ice Cream Flavours
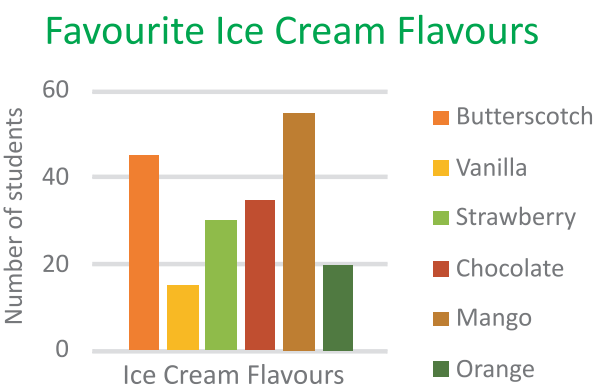
On the other hand, a pie chart is a circular graph that shows the proportionate contribution of different categories to an overall total.

Favourite Ice Cream Flavours

Every sector (as represented by different colours in the above pie chart) of the circle represents each category's contribution, such that the graph resembles a pie that has been cut into different sized slices.

Every 1% contribution that a category contributes to the total corresponds to a slice with an angle of 3.6 degrees.

Let us study the bar graph and pie charts given below and solve some questions.

The bar graph below shows the information about exports from Zedland, a country that uses zeds as its currency.

Total annual exports from Zedland in millions of zeds, 1996-2000

Distribution of exports from Zedland in 2000
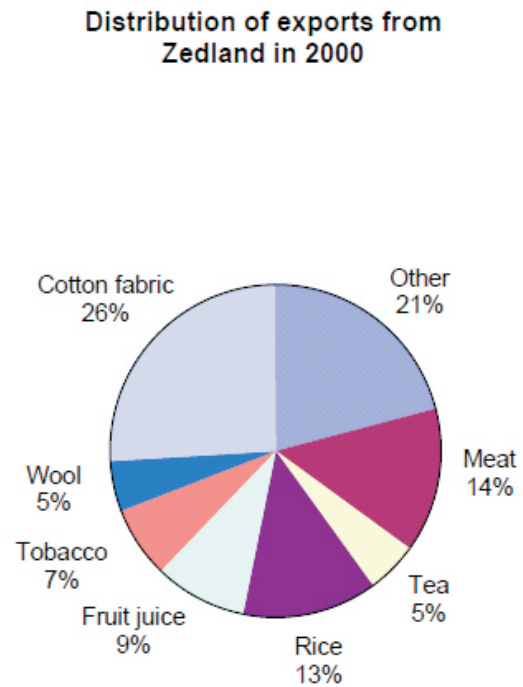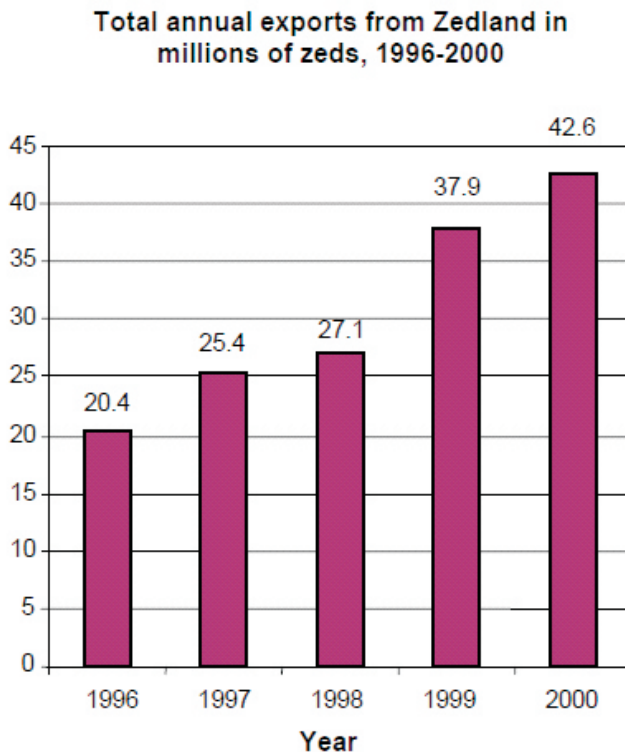
10.1 What was the total exports (in millions of zeds) from Zedland in year 1998?

_____

10.2 What were the value of fruit juice exported from Zedland in 2000?

(a) 1.8 million zeds.   _____

(b) 2.3 million zeds.   _____

(c) 3.4 million zeds.   _____

(d) 3.8 million zeds.   _____

Look what I just found out!

William Playfair — a businessman, engineer and economics writer from Scotland — created the first known pie chart in 1801. We have to thank him for many of the popular graphs that we use today, including the bar graph.

Playfair wrote that 'making an appeal to the eye when proportion and magnitude are concerned, is the best and readiest method of conveying a distinct idea.' So cool!

Unit 11 : Card Game

11.1 Three rectangular cards are numbered 1, 3 and 5

1 **3** **5**

Sanjay picks one of these cards at random.

Find the probability that the number on the card he picks is . . .

(a)   5

_____

(b)   an even number.

_____

11.2   Three circular cards are numbered 2, 3 and 4

2 **3** **4**

Sharda randomly picks one of these circular cards. Find the probability that the number on the card which she takes out is an even number.

_____

11.3 Amrita has all six cards. She picks one rectangular card and one circular card. She adds together the numbers on the two cards to find the total for these two cards. Complete the table to show all possible totals. Three totals have been done for you.

Number on rectangular card

	1	3	5
2	3		
3			8
4	5		

Number on circular card

11.4 Find out the probability that the sum of the numbers on the cards that Amrita picks up is 8

What are the Odds?

A Croatian man named Frane Selak, born in 1929, escaped death seven times in several accidents—car, bus, flight. Later, he won a lottery worth US$1,110,00 in 2003. These are the reasons why journalists labelled him 'The World's Luckiest Man'!

Unit 12 : Tracking the Journey

The 'odometer' of a car tells you how far the car has travelled in its entire life. The 'trip odometer' can be reset any time if you wish to find out the length of a trip.

Last year, the Mehta family travelled for a vacation to Shimla in their brand-new car. After a while, Mr. Mehta noted that the main odometer of their car read 490 km and the trip odometer was showing 22.

When the Mehta family reached the destination, Mr Mehta asked his daughter Ishita," The main odometer is showing precisely two times the trip odometer. How much have we travelled today?"

Ishita made the following observation table to analyse the progress of the journey-

Distance travelled (km)	Odometer	Trip Odometer	Difference between Odometer and Trip Odometer
....	490	22	468
1	490+1 = 491	22+1 = 23	468
2	490+2 = . . .	22+2 = . . .	468
3	490+ . . . = 493	22+ . . . = 25	.....
4	490+ . . . = . . .	22+ . . . = . . .	.....
.			
.			
x	490+x	–	468

12.1 Can you help Ishita to find out how much distance did the Mehta family travel from home to reach the hill station?

_____

_____

_____

_____

I bet you didn't know this.

- The road distance between Srinagar to Kanyakumari is around 3700 kms.
- Sunita Dugar, Parneet Sandhu, and Neetha Jegan travelled in an SUV, by road, from Kanyakumari to Kashmir. They started on 8 August 2015 and finished on Independence Day eve.
- Lt Col Bharat Pannu did it the eco friendly way and rode the length of India on his bicycle in 8 days, 9 hours and 48 minutes, He left Srinagar on October 21, 2019 and reached Kanyakumari on October 29, covering 3,600 km.

Unit 13 : Snow White and the Seven Dwarfs

Meet Snow White and her friends 'The Seven Dwarfs'.

| Doc | Grumpy | Bashful | Dopey |

| Happy | Sleepy | Sneezy |

Colour them according to your choice

One day, Snow White asked the seven dwarfs about their birthdays. Dopey answered that they were all born on the same day.

Snow White was taken aback and said, 'But you don't look like septuplets'.*

So Doc said that they were born on the same day, but on seven consecutive years and the ages of the youngest three added up to 42 years.

---

* *Septuplates are seven babies born together, on the same day and date by the same mother..*

13.1 Then, Grumpy asked Snow White if she could tell them the ages of the oldest and the youngest amongst them.

Snow White takes the age of the youngest dwarf as **x** years.

Then, the age of the dwarf who is one year older is _____ years.

And, the age of the third dwarf will be _____ years

_____

_____

_____

The youngest dwarf is .... years old and the oldest dwarf is .... years old.

Did you know this?
- 'Snow White' is a 19th-century German fairy tale.
- The Grimm Brothers published it in 1812 in the first edition of their collection Grimms' Fairy Tales and numbered it as Tale 53.
- This fairy tale was performed for the first time as a Broadway play at the Little Theatre in New York City, on October 31, 1912.
- The 7 dwarfs in it were— Blick, Flick, Glick, Snick, Plick, Whick and Quee

Unit 14 : Olympic Mathlete Competition

There were 8 contestants who competed in the Olympic mathlete competition

A	B	C	D	E	F	G	H
Ali	Babita	Chintu	David	Ellie	Fahim	Geeta	Hari
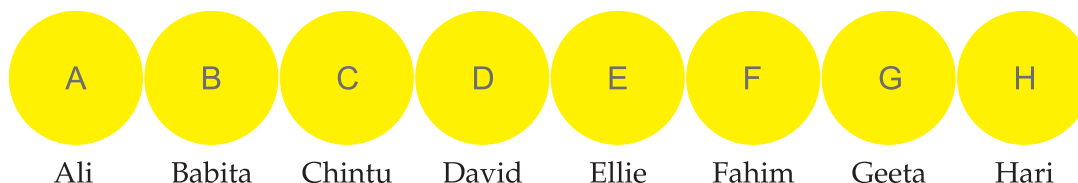
There are 3 medals available - Gold, Silver and Bronze. Each medal is awarded to one student only:

14.1 Gold medal being awarded first in the ceremony. How many candidates are there for the gold medal?

_____

14.2 Once the gold medal is awarded, how many candidates are there for the silver medal?

_____

14.3 Once the gold and silver medals are awarded, how many candidates are there for the bronze medal?

_____

14.4 In how many ways can we award the medals among the 8 contestants?

_____

[Hint: We have to choose 3 people out of 8. To do this, we start with all options (8), then take them away one at a time (7, then 6) until we ran out of medals].

