



# HAPPY MATHS

## Shapes and Data



Written by Mala Kumar  
Illustrated by Angie & Upesh

Happy Maths - 2 Shapes and Data by Mala Kumar  
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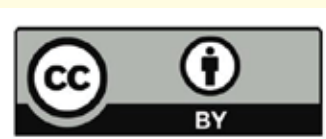
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# Happy Maths - 2

## Shapes and Data



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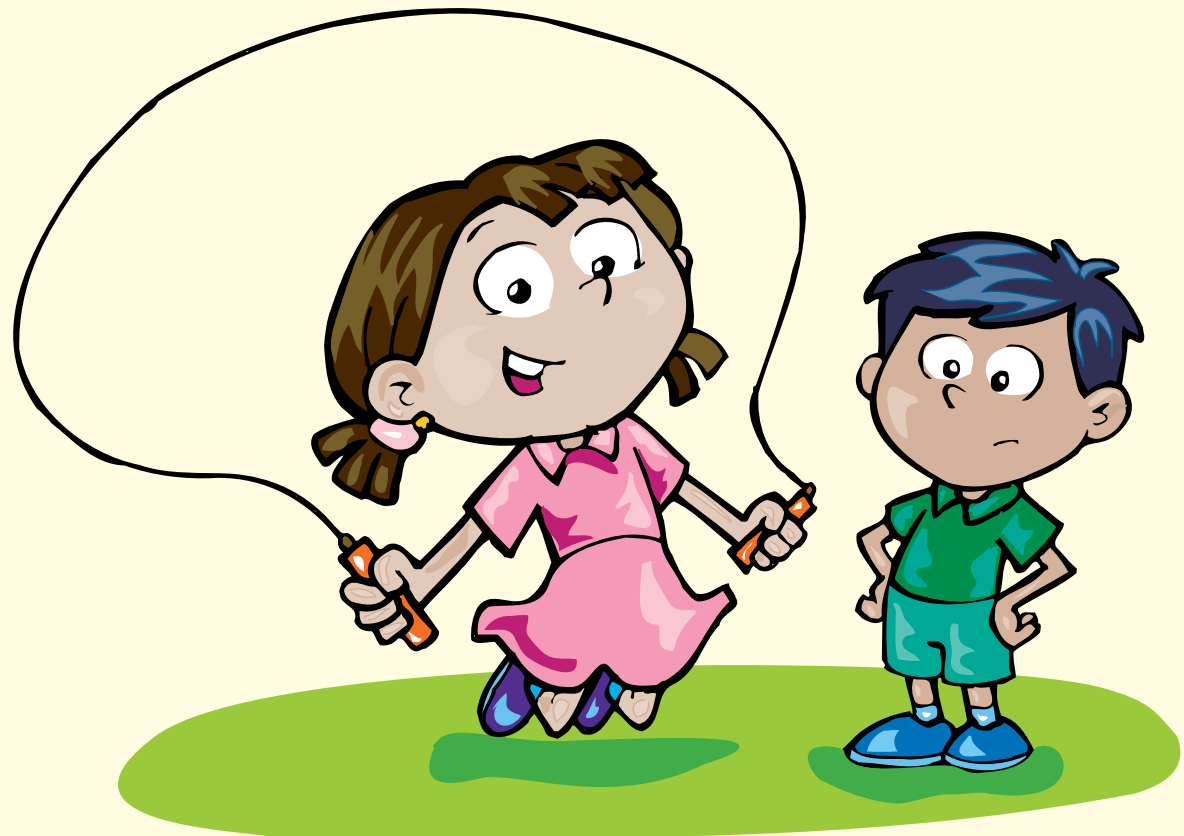
**Sankhya and Ganith have been learning a lot of things  
in their mathematics class.**

**Join Sankhya and Ganith in their  
happy discoveries about mathematics.**

**Zzero and Eka are friends of Sankhya and Ganith.**

**In this book, Sankhya and Ganith learn that different shapes  
have different properties. They also try to understand how  
to make sense of all the information that they gather.**

**Sankhya likes to skip.  
The last time her brother Ganith counted,  
she skipped a 110 times in 5 minutes!  
Ganith tried it too.  
He skipped 30 times...  
tripped and fell down.  
It's fun to count sometimes.  
Numbers are just one part of mathematics.  
This book tells you how you can play with mathematics.  
You see it can be fun almost all the time.**



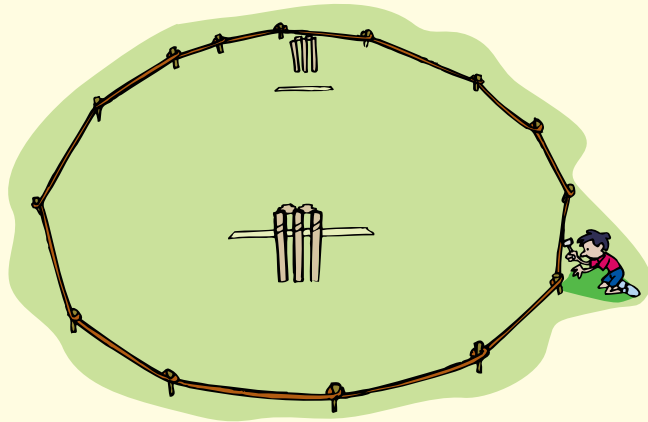
# The Funny Cricket Ground

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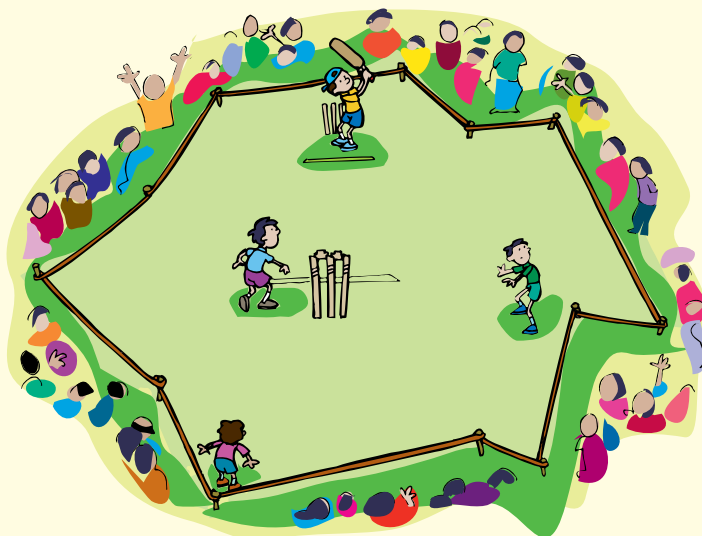


The cricket ground in Aryanagar is large. Its boundary is not clear. Sometimes, the boys put pegs around it at equal distances and they put a rope around the pegs. The rope becomes the boundary. If the pegs are put neatly, we get a circle.

