Name: _____ Date: _____

Square Roots and Irrational Numbers
Algebra 1

Square roots are important numbers in mathematics because they are involved in a variety of problems. Recall that for any real numbers a and b if $a^2 = b$ then we say that a is a square root of b.

***Exercise* #1:** Find all square roots of the following numbers.

(a) 25 (b) 81 (c) 4

From Exercise #1, we see that positive, real numbers will always have two square roots, one positive and one negative. Oftentimes, we want to consider only the positive square root of a number; this is called the **principal square root**. We show the principal square root of a number b as $+\sqrt{b}$ or more commonly just $\sqrt{b}$.

Many whole numbers are not perfect squares and thus have irrational numbers as their square roots. In practical calculations, these square roots always need to be evaluated on a calculator and rounded.

***Exercise* #2:** Find the principal square root of each of the following real numbers and specify each answer accurate to the nearest *tenth*.

(a) 40 (b) 12 (c) 22

***Exercise* #3:** It is good to be able to estimate values of square roots that produce irrational numbers. Consider the following:

(a) What is the value of $\sqrt{25}$? Justify.

(b) Write the whole number 6 as an expression involving a square root.

(c) Between what two consecutive integers must $\sqrt{30}$ lie? Explain without the use of a calculator.

***Exercise* #4:** Between what two consecutive integers must $\sqrt{70}$ lie? Explain your answer without the use of a calculator.

The multiplication of square roots is an important skill to develop for a variety of applications.

THE MULTIPLICATION PROPERTY OF SQUARE ROOTS

$\sqrt{a}\cdot\sqrt{b}=\sqrt{a\cdot b}$ for all real numbers, *a* and *b*, such that $a\geq 0$ and $b\geq 0$

***Exercise* #5:** Verify the Multiplication Property of Square Roots for $\sqrt{4}$ and $\sqrt{9}$.

***Exercise* #6:** Evaluate each of the following square root products.

(a) $\sqrt{2}\cdot\sqrt{8}$ (b) $\sqrt{3}\cdot\sqrt{12}$ (c) $\sqrt{5}\cdot\sqrt{20}$

Simplifying Irrational Square Roots – Many times we want to write an irrational number in its "simplest" form by taking the square root of all perfect squares that are factors of the number. We do this by reversing the Multiplication Property.

***Exercise* #7:** Express each of the following square roots in simplest radical form.

(a) $\sqrt{8}$ (b) $\sqrt{18}$ (c) $\sqrt{28}$

(d) $\sqrt{45}$ (e) $4\sqrt{27}$ (f) $-3\sqrt{20}$

(g) $5\sqrt{48}$ (h) $-\frac{2}{5}\sqrt{75}$ (i) $\frac{\sqrt{24}}{2}$

Name: _____ Date: _____

Square Roots and Irrational Numbers
Algebra 1 Homework

Skills

1. Express each of the following irrational numbers in simplest radical form.

(a) $\sqrt{50}$ (b) $\sqrt{72}$ (c) $\sqrt{54}$

(d) $5\sqrt{8}$ (e) $7\sqrt{45}$ (f) $-3\sqrt{80}$

(g) $\frac{1}{2}\sqrt{32}$ (h) $-\frac{2}{3}\sqrt{27}$ (i) $\frac{5}{2}\sqrt{200}$

(j) $-5\sqrt{40}$ (k) $\frac{4}{3}\sqrt{162}$ (l) $-3\sqrt{98}$

2. Round each of the following irrational numbers to the nearest *hundredth*.

(a) $\sqrt{85}$ (b) $\sqrt{45}$ (c) $\sqrt{112}$ (d) $\sqrt{60}$

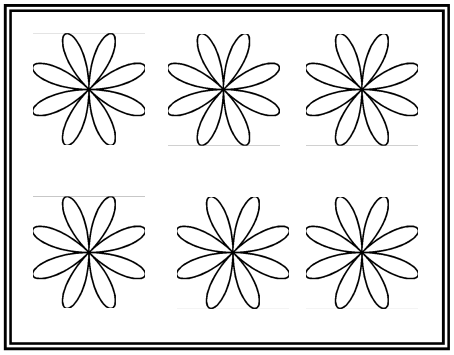
3. Evaluate each of the following products. Place each answer in simplest radical form. The first is done as an example for you to follow.

(a) $\sqrt{2}\cdot\sqrt{6}$ (b) $\sqrt{5}\cdot\sqrt{10}$ (c) $\sqrt{6}\cdot\sqrt{8}$ (d) $\sqrt{15}\cdot\sqrt{3}$

$$\sqrt{2}\cdot\sqrt{6} = \sqrt{12}$$
$$= \sqrt{4}\cdot\sqrt{3}$$
$$= 2\sqrt{3}$$

Applications

4. A rectangular flower garden is shown at the right. It has a length given by $\sqrt{15}$ yards and a width given by $\sqrt{10}$ yards. Answer the following questions based on this information.



(a) Find the area of the garden in simplest radical form.

(b) Find the area of the garden to the nearest *tenth* of a square yard.

(c) If it costs \$2.50 per square yard to cover the garden with fertilizer, then how much does it cost to apply fertilizer to the entire area that you found in part (b)?

Reasoning

5. Between what two consecutive integers must $\sqrt{19}$ lie? Explain your answer without the use of a calculator.

6. Between what two consecutive integers must $\sqrt{45}$ lie? Explain your answer without the use of a calculator.

7. Michael is trying to determine a rational approximation for $\sqrt{55}$. Which of the following rational numbers, $\frac{15}{2}$ or $\frac{37}{5}$, is a better approximation of $\sqrt{55}$? Justify your choice.