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| **Type in POS Math descriptor here**  | **=** | **Apply properties of rational and irrational numbers to solve real-world mathematical problems** |
| **Program Task:** Enter POS task here. | **PA Core Standard:** CC.2.1.HS.F.2 **Description:** Apply properties of rational and irrational numbers to solve real-world mathematical problems. |
| **Program Associated Vocabulary:**ENTER PROGRAM VOCABULARY HERE  | **Math Associated Vocabulary:**SQUARE ROOT, PRIME FACTORIZATIONS, PERFECT SQUARE, FACTOR, RADICAL, SIMPLEST RADICAL FORM |
| **Program Formulas and Procedures:**Display program example of math concept by entering text, graphic, and formulas in this column. | **Formulas and Procedures:**Usually, one would find the square root of a number using a calculator. Sometimes it is beneficial to simplify a square root which is the same as the **simplest radical form** or simplifying the radical. Two situations could make it is necessary to simplify square roots by factoring. Usually square roots are factored when precision is required and rounding must occur at the very end of the process. Square roots are sometimes factored to make estimation easier when a calculator is not handy.**Example**: Simplify$\sqrt{48}$.**Method 1 - Simplifying Square Roots Using Prime Factorization:**1. Factor the number under the radical until all factors are prime numbers.

48 = 6(8) 🡨factor the 6 and 8 =2(3)(2)(4) 🡨factor the 4 =2(3)(2)(2)(2)🡨all numbers are prime1. Collect pairs of matching numbers.

=2(3)(2)(2)(2) 2,2,2,2,3 (two pairs of 2)1. Place one number from each pair outside of (or in front of the radical) and multiply.

2(2)$\sqrt{}$ 4$\sqrt{}$1. Place numbers without pairs inside the radical and multiply them to get your final answer

$$4\sqrt{3}$$**Method 2 - Simplifying square roots by factoring out perfect squares:**You do not have to factor the radical into prime factors if you can factor out perfect squares (4, 9, 16, 25, etc…).For example, you can factor 48 into 16 and 3 16 is a perfect square and $\sqrt{16}=4, so\sqrt{48}=\sqrt{16}\sqrt{3}=4\sqrt{3}$. |

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| **Instructor's Script – Comparing and Contrasting**The Math or program area instructor should fill in this area by comparing academic math problems to lab area problems. The teacher should describe ways that CTE program math is similar to or different from the academic math that occurs in the PA Core Math standard or on Keystone related exams. |

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| **Common Mistakes Made By Students****Errors in factoring****Mistakenly identifying a pair of prime factors and placing both numbers outside of the radical**Example: $\sqrt{12}\ne 4\sqrt{3}$, Factoring 12 yields 2 x 2 x 3. Students will often identify the pair of 2s, but then place the product of the pair (4) outside of the radical sign.**Not simplifying completely**Example: $\sqrt{108}=\sqrt{9}\sqrt{12}=3\sqrt{12}$, in this example, $\sqrt{12}$ can be simplified further. |

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| **CTE Instructor's Extended Discussion**The CTE instructor may add comments here describing the importance of this math skill in relationship to the program task, or note common problems which students have when making the computations. |

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| **Problems Career and Technical Math Concepts Solutions** |
| 1. Program relevant problem
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| **Problems Related, Generic Math Concepts Solutions** |
| 1. The distance formula has been applied to determine the exact distance between points A and B. Computations have been made and the answer is$\sqrt{96}$. Simplify this radical.
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| 1. The quadratic formula has been applied to find the roots of a polynomial function. The answer before simplifying contains$\sqrt{52}$. Simplify this radical.
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| 1. The Pythagorean Theorem is applied to determine the length of cable needed to install a cable from the top of a building to the ground, 5 feet from the base. The engineers would like an exact answer. Simplify:$\sqrt{575}$.
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| **Problems PA Core Math Look Solutions** |
| 7. Simplify. a) $2\sqrt{3}$  b) $ 4\sqrt{6}$ c) $ 8\sqrt{3}$  d) $ 2\sqrt{6}$ |  |
| 8. Simplify $\sqrt{242}.$ a) 2$\sqrt{11}$ b) 11$\sqrt{2}$ c) 121$\sqrt{2}$ d) 4$\sqrt{11}$ |  |
| 9. Simplify$ \sqrt{128}$. a) 2$\sqrt{64}$ b) 2$\sqrt{8}$ c) 8$\sqrt{2}$ d) 4$\sqrt{32}$ |  |

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 | Allow work space here |
| **Problems Related, Generic Math Concepts Solutions** |
| 1. The distance formula has been applied to determine the exact distance between points A and B. Computations have been made and the answer is$\sqrt{96}$. Simplify this radical.
 | $$\sqrt{96}= \sqrt{16 ×6 }= \sqrt{16} × \sqrt{6}=4\sqrt{6}$$ |
| 1. The quadratic formula has been applied to find the roots of a polynomial function. The answer before simplifying contains$\sqrt{52}$. Simplify this radical
 | $$\sqrt{52}= \sqrt{4 ×13} = \sqrt{4} × \sqrt{13} =2\sqrt{13}$$ |
| 1. The Pythagorean Theorem is applied to determine the length of cable needed to install a cable from the top of a building to the ground, 5 feet from the base. The engineers would like an exact answer. Simplify:$\sqrt{575}$.
 | $$\sqrt{575}= \sqrt{25 ×23 }= \sqrt{25} × \sqrt{23}=5\sqrt{23}$$ |
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| 7. Simplify.$a) 2\sqrt{3}$ b) $4\sqrt{6}$$c) 8\sqrt{3}$  d) $2\sqrt{6}$ | d) $\sqrt{24}= \sqrt{4 ×6 }= \sqrt{4} × \sqrt{6 }=2\sqrt{6}$ |
| 8. Simplify $\sqrt{242}.$a) 2$\sqrt{11}$b) 11$\sqrt{2}$c) 121$\sqrt{2}$d) 4$\sqrt{11}$ | b) $\sqrt{242}= \sqrt{121 ×2 }= \sqrt{121} × \sqrt{2 }=11\sqrt{2}$ |
| 9. Simplify$\sqrt{128}$. a) 2$\sqrt{64}$ b) 2$\sqrt{8}$ c) 8$\sqrt{2}$ d) 4$\sqrt{32}$ | c) $\sqrt{128}= \sqrt{64 ×2 }= \sqrt{64} × \sqrt{2 }=8\sqrt{2}$  |