Sometimes, when one of the boys is a bit lazy and does not measure the distance between two pegs carefully, the shape of the field changes. When a match is boring, the crowd stays away.



But when there is an interesting match, the viewers come closer and closer to the pitch and the field takes on different shapes depending on which side of the crowd is pushing in stronger!



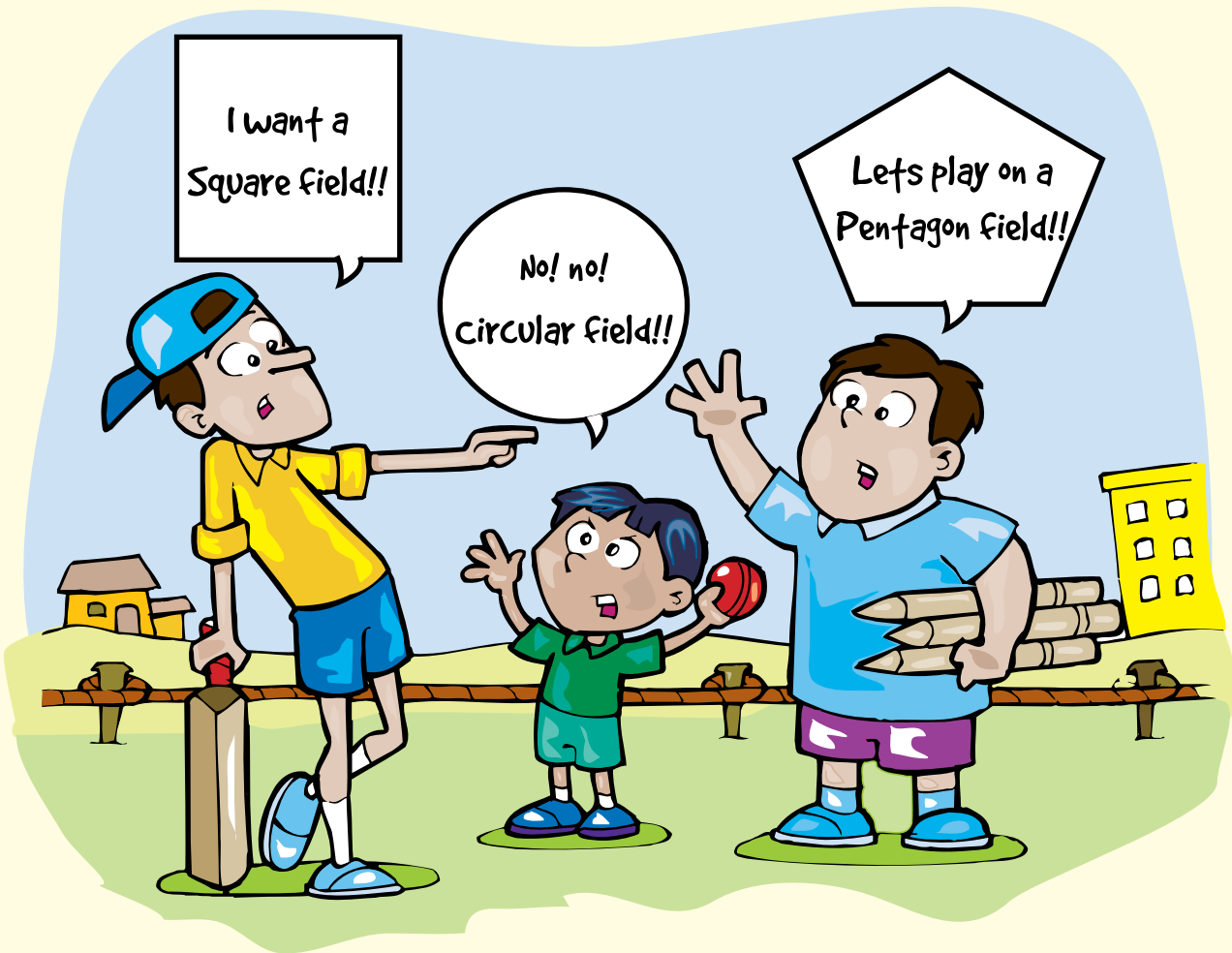
Most professional cricket grounds should be large enough to mark an oval boundary measuring 65 metres from the stumps at either end of the wicket. Official cricket fields in the world usually measure about 90 to 150 metres across.

At Aryanagar, rules keep changing.

Ashwin, the tallest fellow in Aryanagar wants a square field.

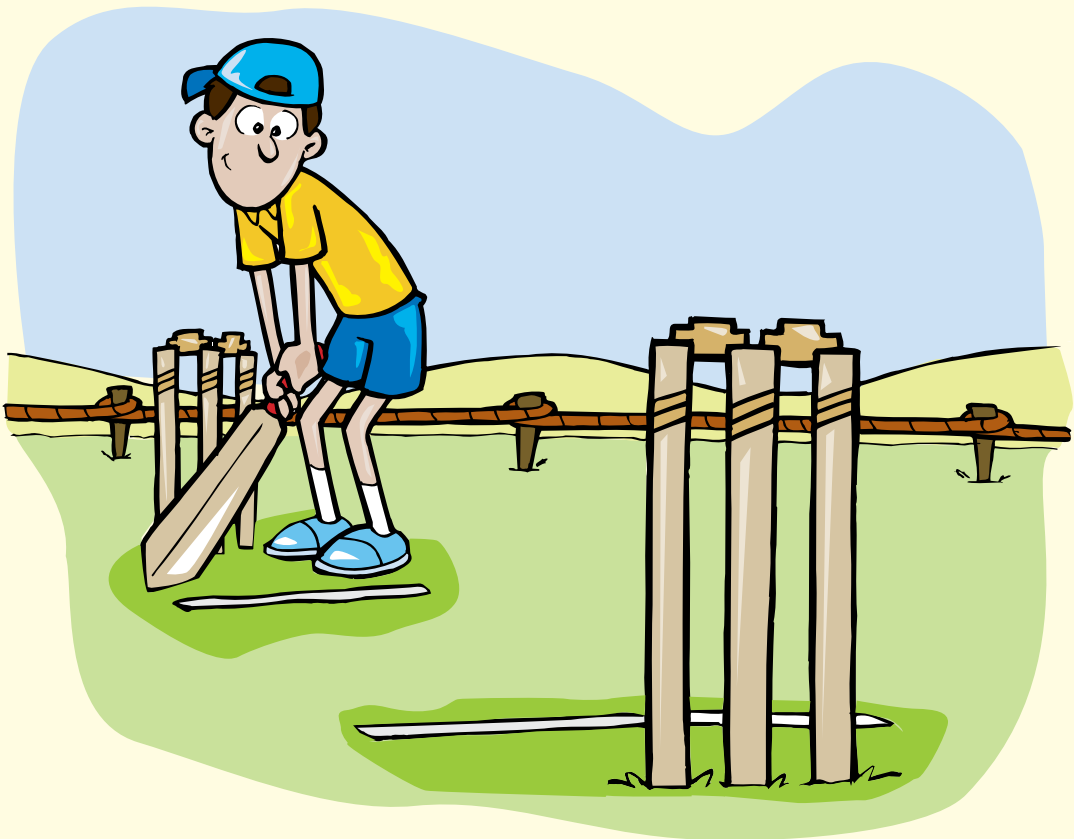
Little Meenu wants a small, circular field.

