UC IRVINE MATH CEO

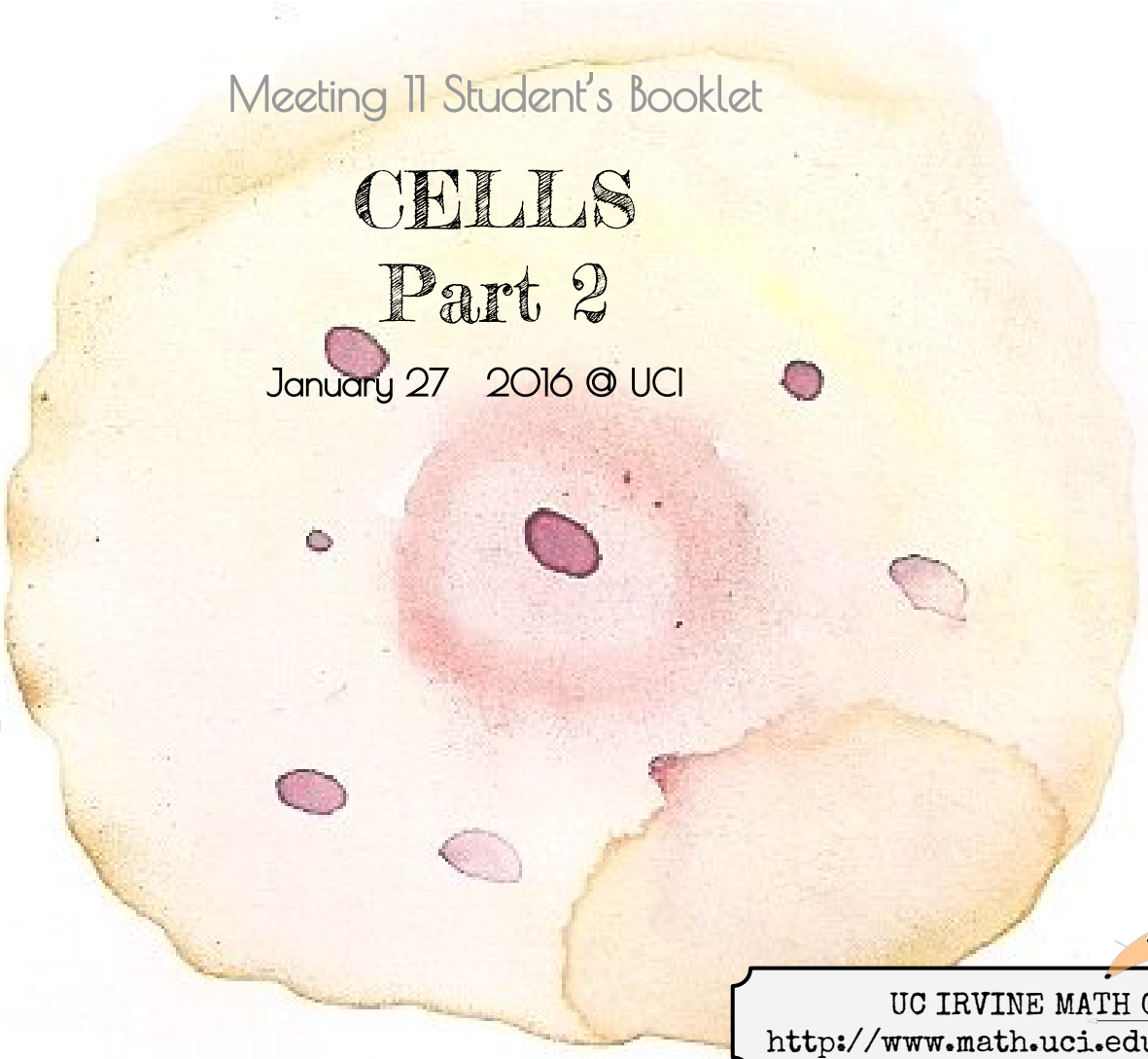
Community Educational Outreach

Meeting 11 Student's Booklet

CELLS

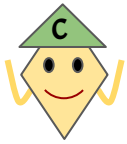
Part 2

January 27 2016 @ UCI



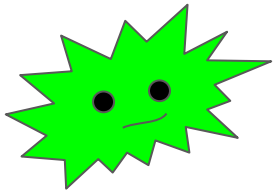
Contents

1 Cancer growth



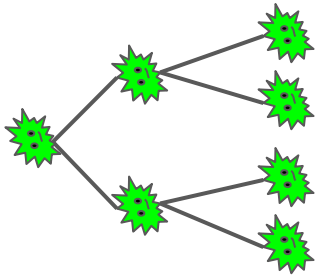
Let us Imagine that we are doctors! Our task is to detect Cancerin and her daughters as soon as possible.

