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| **TYPE POS MATH DESCRIPTOR HERE** | **=** | **USE REASONING TO SOLVE EQUATIONS AND JUSTIFY THE SOLUTION METHOD.** |
| **Program POS Task:** Enter POS task here | **PA Core Standard:** **CC.2.2.HS.D.9****Description:**  Use reasoning to solve equations and justify the solution method |
| **Program Associated Vocabulary**ENTER PROGRAM VOCABULARY HERE  | **Math Associated Vocabulary**INVERSE, RECIPROCAL, PROPORTION, CROSS MULTIPLICATION, RATIO, CONSTANT |
| **CTE Program Formulas and Procedures**Display program example of math concept by entering text, graphic and formulas in this column. | **Formulas and Procedures****Direct Proportions****Two quantities, A and B, are directly proportional if by whatever factor A changes, B changes by the same factor.**Example 1: Take the formula distance = rate x time. If the rate remains constant, 30 miles per hour, then the time and distance are directly proportional. \*Note that when the time doubles, so does the distance.d = 30twhen t = 2, d = 60when t = 4, d = 120 Example 2: If speed is directly proportional to distance and a car can travel 100 miles at 50 miles per hour. How far can that car travel during the same time if it travels 70 mph?Step 1: Set up proportion.Step 2: Cross multiply and divide to solve.50x=70(100) 🡪 50x = 7000 🡪 x = 140 miles**Indirect Proportions****Two quantities, A and B, are inversely proportional if by whatever factor A changes, B changes by the multiplicative inverse, or reciprocal of that factor.****Example 1:** Take the formula distance = rate x time. If the distance is constant, 100 miles, then as the rate increases the time decreases. 100 = rt\*Note that when the rate doubles, the time is halved.When r = 100, t = 1When r = 50, t = 2 **Example 2:** If the time needed to complete a job is inversely proportional to the number of people working, how long would it take 4 people to paint a room if 1 person needs 8 hours? Step 1: Set up the proportion. Step 2: Invert (flipA) one ratio Step 3: Cross-multiply and divide to solve4x=8, x = 2 4 people can paint the room in 2 hours. |

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| **Instructor's Script – Comparing and Contrasting**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 or different from the academic math that occur in the common core or on Keystone related exams. |

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| **Common Mistakes Made By Students**When students compare Direct and Inverse Proportional relationships, they may become confused and have difficulty differentiating one from the other. One way to keep them straight is to: 1. Set up one pair of values on the same line, e.g., 12" = 100 lbs.
2. Beneath that line, place the other pair of values, 24” x lbs.
3. Cross multiply (24 times 100) and (12 times x), but first determine if you have to invert one ratio.
4. Students need to be aware that direct proportions mean that as one variable increases so does the other variable. An indirect proportion means that as one variable increases when the other one decreases. Students struggle with this concept.
5. If you have to invert one ratio, then it is an inverse proportion.
6. If need be, set up the problem and do it both ways to see which answer makes sense! We know in *problem #9*, for example, that it won't take 5 rabbits more time than it took 1 rabbit to eat 20 carrots, so it must be an inverse proportion.
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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 Concepts Solutions** |
| 1. Program relevant problem
 | Allow work space here |
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 | Allow work space here |
| 1. Program relevant problem
 | Allow work space here |
| **Problems Related, Generic Math Concepts Solutions** |
| 1. If it takes 12 eggs to make 1 dozen, how many eggs will be needed to make 9 dozen?
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| 1. The pressure of a gas and its corresponding volume are inversely proportional. If the pressure of 0.24 m3 is 0.5 atm, what would the pressure be of 0.060 m3 of the same gas at the same temperature?
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| 1. If it takes 26 lbs. of metal to make 10 castings, how many pounds of metal will be needed to make 14 castings?
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| **Problems PA Core Math Look Solutions** |
| 1. Given that y and x are **directly** proportional and y = 2 when x = 5, find the value of y when x = 15.
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| 1. Given that y and x are **inversely** proportional and y = 2 when x = 5, find the value of y when x = 15.
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| 1. If one rabbit can chew 20 carrots in 15 hours, how long will it take 5 rabbits to chew the same 20 carrots?
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| **Problems Career and Technical Concepts Solutions** |
| 1. Program relevant problem
 | Provide answer here |
| 1. Program relevant problem
 | Provide answer here |
| 1. Program relevant problem
 | Provide answer here |
| **Problems Related, Generic Math Concepts Solutions** |
| 1. If it takes 12 eggs to make 1 dozen, how many eggs will be needed to make 9 dozen?
 | **(Direct)** |
| 1. The pressure of a gas and its corresponding volume are inversely proportional. If the pressure of 0.24 m3 is 0.5 atm, what would the pressure be of 0.060 m3 of the same gas at the same temperature?
 | **(Inverse)**(Invert one ratio since it is an inverse proportion)  |
| 1. If it takes 26 lbs. of metal to make 10 castings, how many pounds of metal will be needed to make 14 castings?
 | **(Direct)** |
| **Problems PA Core Math Look Solutions** |
| 1. Given that y and x are **directly** proportional and y = 2 when x = 5, find the value of y when x = 15.
 | **(Direct)** |
| 1. Given that y and x are **inversely** proportional and y = 2 when x = 5, find the value of y when x = 15.
 | **(Inverse)** |
| 1. If one rabbit can chew 20 carrots in 15 hours, how long will it take 5 rabbits to chew the same 20 carrots?
 | **(Inverse)** |