Samir, the strongest boy in Aryanagar wants a large, pentagon shaped field.





1. Draw cricket fields in different shapes. Do all these shapes have names?
2. If you had to have a cricket ground with straight lines as boundaries, what is the smallest number of straight lines that you would require to form a field?
3. If a batsman hits a boundary, he gets four runs. If you were a batsman, what shape of field would you like to play on? Why?
4. In a circular field, the stumps on either end of the pitch are 65m from the boundary. The pitch is 20m long. Would you be able to tell how long the rope of the boundary should be?



## Try This

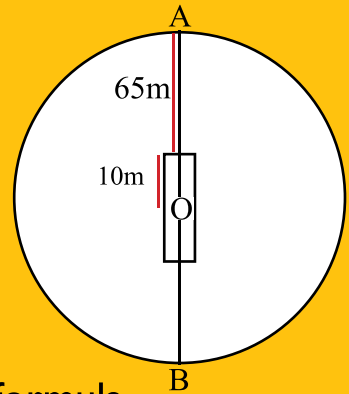
In a circle, the centre  $O$  is equidistant from every point on the circle.

Pitch length = 20m

Radius of circle =  $10\text{m} + 65\text{m} = 75\text{m}$

Circumference of a circle is given by the formula -

Circumference =  $2\pi r$

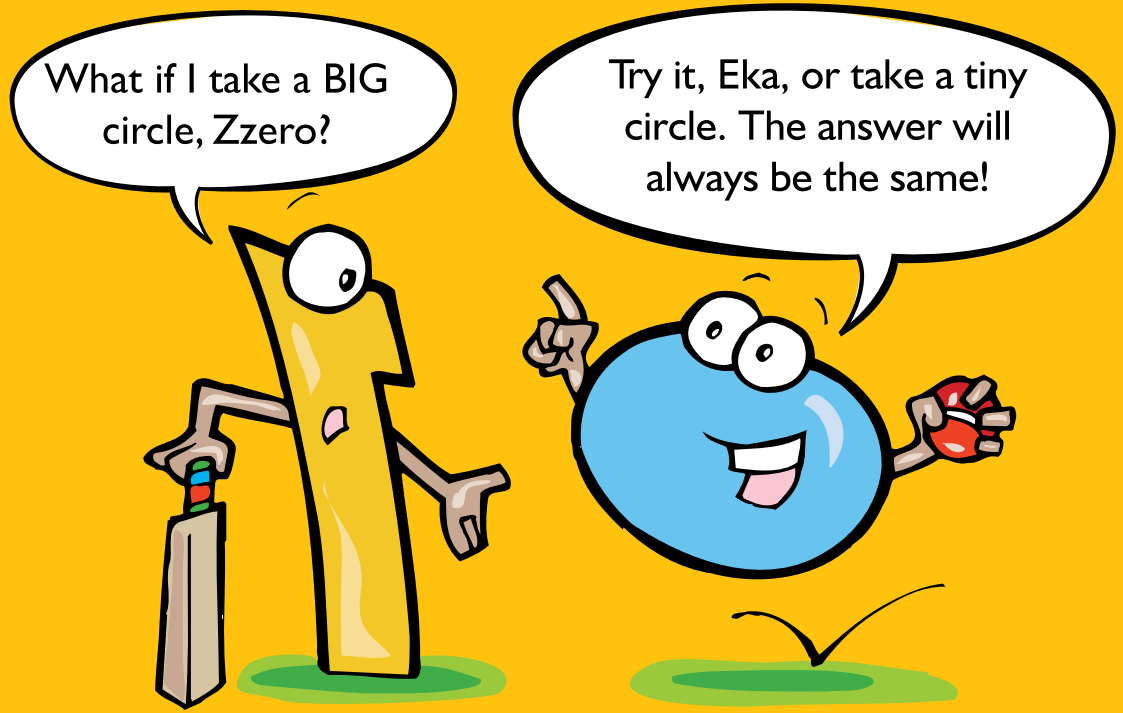


## What's $\pi$ ?

Pi is a value. When you divide the circumference of a circle by its diameter, you always get  $22/7$ .

Take any circle. Measure its circumference. Measure its diameter. Divide the circumference by its diameter.

Answer =  $22/7$ .



# Floor Designs

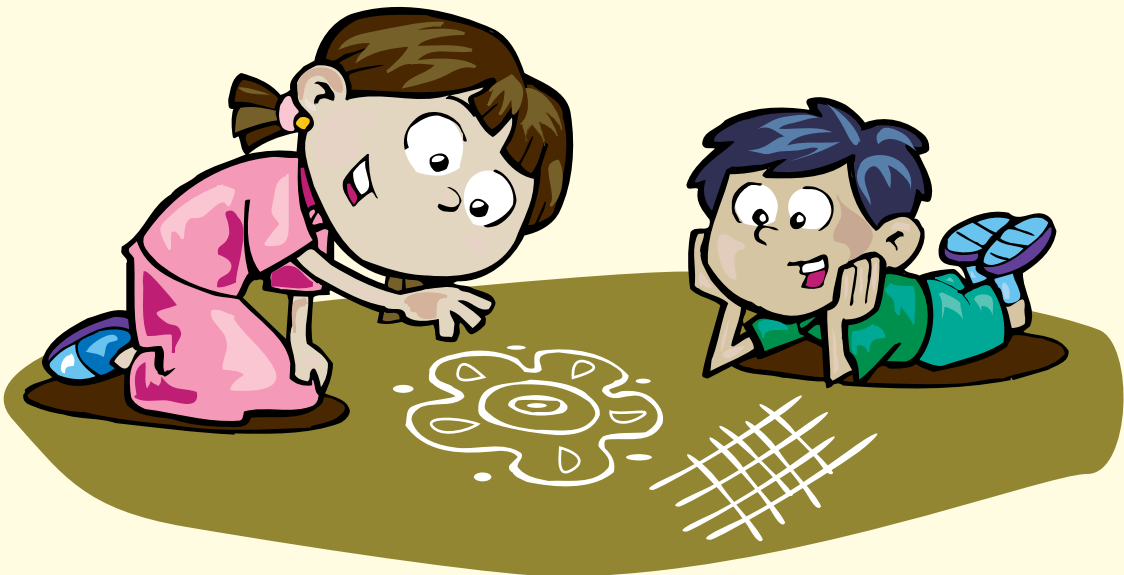
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Sankhya was making a *rangoli* on the floor.