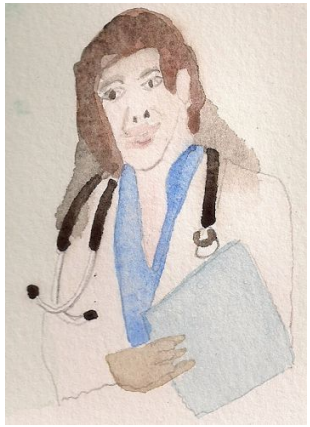
Cellulin just got a friend, which is a little bit bad-behaved. Her friend is a cancer cell and her name is Cancerin.



The problem with Cancerin cells is that if they are many, they can form a tumor! We know that tumors are bad for the human body.

Cancerin splits every hour! This means that the cell has two daughters (both cancerin cells) every hour and dies when her daughters are born.





a The tumor can only be detected by a doctor if there are more than 105 cancerin cells. After how many hours can the tumor be detected?

_____

b When a tumor reaches approximately 1010 cells, it must be removed by a doctor. How many hours does it take for a tumor to grow that big?

_____

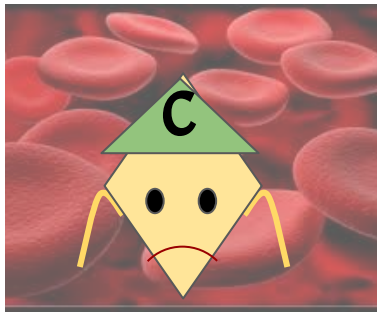
c Answer questions a) and b) again, but assuming that there is a split every 30 minutes.

_____

d Answer questions a) and b) again, but assuming that there is a split every 2 hours.

_____

2 Cellulin is lost in the blood



The blood is made of red blood cells, white blood cells, plasma and water. Cellulin is lost in the blood of a healthy kid, and she wants to know how many cells are there… Let us figure it out!

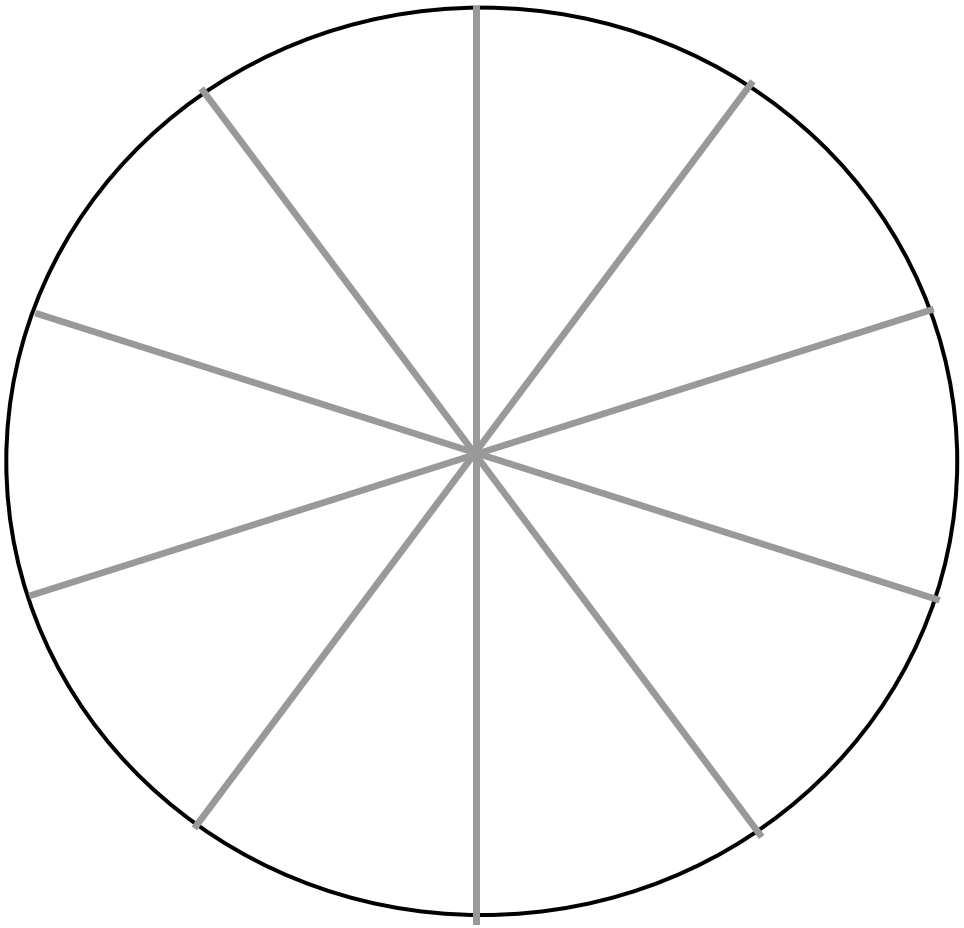
A healthy 10-13 years old kid has around **5 liters** of blood in her/his body, where:

