Electrical (46.0399) T-Chart

Utilize graphs to organize data	=	Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs, data displays

Program Task: Use graphs to locate Ohm's Law properties (voltage, amperes, and resistance). Create graphs and tables to plot Ohm's Law variables.

Program Associated Vocabulary:
TABLE, GRAPH, COORDINATE, X-AXIS, Y-AXIS, FUNCTION, MEASURABLE VARIABLES
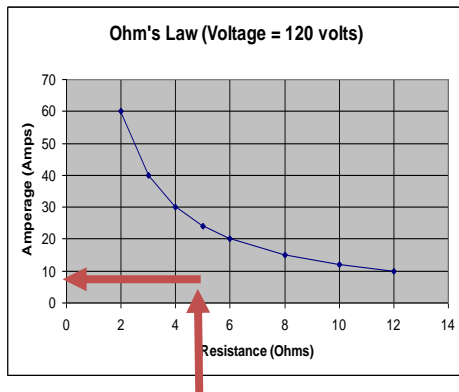
Program Formulas and Procedures:
A graph relating to electrical properties can be used to match certain values.

For instance, if a graph is providing two values, then we will be able to figure out the unknown value by plotting points on the graph to represent that value.

$I = E \div R$

$I = 120 \div R$

R	I
2	60
4	30
6	20
8	15
10	12
12	10

Ohm's Law (Voltage = 120 volts)

This graph is utilized on the following pages. Study it, and see how many plot points you can find that represent the ohm's value.

Example:
By looking at the graph above, what is a good estimate for the Current (I) when the resistance in 5 ohms?

Locate 5 ohms on the horizontal axis, go up on the graph until you hit the curve, and follow the graph to the left until you hit the vertical axis.

22 amps is a good estimate for the value of I when the resistance is 5 ohms.

Use the formula to check the accurate answer.

$I = E \div R = 120 \div 5 = 20$ ohms

PA Core Standard: CC.2.1.HS.F.3
Description: Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs, data displays.

Math Associated Vocabulary:
FUNCTION, TABLE, COORDINATE, SLOPE, X-INTERCEPT, Y-INTERCEPT, X-AXIS, Y-AXIS, CARTESIAN COORDINATE SYSTEM, QUADRANT, ORIGIN, MAKE PREDICTIONS, ANALYZE
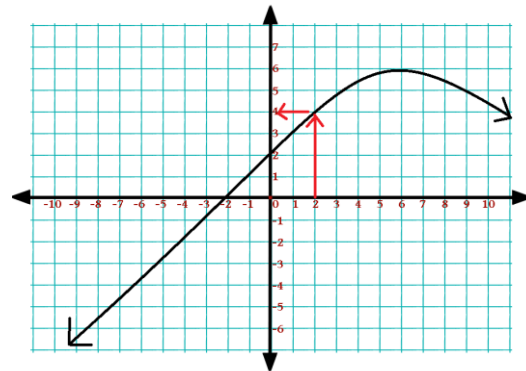
Formulas and Procedures:
The typical notation for a function is f(x). This is read as "f of x" This does NOT mean f times x. This is a special notation used only for functions.

To read a function value, f(a) from a graph….
1. Draw a vertical line through *a* on the x-axis
2. Find the point of intersection of that line with the graph
3. Draw a horizontal line through the graph at that point
4. Find the intersection of the horizontal line and the y-axis
5. f(a) is that y value.

Example:
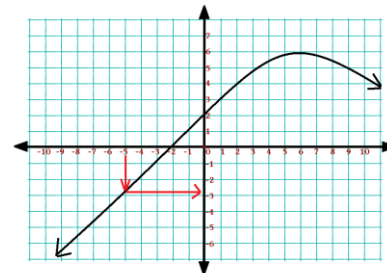Consider the following graph, use the graph to estimate f(2).

To read an x-value from a graph…
1. Draw a horizontal line through the function value on the y-axis
2. Find the point of every intersection of that line with the graph
3. Draw a vertical line through line through the graph at that point(s)
4. Find the all intersections of the vertical lines and the x-axis.
5. This will give the related x-value

Example:
Consider the following graph, use the graph to estimate f(x) = -5.