Ganith did not like it. “Akka, why do you always make *rangolis* that look like *jalebis*? See, I will make a new *rangoli*.”

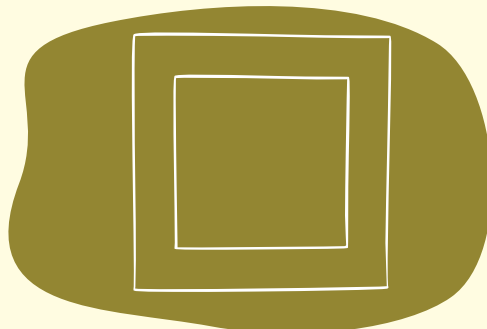
Ganith made some straight lines on the mud floor.

Sankhya giggled. “Your *rangoli* looks like a lot of bricks. I don’t like that.”



Ganith looked up at the mango tree nearby. He drew a square to represent the tree.

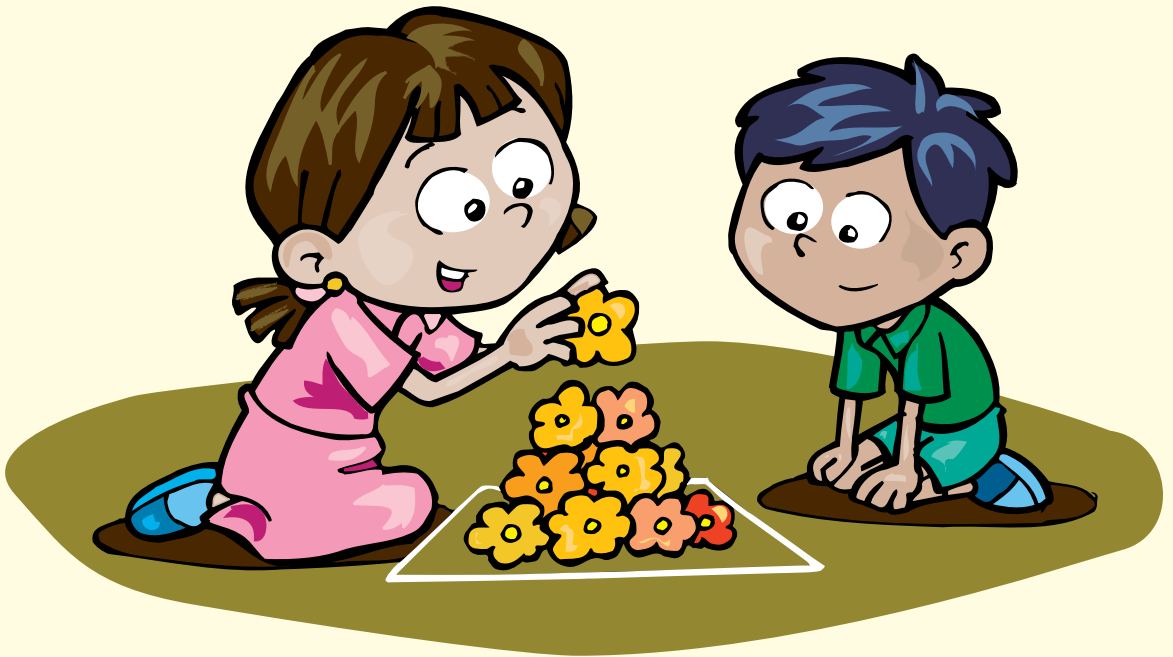
Sankhya drew a smaller square inside the big square to show the base of the tree.



Ganith went around the garden and brought a huge mound of flowers for her to decorate the *rangoli* with.

Sankhya started keeping the flowers on the inner square.

Four flowers fitted side-by-side on one side of the inside square.



After Sankhya had filled the square with flowers, she put flowers on top of these. She repeated this four times. The *rangoli* now looked like a solid tower.

Sankhya picked up some more white powder and started humming to herself. As she sang, her hands flew on the floor and soon she had a beautiful figure that had many curves. It did not have any sharp corners.

“Akka, you are an artist!” said Ganith.

1. Do you like to do freehand drawing? Can you draw this figure without lifting your pencil off the paper or retracing your lines?

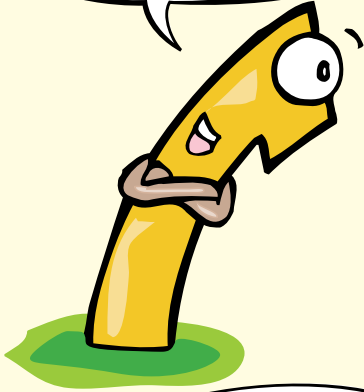


2. Draw the *rangoli* that Sankhya and Ganith drew and then decorated with flowers.
3. How many sharp ‘corners’ does this figure have?
4. How many flowers did Sankhya use to decorate the *rangoli*?
5. Instead of 4, if Sankhya had used 10 flowers along each line of the inner square, how many flowers would she have needed to make a ‘tower’ 10 floors high? (Or you could say, 10 flowers high!)

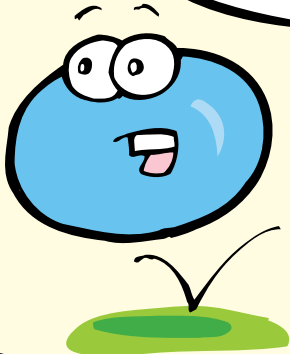


# Zzeros Chatter

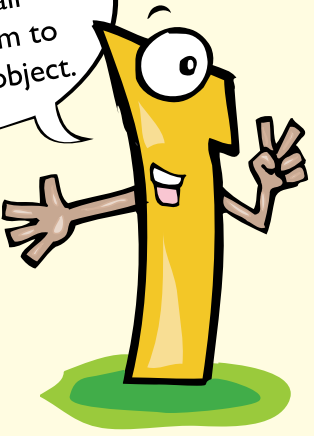
ZZero, do you know what 2D and 3D mean?



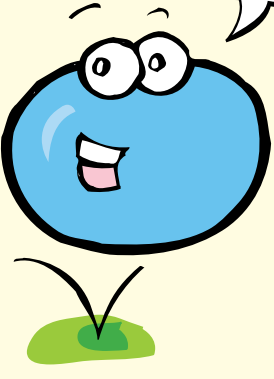
Are they the classes in which Neela and Suresh study, Eka?



