## A Truckdriver Looks At Squareroots By John W. Risoen and Jane G. Stenzel

It was the end of summer and teachers were trying to get rooms ready for the coming year. Some weighed the pros and cons of new bulletin board ideas; others tried to remember where they had put last year's Posters. The seventh and eighth grade ,,math department" (all four of us) met in the math lab to decide who would use which of the available texts. Mr. R. who makes ends meet by driving a truck from June to August, breezed into the lab and made a beeline for the chalkboard. „Hey!" he said. ,,Come here and let me show you what I discovered while I was hauling cheese this summer." Well, we all had things to do, but Mr. R's enthusiasm is infectious. We leaned against the kids' desks while he located some chalk. „I was thinking about square roots one night, somewhere between L.A. and Sacramentoyou have to think about something or you go to sleep on that highway. Anyway. I got an idea, see? I started doing some square root problems in my head, and when I hit the sack I couldn't get to sleep. Well, I finally got up and tried a lot of different numbers with pencil and paper. I know this method can't be new, but it's new to me. Tell me if you ever saw this before." On the chalkboard he wrote:

$$
\sqrt{25}=5 \quad \sqrt{36}=6
$$

,,First," he said, ,I noticed that the difference of the consecutive perfect squares is equal to the sum of their square roots ( $36-25=6+5$ ). I tried it with a lot of consecutive perfect squares and it worked every time. May be I didn't try big enough num-
bers; I don't know. ,,Then I thought, what about $\sqrt{30}$ ? Thirty is between 25 and 36 , so $\sqrt{30}$ is between $\sqrt{25}$ und $\sqrt{36}$." He wrote on the chalkboard:

$$
\sqrt{25}=5 \quad \sqrt{30} \approx ? \quad \sqrt{36}=6
$$

,,Therefore $\sqrt{30}$ is between 5 and 6. So $\sqrt{30}$ is 5 plus some fraction. Finding that fraction is the twist. ,,As the denominator of the fraction, I used the sum, $5+6$, of the integral square roots between which $\sqrt{30}$ lies. Then I took the difference between 30 and the next lower perfect square, $30-25$ and made that the numerator. I came up with this." He wrote:

$$
\sqrt{30} \approx 5 \frac{5}{11}
$$

,,In decimal form, to the nearest thousandth, that's 5.455. When I later checked a square root table, I found $\sqrt{30}=5.477$, to the nearest thousandth which is 0.022 greater than the approximation I got.

Okay!" Mr. R was really excited now. The chalk flew over the chalkboard. ,,Okay, take $\sqrt{68}$." He wrote:

$$
\sqrt{64}=8 \quad \sqrt{68} \approx ? \quad \sqrt{81}=9
$$

,,The square root of 68 is 8 plus a fraction. To approximate that fraction, use the denominator $8+9$ and the numerator $68-64$. Then $\sqrt{68} \approx 8 \frac{4}{17}$. In decimal form that's 8.294 to the nearest thousandth. The square root table says $\sqrt{68} \approx 8.246$ to the nearest thousandth, just 0.048 less than I got.
,,Take some bigger numbers: $\sqrt{135}$. The square root of 135 is between $\sqrt{121}$ and $\sqrt{144}$; that is between 11 and 12. So-" He wrote:

$$
\sqrt{135} \approx 11 \frac{135-121}{11+12}
$$

,"The approximation of $11 \frac{14}{23}$ is about 11.609. The table says 11.619 , a difference of 0.01 .
,,I tried $\sqrt{1050}$. That's between $\sqrt{1024}$, which is 32 , and $\sqrt{1089}$, which is 33 . By my method, $\sqrt{1050}$ is approximately $32 \frac{26}{65}$. That's 32.4 . The table says 32.404 , which is 0.004 greater than I got.
,"Well, I tried the system with a lot of numbers, and every time it worked out to within a few hundredths often less- of the square root the table gave me. How close does anybody usually need to get? Sure, I know calculators are cheap und you can find square root tables without too much trouble, but it's kind of fun to be able to do without them. When I think how hard it is to teach kids to 'divide and average', or to use any of the other methods I've seen in textbooks, I wonder why my way never got into any book I've ever seen.
,,You know, I was so excited that night I couldn't get to sleep till four a.m. I almost didn't show up on the job at six!".
Bulletin boards. Posters. Room decorations. Do these stimulate the kind of excitement that would keep a student awake? How can we generate enough interest in mathematics so that students, also, can experience such a thrill of discovery?

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