Electrical (46.0399) T-Chart

Read, convert, use fractions/decimals =	Apply properties of rational and irrational numbers to solve real-world or mathematical problems
Program Task: Solve trade related problems pertaining to measurements.	**PA Core Standard:** CC.2.1.HS.F.2 **Description:** Apply properties of rational and irrational numbers to solve real-world or mathematical problems.
Program Associated Vocabulary: STANDARD, DECIMAL, FRACTION	**Math Associated Vocabulary:** REAL NUMBER, RATIONAL NUMBER, IRRATIONAL NUMBER, DECIMAL, FRACTION, SQUARE ROOT

Program Formulas and Procedures:

Electricians utilize a measuring instrument on a daily basis. Being able to read a ruler and/or convert fractions to decimals is an absolute must in this trade. The following decimal to fraction equivalents are those most commonly used by tradesmen.

To convert fractional inches to decimals just divide the fraction. For example, 1/16" = 1÷16 = 0.0625". Common fractions and their equivalents are show below.

1/16"	=	.0625
1/8"	=	.125
1/4"	=	.25
5/16"	=	.3125
3/8"	=	.375
7/16"	=	.4375
1/2"	=	.5
9/16"	=	.5625
5/8"	=	.625
3/4"	=	.75
7/8"	=	.875
15/16"	=	.9375
1"	=	1

Formulas and Procedures:

It is relatively simple to compare numbers when they are in the same form. For example 0.15 is smaller than 0.25. The numbers are both in decimal form, so they are easily comparable. It becomes more difficult to compare numbers that are either in different forms, such as a fraction to a decimal, or in fractional form with different denominators, such as 3/4 and 7/8.

The easiest way to compare numbers that are in different forms is to convert each number to its decimal form.

Example: Which of the following numbers is largest?

$$5/16 \qquad 3/8 \qquad 0.35$$

1. Convert each number to its decimal equivalent:

$$0.3125 \qquad 0.375 \qquad 0.35$$

2. Round to nearest tenth, hundredth, or thousandths, whichever one will yield different digits after the decimal.

   For instance, we cannot round to the nearest tenth, because it would give us the same value of .3 for all of the numbers.

   Rounding to the nearest hundredth would make the numbers:

$$0.31 \qquad 0.38 \qquad 0.35$$

3. Since all numbers have the same amount of digits, we can figure out which decimal is largest.

   Since 38 is larger than 31 and 35, 0.38 (3/8) is the largest number.

Instructor's Script – Comparing and Contrasting
Career and technical instructors often teach students how to convert between fractional and decimal measurements. The eligible content described in this T-Chart takes this skill a step further by assessing a student's ability to compare and order numbers in different forms. For instance, which measurement is largest: $^5/_8$, $^3/_{16}$, or .4375? The eligible content also includes irrational numbers, like the $\sqrt{5}$. The approximate value of the square root of 5 is 2.236. It's an approximate value because irrational numbers are non-repeating, non-terminating decimals that must be rounded. Which measurement is the square root of five inches closest to $2\,^1/_8$, 2 ¼, or $2\,^3/_8$? There are many ways for teachers to connect this eligible content math concept to their trade areas.

Common Mistakes Made By Students
Comparing decimals: Decimals are easier to compare if the number of digits after the decimal point is the same. For instance, students often think that 0.6 is less than 0.34 because 6 is less than 34. A zero must be added to the 6 to make the number .60 so that the student can compare 0.60 and 0.34

Comparing fractions: Fractions can be compared when they have a **common denominator**. For instance, 5/16 inches and 3/8 inches are two measurements on a ruler. In order to compare the two fractions, they must have a common denominator, 16. 3/8 is larger than 5/16.

$$\frac{3}{8} = \frac{}{16} \qquad \frac{3 \times 2}{8 \times 2} = \frac{6}{16}$$

One can quickly make the conversion by multiplying the top and bottom number by 2, since 8 x 2 = 16. One could also cross multiply, but it would take longer.

The student can then easily see that $\dfrac{5}{16} < \dfrac{6}{16}$ and therefore $\dfrac{5}{16} < \dfrac{3}{8}$

CTE Instructor's Extended Discussion
The electrician and/or the electrical apprentice must be fluent in reading and measuring, and using different types of measurement instruments. Proficiency in reading and understanding fractions and their decimal equivalents will enable students to perform their duties as a tradesperson more effectively. Adding and subtracting fractions and decimals accurately will be a required on future jobs.

Sometimes it is necessary to convert a decimal back into a measureable fraction. You would multiply the decimal by 16 because that is the smallest marking on a standard rule. Doing this will get you the numerator of the fraction and the denominator would be 16. Below are two examples of this procedure.