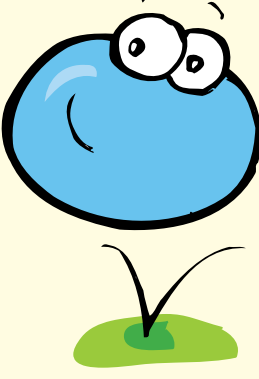
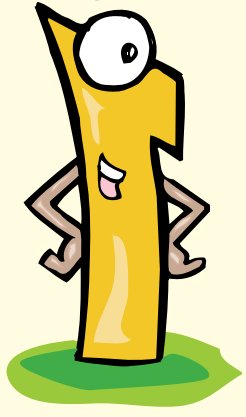
No, no, Zzero. 2D stands for two dimensions. Length, and height and width are all dimensions. We use them to measure the size of an object.



So 3D means three dimensions!



Very smart, Zzero!



# So Much Information!

---

“Today’s weather - warm and sunny throughout the day, heavy rain expected in the evening,” said a stylish newsreader on television.

“You better carry your umbrella, Sankhya,” cautioned Amma.

“I think I’ll cut the grass in the backyard tomorrow,” said Father.

“I’m going to make paper boats of all kinds. Yippee!” danced Ganith.



## Data

Data is nothing but information.

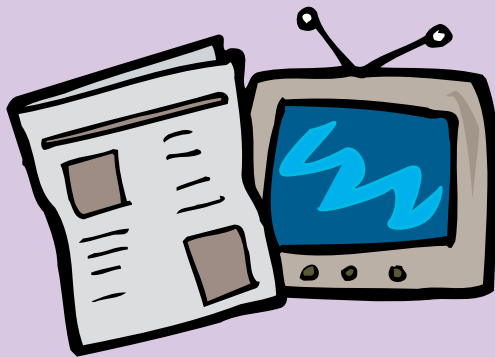
Actually, the singular of data is datum. Funny word!

We use data to form opinions, to make arrangements, to organise matters and to inform others.

Sankhya and her family used the data from the news on television to organise their time. Mathematical data is very useful too.

We use mathematical data, also called statistics, in many ways.

### Different forms of Data



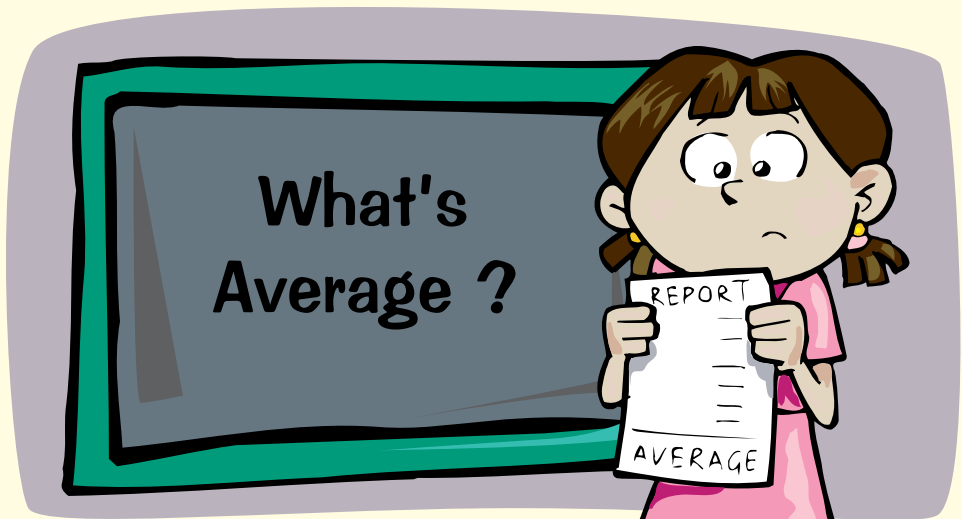
on Television

in a Newspaper



Charts  
and  
Statistics





Sankhya likes writing tests. Her marks indicate whether she has learnt her lessons well. When she gets 'above average' marks she feels happy.

But what does average mean?

Let's see. These are the marks out of 100 that Sankhya and her 19 classmates got in the last mathematics examination.

74, 65, 35, 57, 59, 53, 44, 88, 97, 33, 86, 88, 88, 45, 61, 79, 88, 56, 57, 67.

Let us add all these marks.

$$74 + 65 + 35 + 57 + 59 + 53 + 44 + 88 + 97 + 33 + 86 + 88 + 88 + 45 + 61 + 79 + 88 + 56 + 57 + 67 = 1320.$$

The number we get when we divide the sum by the number of students is called Arithmetic Mean, or average.

$$1320 \text{ divided by } 20 = 66.$$

Mean score in Sankhya's class in mathematics is 66. Anyone who gets around this has scored average marks. Students who get higher marks than the mean have scored above average marks. Students who score much less than the mean need to do much better in the next examination!

## Mode

What have most students in Sankhya's class scored?

30		41		51		61	✓	71		81	
31		42		52		62		72		82	
32		43		53	✓	63		73		83	
33	✓	44	✓	54		64		74	✓	84	
34		45	✓	55		65	✓	75		85	
35	✓	46		56	✓	66		76		86	✓
36		47		57	✓ ✓	67	✓	77		87	
37		48		58		68		78		88	✓ ✓ ✓ ✓
38		49		59	✓	69		79	✓	89	
39		50		60		70		80		90	
40										97	✓

Let's put the marks in ascending order, that is, from the lowest to the highest.

Mode is the figure that appears most often in the list.

In the list 88 is the Mode.

## Median

Median is the number that appears in the middle of the list after you have put it in descending or ascending order.



In a group of 20 numbers, the 10<sup>th</sup> and 11<sup>th</sup> numbers are in the middle. Median is the value between these two numbers that is between 61 and 65.