- 1/2 of 6/10 of the blood is red cells.
- 10% of the blood is white blood cells.
- 1 liter of the blood is plasma.
- _?_ is made of water.

a Fill the following chart with the fractions, percentages and amount of liters of each of the blood components.

	Fraction of the blood	**Percentage of the blood**	**Amount in liters**
		10%	
			1 liter
Total			5 liters

b Using the symbol of each component of the blood, draw the corresponding fractions in the circle below:



c Using the data from the previous page, let us solve the following:

A boy has a blood disorder called **anemia**, which consists in having a low number of red blood cells.

The doctor tells him that he only has 0.5 liters of red blood cells.

How many liters of red blood cells is he missing?

_____

Which fraction of total red blood is he missing?

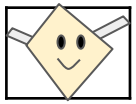
_____

What is the percentage of red blood that he has?

_____

3 Cellulin Tilings

a Cellulin got bigger and now instead of occupying one space in the matrix below, she occupies two spaces.



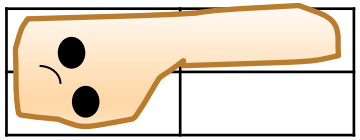
before

Now

What is the maximum number of big Cellulins that you can fit in the following matrix? Can you fill up all the matrix? Why?

Can you fill up a matrix with 3 rows and 4 columns? Draw it!

b We now have t-cells, each occupying three spaces:



How many t-cells can we fit in this matrix?

Can you draw a matrix that is full of t-cells without any free space?

4. Powers of 10

The symbol 10^3 **(= 10^3)** means
10 x 10 x 10 (3 times).
The number 3 is called the
exponent, while 10 is the **base**.

10^0 =1
10^1 = 10 (1 time) = 10
10^2 = 10 x 10 (2 times) = 100
10^3 = 10 x 10 x 10 (3 times) = 1,000
10^4 = 10 x 10 x 10 x 10 (4 times) = 10,000
10^5 = 10 x 10 x 10 x 10 x 10 (5 times) = 100,000
10^6 = 10 x 10 x 10 x 10 x 10 x 10 (6 times) = 1,000,000
10^7 = 10 x 10 x 10 x 10 x 10 x 10 x 10 (7 times) = 10,000,000
10^8 =10 x 10 x 10 x 10 x 10 x 10 x 10 x 10 (8 times)=100,000,000

Do you see the magic?

Did you see the magic?

