8.NS Estimating Square Roots

Alignments to Content Standards: 8.NS.A

Task

Without using the square root button on your calculator, estimate $\sqrt{800}$ as accurately as possible to 2 decimal places.

(Hint: It is worth noting that $20^2 = 400$ and $30^2 = 900$.)

IM Commentary

By definition, the square root of a number n is the number you square to get n. The purpose of this task is to have students use the meaning of a square root to find a decimal approximation of a square root of a non-square integer. Students may need guidance in thinking about how to approach the task.

Solutions

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Solution: Using the definition of a square root

We know that

$$20^2 = 400$$

and

$$30^2 = 900$$

so

$$20 < \sqrt{800} < 30$$

Choosing successive approximations carefully, we see that:

n	n^2	m^2	m
28	784	851	29
28.2	795.24	800.89	28.3
28.28	799.7584	800.3241	28.29
28.284	799.984656	800.041225	28.285

So $\sqrt{800} \approx 28.28$.

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Solution: Another approach

We know that $20^2 = 400$ and $30^2 = 900$, so

$$20 < \sqrt{800} < 30.$$

If we take the average of 20 and 30, we get $\frac{20+30}{2} = 25$. Since $25^2 = 625$, we know that

$$25 < \sqrt{800} < 30.$$

If we take the average of 25 and 30, we get $\frac{25+30}{2} = 27.5$. Since $27.5^2 = 756.25$, we know that

$$27.5 < \sqrt{800} < 30.$$

If we take the average of 27.5 and 30, we get $\frac{27.5+30}{2} = 28.75$. Since

$28.75^2 = 826.5625$, we know that

$$27.5 < \sqrt{800} < 28.75.$$

Continuing in this way, we get

$$\sqrt{800} \approx 28.28.$$