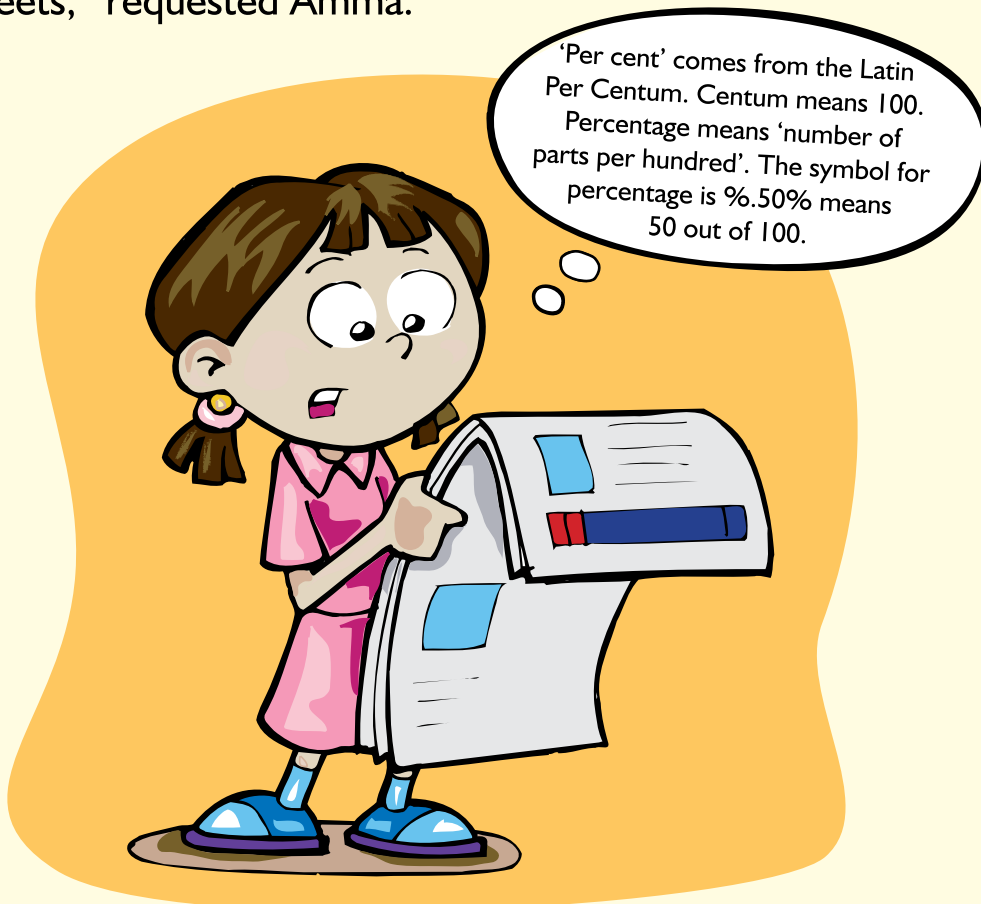
Median in this example is 63.  $(61 + 65 / 2 = 126 / 2 = 63)$

# Sankhya is Confused

“In the Class 10 Board examinations, 50% of students have passed. 10% of students who have passed are from the urban centres in the State. While 80% of girls who have passed have scored first class marks only 70% of boys have secured first class. ....” Sankhya read from the day’s newspaper.

“How did the newspaper get so much information in one day? No one came to Aryanagar to find out. So how do they know how the boys and girls in our school have fared in the examinations?” asked a very confused Sankhya.

“Forget that, Sankhi, come here and help me sort these answer-sheets,” requested Amma.





Sankhya's mother is a geography teacher in Aryanagar Vidyamandir. "Put all Class 5 papers here, Class 4 papers in this pile, and Class 6 papers here."

Mother and daughter counted the number of answer copies in each class. Sankhya spent the day helping her mother to fill up the record book that had columns for Name, Marks and Comments.

**At the end of the day, Sankhya could guess some things clearly:**

- There were more students in Class 4 than in Class 5.
- The Class 6 answer papers were thicker than the answer papers of Class 4.
- More girls in Class 6 had passed than boys.
- An equal number of girls and boys had passed in Class 4.

Now, let's go back to the newspaper.

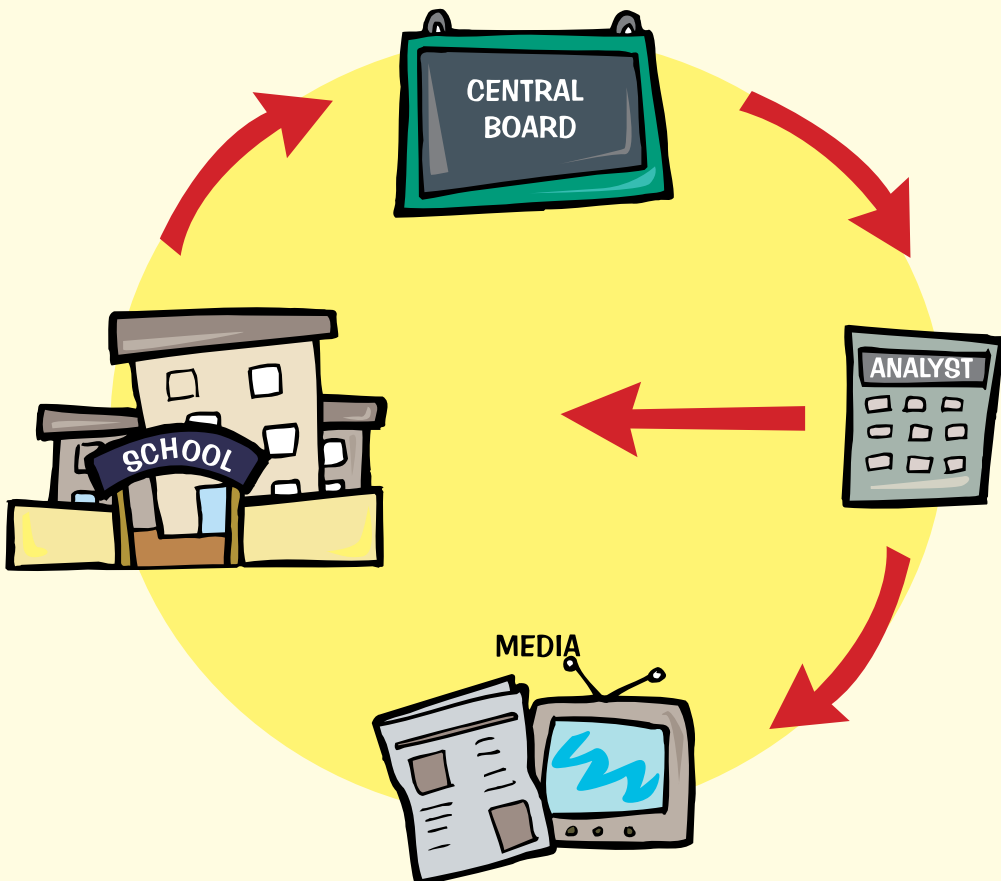
Schools send their lists with the names of students to a Central Board. After the papers are corrected, the Central Board makes a list with the names of all the students and their marks.

People called Analysts or Statisticians read this information, understand it, and write it in the form of tables so that we can understand the information easily.

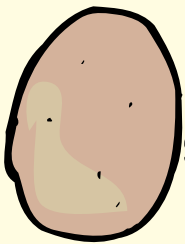
The table is given to newspapers, television channels and to all the schools in the country immediately.

Over 6,00,000 students wrote the Class 10 examinations in the CBSE Board in 2006.

“And lakhs of students must have written the Class 10 exams of other Boards too, isn't it ?” asked Sankhya.

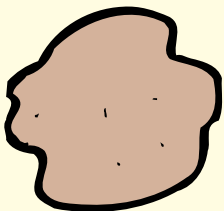
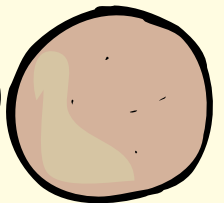


“Yes, Sankhya. Now call Ganith and I’ll teach you how to make rotis.”



