# Lesson 4 Tools for Solving

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*A Practice Understanding Task*

Square root and inverse variation functions can be represented with an equation, graph, table or with words describing the relationship. In this task you will be presented with problems that involve square root and inverse variation functions. For each of the following problems...

- Write an inverse variation or square root equation or inequality that represents the context.
- Create a table that represents the situation and label where the solution to the problem is found on the table.
- Create a graph that represents the situation and label where the solution to the problem is found on the graph.
- Write a statement that includes the answer to the problem in the context of the problem using the correct units of measure.

1. The relationship between rate, distance and time can be calculated with the equation $r = \frac{d}{t}$ where $r$ is the rate (speed), $d$ represents the distance traveled, and $t$ represents the time. If the speed of a wave from a tsunami is 150 m/s and the distance from the disturbance in the ocean to the shore is 35 kilometers, how long will it take for the wave to reach the shore?

Inverse

$$150 \text{ m/s} = \frac{35000 \text{ m}}{t}$$

$$t = \frac{35000}{150}$$

$$t = 233\tfrac{1}{3} \text{ seconds}$$

$\approx 3.9$ minutes

$\approx .06$ hours

| t | r |
|---|---|
| 100 | 350 |
| $233\frac{1}{3}$ | 150 |
| 350 | 100 |

It will take the tsunami 233⅓ seconds to reach the shore.

2. The speed of a wave during a tsunami can be calculated with the formula $s = \sqrt{9.81d}$ where $s$ represents speed in meters per second, $d$ represents the depth of the water in meters where the disturbance (for example earthquake) takes place, and 9.81 m/s$^2$ is the acceleration due to gravity. If the speed of the wave is 150 m/s, what is depth of the water where the disturbance took place?

$$s = \sqrt{9.81\,d}$$
$$150 = \sqrt{9.81\,d}$$
$$\frac{(150)^2}{9.81} = \frac{\cancel{9.81}d}{\cancel{9.81}}$$
$$d = \boxed{2293.58\text{m}}$$
or
$$\approx \boxed{2.3\text{ km}}$$

3. The distance a person can see to the horizon can be approximated by using the function $d(h) = \sqrt{1.5h}$, where $d$ represents the distance in miles and $h$ represents the height the person is above sea level in feet. Jacob is standing at the top of Mount Mitchell, which is the highest peak in the US east of the Mississippi. The top of Mt. Mitchell is 6684 ft above sea level and Jacob's eye level is 6 feet from the ground. How far can Jacob see?

$$d(6690) = \sqrt{1.5(6690)}$$
$$= \boxed{100.2\text{ miles}}$$

4. Tamara is looking to purchase a new outdoor storage shed. She sees an advertisement for a custom built shed that fits into her budget. In this advertisement, the builder offers a 90 square foot shed with any dimensions. Tamara would like the shed to fit into a corner of her backyard, but the width will be restricted by a tree. She remembers the formula for the area of a rectangle is $l \cdot w = a$ and solves for the width to get $w = a/l$. She then measures the restricted width to be 12 feet. What will be the length of her shed?

| ↑ l | w ↓ | A |
|---|---|---|
| 2 | 45 | 90 |
| 3 | 30 | 90 |
| 9 | 10 | 90 |
| 10 | 9 | 90 |
| 12 | w | 90 |

$w = \frac{90}{l}$

$w = \frac{90}{12}$

$w = 7.5$

$\boxed{7.5 \text{ ft.}}$

5. In kickboxing, it is found that the force, *f*, needed to break a board, varies inversely with the length, *l*, of the board. If it takes 5 lbs. of pressure to break a board 2 feet long, how many pounds of pressure will break a board that is 6 feet long?

$f = \frac{k}{l}$

| length | force | |
|---|---|---|
| 2 | 5 | = 10 |
| 6 | $1\frac{2}{3}$ | = 10 |

$f = \frac{10}{6}$

$f = \boxed{1\frac{2}{3} \text{ lbs.}}$

6. To be considered a 'fuel efficient' vehicle, a car must get more than 30 miles per gallon. Consider a test run of 200 miles. How many gallons of fuel can a car use on this test run and be considered 'fuel-efficient'?

$$\frac{\text{miles}}{\text{gallon}} > 30$$

$$\frac{200}{g} > 30$$

$$\frac{200}{30} > \frac{30g}{30}$$

$$6\tfrac{2}{3} > g$$

or

$$g < 6\tfrac{2}{3}$$

A car can use less than $6\frac{2}{3}$ gallons.

7. The centripetal force $F$ exerted on a passenger by a spinning amusement park ride is related to the number of seconds $t$ the ride takes to complete one revolution by the equation $t = \sqrt{\frac{155\pi^2}{F}}$. What is the centripetal force exerted on a passenger when it takes 12 seconds for the ride to complete one revolution?

$$12 = \sqrt{\frac{155\pi^2}{F}}$$

$$12^2 = \frac{155\pi^2}{F}$$

$$F = \frac{155\pi^2}{12^2}$$

$$F \approx \boxed{10.6 \text{ units of force}}$$