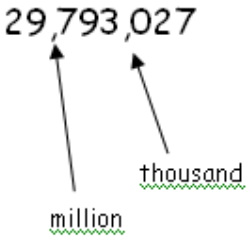
How Many Hula Hoops?

What's this one all about?



Apparently there was an advert where hula hoops (the small, crunchy, eating variety) were stacked in a pile beside Big Ben (the clock on the Houses of Parliament in London) from top to bottom to see how many there would be.

One of our Primary 3 pupils thought it would be much more interesting to find out how many would stretch from the school to Big Ben – it turned out to be quite a lot, since we were in Edinburgh in Scotland!

You will have GREAT fun investigating this!

The children drive the investigation with their ideas, but you have a pre-thought-out idea of where it is likely to go.

The first step is to work out how many hula hoops fit into one metre.

It is wonderful to watch the children trying to work this out. There aren't enough in one packet to fill a whole metre, so some may decide to move hula hoops from the end of the line to the front, others may work out how many there are in half a metre and double it, and others may investigate the number in 10cm and then multiply by 10.

You can then have a delightful time going round the room and getting each group to demonstrate their method.

After that you are likely to be onto one of the auto websites to find out the distance from your place to Big Ben.

And then the work with Big Numbers begins!!

The teacher bits...

Learning Intentions: *I can measure accurately with a metre stick. I can use my knowledge of smaller numbers to solve problems with larger numbers. I can use a conversion table to calculate distances.*

Ages: 7-10

What you need: Class whiteboard, individual pupil whiteboards, metre sticks, packets of hula hoops, a picture of Big Ben, internet access (one machine), pencils & paper.

The investigation

Preparation

Purchase one small pack of hula hoops for each group of pupils. Find a picture of Big Ben.

Initial Discussion

Gather the pupils together. Show them the picture of Big Ben and ask them where it is. (Discuss London, Houses of Parliament etc) Show them a packet of hula hoops. Suggest that it might be fun to work out how many hula hoops you would need to lay side by side to stretch the whole way from where you are to Big Ben.

[Note – if you are outside the UK, or if big Ben is more than 1000km away from where you are, then choose an appropriate alternative nearer landmark in your own country!]

Ask the pupils for suggestions as to how you might work it out. Write each idea on a separate small whiteboard, together with the name of the child who came up with the idea. Some of the following ideas/questions are likely to be offered. Allow the more able pupils to build on each others' ideas for now and follow the discussion where it goes – there will be a chance to work step by step later on.

- You could work out how many hula hoops there are in a metre.
- You could use the internet to find out how many metres it is from the school to Big Ben.
- You could do how many metres in a mile and how many miles to Big Ben.
- If it's 2000m to Big Ben and 70 Hula hoops in a metre then you would do 2000 x 70 (2000 lots of 70).
- Instead of 2000 lots of 70 you could do 70 lots of 2000.
- To do this, you could do 2 x 7 first and put zeroes back on.
- What if the hula hoops don't fit exactly?

Agree that a good starting point would be to tackle the simpler question of how many hula hoops there would be in one metre.

Group Task – How many hula hoops in one metre?

Arrange pupils in groups of about 4. Give each group a metre stick and a packet of hula hoops and some individual whiteboards and set them the challenge of working out how many hoops there are in one metre. As the pupils work, circulate, noting the different strategies that emerge.

Most groups are likely to try arranging the hula hoops along the metre stick. They will quickly discover that there are not enough hula hoops in one packet to go the full length!

The following are likely solutions to this problem

- Arrange them along the stick, count them, and then move use the ones from the beginning of the line to the end to complete the count.
- Find out how many there are in 50cm and double.
- Find out how many there are in 10cm and multiply by 10.

Once the pupils have had a suitable length of time, gather the class around each table in turn and let the 'host group' explain their strategy to the others. Collect the answers.

The answers are likely to be around 60, but unlikely to all be exactly the same. Discuss why this might be

- hoops may be slightly different sizes
- lines may not be perfectly straight
- pupils may have lost count
- there may be errors in calculation

Collect all the answers together and look at them as a class (eg 60, 59, 60, 61, 62, 61, 60 etc). Discuss the concept of an average. Explain median and mode

- Mode - the one that occurs most.
- Median – arrange the numbers in order and choose the middle one.

Agree as a class an appropriate median. Hopefully it will turn out to be 60. If it doesn't, then discuss the concept of rounding and suggest that 60 would be an easier number to work with than 61 or 59! Agree on 60 as your answer.

Class Discussion – How many metres to Big Ben?

Agree that the next step will be to work out the number of metres from where you are to Big Ben. Ask how you might do this. Introduce the idea of a routeplanner web site which uses Post Codes and names of landmarks and calculates road distances.

