EQ: How does the square root function compare to other functions we have studied?
NC Math 2 Unit 6 Square Root and Inverse Variation Functions

Lesson 1 Watch Out For That Wave!
A Develop Understanding Task

Family Kingdom Amusement Park in Myrtle Beach is a family friendly carnival style attraction right on the beach in SC. It is a great place to take a break from laying on the beach. However, with its proximity to the ocean, there are certain hazards that need to be

https://pixabay.com/en/photos/wave/ accounted for.

One such ocean hazard is a tsunami. A tsunami is a long high sea wave caused by an earthquake, ocean floor landslide, or other underwater disturbance. These waves grow higher the closer to land they travel and can cause devastating damage. Many tsunamis are caused by seismic activity which is closely monitored by the US Geological Survey. When an earthquake is recorded in the ocean, they will send out warnings to the communities in the path of potential waves. The speed of a wave during a tsunami can be calculated with the formula $s=\sqrt{9.81 d}$ where $s$ represents speed, $d$ represents the depth of the water where the earthquake takes place, and $9.81 \mathrm{~m} / \mathrm{s}^{2}$ is the acceleration due to gravity.

1. Let's take a look at this function! Create a table and graph of this function.

| depth | speed | R.O.C. |
| :---: | :---: | :---: |
| 0 | 0 |  |
| 1 | 3.13 | +3.13 |
| 2 | 4.43 | +1.3 |
| 3 | 5.42 | +.99 |
| 4 | 6.26 | +.84 |
| 5 | 7.00 | +.74 |
| 6 | 7.67 | $\$ .67$ |
| 7 | 8.29 | +.62 |

R.O.C. is positive so the function is increasing. However, the rate of change is decreasing.

Developed by CHCCS and WCPSS


End Behavior Right End Behavior (R.E.B.)

$$
x \rightarrow \infty, y \rightarrow \infty
$$

Left End Behavior (L.E.B.) Does not Exist
2. Describe the domain of the function. Explain.


The square root of a negative is imaginary, therefore
$9.81 d \geq 0$ (The radicand has to be 20)
3. What is the range of the function? Explain.

$$
[0, \infty)
$$

The square root of a value can not be negative $\therefore$ the range $\geq 0$
4. Describe the rate of change of the function. How does the rate of change of this function compare to the rate of change of other functions that we have encountered?

The rate of change is decreasing.
Remember
Linear it was constant
Quadratic increasing linearly.
5. In the formula, 9.8 is the acceleration due to gravity and is measured in $\mathrm{m} / \mathrm{s}^{2}$. If the depth is measured in meters, what will the unit of measure be for the speed, $s$, that we find? Explain your thinking.

$$
\begin{aligned}
\text { speed } & =\sqrt{9.81 d} \\
\text { speed } & =\sqrt{\frac{m}{s^{2}} \cdot m} \\
\text { speed } & =\sqrt{\frac{m^{2}}{s^{2}}} \\
\text { speed } & =\frac{m}{s}
\end{aligned}
$$

6. We can detect earthquakes even when they happen under the ocean. There are monitoring stations all over the globe. An earthquake is detected at $22^{\circ} 27^{\prime} 06^{\prime \prime} \mathrm{N}$ and $54^{\circ} 02^{\prime} 47^{\prime \prime} \mathrm{W}$. This is off the coast of South Carolina. The ocean at that point has a depth of 5150 m , so how fast would you expect the wave to be traveling?

$$
\begin{aligned}
& S=\sqrt{9.81 d} \\
& S=\sqrt{9.81(5150)} \\
& S=224.8 \mathrm{~m} / \mathrm{s}
\end{aligned}
$$

Which representation of the function did you use to find the speed of the wave? Explain how you used this representation find your answer.
7. If a wave is detected traveling at $185 \mathrm{~m} / \mathrm{s}$ how deep was the epicenter that created it?

$$
\begin{aligned}
& S=\sqrt{9.81 d} \\
& 185=\sqrt{9.81 d} \\
& \frac{185^{2}}{\frac{2.51}{10}}=\frac{9.81 d}{9.8}
\end{aligned}
$$

$$
d=\frac{185^{2}}{9.81}
$$



$$
d \approx 3488.8 \mathrm{~m}
$$

Which representation of the function did you use to find the depth of the epicenter? Explain how you used this representation find your answer.

Reminder $\div \frac{m}{s^{2}}$
$-\frac{s^{2}}{m}$

$$
\begin{aligned}
& \begin{array}{l}
\text { Speed }=\sqrt{9.81 \text { depth }} \\
(\mathrm{m} / \mathrm{s})^{2}=\left(\sqrt{\frac{m}{s^{2}} \cdot d}\right)^{2}
\end{array} \\
& \frac{8^{2}}{w} \cdot \frac{m^{2}}{s^{2}}=\frac{s^{2} m^{2} m^{2}}{s^{2}} \cdot d \\
& m=d
\end{aligned}
$$