Aah! So that's what happened!

- Lots of people accept that the medal (form and content), was invented by the Italian painter Antonio Pisano (1395–1455), called Pisanello.
- The gold, silver and bronze Olympic medals were first used at the 1904 Summer Olympics.
- At one time, Olympic gold medals were real solid gold. A solid gold medal was awarded at the 1912 Stockholm Olympics for the last time. After that, gold medals were made of sterling silver that were plated with gold.

Unit 15 : School Swimming Club

Seven students of Anand Public School want to join the swimming club of the school.

Following information about the students is recorded in the table below.

Name	Month and Year of Birth	Height (in meters)	Distance each Student can swim (meters)
Ali	November 2004	1.62	200
Vibha	October 2006	1.43	500
Kiran	February 2006	1.53	1500
Daisy	January 2007	1.56	1000
Faizal	December 2005	1.64	600
Kuljeet	August 2006	1.52	1000
Ila	January 2006	1.46	1000

15.1 Can you identify the students who can join the club?

Remember
One meter= 100 Centimeter
One Kilometer = 1000 meter

To join the swimming club you must be -
· at least 12 years old in March 2018
· at least 150 centimetres tall
· able to swim at least 0.5 Kilometres.

Let us complete the table given below to make our choices easier.

Name	Month and Year of Birth	Height (Meters)	Distance each student can swim (Meters)	Age on 31st March 2018)	Height (cms)	Distance each student can swim (kilometers)
Ali	November 2004	1.62	200		162	0.2
Vibha	October 2006	1.43	500	11 years 5 months		
Kiran	February 2006	1.53	1500		153	
Daisy	January 2007	1.56	1000			
Faizal	December 2005	1.64	600			
Kuljeet	August 2006	1.52	1000			
Ila	January 2006	1.46	1000			

The following students can join the swimming club:

1. _____

2. _____

3. _____

4. _____

15.2 The swimming pool has a diving board, where the swimming coach trains the students to dive off boards that are placed at different heights. The speed, S m/s, when they enter the water from a board of height h metres, can be found using this formula.

$$s = \sqrt{1.96\,h}$$

a) Calculate the value of s when h = 10 m.

_____

_____

b) Find the value of h, when s = 4.2 m/s.

_____

_____

This is interesting . . .

- Diving has been a popular pastime across the world since ancient times but the first modern diving competitions were held in England in the 1880s.

- The 1877 edition to British Rural Sports by John Henry Walsh makes note of a 'Mr. Young' plunging 56 feet (17 m) in 1870.

- The Swimming Association of Great Britain first started a 'plunging championship' in 1883 but it was discontinued in 1937 when fancy diving began.

Unit 16 : My Calendar

I have had this lovely calendar that has cute cut out labels for each month, which I had assembled.

Yesterday my cat jumped on the desk and the calendar fell down, mixing up all the pages.

M	T	W	T	F	S	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

M	T	W	T	F	S	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

M	T	W	T	F	S	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

M	T	W	T	F	S	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

M	T	W	T	F	S	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28		

M	T	W	T	F	S	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

M	T	W	T	F	S	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

M	T	W	T	F	S	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Please help me label the names of the month correctly.

16.1 Lets' first identify February from the above Calendar sheets.

Now that you know which one is February, can you figure out the following?

(a) 1st of March is a _____.

(b) 31st of January is a _____.

(c) The Labour Day which falls on 1st of May is a Thursday. Then, the Independence Day falls on _____day.

(d) If 5th of September, Teacher's Day, falls on Friday, then, 2nd of October, Gandhi Jayanti is on _____ day.

Now figure out this Calendar for the rest of the year

This is interesting…

- Today's records of time are split into two major units: BCE (Before Common Era) and CE (Common Era), whereas the previously used terms were BC (Before Christ) and AD (Anno Domini, or in the year of our Lord).
- The term calendar is taken from *calendae*, the term for the first day of the month in the Roman calendar, related to the verb *calare* 'to call out', referring to the 'calling' of the new moon when it was first seen.
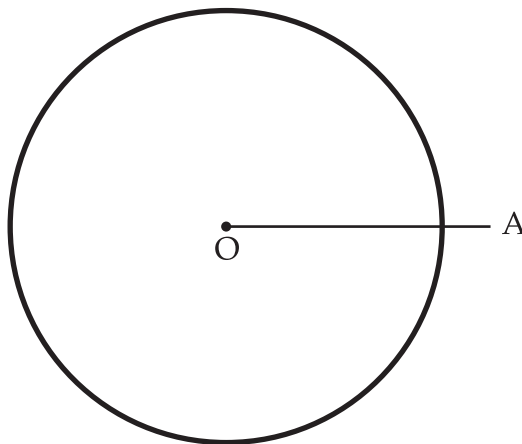
Unit 17 : Football Match

The results of the school's senior football team during a year are recorded, using W for a win, L for a loss and D for a draw. They are:

L	L	W	D	L	W	L	W
L	L	D	L	L	W	W	L
W	L	L	W	D	L	L	W

17.1 Complete the table given below.

Type of Result	Frequency	Pie chart angle (central angle)
W	8	$\dfrac{8}{24} \times 360° = 120°$
L		
D		
Total		360°

17.2 Now complete the Pie chart

Colour all sectors (parts) differently

Key :

L - ☐

D - ☐

W - ☐

Pie Chart is also known as Circle graph. It is a type of graph in which a circle is divided into sectors such that each represents part of a whole.

Follow these instructions to complete the given pie chart:

- Complete the table given above to find out all the central angles.
- Take OA as the base and O as the centre and draw any one of the central angle using a protractor.
- Similarly draw all the central angles.

Ever heard of football-tennis?

Futnet evolved in ex-Czechoslovakia in 1920s when young football players started to kick the ball over a horizontal rope which was later replaced by a net. Each side has 1 to 3 (maximum) players. The Futnet ball is similar to the football in size but bounces more than half a meter when inflated properly. The team in possession can touch the ball three times, allowing one bounce between each touch, before knocking it over the rope to their opposition. It is a frequent training game in many professional football clubs.

Unit 18 : Pile of Cans

Alka loves to organize cans in triangular piles, where each row has one can less can than the row below and there is only one can in the top row. To arrange 10 cans in total, she places 4 cans in the bottom row and 3 cans in the row above it and so on .
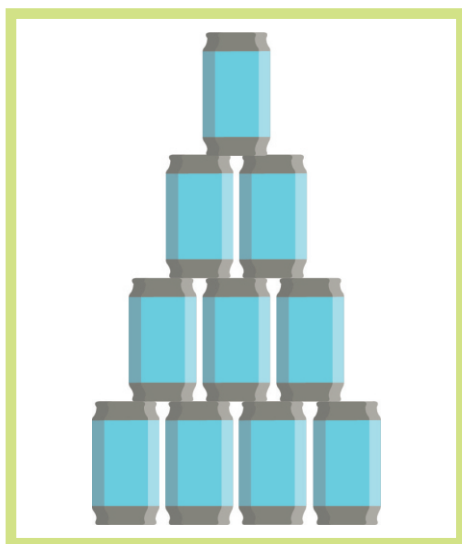
18.1 Alka now arranges a pile having 20 cans in the bottom row, ending with one can in the top row. The total number of cans in the arrangement are

(a) 200   (b) 210

(c) 190   (d) 20

18.2 There are 820 cans in a pile. How many cans are there in the bottom row?

_____

_____

18.3 Alka has 200 cans. Explain why she will not be able to organize the cans in a triangular pile.

_____

_____

Cans that Alka is using for creating piles are the packaging material which companies use for preserving foods. About 200 billion cans are used in preserving/packaging of juices/cold drinks/jam etc. every year across the world. These cans are made up of aluminium or some other metal. Reusing and recycling of cans is important to minimize our carbon –footprint. Can you find out what is carbon-foot print?

Unit 19 : Build your Mathematical Vocabulary

The following mathematical terms are hidden in the given word search. Can you find all these terms?