Visit the suitable web site and do the relevant search (the RAC and AA both have these). The answer may come up in both miles and kilometres. Agree that kilometres is the most useful measurement since there are exactly 1000m in a kilometre. (More able pupils are likely to be ahead in their thinking and suggest multiplying by 1000 to solve the problem. Acknowledge this as a good idea without getting drawn into too much discussion – you need to take everyone else with you as well.)

The figure on the web site is likely to be presented as a decimal. eg 642.78km. Discuss the concept of rounding and round the number to the nearest whole. (If the pupils have not been introduced to the idea of decimals you can simply refer to this number as meaning, eg '642 and a bit' and being nearest to 643 since 78 is more than half way to 100'.

Discuss the fact that there are 1000m in a km. So 642km means 642 thousand metres! This is a seriously big number, so we will need some skill to work out the next bit...

Using a Conversion Table

Bring the pupils back to the idea of solving a simpler problem before working out the real one. Introduce the idea of a conversion table (see copymaster 'How many hula hoops in 1km?'). Explore the idea that if we know how many hula hoops there are in 1m, then we could work it out for 2m, 3m and so on up to 10m.

If we know 10m then we could work out 20m, 30m and so on up to 100m and this way we could get bigger and bigger numbers.

Set the pupils the task of completing the conversion table to work out how many hula hoops there are in 10m. Those who finish this quickly could then go on to complete the second table, working out how many in 100m and then the third table to work out how many in 1000m.

Draw the class together at appropriate points and look at the emerging results. Discuss patterns in the numbers, eg.

- how the 60x table links to the 6x table.
- what happens when you make something 10x, 100x and 1000x bigger.
- etc

Recap the fact that 1000m = 1km. So we now know how many hula hoops there are in 1km. (60,000) Agree that having found the number of hula hoops in 1km we'll next need to find out how many there are in the whole distance to Big Ben.

Large Numbers

This would be a good point in the investigation to pause and have a general discussion about reading aloud large numbers. The suggestions that follow cover numbers up to millions. If you want to go further and teach the pupils how to read any large number up to trillions there is a fuller discussion in the investigation on 'Populations'.

Write an 8 digit number on the board ending in 5 zeroes, eg.
32900000

Ask the pupils if they can read the number. There is likely to be some bewilderment! Enjoy the moment and then announce that you are going to teach them a trick that will let them read a long number like this. They will then be able to go home and amaze their parents with their mathematical skills.

Discuss why the number you have written is difficult to read (there are a lot of digits, they are all close together etc). Ask the pupils how you could make the number easier to read. Establish that long numbers are usually written with spaces or commas every so often. Ask the pupils where they think the commas should go.

It is likely that someone will know that the commas go after every third digit. Follow their suggestion to put in commas. They are likely to begin at the beginning so you will get a result like this.
329,000,00

Ask what others think of this and establish that it does not look right. You cannot have two digits on their own at the end. Establish that this problem can be solved if the commas are put in *beginning at the end.*

Rub the commas out and put them in again starting at the other end.
32,900,000
Agree that this looks better. Who thinks they could read the number now? Ask for a show of hands. You may get a few hands up, but a sizeable number will not be too sure! Suggest that we should begin by *trying a simpler case*.

Replace all the zeroes with other non-zero digits. eg
32,941,263

The pupils will protest that this number is harder, not easier!

Cover up all but the last digit. 'OK, Here's a really easy number!'
3
Get everyone to say it!

Add the previous digit in front.
63
Get everyone to say it.

Add the previous digit in front.
263
Get everyone to say it.

Add the previous digit in front, including the comma.
1,263
Point out that when read this number you say the number in front of the comma - '1', then say 'thousand' when you see the comma, then read the number after the comma - '263'.
Get everyone to say it.

Repeat with the next digit.

41,263

Say the number in front of the comma - '41', then say 'thousand' when you see the comma, then read the number after the comma - '263'.

Get everyone to say it.

Repeat with the next digit.

941,263

Now add the next digit.

2, 941,263

Point out that there are now two commas. When you see the first one, you say 'million'. When you see the second one, you say 'thousand'. So the number goes like this.

2 million

941 thousand

263

Add the final digit.

32, 941,263

Read the whole number.

32 million

941 thousand

263

[There is likely to be some discussion at this point as to what happens if the number is even longer. Suggest the enthusiasts do an internet search if they wish to find words for bigger numbers!]

Now practice the skill as a class on several other long numbers using the 'cover up method' as follows.

- Write the whole number.
- Put in the commas working backwards from the end.
- Cover up all but the last digit and ask the class to read aloud the visible number.
- Reveal the next digit and ask the class to read aloud the visible number.

