**Activity 4.7.1 Irrational Square Roots in Standard Form**

Recall if *x*2 = 25 then $x=\pm \sqrt{25} or \pm 5$ since $(-5)^{2}=25$ and $(5)^{2}=25$. In geometry, we often only use the positive square root or principal square root. For this reason when talk about “square root” in this activity we are referring to the principal square root.

**Part I:**

1. Evaluate each expression

a. $\sqrt{25}-\sqrt{9}$ b.$ \sqrt{25-9}$

c. $\sqrt{16}+\sqrt{9}$ d. $\sqrt{16+9}$

e. $\frac{\sqrt{36}}{\sqrt{9}}$ f. $\sqrt{\frac{36}{9}}$

g. $\sqrt{4}⋅\sqrt{9}$ h. $\sqrt{4⋅9}$

2. Suppose *a* and *b* are any positive numbers. Which of these statements are always true? Sometimes true? Never true? (Look at the examples in question 1 and test with other values for *a* and *b*.)

a. $\sqrt{a}+\sqrt{b}=\sqrt{a+b}$. b. $\sqrt{a}-\sqrt{b}=\sqrt{a-b}$ whenever *a*≥ *b.*

c. $\frac{\sqrt{a}}{\sqrt{b}}=\sqrt{\frac{a}{b}}$. d. Does $\sqrt{a}⋅\sqrt{b}=\sqrt{a⋅b}.$

**Part II:**

Many times in mathematics we simplify square roots to make them simpler to approximate or to put it in a form that is helpful to finding patterns. For example, $\sqrt{40}$ can be rewritten as $\sqrt{4}⋅\sqrt{10}$ or $\sqrt{5}⋅\sqrt{8}$.

3. Find another equivalent expression of $\sqrt{40} $as the product of two square roots. \_\_\_\_\_\_

In the case of the two factors where one is a perfect square, $\sqrt{4}⋅\sqrt{10}, $you can now simplify this expression and write it as $2⋅\sqrt{10}$.

4. Verify that $\sqrt{40}$ = $2⋅\sqrt{10}$ by finding a decimal approximation for each on your calculator.

5. Simplify each of the following square roots:

a. $\sqrt{12}$ b. $\sqrt{56}$ c. $\sqrt{75}$

d. $\sqrt{27}$ e. $\sqrt{15}⋅\sqrt{6}$

**Part III:** Applying Simplified Square Roots

6. Solve for the missing side length of each right triangle and write your answer in simplified square root form.

a. b. c.





**Part IV:** Rationalizing a denominator.

Often we prefer not to have an expression with a square root in the denominator. We can often eliminate the square root by multiplying both numerator and denominator by the same number so that the denominator is “rationalized”

For example, $\frac{4}{\sqrt{5}}$ = $\frac{4}{\sqrt{5}}∙\frac{\sqrt{5}}{\sqrt{5}}$ = $\frac{4\sqrt{5}}{5}$

7. Verify that$ \frac{4}{\sqrt{5}}$ = $\frac{4\sqrt{5}}{5}$ by finding a decimal approximation for each on your calculator.

8. Simplify each of the following fractions by rationalizing the denominator:

 a. $\frac{1}{\sqrt{2}}$ b. $\frac{3}{\sqrt{10}}$ c. $\frac{1}{\sqrt{3}}$ d. $\frac{\sqrt{5}}{\sqrt{2}}$ e. $\frac{\sqrt{6}}{\sqrt{3}}$