Denominator, Set, Integer, Equivalent, Positive, Negative, Equal, Fraction, Ratio, Percent, Computation, Word Problems, Algebra, Geometry, Factor, Sum, Octagon, Pentagon, Table, Quotient, Product, Minus, Plus, Number, Angle, Square, Rectangle, Triangle, Division, Multiplication, Subtraction, Addition, Graph, Math, Parallel

```
F  D  P  N  Z  G  A  A  M  U  L  T  I  P  L  I  C  A  T  I  O  N  B  P
Q  H  P  A  R  G  E  J  N  M  A  U  T  K  F  B  U  E  T  G  P  Y  A  T
Y  B  L  K  J  R  M  P  P  G  X  G  X  F  M  S  J  Q  H  V  U  Q  W  R
F  R  A  C  T  I  O  N  E  P  L  Z  E  R  J  E  U  B  D  Z  G  U  G  N
F  F  S  K  S  Q  L  R  N  A  W  E  K  O  V  Q  C  M  K  Z  J  O  M  O
F  O  H  C  M  G  R  T  T  R  H  M  M  I  M  O  K  A  U  C  O  T  L  I
I  N  T  E  G  E  R  F  A  A  U  M  T  E  D  E  E  T  N  H  M  I  V  T
E  C  G  R  W  G  J  O  G  L  P  A  I  A  S  X  T  H  A  L  Q  E  K  A
S  R  R  A  N  V  X  Y  O  L  G  B  I  Z  N  R  V  R  O  Z  B  N  V  T
U  A  A  X  F  N  Y  R  N  E  R  O  T  C  A  F  J  L  Y  I  T  T  C  U
B  R  W  U  D  Q  Q  N  N  L  N  W  L  H  U  G  N  W  G  A  T  M  X  P
T  Z  O  I  Q  P  B  P  U  N  N  A  O  V  H  O  O  W  R  R  U  A  X  M
R  M  D  T  N  S  L  Z  O  N  U  E  V  I  T  I  S  O  P  S  V  P  R  O
A  R  K  W  A  U  P  I  U  Q  B  X  J  M  T  D  L  D  F  M  A  D  P  C
C  O  O  Z  S  R  S  P  E  Q  Z  T  Q  Y  W  E  G  O  Y  E  N  K  R  N
T  T  T  T  K  I  E  R  X  A  R  B  E  G  L  A  F  U  H  L  O  V  E  W
I  A  H  N  V  L  S  M  P  T  R  N  O  I  T  I  D  D  A  B  G  J  B  E
O  N  F  I  E  T  K  R  U  M  Z  Q  H  R  D  W  L  W  X  O  A  J  M  K
N  I  D  J  O  C  O  Q  I  E  V  P  J  V  U  Z  E  L  L  R  T  Q  U  M
A  M  L  D  V  D  R  N  G  Y  N  Z  O  A  U  U  N  R  O  P  C  E  N  Z
A  O  I  B  U  Y  U  E  T  N  E  L  A  V  I  U  Q  E  B  D  O  C  M  L
T  N  S  C  W  S  I  A  P  E  Z  E  X  M  C  W  A  D  K  R  N  U  W  Q
S  E  T  T  R  I  A  N  G  L  E  H  F  V  E  L  B  A  T  O  M  F  P  W
T  D  B  W  G  Q  K  R  E  C  T  A  N  G  L  E  L  I  D  W  F  V  D  V
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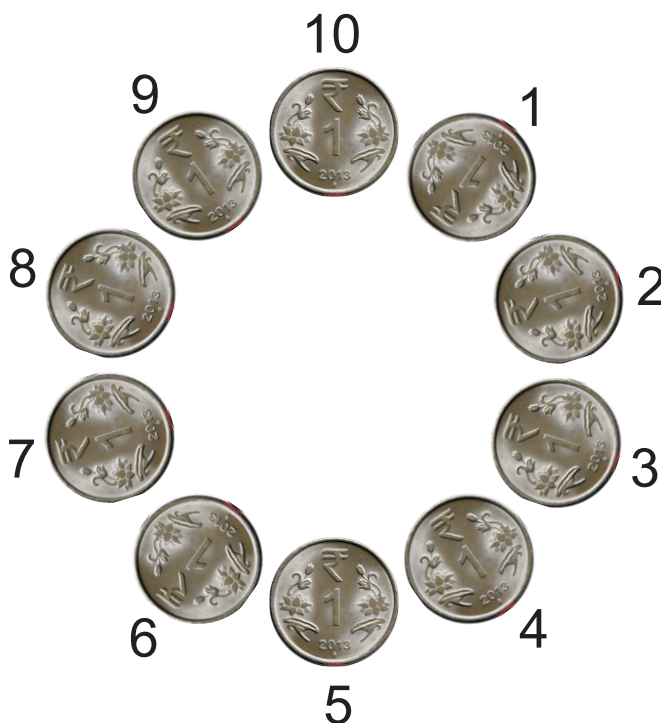
And that was so much fun!

Unit 20 : Puzzled!

20.1   Kareem and Chanda were talking about an old puzzle. Where you put ten 1-rupee coins as pictured below.

Starting at number 1, and counting by three, you eliminate every third coin.

(a)   Can you find which coin will remain in the end?

_____

(b)   Kareem says to Chanda 'That means if I count by fives instead of threes, the last coin remaining will be coin number 6.' Chanda said 'You are way off.' The last coin will be . . .

(i) 10   (ii) 7

(iii) 3   (iv) 1

20.2   There was a king who owned a large plot of land that he wanted to leave for his seven princes. It was a square piece of property with seven gold mines on it. The king really liked puzzles and decided to give all seven gold mines to the first prince who could divide the land with three and only three lines such that each section has one gold mine. Here is how the mines were situated.
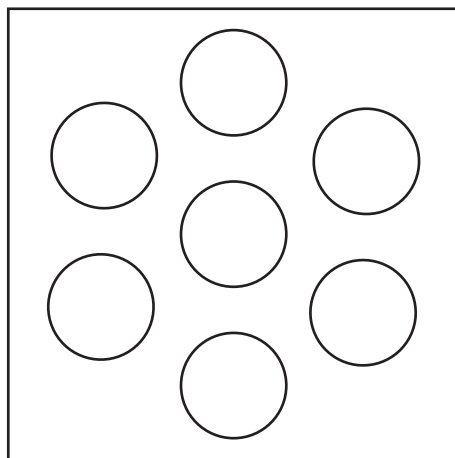
Months went by and no one could solve the puzzle until one day a young farmer wrote a letter to the king with a sketch of how it could be done.

The king was so impressed that he gave the land to the young farmer and appointed her in the royal treasury as an accountant.
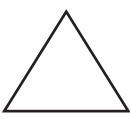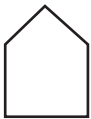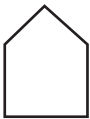
Can you draw the lines, such that there is only one mine in each of the seven sections?
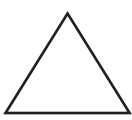
(Remember the seven sections do not have to be equal in area).

Unit 21 : Mental Athletics

And now, time for some mental atheletics.

21.1 Two shapes are given such that each shape represents a natural number.

$$\triangle + \house \; \house = 20$$

$$\house < \triangle$$

$$\house \; \house = 10$$

(a) Write the value of the shapes.

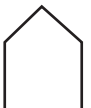$$\triangle = \text{.........................}$$

$$\house = \text{.........................}$$

(b) Once you know the value, do the following questions by replacing the shape with its value.

(i) $\house + \triangle = \underline{\qquad}$

(ii) $\triangle + \house \times \triangle = \underline{\qquad}$

(iii) $\triangle + \house \times \triangle - \house = \underline{\qquad}$

(iv) $\triangle \times \triangle \times \triangle \times \triangle + \triangle = $ _____

(v) $\triangle + \house \times \house + \triangle = $ _____

21.2 Analogy puzzles helps us to think about the relationship between two things. The symbol ' : : ' means 'is the same as ' or 'is analogous to'.

For example, 5 : 25 : : 6 : ? would be read as 5 is to 25 as 6 is to what?

The answer is 36 because 5 times itself is 25 and 6 times itself is 36.

Use the example above to answer these analogy puzzles.

(i) 7 : 49 : : 10 : ?

(a) 12

(b) 32

(c) 25

(d) 100

(ii) Triangle : Hexagon : : Rectangle: ?

(a) Square

(b) Pentagon

(c) Line

(d) Octagon

(iii) $270° : \dfrac{3}{4}$: : 300° : ?

(iv) 4 : Square : :   ?   : Decagon

(v) 180° : Triangle : : 540° : ....?..........

(vi) B : H : : D : .....?.....

21.3   Unscramble the words in the column on the right and write them correctly in the spaces provided. The first letter of each unscrambled word, reading from top to bottom spells out the answer to the following question.

What is a closed plane figure formed by three line segments known as ?

_____ _____ _____ _____   N E S T

_____ _____ _____ _____ _____   G I R T H

__ __ __ __ __ __ __ __ __   S S O I L E ECS

_____ _____ _____ _____ _____   N G L E A

___ ___ ___ ___ ___ ___ REBNUM

_____ _____ _____ _____ _____   H P A R G

_____ _____ _____ _____   L E I N

_____ _____ _____ _____ _____   G H T E I

Unit 22 : A Unique Village in India

In Mahatma Gandhi's words, "If the village perishes, India will perish too." India has nearly 6.5 lakh villages, where 68.8 percent population of the country lives. Rural development has been considered a key parameter in India's growth and prosperity.

