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THE PI NUMBER AND ITS APPLICATION IN PHYSICS

Only a few of all the numbers that are used in mathematics, in natural sciences, in engineering and in everyday life are given as much attention as the Pi number. It is considered that Pi is one of five most important numbers in mathematics. This number shows the ratio of the circumference of a circle to its diameter. This constant was first designated by the Greek letter "pi" in 1706 by the English mathematician William Jones, and thanks to Leonard Euler (1737), it became generally accepted.

The exact value of Pi cannot be calculated. Why? Since this number is irrational, it cannot be written in a form of simple fraction, if you write it as a decimal fraction, it would be unlimited. The number pi can be calculated infinitely and it will have infinitely many decimal places. This, however, does not deter mathematicians from tiresome attempts to calculate as many decimal places of a number as possible. There were attempts to calculate the exact value of Pi in ancient times. The Babylonians found an approximation equal to 3 and 1/8 (3,125). The Egyptians were a little less accurate and found an approximate value of Pi equal to 3.16. In the III century BC, the Greek mathematician Archimedes made probably the first scientific attempt to calculate the Pi number. According to his calculations, Pi was approximately equal to 3.14.

Scientists from the Higher School of Applied Sciences of the Swiss Grisons using a supercomputer updated the value of Pi to 62.8 trillion digits, thus setting a world record. It took specialists 108 days and 9 hours to update the number of Pi. This is about 3.5 times faster than the last world record in 2020. The previous world record numbered 50 trillion digits in the value of this famous mathematical constant.

We could find very interesting and exciting parallels, connected with the Pi number in physics. Let's discuss the following problem, imagine that we have two blocks and the wall. One of them is motionless and the other is moving uniformly from the left, the wall is on the right. Both are stored on the smooth surface, which means that they don't experience friction. Let's consider that all collisions are perfectly inelastic, so no energy is lost.

We would start with elementary case: blocks have equal mass. It means that the second block would hit the stationary one (the first) and give it all of its energy. The second block would stay at the position of collision while the first one would bounce off the wall and then bump into the motionless. There are 3 collisions. What will happen if the second block would have a 100 times mass of the first? Having calculated, we could say that there are 31 collisions before each block is sliding up towards infinity. If we continue to increase the mass of the second block, we could find an amazing regularity. When the moving body has a 10000 times mass of the motionless one, there would be 314 hits. Probably you can find the connection between these variables. So, the digits of Pi number are shown to us in the form of number of collisions, when blocks have a special ration of their masses.

This amazing result was received by Gregory Galperin in 1996. The mathematician published his work with a funny title «Playing poll with Pi» on December 9, 2003. He delivered the lectures in several American universities and the audience was shocked about such an unbelievable connection and the loveliness of this puzzle. Moreover, Galperin discovered some more beautiful relations between dynamical problems and the Pi number, among them exciting problem about reflections of a beam of light inside the angle.

The solution to this puzzle is connected with configurational or usually called phase space. The main idea is to use the law of conservation of momentum together with the conservation of energy and then show the velocities of blocks in a graphical way. This method helps us to transform serious dynamical problem into graphical one, which could be simply solved.