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Drama in the Rationals

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TIME: January 1966

PLACE: Large Edmonton high school classroom

OCCASION: The writer was one of an inspectional team sent out by the provincial Department of Education to evaluate city schools. This particular episode took place in a Grade X classroom.

CHARACTERS: $\{S_1 S_2 S_3 \dots S_{30}\}$ - all bright students
Teacher (T)
Supervisor, the writer (W)

SCENE 1

T had just concluded a lesson on factoring and polynomials, in which he occasionally made use of some rational numbers, when S_1 enquired: "Mr. T, would you please explain exactly what you mean when you use the term 'negative three-quarters'?"

continued ...

An editor's view of Chuck Allen's remarks at the MCATA annual meeting

WHAT ARE CHILDREN LIKE?

Teachers need to maintain their enthusiasm to create a motivating atmosphere.

Teachers create the atmosphere to motivate or "turn-off" the pupils.

Teachers know what needs to be done. Do we have the ability, wisdom, knowledge, and patience to do it? Does anyone have the talents and gifts to be ideal in all these areas? Use interesting, novel ideas to create activities that will help make basic facts fun to learn. Many ideas were presented at the opening session to show that there are interesting activities without spending money for sophisticated equipment.

Ed Carriger

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T seemed a bit annoyed at being interrupted by such a mundane question. However, he managed a courteous smile and stepped over to the chalkboard. There he drew a circular figure and explained: "Imagine that this is a whole pie. I shall cut it into 4 equal pieces using two right-angled diameters." The class nodded. It was evident that they were interested in the question and the answer.

The writer, having been trapped by a similar question in his teaching experience, was keenly interested. Mr. T went on: "Now I shall erase these 3 pieces or quarters." Nodding to S_1 , he continued: "That represents $-3/4$!"

S_2 , with a vigorous wave of his arm, asked: "Does that mean that the piece left over represents $+1/4$?" T replied: "Well, what do you think?"

S_3 continued: "If you had erased the whole pie, would what was left represent -1 ?"

By now, the class was very quiet but very alert. S_4 stated: "If this were true, then $0 = -1$." S_2 added: "Yes, and if you had erased 3 pies, would you not have $0 = -3$?" S_1 continued: "Therefore, $-1 = -3$." S_4 concluded: "And, if we extrapolate, all negative numbers are equal to zero!"

Fortunately for Mr. T, the dinner bell rang and, for the moment at least, he was saved.

SCENE 2

TIME: Lunch period

PLACE: Teachers' cafeteria

Mr. T asked apologetically: "Where did I go wrong in that explanation?"

W replied: "Don't feel badly. Many teachers (yes, and authors of textbooks) have made the same mistake by attempting to explain a purely abstract number with concrete examples. All signed numbers, be they rationals or integers, can be depicted physically only by a number line. A number line shows clearly a starting point zero and clearly opposite directions. There are the two basic concepts of signed numbers. If we do a good job depicting integers on a number line, the rationals follow easily.

"When you used the pie as your starting point, you were beginning with the whole number 1. Then you subtracted $3/4$, which is a fraction. The quarter pie remaining was another fraction and neither positive nor negative. In other words, you were trying to explain rationals and integers in terms of fractions and whole numbers, all of which are different number systems having entirely different operational rules and representing different concepts.

"Signed numbers are pure abstractions. What you illustrated on the chalkboard was mathematically $1 - 3/4 = 1/4$. Each of these numbers represents objects or concrete things which can be illustrated physically. One should be careful never to confuse the operation of subtraction with negative numbers. They are not interchangeable."

Whereupon Mr. T thanked Mr. W and both enjoyed a delicious luncheon. ■