0.0625 = ?	0.375 = ?
0.0625 x 16 = 1	0.375 x 16 = 6
So 0.0625 = 1/16	So 0.375 = 6/16 or 3/8

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	Problems Career and Technical Math Concepts Solutions	
1.	Convert the following fractions to their decimal equivalents, and place those quantities in order from smallest to largest. (5/8, 7/8, 3/8, 1/8)	
2.	An electrical box requires a knockout to accommodate a piece of conduit that has a trade size of two inches. Start with the smallest size knockout punch, and proceed in size to the largest size knockout needed to perform this task. (2", 11/4", 11/2", ½", 1", ¾")	
3.	Match the decimals to their fractional equivalents. a) .125 1) 1/4 b) .625 2) 9/16 c) .875 3) 7/8 d) .5625 4) 1/8	

	Problems Related, Generic Math Concepts Solutions	
4.	Which of the following measurements is longest? 2 ½ inches, $2\,^3/_8$ inches, $2\,^7/_{16}$ inches	
5.	Order the following measurements from least to greatest: $\sqrt{7}$ feet, 2 ½ feet, 2.6 feet	
6.	Which of the following measurements is largest? 2π cm., $\sqrt{41}$ cm., 6.25 cm.	

	Problems PA Core Math Look Solutions	
7.	Order the following numbers from least to greatest: 2.4, $\sqrt{5}$, $2\,^7/_8$	
8.	Order the following numbers from largest to smallest: 0.02, 0.223, 0.24, 0.243	
9.	Order the following numbers from least to greatest: $\sqrt{10}$, π, $3\,^1/_5$, 3.25	

Problems	Career and Technical Math Concepts	Solutions
1. Convert the following fractions to their decimal equivalents, and place those quantities in order from smallest to largest. (5/8, 7/8, 3/8, 1/8)	5/8 = .625 7/8 = .875 3/8 = .375 1/8 = .125 Since the tenths number is different in all the numbers, we can easily put in order from smallest to largest. .125 (1/8), .375 (3/8), .625 (5/8), .875 (7/8)	
2. An electrical box requires a knockout to accommodate a piece of conduit that has a trade size of two inches. Start with the smallest size knockout punch, and proceed in size to the largest size knockout needed to perform this task. (2", $1^1/_4$", $1^1/_2$", ½", 1", ¾")	This solution requires a simple ruler reading process. To make the hole progressively larger the knockout punch sequence would be: ½ ", ¾ ", 1", $1^1/_4$", $1^1/_2$", 2"	

3. Match the decimals to their fractional equivalents.
   a) .125   1) 1/8
   b) .625   2) 9/16
   c) .875   3) 7/8
   d) .5625   4) 5/8
	a) .125 1/8
	   b) .625 5/8
	   c) .875 7/8
	   d) .5625 9/16	

Problems	Related, Generic Math Concepts	Solutions
4. Which of the following measurements is longest? 2 ½ inches, $2^3/_8$ inches, $2^7/_{16}$ inches	List numbers: 2 ½ inches, $2^3/_8$ inches, $2^7/_{16}$ inches Rewrite as decimals: 2.5 inches 2.375 inches, 2.4375 inches Round to the hundredth: 2.50 2.38 2.44 2 ½ inches is longest	
5. Order the following measurements from least to greatest: $\sqrt{7}$ feet, 2 ½ feet, 2.6 feet	List numbers: $\sqrt{7}$ ft. 2 ½ ft. 2.6 ft. Rewrite as a decimal: 2.646 2.5 2.6 Round to the nearest hundredth: 2.65 2.50 2.60 Least to greatest: 2 ½ ft., 2.6 ft., $\sqrt{7}$ ft.	
6. Which of the following measurements is largest? 2π cm., $\sqrt{41}$ cm., 6.25 cm.	2π cm. $\sqrt{41}$ cm. 6.25 cm. 6.28 cm. 6.40 cm. 6.25 cm. $\sqrt{41}$ cm is largest	

Problems	PA Core Math Look	Solutions
7. Order the following numbers from least to greatest: 2.4, $\sqrt{5}$, $2^7/_8$	List numbers: 2.4 $\sqrt{5}$ $2^7/_8$ Rewrite as a decimal: 2.4 2.2360… 2.875 Round to nearest tenth: 2.4 2.2 2.9 Least to greatest: $\sqrt{5}$, 2.4, $2^7/_8$	
8. Order the following numbers from largest to smallest: 0.02, 0.223, 0.24, 0.243	Convert to thousandths: 0.020, 0.223, 0.240, 0.243 Order the converted numbers from largest to smallest: 0.243, 0.240, 0.223, 0.020 Place final answer with numbers in original form: 0.243, 0.24, 0.223, 0.02	
9. Order the following numbers from least to greatest: $\sqrt{10}$, π, $3^1/_5$, 3.25	List numbers: $\sqrt{10}$ π $3^1/_5$ 3.25 Rewrite as a decimal 3.16228… 3.14286… 3.2 3.25 Round to the hundredth: 3.16 3.14 3.20 3.25 Least to greatest: π, $\sqrt{10}$, $3^1/_5$, 3.25	