Piplantri is one of such unique villages of India. The story of Piplantri is a perfect example of what communities can accomplish, when residents come together and work with a common goal.

In a noble attempt to save the girl child while creating environmental benefits, the villagers of Piplantri plant 111 trees every time a girl child is born. The villagers also raise money and put it in a fixed deposit, to ensure that the girl gets good education as she grows up. The villagers also ensure that the planted trees survive and flourish.

22.1   Renu reads an article about 'Piplantri' and decides to visit the village which is 175 km from her native place in Jodhpur. The taxi fare is as follows. For the first kilometre, it is Rs 20 and for the subsequent distance it is Rs 12 per km. What will be the total charges that Renu will pay after reaching Piplantri ?

(a) Rs 2100   (b) Rs 2090

(c) Rs 2110   (d) Rs 2108

22.2   The average speed of the taxi was 35 km/h. If Renu started at 1045 hours from Jodhpur she will reach Piplantri at

(a) 1145 hours   (b) 1545 hours

(c) 1345 hours   (d) 1435 hours

22.3   Rahul is blessed with a baby girl so he decided to plant 111 trees in his village. The cost per tree is Rs. 95 and the shop is giving a discount of 20%. What will be the total amount that Rahul has to pay to the shopkeeper ?

(a) Rs. 8436   (b) Rs. 10545

(c) Rs. 12643   (d) Rs. 10547

22.4   The villagers contributed and deposited Rs 5000 for 1 year at 7% in a fixed deposit for Rahul's daughter. The amount Rahul will get after 1 year is :

(a) Rs. 5110   (b) Rs. 5350

(c) Rs. 6000   (d) Rs. 5840

22.5 111 trees are planted every time a girl child is born in Piplantri. The number of trees in December 2018 was 5000. Assuming that in the year 2019, a girl child is born every month. Then, in which month will the number of trees be 6221 ?

(a) August

(b) September

(c) October

(d) November

Unit 23 : Polygon Fun

Have you ever played with a tangram? Do you know what it is?

Tangram is a dissection puzzle consisting of seven flat polygons, called *tans*, which are put together to form shapes. It is reported to have been invented in China sometime around the late 18th century. One such puzzle is given below.
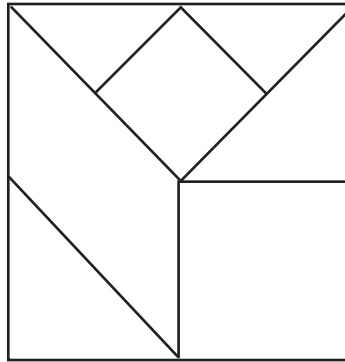
Over the years, new varieties of puzzles, similar to the above Tangram have emerged. For example:

The puzzle below has 8 pieces, instead of the original 7. They are 2 equilateral triangles, 2 parallelograms, one regular hexagon and 3 isosceles trapeziums.
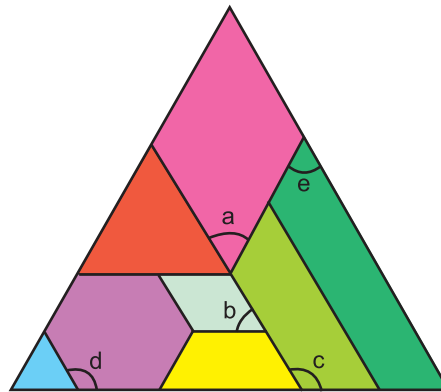
23.1   In the above figure, if all the 3 triangles, red, blue and the figure itself, are all equilateral triangles, find the measures of angles **a** to **e** as shown in the figure.

_____
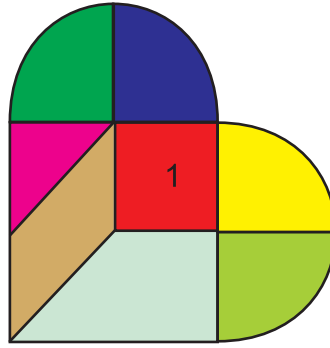
_____

_____

_____

23.2 Now, look at the figure below. If the square in the figure labelled 1 has an area of 1cm^2, What is the area of the above figure? (use $\pi = 3.14$)
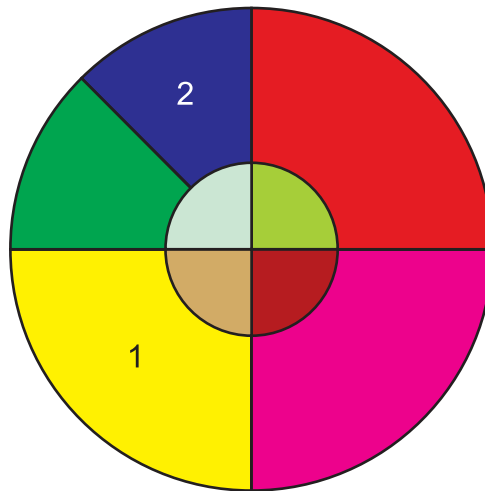

_____

_____

_____

_____

23.3 Given that the radii of the big circle is 3 cm and the smaller circle is 1cm, what are the areas of : (use $\pi = 3.14$)
(a) Yellow portion - 1
(b) Deep blue portion - 2

_____

_____

_____

_____

Unit 24 : Statistics Project

24.1   Mr. Krishnan asks his class to complete a statistics project on a book that they have been reading. He asks the class to study the number of letters in each of the last fifty words of a book.

Ashima starts to count the number of letters in each of the last 50 words in the book that she was reading. She has only counted letters in 43 words so far.

Her results for these 43 words are shown in the table below.

Number of letters in each word	Tally	Frequency
1					
2							
3														
4										
5											
6					
7				
8		
9			

The last seven words in this book that Ashima is examining are '. . . and they all lived happily ever after.'

Now complete the tally marks and the frequency column in the table above.

24.2   Words with what number of letters have the most and the least frequencies?

_____

_____

Whether you realize it or not, statistics is involved inherently in our daily life.
- About 90% of all people live in the Northern Hemisphere.
- 0.3% of solar energy from the Sahara is sufficient to power the whole of Europe.
- The risk of a heart attack is about 20% greater on Mondays for adult men, and 15% greater for adult women.
- Dragonflies are the most efficient predators on Earth with near or at a 95% hunt-to-kill ratio.

Unit 25 : For the Love of Books

Old books have a unique smell. If you don't believe that, check out some old books at your home or in the library. They will certainly smell good!

Tarun asked 60 students in his school about their favourite category of books. He represented the information using a pictogram.
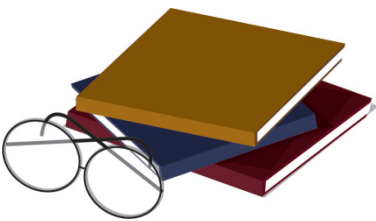
Genre of book		Frequency
Non-Fiction	⊞ ⊞ ⊞ ⊞	
Science fiction	⊞ ⊞ ⊟	10
Poetry	⊔	
Humour	⊞ ⊞ ▫	
Horror		8
Adventure		14

Key: ⊞ represents ……. books.

The science fiction row in the pictogram is complete.

25.1   Now, why don't you complete the key.

25.2   Complete the pictogram as well.

25.3   What is the mode of the given frequency table ?
(Hint: book liked by maximum number of students)

_____

25.4   How many more students prefer adventure books to humour books?

_____

_____

The typical smell is due to the breakdown of two chemical components of paper-cellulose and lignin. In fact, the chemicals responsible for the smell of a book can be used to figure out its age, just like carbon dating.

Unit 26 : Homeward Bound

Geetali is travelling back home by train from Mumbai to Pune.

26.1   The price of a ticket is Rs.1350. Geetali being a student gets a rebate of one-third on her ticket. Calculate the amount that she pays for her ticket.

_____

_____

_____

26.2   Geetali travels by two trains. The first train goes from Mumbai to Lonavala. The second train goes from Lonavala to Pune. Look at some information that she has written down about the schedule of the trains.