- Continue, digit by digit till the whole number is revealed, reading aloud the visible number each time.

Once the pupils are confident, introduce numbers with zeroes at the end as follows.

Take a number you have practised and modify it by changing the last digit to zero.
32,941,260

Read the whole number.
32 million
941 thousand
260

Repeat, changing the next to last digit to 0.
Read the whole number.
32 million
941 thousand
200

Change the next digit to zero.

Read the whole number.
32 million
941 thousand
(Note with the pupils that the 000 at the end doesn't get spoken. It just sits there.

Continue in the same way changing further digits to zeroes in turn.

Repeat with a few other numbers until the pupils are confident.

Finally, introduce numbers with zeroes in random places. A tricky example might be as follows.

20,040,063

20 is straightforward.
Agree that 040 should just be read as 40.
063 would therefore be read as 63.

So the number should read
20 million
40 thousand
63.

Agree that this doesn't sound right. What we do is put the word 'AND' in before the 63 so we get.
20 million
40 thousand
AND 63.

The rule is, if there is a zero after the *last* comma, you say AND when you get to that comma. (You don't say AND for the other comma.)

That's it! Your pupils should now be confident reading any large number up to 9 digits. A worksheet is provided below if you wish to consolidate this as an individual class or homework activity.

Hula Hoops to Big Ben

For this section the pupils will need calculators.

Gather the pupils round. Recap on the distance to Big Ben in km that we got from the research earlier. Write this on a whiteboard.
- eg Distance to Big Ben = 632km
Recap on the number of hula hoops in 1km. Write this down.
- 60,000 hula hoops in 1 km.

Ask for suggestions as to what you could do now. Someone may suggest multiplying the numbers together. Don't accept this immediately as the correct thing to do. Engage in dialogue to get others to explain what they think. Can anyone explain **why** we should multiply?

It is likely that some pupils will not be sure whether this is the correct approach. Suggest again that you try a simpler case. Agree 60,000 hula hoops in 1km. Discuss how many in

2km. Then 3km etc. Build up together the chart on pupil copymaster 'How Many hula hoops to Big Ben?' (You may prefer to project this onto the whiteboard.)

Engage the pupils in discussion as to how the 'km numbers' are turned into the 'hoop numbers'. Someone will no doubt offer multiplying by 60,000 as an idea. Check on calculators that this works. It does.

Ask how you could work out the number of hoops for the total distance. Establish that multiplying the number of km by 60,000 will work in this case also.

Calculate the real distance and practice reading the number aloud.

Investigation complete!

Name: _____ Class: ____ Date: _____

Reading Large Numbers - Homework Activity

Ask one of your family to write down a 7 or 8 digit number for you.

(Use the back of this sheet.)

Example

29793027

Put a comma after every 3rd digit, **working backwards from the end**.

Example

29,793,027

Name the commas in your head, working backwards.

Example

29,793,027

thousand

million

Read the number aloud, working forwards.

29 million

793 thousand

AND 27

Repeat till you have practised ten large numbers altogether.

Name: _____ Class: ____ Date: _____

How Many Hula Hoops in 1 kilometre?

_____ hula hoops fit in 1 metre.

Complete this conversion table.

Metres	Hoops
1m	
2m	
3m	
4m	
5m	
6m	
7m	
8m	
9m	
10m	

Metres	Hoops
10m	
20m	
30m	
40m	
50m	
60m	
70m	
80m	
90m	
100m	

Metres	Hoops
100m	
200m	
300m	
400m	
500m	
600m	
700m	
800m	
900m	
1000m	

1000m = 1 kilometre.

So _____ hula hoops fit in 1 kilometre.

Name: _____ Class: ____ Date: _____

How Many Hula Hoops to Big Ben?

_____ hula hoops fit in 1 kilometre.

Complete this conversion table.

Metres	Hoops
1km	
2km	
3km	
4km	
5km	

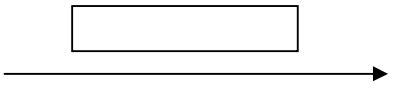
How do you turn the 'metre' numbers into the 'hoop' numbers?

Experiment on your calculator.

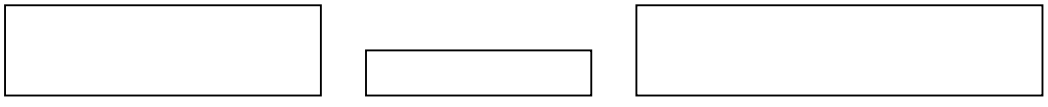
Complete

To find the number of hoops you take the distance in km

and _____.

Number of km  Number of hoops

Now use your calculator to work out the number of hula hoops to Big Ben.



km to Big Ben → hula hoops to Big Ben