Name: _____ Period: _____ Date: _____

11th Grade Mathematics PSSA Preparation Program ☐ Mastered On: _____

Square Roots

Anchors Addressed
M11.A.1.1.1 – Find the square root of an Integer to the nearest tenth using either a calculator or estimation.
M11.A.1.1.3 – Simplify square roots.

Square roots are the reverse operation of squaring a value. Numbers whose square roots are Integers are called ***perfect squares***. For example: $\sqrt{4} = 2$. The square root sign ($\sqrt{\ }$) is called a radical. Use can use a calculator to determine the approximate value of a square root, estimate where the square root is on a number line, or simplify square roots, as shown below:

Calculating the Value of a Square Root

To estimate the value of a square root, use a calculator. Some calculators require you to enter the value first and then press the square root key ([2nd][$\sqrt{\ }$]) and others require you to press the square root key and then enter the value. You will need to determine which method your calculator uses.

Example 1: Find the square root of $\sqrt{18}$. Round the answer to the nearest tenth.

Solution: Press [2nd][$\sqrt{\ }$] and type 18, then press [ENTER]. 4.242640687

Rounding the answer to the nearest tenth, yields a final solution of 4.2.

Test Taking Tip: Take the test on a calculator that you are familiar with. Understand how the features of the calculator work, including how to enter expressions into the calculator. Make sure your calculator has fresh batteries and is working properly prior to the day of the test.

Estimating a Square Root on a Number Line

It is possible to estimate the value of a square root and approximate its value on a number line. These types of problems are typically found on the first page of the PSSA exams and calculators are not permitted. To estimate the value, we will determine which perfect square is larger and which is smaller than the value in the radical.

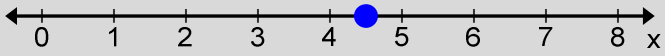
Example 2: Approximate $\sqrt{21}$ and place the value on the number line.

Solution: Since 21 is between 16 and 25, both perfect squares, the $\sqrt{21}$ is between 4 and 5, which are the square roots of 16 and 25. To determine the tenths place, divide the difference of the number (21) and the lower perfect square (16) by the difference between the two

perfect squares.

$\frac{21-16}{25-16} = \frac{5}{9}$ as a decimal, the value is: $0.\overline{5}$

Plotting this approximate value on the number line would produce a value near 4.6 (rounding to the nearest tenth) since 21 is near the middle, between 16 and 25.



Simplifying Square Roots

Square roots that are not perfect squares can sometimes be simplified. To simplify a square root, factor the number inside the radical into prime factors. Each pair of the same factors can be moved to the outside of the radical. Simplify the factors on the outside of the radical by multiplying, then do the same to the inside.

Example 3: Simplify $\sqrt{160}$.

Solution: Factor 160 inside the radical: $\sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 5}$. Since there are two pairs of two, one 2 from each pair can be removed from the radical (Think of it as 2 times 2 is 4 and the square root of 4 is 2, so a 2 is placed outside). Repeat this step for all pairs, as shown: $2 \cdot 2\sqrt{2 \cdot 5}$. Finally, multiply the numbers outside the radical and then those inside the radical, as shown: $4\sqrt{10}$.

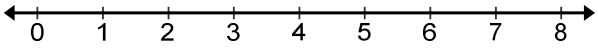
Exercises

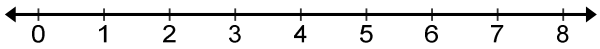
A. Estimate the values of the following square roots to the nearest tenth without using a calculator.

1. $\sqrt{11}$
2. $\sqrt{38}$
3. $\sqrt{92}$
4. $\sqrt{18}$
5. $\sqrt{14}$
6. $\sqrt{56}$

B. Estimate the values of the following square roots to the nearest tenth without a calculator, then graph the value on the number line.

7. $\sqrt{44}$
8. $\sqrt{28}$





C. Use a calculator to verify your results for questions 1-8.

D. Simplify the following square roots. Use a calculator to verify your answers and make corrections as needed.

9. $\sqrt{24}$

10. $\sqrt{10}$

11. $\sqrt{32}$

12. $\sqrt{18}$

13. $\sqrt{54}$

14. $\sqrt{98}$

15. $\sqrt{20}$

16. $\sqrt{17}$

17. $\sqrt{112}$

18. $\sqrt{132}$

19. $\sqrt{63}$

20. $\sqrt{125}$

21. $\sqrt{45}$

22. $\sqrt{12}$

23. $\sqrt{28}$

E. Use a calculator to estimate the value of each square root to the tenths place.

24. $\sqrt{11}$

25. $\sqrt{10}$

26. $\sqrt{16}$

27. $\sqrt{42}$

28. $\sqrt{14}$

29. $\sqrt{20}$

30. $\sqrt{59}$

31. $\sqrt{4}$

32. $\sqrt{8}$

33. $\sqrt{9}$

34. $\sqrt{7}$

35. $\sqrt{45}$

36. $\sqrt{15}$

37. $\sqrt{67}$

38. $\sqrt{17}$

F. Answer the following questions.

39. In your own words, explain how to simplify a square root.

40. Without a calculator, find the approximate value of $\sqrt{32}$. Explain each step.