<u>First train</u>

Mumbai   departs   13 45 hrs.
Lonavala   arrives   16 39 hrs.

<u>Second train</u>

Lonavala   departs   17 12 hrs.

Express the time 13 45 hrs. using the 12-hour clock.

_____

26.3 Find the time that the first train would take to travel from Mumbai to Lonavala. Give your answer in hours and minutes.

_____

_____

26.4 The first train arrives 46 minutes late at Lonavala. By how many minutes has Geetali missed her second train?

_____

_____

26.5 The next train from Lonavala to Pune is at 18 12 hrs. The journey is 76 km and the train travels at an average speed of 48km/h. Find the time at which the train arrives in Pune.

_____

_____

Mumbai local trains: Facts that'll blow your mind!

- The Mumbai suburban railway system is spread over 400 km.
- It carries more than 7.5 million commuters daily.
- The railway tracks are silent only for about 90 minutes a day.
- Without the Mumbai local trains, many Mumbaikars would go hungry, thanks to the dabbawallahs who bank on these locals to operate one of the most enterprising food delivery system.

Unit 27 : Prize Money

Three school students Ved, Mallika and Juhi bagged the First Prize in a model making competition based on Artificial Intelligence. The prize money of Rs. 18000 was distributed equally among them by the Principal.

27.1 Ved spends 40% of his prize money of Rs 6000. He spends the money in the following ratio:- clothes : books : music CDs = 10 : 2 : 3.

(i)   Find the amount he spends on music CDs.

_____

_____

(ii) Find out how much more he spends on clothes as compared to books.

_____

_____

27.2 Malika invests her Rs.6000 for 1 year at a rate of 4% per year simple interest.
        Calculate the interest Malika receives at the end of the first year.

_____

_____

_____

27.3 Juhi goes on holiday to Europe with her family and converts her Rs. 6000 into euros (€). She spends €25 to buy souvenirs for her friends. When she gets home, she changes the remaining euros into Indian Rupees. The exchange rate was €1 = Rs 80. Find the amount of money that she is left with.

_____

_____

_____

_____
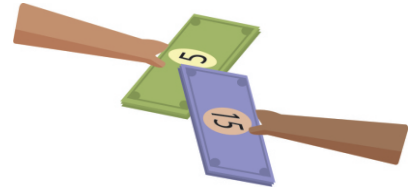
Whoever said money can't buy happiness simply didn't know about the prize money of these shows!

- Kaun Banega Crorepati- The prize money of the show was raised from Rs. 1 crore in season 1 to Rs. 7 crores in season 7.
- Bigg Boss- Rs. 50 lakhs cash prize.
- Indian Idol- The winner gets a chance to create own music album along with a prize money of Rs. 25 lakhs.
- Master Chef India- Rs. 25 lakhs cash prize.

Unit 28 : Optical Illusions

Optical Illusions are arrangements of images and colour to create interesting visual effects. Let's see one to experience it.
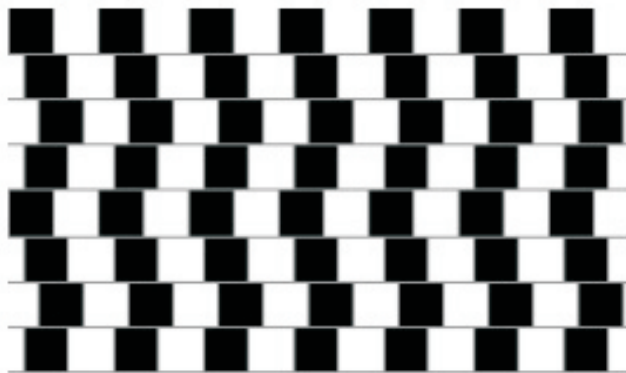
Now, let's create one-

Step 1. Draw a regular hexagon of convenient size. **A regular figure** is a figure in which all the sides are equal and all the interior angles are also equal.

For example, an equilateral triangle is a **regular shape** because all the sides are equal and all the angles are equal.

Step 2. Mark midpoints on each line as shown in the figure.

Step 3. Connect the points as shown below.

Step 4. Erase those lines as shown in the fig below.

Step 5. Now colour according to your own choice, keeping in mind the different shades. You can use three different colours or three different shades of the same colour to colour each pair of opposite side.

Now you look at the cube that you have just created.

28.1 What is the ratio of the surface areas of the smaller cube and the bigger cube?

_____

_____

_____

28.2 What is the ratio of the volumes of the smaller cube and the bigger cube?

_____

_____

_____

28.3 What would be the changes in the ratios of volumes, instead of midpoints, you take the points 1/3 and 1/4 distance from the center?
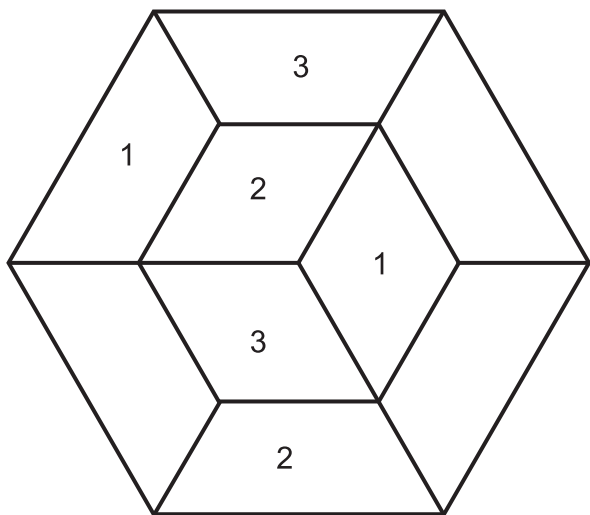
_____

_____

_____

A few figures for you to explore your artistic side. Choose any 3 colours of your choice. Colour the areas which have the same number, in the same shade.
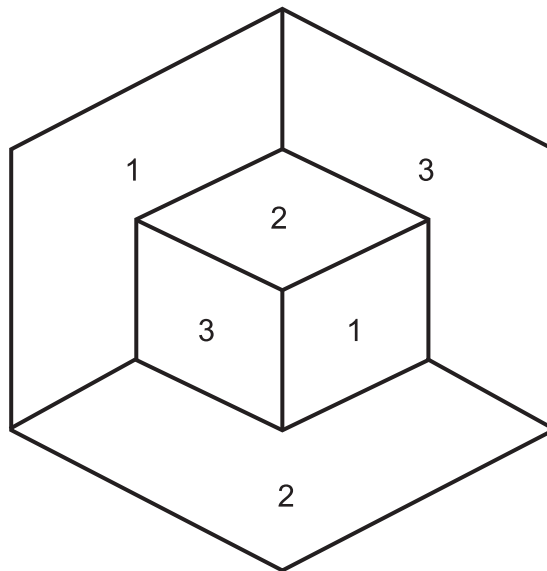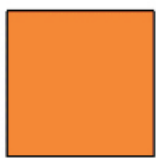
Unit 29 : Shapes and Patterns

Let's explore our creative side by learning how to inscribe and circumscribe regular figures using geometrical constructions.
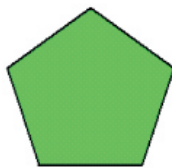
Regular Figures or Regular Polygons are those which are equiangular (all angles equal), as well as equilateral(all sides equal). For example,
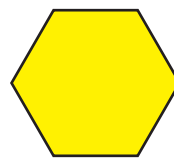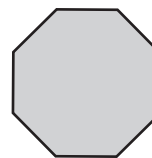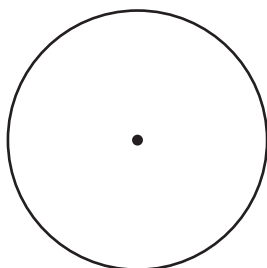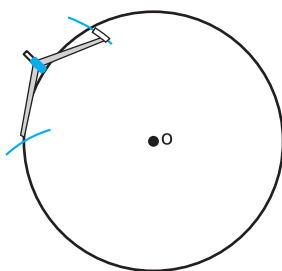
| Triangle | Square | Pentagon | Hexagon | Octagon |

29.1.   Let's learn to inscribe a regular hexagon in a circle. Follow the instructions and create your own regular hexagon.
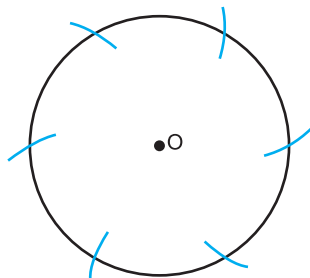
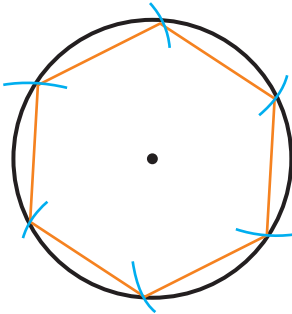**Step 1 :** Draw a circle of a suitable radius.

Step 2 : Without changing the radius and keeping the needle of the compasses on the circumference (boundary) draw a small arc on the circle.

Step 3 : Again, with the same radius draw arcs on the circle, as shown in the figure, till you reach the first arc.

Step 4 : Join the points marked by the arcs.

Step 5 : Erase the circle outside.
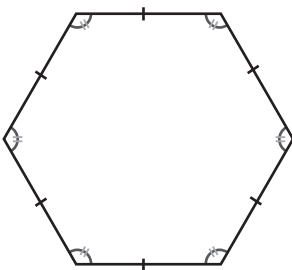
Hexagon is Ready!

(a) Given the radius of the circle, how will you find the area of the inscribed hexagon?

_____

_____

(b) Find the areas of both the circle and the hexagon.
(Hint: What kind of triangle is ΔEOD?)

_____

_____

_____
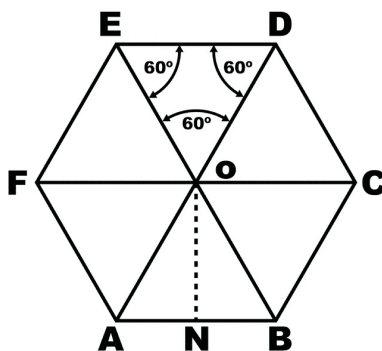
29.2   How to inscribe a circle inside a hexagon:

Step 1 : Draw a hexagon.
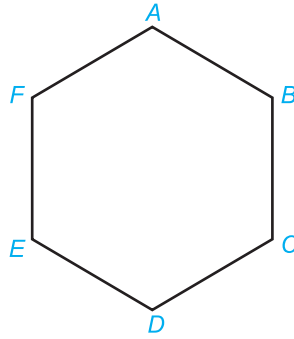
Step 2 : Join AD, BE & CF. These are called the main diagonals of a hexagon.
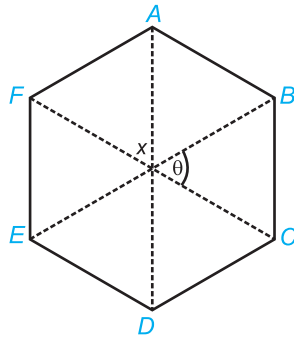
Step 3 : Draw the apothem **c** from the centre of the hexagon to a side.
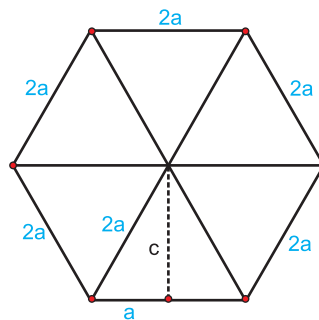
New Word!
Apothem – A perpendicular from the center of a regular polygon to any of its side.

