

What I am trying to present you today will not be a lecture, it will be rather a demonstration or an experiment. This experiment or demonstration or whatever you like to call it, has the aim to present to you my attitude to teaching. You see, it is not a method, it is not a system, teaching is not a science it is an art, you cannot put it really in a system but you may have an attitude to it. This attitude cannot easily be described in words, more in acts and I will show you that afterwards if I can but I can tell you a few slogans. Let me put my first point in the question and answer form:

What is teaching?

In my opinion teaching is giving opportunity to the students to discover things by themselves.

Not the teacher should tell the things to the students, if they wish to learn really they have to discover.

A second point. First guess then prove. All great discoveries were made in this time, the discoveries in the mind of Archimedes or Gauss or Newton, were conceived this way or anyhow some of the important ones and any kid in the classroom finds things this way. First guess then prove.

My third point is a straightforward application of this point to mathematics. Mathematics seems to consist of proofs, but is not quite so. Finished mathematics consists of proofs but mathematics in the making consists of guesses.

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Rosenbaum speech

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THE LECTURE (which is not a lecture)

Ladies and gentlemen I don't wish to give you a lecture, you see, but (we) I wish to teach you about guessing (see), it's a very important part in life to be a good guesser (you see), it's a very important part in mathematics. You wonder a little how because in mathematics if anywhere so in mathematics you have proofs and only that is valid in mathematics what is proved. What is there the part of guessing, yes there is a part. Mathematics when it is finished, complete, all done then it consists of proofs but when it is discovered it always starts with a guess. And I wish to give you a real experience of it, so I don't wish don't will

give you a lecture but we play together a guessing game (you see). You should, you should find (for) out from your own experience what is reasonable guessing, not wild guessing (that can't anyway) wild guess is (NOT WORTH ??) to learn . . . wild guess the less you know the easier to make a wild guess. But, but educated guessing, reasonable guessing that is something else. That can be, should be learned. The mathematics class is a good opportunity to learn it. So we play it, so we play it together a guessing game, this as any other game has rules but the rules are very simple. And there are just two rules. One for those people who will know already my question, I hope there are very few but if you know already my question, if you know already my problem don't answer my questions, that would be unfair. If you know already the answer in advance you wouldn't be guessing and you would spoil the fun of all of us, so don't do that. However if you don't know the answer to my question the don't [throw it back ?? hold ??] don't be bashful. Of course your guess may be wrong but that's one of the art points in the art of guessing, even a wrong guess is helpful the wrong guess leads you to a better guess an that(s) to still better guess and finally you get the [toes ??].

Well, that was enough introduction let us go into the matter so I('ll) give you a problem to guess. It

will be really a problem of solid geometry but you know as solid geometry not much is there to know for instance everybody know what is a plane. A plane is very flat, the top of this desk, this is part of a plane or approximately the better is made, the smoother it is, the flatter it is the better it resembles the ideal plane of mathematics but the ideal plane of mathematics goes over in all directions, it is infinite so you know what is a plane it is flat and infinite.

Now my problem is about planes, several of them, and to tell the whole story about five planes. So you imagine five planes. If you cut so that is one plane, two planes three, four, five planes. Now these five planes cut the space in many parts or divisions or compartments or whatever you call it, and that's just the question. How many parts?

This is my question or almost, there is something to be added but I'll wait till you find it out by yourselves but you understand it (you soo [see]) imagine a big piece of cheese, some cheese you like. It may be green cheese, It may be Swiss cheese whatever you like and then you cut it once twice, three, four five times very sharp in a plane there are lots of many pieces and you have to guess how

many who is ready with a guess, don't be bashful go ahead yes say something.

Twenty five

Twenty five (grand grand??), how did you get it?

I worked out five times five.

Five times five, well that an idea. there is some idea. Anybody ready for some other guess yes please

Thirty two.

Thirty two oh uuuh have something behind you, oh thirty two, interesting, (so ever??) quite big numbers. Still another guess. Well that's enough to start with. Can both guesses be correct? Can both guesses be correct?