100=10X10 = 10^2

2 zeros

1000=10x10x10= 10^3

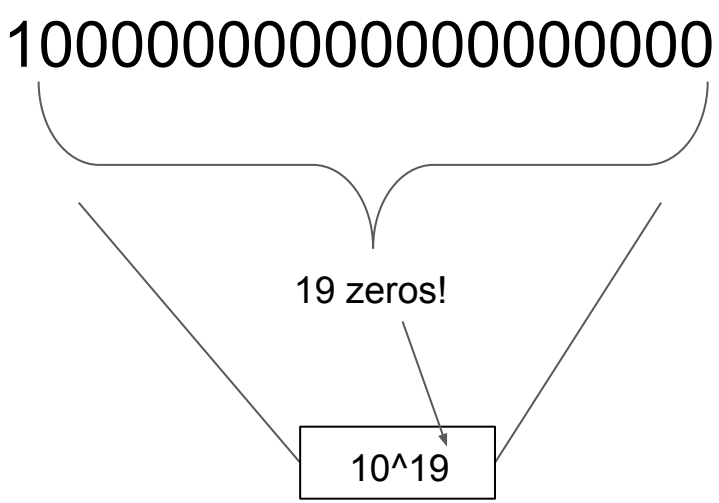
3 zeros

10000=10x10x10x10=10^4

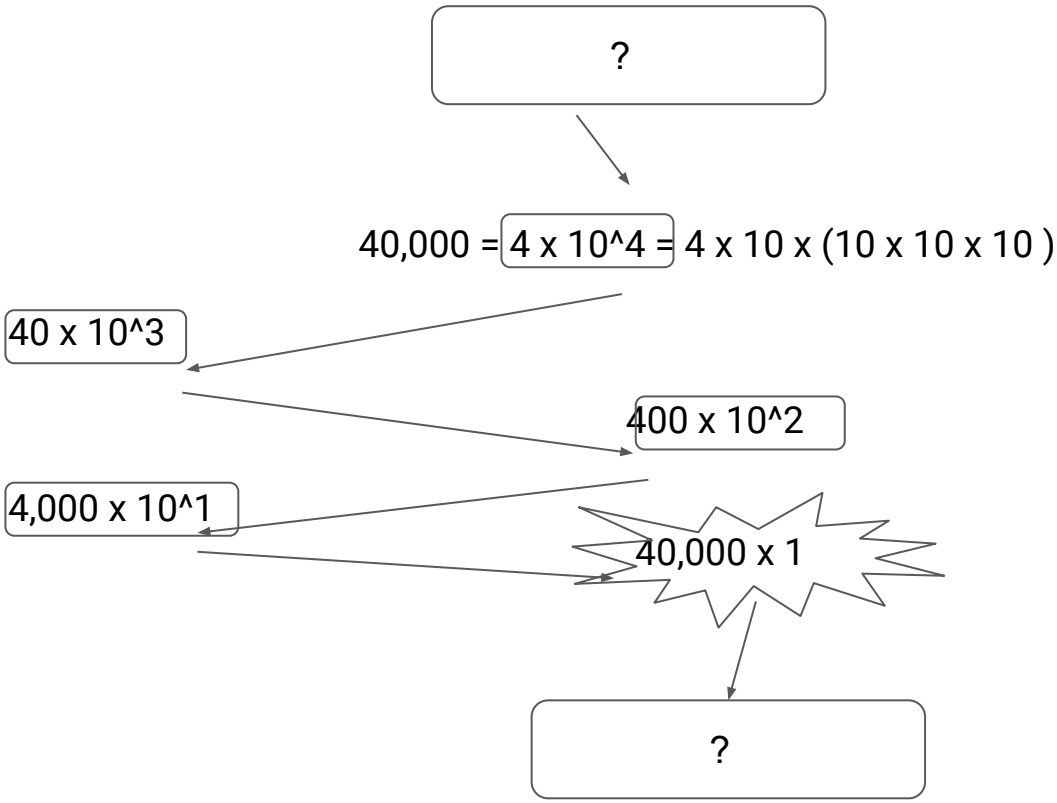
4 zeros

Did you find out the rule?!

There is something called **scientific notation**! This notation is very fun because any number can be written in very compact form! See:

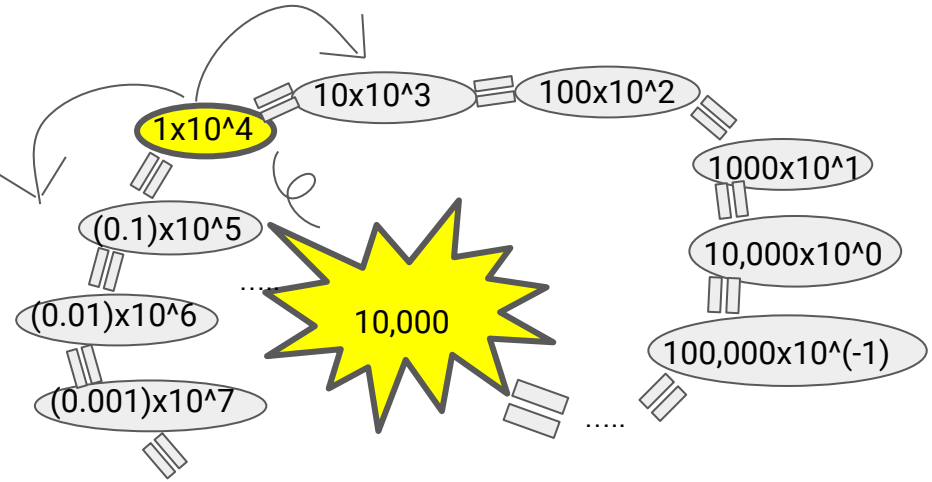


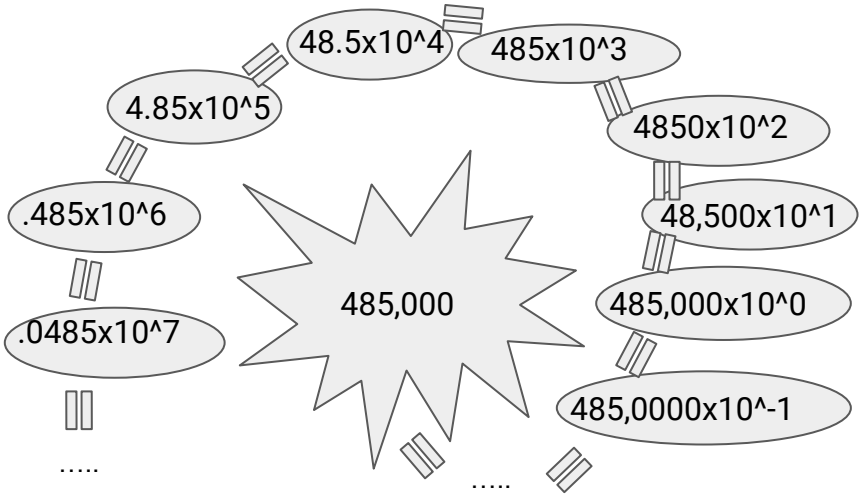
Different ways to write the same!!!



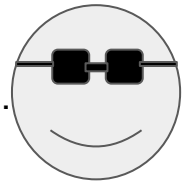
a Find **SIX** different ways to write 7,000 using powers of 10.

Different ways to write the same!!!





This is cool.



b Find **SIX** different ways to write 42 using powers of 10.

Different ways to write the same!!!

We can organize powers of 10 in different groups...

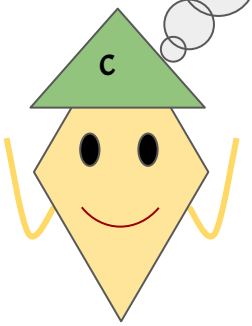
$$1000{,}000{,}000 = \underbrace{10\text{x}10\text{x}10\text{x}10\text{x}10\text{x}10\text{x}10\text{x}10\text{x}10}_{9\text{ times}} = 10^9$$

$$= \underbrace{10\text{x}10\text{x}10\text{x}10\text{x}}_{5\text{ times}}\underbrace{10\text{x}10\text{x}10\text{x}10\text{x}10}_{4\text{ times}} = (10^4)\text{x}(10^5) =$$

$$= \underbrace{10\text{x}10}_{2\text{ times}}\text{x}\underbrace{10\text{x}10\text{x}10\text{x}10\text{x}10\text{x}10\text{x}10}_{7\text{ times}} = (10^2)\text{x}(10^7)$$

C Find **SIX** other ways to write this using powers of 10.

Remember to use
SCIENTIFIC NOTATION
$10^1 = 10$
$10^2 = 10 \times 10 = 100$
$10^3 = 10 \times 10 \times 10 = 1000$



1/1000 of a liter

d If in 1 milliliter we have 5 000'000 red blood cells, we would like to know <u>how many red blood cells are there in our body</u>. Let's go step by step...

How many red blood cells are there in 10 milliliters?

_____

How many red blood cells are there in 100 milliliters?

_____

How many red blood cells are there in 1000 milliliters?

_____

How many milliliters are there in 1 liter?

_____

How many milliliters are there in 5 liters?

_____

How many red blood cells are there in 5 liters?

_____

Capacity of the Angel's stadium = 45,000 = 4.5 x 10^4
Capacity of the Dodger's stadium = 56,000 = 5.6 x10^4
Number of sand grains in a cup = 15'000000 = 1.5 x 10^7
Number of people in California in 2014 = 38'000000 = 3.8 x10^7
Number of cars in the U.S. in 2014 = 2.5 x10^8
Number of people in the U.S. in 2014 = 3.1 x 10^8
Number of people in the word in 2014 = 7.4 x 10^9
Number of sand grains in the Earth =7.5 x 10^18

Number of stars visible from the Earth = 7

x10^22