Step 4 : With the apothem as the radius and centre as O, draw a circle as shown below.
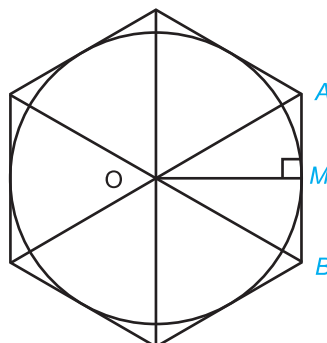
Circle is Ready!

(a)   Draw 2 circles, one circumscribing and one inscribed in the same hexagon.
(b)   Create more such patterns and colour them.
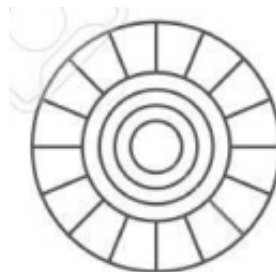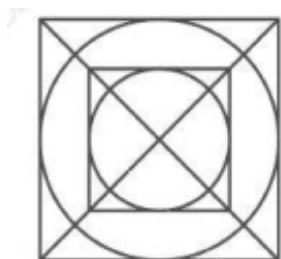
The hexagon is everywhere!

The simple hexagon with six sides is actually fascinating. And, if you look closely, you will find it in many places!

- The eyes of a dragonfly are a collection of tiny eyes called compound eyes, each forming the shape of a hexagon.
- Carbon has a molecular structure of a hexagon too.
- You must have seen the hexagonal nuts and bolts. This shape makes the tools grip the bolt easily.

    And finally, your pencil : check, if it too has a hexagonal shape.

Unit 30 : Honeybees and their Family Tree

There are over 30,000 species of bees and most of these bee species live solitary lives. However, the one that we know best, honeybee, lives in a colony called a beehive and they have a unique family tree.

- In a colony of honeybees, there is one special female called the queen.

- There are many worker bees who are females as well, but unlike the queen bee, they produce no eggs.

- There are some drone bees who are males and do no work.

- Males are produced by the queen's unfertilized eggs, so male bees only have a mother but no father!

- All the females are produced when the queen has mated with a male and so they have two parents. Females usually end up as worker bees but some are fed with a special substance called royal jelly which makes them grow into queens ready to go off to start a new colony when the bees form a swarm and leave their home (a hive) in search of a place to build a new nest.

So female bees have 2 parents, a male and a female. Whereas, male bees have just one parent, a female.
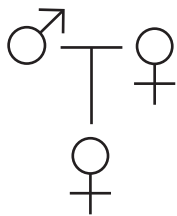
Queens have 2 parents   Males have 1 parent

Here we follow the convention of family trees that parents appear above their children, so the latest generations are at the bottom and the higher we go, the older people are. Such trees show all the ancestors (predecessors, forebears, antecedents) of the person at the bottom of the diagram.

Let's look at the family tree of a male drone bee.

1. He had 1 parent, a female.

2. He has 2 grand-parents, since his mother had two parents, a male and a female.

3. He has 3 great-grand-parents: his grand-mother had two parents but his grand-father had only one.

4. How many great-great-grand parents did he have?
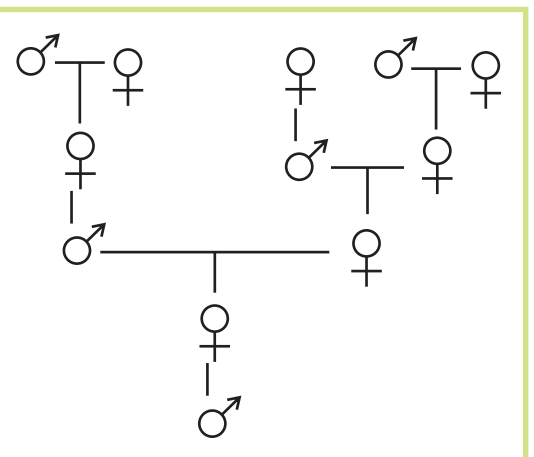
Number of	Parents	Grand Parents	Great Grand Parents	Great Great Grand Parents	Great Great Great Grand Parents
Male Bee	1	2	3	5	8
Female Bee	2	3	5	8	13

Now if you notice the family tree of a bee follows the **Fibonacci Sequence.**

A Fibonacci sequence is a sequence of numbers where after the first two terms, each term is the sum of the previous two terms.

e.g. $2, 3, 5, 8, 13, \ldots\ldots$

$$5 = 2 + 3, \qquad 8 = 5 + 3, \qquad 13 = 8 + 5$$

Fibonacci Numbers occur at an amazing number of places. They are very common in plants.

Here is a daisy with 21 petals (but expect a few more or less, because some may have dropped off or are just growing)

30.1   Write down the next three terms of this Fibonacci sequence.

$5, -1\ 4, \underline{\hspace{2cm}}, \underline{\hspace{3cm}}, \underline{\hspace{2cm}}$

30.2   For the Fibonacci sequence

$4, -3, 1, -2, -1, -3, -4, \ldots\ldots$

Show that the sum of the first six terms is equal to four times the fifth term.

_____

_____

_____

_____

30.3 One of the most interesting Number Patterns is Pascal's Triangle (named after *Blaise Pascal*, a famous French Mathematician and Philosopher.)

To build the triangle, start with "1" at the top, then continue placing numbers below it in a triangular pattern such that each number is the sum of the numbers directly above it.

(Look carefully, we have shown that **1 + 3 = 4**)
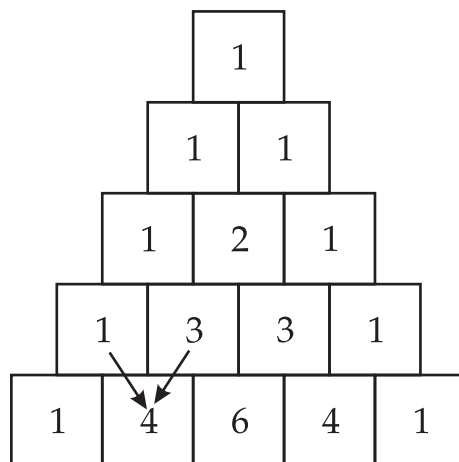
The numbers of the Fibonacci sequence can be obtained from the numbers in Pascal's Triangle by adding the diagonals as shown in the adjoining figure.

Following the same pattern, which numbers of Pascal's triangle can be added together to give the next number of the Fibonacci sequence?
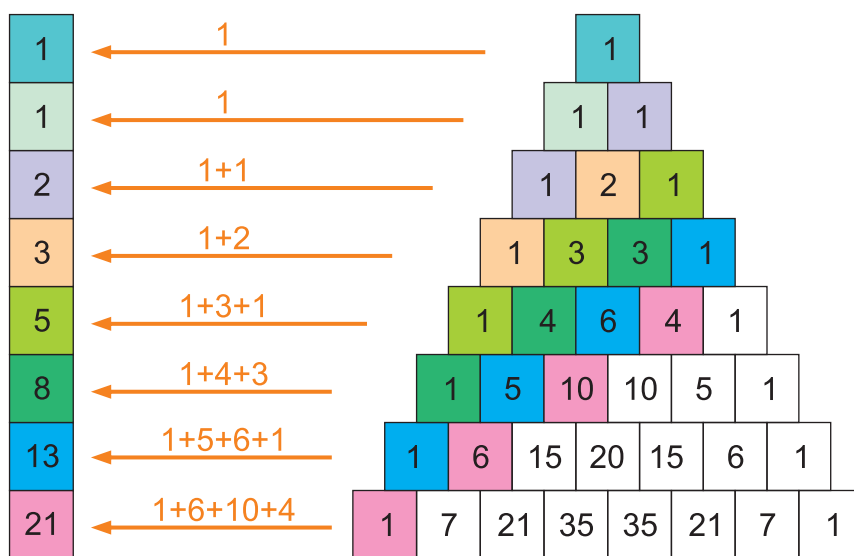
And a Bonus Puzzle!

Divide and Conquer

A division problem was being worked on. Some digits from this division, however have gone missing. Come on, we need you to help us get this job done. Fill the boxes below to complete the task!

$$
\begin{array}{r}
4 \quad ? \\
8 \,\overline{)\; 3 \;\; ? \;\; ?} \\
-\; ? \;\; ? \\
\hline
\qquad 5 \;\; ? \\
\qquad -\; ? \;\; ? \\
\hline
\qquad\qquad 0
\end{array}
$$

Take a moment to reflect on your journey through this book. What have you learnt? Which type of problems were easy or difficult for you? Did you find some areas so challenging or interesting that you went back to them? Or did you just breeze through this book and had a very happy feeling of accomplishment! Go ahead and discuss these with your mentor teacher.

ANSWER KEY

Unit 1 : Messy Integers

1.1

Positive Integers	Negative Integers
+2, +5, +8, +11, 13, 28	-3, -7, -9, -11

0 goes in the circle in between, since it is neither a positive nor a negative integer.

To understand integers, a number line could be drawn to illustrate it:

-11… -9 … -7 … -3 … 0 … 2 … 5 … 8 …11... 13 … 28 …..

1.2   T E A C H E R
9 1 4 7 3 1 6

Unit 2 : Rainbow Integers

2.1
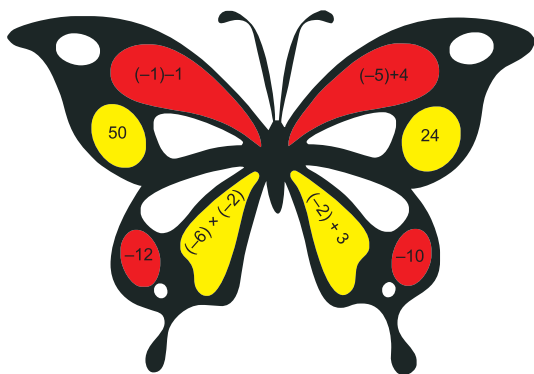
Positive Integers	Negative Integers
(-2)+3 = 1	(-1)-1 = -2
(-6)x(-2) = +12	(-5)+4 = -1
50	-12
24	-10

2.2   Answer : 93 years

Unit 3 : Magic Squares

3.1 Magic Square, using 7 to 21 given that the Magic Constant = 14 x 3 = 42.

10	15	17
21	14	7
11	13	18

3.2 Magic Square, using 7 to 15. Thus, the Magic Constant = 11 x 3 = 33.

8	13	12
15	11	7
10	9	14

* = 8

Creative Corner

6	11	10
13	9	5
8	7	12

* Suggested arrangement

Unit 4 : Climatic Diversity of India