Yes

Yes? Oh that's interesting (??) this I didn't expect this answer but see you may be right who knows (laughing) I saw ?? Alright, any other guess? any other question? yes please

I'd say ten spaces.

Ten spaces. Ten, so many. We have ten. Well we shall see who is right. But you see, there is another point, you see. Guessing that's the important

beginning of solving any problem. The real problem is difficult, a real problem you cannot do right away, otherwise it wouldn't be a problem. It belongs to the idea of a problem that there is some difficulty. So if you cannot do a problem, what to do just wait for an idea? nooo, the right thing is try to imagine some easier problem which could prepare you for the good problem, some easier problem which could help. But in this case it is not very difficult to imagine. You must, you should be suspicious in life, you see. So if I ask you five planes then you should have asked yourselves: why does he ask just five, why not four why not six, so what would you ask.

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Yes

I guess you mean (ah) how many planes there ??? I'd say three planes ??? spaces

Three planes good o ??? see

Well the simplest ??? would be two planes I guess

Two, is that the simplest? ha ha ha

One

One, one plane. Oh yes. Well always try to find the simplest. One, yes that is the simplest. You see but it is so in mathematics often the simplest is the best. So here is, here is for you one plane. Oh you

tell me it is just one line in the blackboard. Yes it is true but I mean it in the following way, you see this line on the blackboard is the intersection of the blackboard with a plane you see, is by this plane I am showing you is a horizontal plane, and this horizontal plane could be the surface of quiet water of a reflecting pond (pool) there is nothing else in the world just this surface and over it air and under it water, so how many parts?

Two

Two

Yes?

I'd like to add twelve to the guess?

Twelve

Oh yes (sir??), guesses are always accepted. So but in this case there are just two parts, is that clear, you see, but in mathematics that is an advantage first of all, you can make yourselves completely clear the first cases and they are useful. So in order not to forget it I wish to note it down. So I have just one dividing plane, it is long to write on dividing I just write the end, dividing plane. And there is just one dividing plane then the number of parts is exactly two. Good this was one plane so what is next case? After one, what comes after one?

Two

That's a good, so good, so great ??? can all we count to two, that's good, so here that is any plane drawn? at random, here. Oh you see that is not a plane, just a line but I mean this line is the intersection of the plane of the blackboard with you see with such a plane. so you have two planes, one two. And how many parts do you see

Four

Four. Oh please answer loud nice ????. You can shout much louder. O.K. so you have two planes you have four parts, good. Now, what about three planes? Well I will tell you one [interruption]. Yes please

Could I ask you a question? If the planes

Yes please do ask.

If the planes were parallel would still divide in the same ...

Very good question, that's a good question. I waited just for your question. Now eh, that's a very good question. If all the planes are parallel one, two three, four, five, there is no problem. If all five planes are parallel, little imagination, like that, then there are how many parts?



Six

Six. Well then hole problem would be over. This cannot be the question. Very good, that I wanted you bring it out, yes my question was incompletely stated and that is was es it was so intentionall you see, because problems in live real ... even in science the are often incompletely stated. You have to find out what the real question is. So my real question is, you see, that planes should not be parallel or should not all pass through the same point, they should be taken at random. Here is one plane, here, let us see the plane of the ??? and then you wish to make anotehr plane, 'weeell' how shall I make another plane you see so you make could you make on a piece of wood you could make two planes, well is pretty difficult to make a good plane suface on a piece of wood with a planer and when you made one then the second should be parallel. Do you think you will eves succeed? May be will be good enough

for the piece of wood you see you wouldn't see the difference but if both were produced far enough, very like[ly] they would have a little little inclination and far enough they would do, what they would? ... . If they are not parallel they do ... ?

Intersect

Meet, intersect. So you see if the planes are taken at random, then no two will be parallel or no three will pass through the same line, you see, you see eeh that is almost impossible. Well I hope you have a sound idea about it. So this was as two planes taken at random, is, you feel happier about your question?

Yes ...

Good. Was a very good question. Now, look here, so one plane two planes. How many parts?

Four

Four. Goog, answer with conviction. Four