Sankhya's *roti* looked like this. (An Oblong)

Amma's *roti* looked like this. (Perfect Circle)

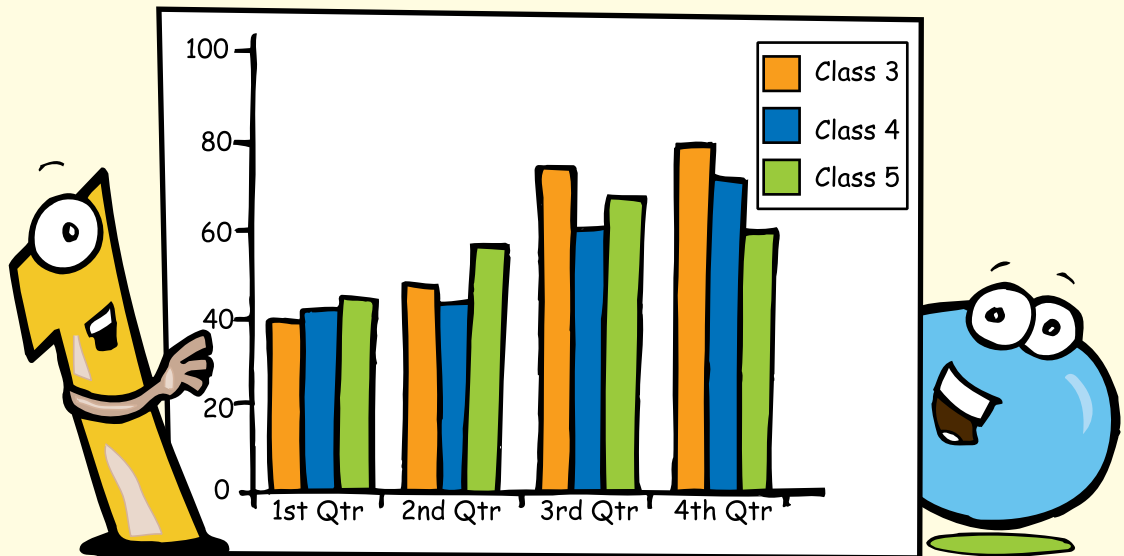


Ganith's *roti* looked like this. (Shapeless)

1. If the full *roti* represents 100 per cent of students who took up the Class X CBSE examination, what part of the *roti* would represent the pass percentage?
2. Students write examinations either in urban centres or rural centres. What part of the *roti* would represent the percentage of students who have passed from rural centres?
3. Take another *roti*. Can you show the percentage of boys who have secured a first class?



# Reading a Picture



A chart can be of many kinds.

It is an easy-to-understand representation of information.

A chart in mathematics can be very helpful. Take a look at the chart presented here. The vertical line shows average marks of a class, 0 to 100.  $\text{Average} = \frac{\text{Sum of the marks of all the students in the class}}{\text{Number of students}}$

- If the sum of marks of 40 students is 2800, then the class average is 70 marks.
- The coloured blocks represent the four Quarterly (Qtr) Examination marks obtained by each class.
- Just by looking at the picture, what are the things that you can learn about the three classes?



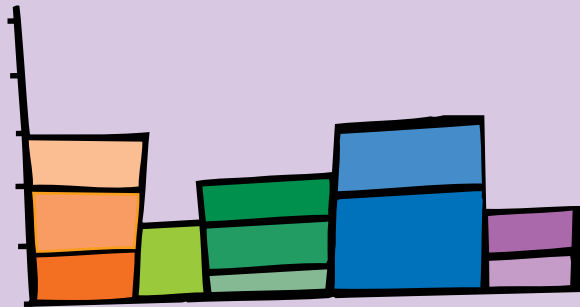
1. Which class has shown the most improvement?
2. Have students of Class 4 improved?
3. What can you say about Class 5 students?

When you see different shapes around you, study them.  
See if there is anything special about these shapes.  
Then you can record your observations in the form of charts.

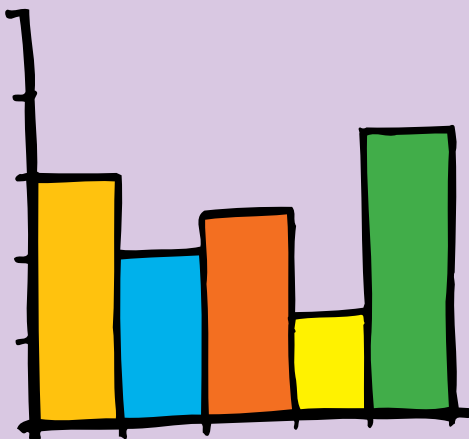
## Different types of charts



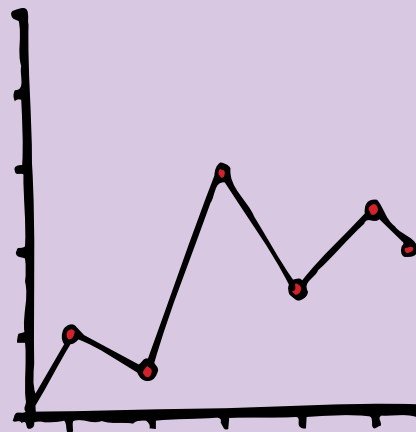
Pie Chart



Divided Bar Graph



Bar Graph



Line Graph

Sankhya and Ganith now enjoy reading the newspaper!

They try to convert several news items into graphs or drawings!

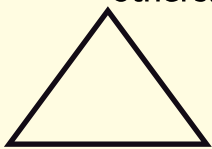
You can do it too!



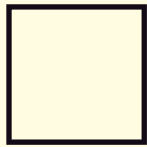
# Answers

## Answers to 'The Funny Cricket Ground' Page 7

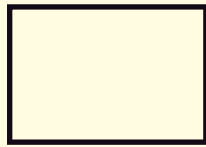
1. Some shapes do not have names. In mathematics, a section of study is called geometry. Under this section, we study shapes called triangles, squares, rectangles, parallelograms, circles and some others.



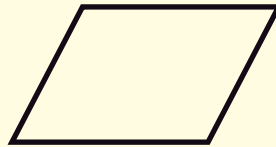
Triangle



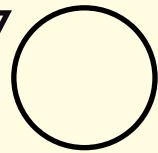
Square



Rectangle

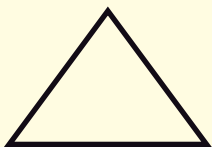


Parallelogram

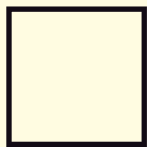


Circle

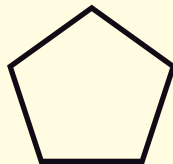
2. Three straight lines on a single plane will form a triangle. So we need at least three straight lines to form a closed figure like a cricket ground. Try to see what happens when you keep extending the triangular shape by adding one more straight line to the formation. (You get a square, a pentagon, a hexagon.... and finally a circle!) And one curved line is enough to form a closed figure... a circle!