4.1   (a)   The Increase in temperature from March to April in Drass is
(2) – (– 6) = + 8 degrees celsius.

(b)   The difference in temperature between Churu and Drass in January.
is (22) – (– 32) = 54 degrees Celsius

Unit 5 : Hit the Boundary

5.1   Perimeter = Sum of All Sides
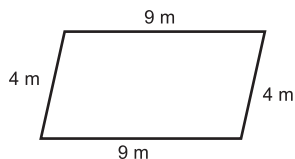
Perimeter = _____

Perimeter = 9m + 4m + 9m + 4m = 26 m
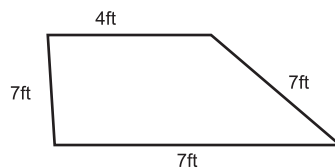
Perimeter = _____

Perimeter = 4ft + 7ft + 7ft + 7 ft = 25 ft.

5.2   **(a)**
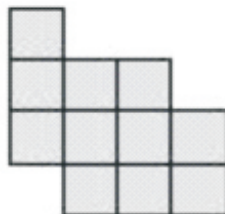
Perimeter = ⌈_____⌉ unit

Perimeter = 16 unit

(b)
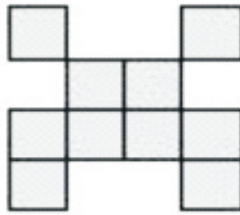
Perimeter = ⬭ unit

Perimeter = 24 unit

Creative Corner

(a)

(b)
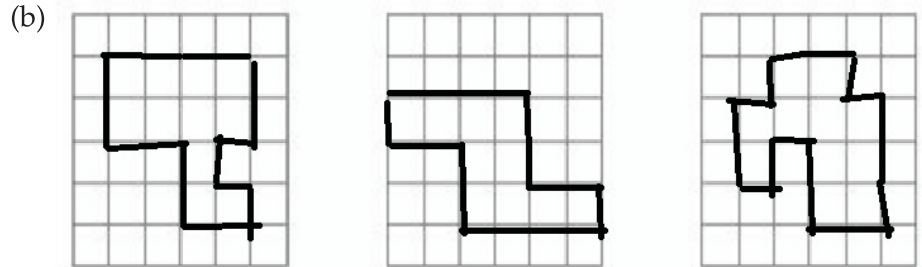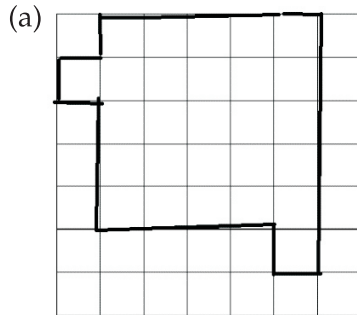
* Suggested answer

Unit 6 : Double Trouble

6.1

| 5 | 8 | x | 3 | = | 1 | 7 | 4 | = | 2 | 9 | x | 6 |

6.2 Orange – 5
Mango – 12
Banana – 15
Apple – 10

Unit 7 : Magical Maths

7.1 Solving the second puzzle algebraically,

(a) x
(b) 3x
(c) 3x + 6
(d) 3x + 6 / 3
(e) x + 2 − x = 2

7.2 (a) x
(b) 4x
(c) 4x + 4
(d) 4x + 4/4
(e) x+1-x

* Suggested answers

Unit 8 : Restaurant Menu

Selection	Price
Crispy Cheese Fries	42
Paneer Rolls	85
Paneer Tikka Sandwich	65

Lazeej Lassi	25
Mint Iced Tea	35
Brownie Bites	55

(a)   Total Bill
$= 42 + 85 + 65 + 25 + 35 + 55 =$ **Rs. 307**

(b)   Final Bill including Tax
$= 0.18 (307) + 307 =$ **Rs. 362.26**

(c)   Total Bill without dessert
$= 42 + 85 + 65 + 25 + 35 =$ **Rs. 252**
$252 (0.18) + 257 = 297.36$

(d)   Total Bill with milkshakes and without dessert
$= 42 + 85 + 65 + 40 + 40 =$ **Rs. 272**
$= 272 + 272 \times 0.18$
$= 272 + 48.96$
$=$ **320.96**
Yes, money is saved.
Money saved = Rs. 362.26 – Rs. 320.96 = **Rs. 41.30**

Unit 9 : Time and Again

Reena's Equation: $c = -2.24t + 105, 0 \leq t \leq 20$

9.1

Independent Variable	Dependent Variable
Time (t)	Celsius (c)

9.2   The boiling temperature of the liquid is **105 degrees Celsius**.

9.3   If the liquid freezes at 26.6 degrees C, the liquid will freeze **35 minutes after boiling i.e at 10:35 am.**

Unit 10 : Circle Pies

10.1   Total export from Zedland in the year 1998 is **27.1 million zeds.**

10.2   Option **(d) 3.8 million zeds**

The total export of fruit juice in year 2000 is 42.6 million zeds
The percentage of juice is 9 in year 2000
Price of fruit juice exported = **42.6 x 0.09 = 3.8 million Zeds**

Unit 11 : Card Game

11.1   a) $\dfrac{1}{3}$ b)   0

11.2   a) $\dfrac{2}{3}$

11.3

	1	3	5
2	3	5	7
3	4	6	8
4	5	7	9

11.4 $\dfrac{1}{9}$

Unit 12 : Tracking the Journey

12.1 According to Ishita, $490 + x = 2(22 + x)$

$$490 + x = 44 + 2x$$
$$490 - 44 = 2x - x$$

x = 446 km is the total distance travelled.

Unit 13 : Snow White and Seven Dwarfs

13.1 Snow White takes the age of the youngest dwarf as x years.

$$x + (x+1) + (x+2) = 42$$
$$x = 13$$

Then, the age of the dwarf who is one year older is **14 years**.

And, the age of the third dwarf will be **15 years**.

Now, the sum of the ages of the three dwarfs is **42 years.**

The **youngest dwarf is 13 years old** while the **oldest dwarf is 19 years old**.

Unit 14 : Olympic Mathelete Competition

14.1	Choices for Gold Medal	8
14.2	Choices for Silver Medal	7
14.3	Choices for Bronze Medal	6
14.4	Total number of ways to award medals	8 x 7 x 6 = 336

Unit 15 : School Swimming Club

Name	Month And Year of Birth	Height (Meters) Can Swim (Meters)	Distance Each Student 31st March 2018)	Age on March 2018	Height (Cms) Can Swim (Km)	Distance Each Student
Ali	November 2004	1.62	200	**13 years 4 months**	162	0.2
Vibha	October 2006	1.43	500	**11 years 5 months**	143	0.5
Kiran	February 2006	1.53	1500	**12 years 1 month**	153	1.5
Daisy	January 2007	1.56	1000	**11 years 2 months**	156	1
Faizal	December 2005	1.64	600	**12 years 3 months**	164	0.6
Kuljeet	August 2006	1.52	1000	**11 years 7 months**	152	1
Ila	January 2006	1.46	1000	**12 years 2 months**	146	1

15.1   Following students can join:
1. Kiran
2. Faizal

15.2   a)   When $h = 10$, $s = 14\,m/s$

b) $h = 3\,m$

Unit 16 : My Calender

16.1   (a) 1st March is a Saturday.

(b) 31st January is a Friday.

(c) Independence Day, 15th August is a Friday.

(d) 2th October, Gandhi Jayanti is a Thursday.

M	T	W	T	F	S	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

May

M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

April

M	T	W	T	F	S	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

March

M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

July

M	T	W	T	F	S	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

September

M	T	W	T	F	S	S
			1	2	3	
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

August

M	T	W	T	F	S	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28		

February

M	T	W	T	F	S	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

November

M	T	W	T	F	S	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

December

M	T	W	T	F	S	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

June

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

January

M	T	W	T	F	S	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

October

17.1

Type of Result	Frequency	Pie chart angle (central angle)
W	8	$8/24 \times 360° = 120°$
L	13	$13/24 \times 360° = 195°$
D	3	$3/24 \times 360° = 45°$
Total	**24**	**360°**

17.2   Frequency

■ W ■ L ■ D
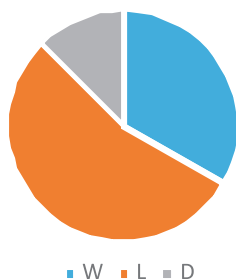
Unit 18 : Pile of Cans

18.1   Formula to calculate the total number of cans: $n(n+1)/2$

Hence, $20(20+1)/2 = 210$ **Option (b)**

18.2   Number of cans in the bottom row:

$$820 = \frac{n^2 + n}{2}$$

Solving $= \frac{n(n+1)}{2}$ 820 gives $n^2 + n - 1640 = 0 \Rightarrow n = 40$ or -41;

n $= -41$ is rejected as n is a natural number. $n = 40$

18.3   Alka will not be able to organize 200 cans in a triangular pile because

Let the total number of cans be S

a $= 1$ and   d $= -1$

No. of rows be n

$$S = \frac{n}{2}(2 + n - 1)$$

$$200 = \frac{n}{2}(n + 1)$$

$$400 = n^2 + n$$

$$n^2 + n - 400 = 0$$

the value of n is an irrational number

Hence he cannot make an arrangement using 200 cans

Has to be done in the workbook itself.

```
F D P N Z G A A M U L T I P L I C A T I O N B P
Q H P A R G E J N M A U T K F B U E T G P Y A T
Y B L K J R M P P G X G X F M S J Q H V U Q W R
F R A C T I O N E P L Z E R J E U B D Z G U G N
F F S K S Q L R N A W E K O V Q C M K Z J O M O
F O H C M G R T T R H M M I M O K A U C O T L I
I N T E G E R F A A U M T E D E E T N H M I V T
E C G R W G J O G L P A I A S X T H A L Q E K A
S R R A N V X Y O L G B I Z N R V R O Z B N V T
U A A X F N Y R N E R O T C A F J L Y I T T C U
B R W U D Q Q N N L N W L H U G N W G A T M X P
T Z O I Q P B P U N N A O V H O O W R R U A X M
R M D T N S L Z O N U E V I T I S O P S V P R O
A R K W A U P I U Q B X J M T D L D F M A D P C
C O O Z S R S P E Q Z T Q Y W E G O Y E N K R N
T T T T K I E R X A R B E G L A F U H L O V E W
I A H N V L S M P T R N O I T I D D A B G J B E
O N F I E T K R U M Z Q H R D W L W X O A J M K
N I D J O C O Q I E V P J V U Z E L L R T Q U M
A M L D V D R N G Y N Z O A U U N R O P C E N Z
A O I B U Y U E T N E L A V I U Q E B D O C M L
T N S C W S I A P E Z E X M C W A D K R N U W Q
S E T T R I A N G L E H F V E L B A T O M F P W
T D B W G Q K R E C T A N G L E L I D W F V D V
```

20.1   (a) 4   (b) 3

20.2

21.1 (a) △ = 10

⌂ = 5

(b) (i) 15
(ii) 60
(iii) 55
(iv) 10010
(v) 45

21.2 (i) d) 100
(ii) d) Octagon
(iii) 5/6
(iv) 10
(v) Pentagon
(vi) J

21.3 T E N S
R I G H T
I S O S C E L E S
A N G L E
N U M B E R
G R A P H
L I N E
E I G H T

Unit 22 : A Unique Village in India

22.1 (d) Rs. 2108
22.2 (b) 1545 hrs.
22.3 (a) Rs. 8436
22.4 (b) Rs. 5350
22.5 (d) November

Unit 23 : Polygon fun

23.1 $a = 60°$
$b = 60°$
$c = 120°$
$d = 120°$
$e = 60°$

23.2 Area of figure $= 4 + \pi$
$= 4 + 3.14$
$= 7.14 \, cm^2$

23.3 (a) Area of yellow portion

$\frac{1}{4} \pi (9-1) = 2\pi$
$= 2 \times 3.14$
$= 6.28 \, cm^2$

(b) Area of deep blue portion.

$\frac{1}{8} \pi (9-1) = \pi$
$= 3.14 \, cm^2$

24.1

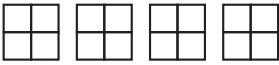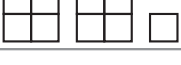| Number of letters in each word	Tally	Frequency
1					3
2	‖‖‖	5
3	‖‖‖ ‖‖‖ ||||	14
4	‖‖‖ ‖‖‖	10
5	‖‖‖ ‖‖‖		11
6					3
7					3
8		-
9			1

24.2 3 Letter Words have and maximum and 8 letter word have the minimum frequency.

Unit 25 : For the Love of Books

Type of Book	Frequency
Non-fiction	16
Science fiction	10
Poetry	3
Thriller	9
Humour	8
Adventure	14
Total	**60**

25.1 The Key represents **4 books.**

25.2

Type of book		Frequency
Non-fiction	⊞ ⊞ ⊞ ⊞	16
Science fiction	⊞ ⊞ ⊟	10
Poetry	⊟	3
Humour	⊞ ⊞ ▫	9

Horror		8
Adventure		14

25.3   The mode of this frequency table is **16**, the **Non-fiction** genre.

25.4   **Five** students have chosen Adventure books over Humour books.

Unit 26 : Homeward Bound

26.1   1/3 of Rs. 1350 = 1/3 x 1350 = Rs. 450

(Amount she pays for her ticket) = 1350 – 450 = Rs. 900

26.2   01:45 p.m.

26.3   2 hours and 54 minutes

26.4   The first train arrives 46 minutes late at Lonavala at 1725 hours. She misses her next train by 13 minutes.

26.5   **Speed = Distance / Time**

48kmph = 76 km / Time (Hour)

Time = 1.583 hours or 95 minutes

The next train from Lonavala to Pune is at 1812 and arrives at Pune at 1947. hours

Unit 27 : Prize Money

27.1   (i)   40% of 6000 = Rs 2400

clothes : books : music CDs = 10 : 2 : 3

Amount spent on music CDs = 3/15 x 2400 = **Rs. 480**

(ii)   Amount spent on clothes more than books = 8/15 x 2400 = **Rs. 1280**

27.2   Simple Interest = PRT/100 = 6000 x 4 x 1 / 100 = **Rs.240**

27.3   The exchange rate is € 1 = Rs 80

Spending = € 25

Amount of money after her holiday = Rs. 6000 – (25x80) = **Rs. 4000**

Unit 28 : Optical Illusions

Assuming,

The side of the bigger cube is **a.**

Then, the side of the smaller cube is **1/2a.**

Surface Area of a cube **= 6 (side)^2**

Volume of a cube **= (side)^3**

28.1   Ratio of the surface areas of the smaller cube and the bigger cube

$$= 6 \times (½\, a)^2 / 6a^2 = \textbf{1:4}$$

28.2   Ratio of the volumes of the smaller cube and the bigger cube

$$= (1/8)\, a^3 /\ a^3 = \textbf{1:8}$$

28.3   Ratio of the volumes of the smaller cube and the bigger cube at 1/3 point

$$= (1/27)\, a^3 /\ a^3 = \textbf{1:27}$$

Ratio of the volumes of the smaller cube and the bigger cube at 1/4 point

$= (1/4a)^3 / a^3 = $ **1:64**

Unit 29 : Shapes and Patterns

29 (a) A regular hexagon is essentially composed of 6 equilateral triangles and the line joining the opposite vertices is the diameter of the circle in which the hexagon is inscribed. So, the radius of the circle forms the side of the equilateral triangle.

Area $= 6 \times \dfrac{\sqrt{3}}{4} a^2$ where a = radius of the circle

(b) Area of the circle $= 3.14 \times r^2$

Area of the hexagon = Area of 6 triangles $= 6 \times (\dfrac{1}{2} \times b \times h)$

Unit 30 : Honeybees and their Family Tree

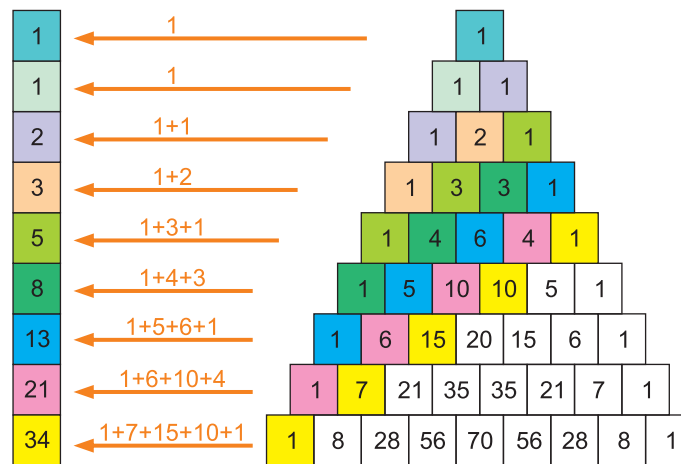**30.1** 5, -1 4 , __3___ , ____7____ , ____10___

30.2 For the Fibonacci sequence

4, -3, 1, -2, -1, -3, -4, …….

the sum of the first six terms is $= 4-3+1-2-1-3 = 5-9 = -4$

four times the fifth term $= 4 \times -1 = -4$

30.3 The correct answer is shown by the pink squares:

$34 = 1 + 7 + 15 + 10 + 1$

Bonus Puzzle

Notes

Integrating Arts in with Mathematics

 The cover design of this workbook is inspired by the British avant-guard art movement called Vorticism from the early 1900s. The art movement combines the essence of abstract and fragmented reality of cubism and futurism with the energy and dynamism of the industrial revolution. It is characterised by the use of bold and bright colours, harsh lines and sharp angles. The geometrical aspects of Mathematics are clearly evident in this composition. The illustration also highlights the properties of line, angles, triangles and circles. It is a reminder that arts are an integral part of all disciplines, including Mathematics.

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