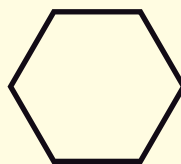
Triangle  
3 sides



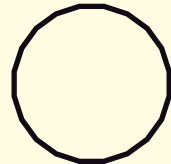
Square  
4 sides



Pentagon  
5 sides

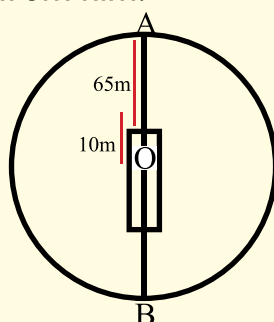


Hexagon  
6 sides



Icosahedron  
20 sides

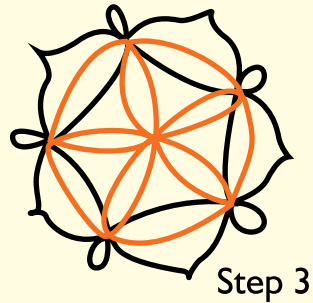
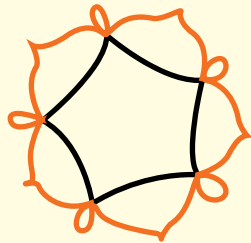
3. Zzero would like to play in a field whose boundary makes a circle. That way every point on the boundary rope would be approximately the same distance from him.



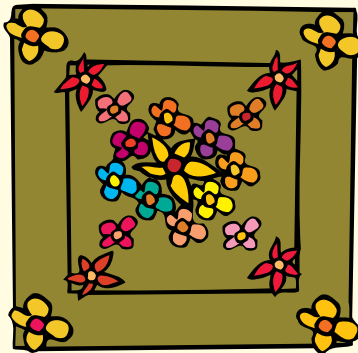
4. Pitch length = 20m, Midpoint =  $20/2 = 10$ m. Radius of circle =  $10 + 65$ m = 75m  
 Circumference of a circle =  $2 \times \pi \times r$   
 where  $\pi = 22/7$ ,  $r$  = radius, Circumference =  $2 \times 22/7 \times 75 = 471$  metres (approximately)

## Answers to 'Floor Designs' Page 11

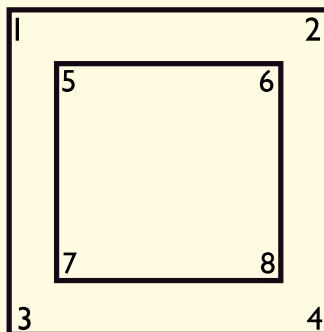
1. There are 3 steps to this *rangoli*.



2. Hope you enjoyed drawing a design and decorating it with flowers!



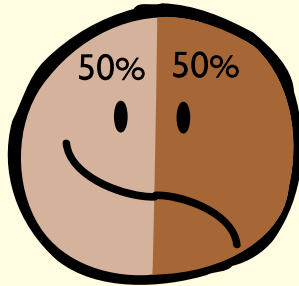
3. 8 corners. In geometry, these are called angles.



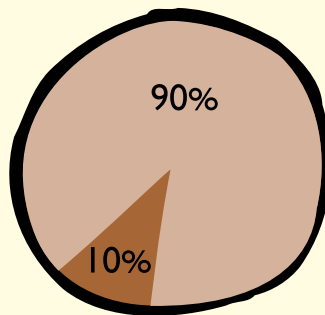
4. 16. She arranged four flowers in a row. In a square, the sides are equal. So if there were four flowers in a row, there would be four in a column.  $4+4+4+4 = 16$ . A simpler method is to multiply 4 (in a row) by 4 (in a column).  $4 \times 4 = 16$ .
5. 1000 flowers.

## Answers to 'Sankhya is confused' Page 21

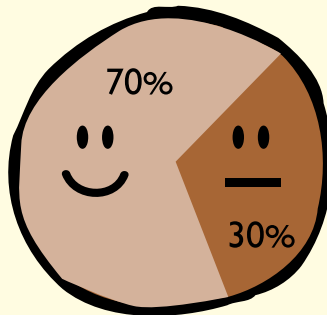
1. Half a *roti*.



2. 90%.

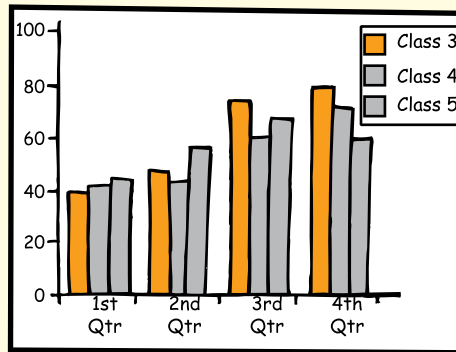


3. 70%. 30% of those who passed did not get a first class.

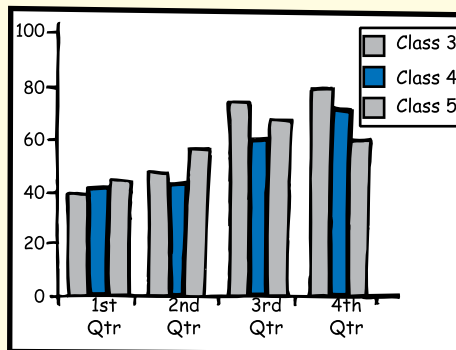


## Answers to 'Reading a Picture' Page 23

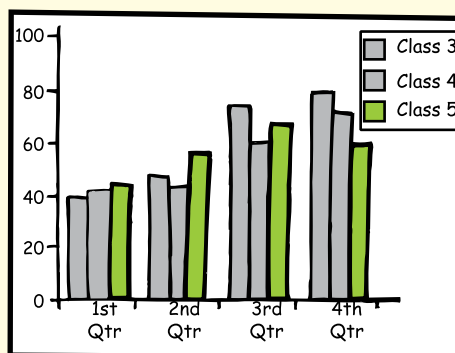
1. Class 3 showed the best improvement of the three classes, from an average of below 40 marks to over 80 marks.



2. Students of Class 4 have improved from getting an average of 42 marks to over 70 marks.



3. Class 5 students did not do as well in the final exam as in the previous examination.





I am Ankit. I study in class 7 and want to become a lawyer when I grow up because the law is equal for everybody. You will never see me lagging behind in disco dancing and cricket also!  
Thank you for buying this book. My friends and I will get to read many more books in our library because you bought this book.



Mala Kumar is a journalist, writer and editor based in Bangalore. Her stories for children have won awards from Children's Book Trust. She discovered her love for teaching while conducting non-formal workshops in mathematics in schools, using the day's newspaper instead of text-books.



Angie is a graphic designer and in her spare time loves to keep busy with ceramic. Upesh is an animator who collects graphic novels and catches up with alternate cinema in his spare time. Together they form 'The Other Design Studio'.



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