Instructor's Script – Comparing and Contrasting
This eligible content item assesses a student's ability to recognize the relationships between tables, graphs, and equations (or functions). Many students do not realize that there is an algebraic model that describes a relationship visually shown in a graph. Many students also fail to see the relationship between table values and coordinates (or points) on a graph. Any assistance that CTE instructors can lend in supporting this knowledge will be very beneficial for students. An extension to the problem listed above is to ask the student which one of the following algebraic models of Ohm's law is depicted: $I = 120/R$, $E = 120R$, $I = E/120$, or $R = 120/I$.
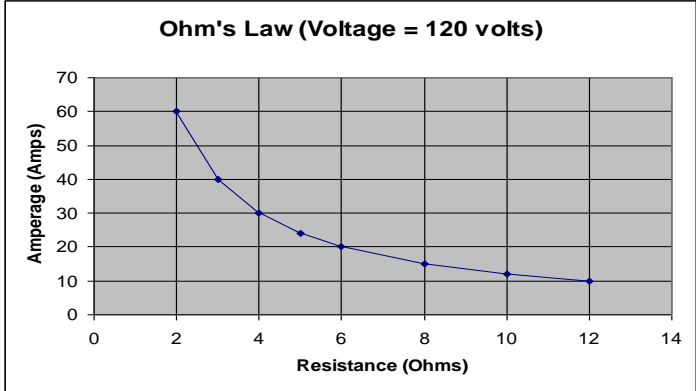
Common Mistakes Made By Students
Matching coordinates to table values: Some students have difficulty reading the scale on a graph. Some axes increase by increments of 10, 5, 2, 1, or less than one. Students should check the scale before identifying the coordinates.
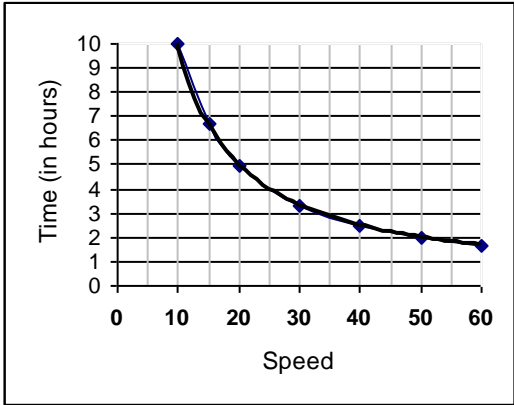
Many students will confuse the x and y axes. The vertical axis is the y axis and the horizontal axis is the x axis.
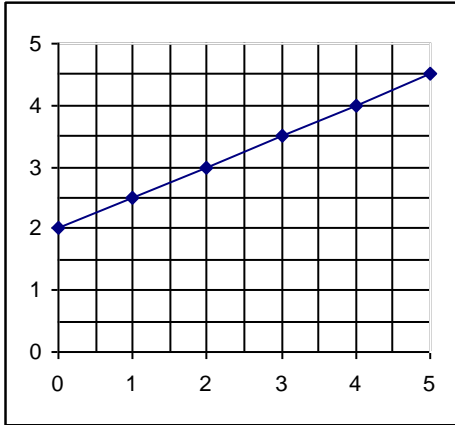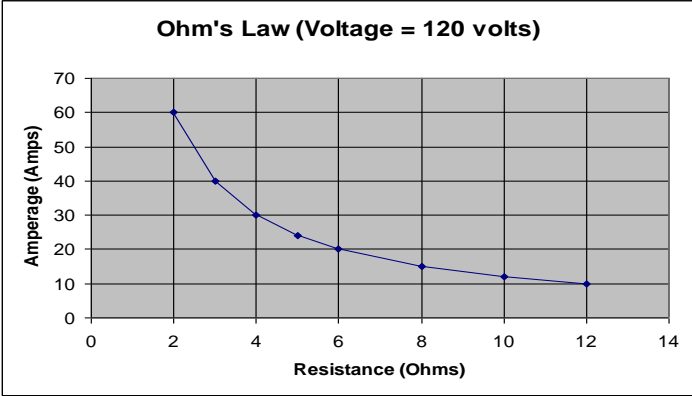
CTE Instructor's Discussion
The Ohm's Law graph (R verses I) that is depicted on this T-Chart has plot points that are inversely proportional to another. By looking at the voltage value (120 volts), we can see that if the resistance or amperage values decrease the value of the other will increase.
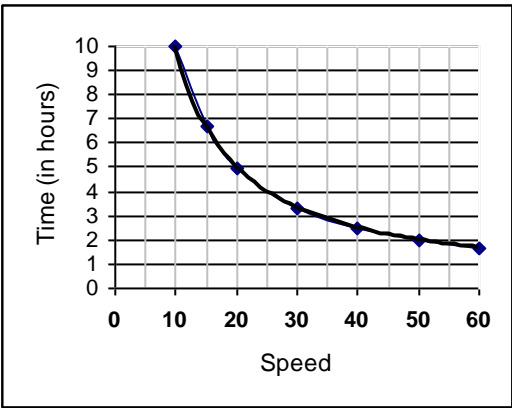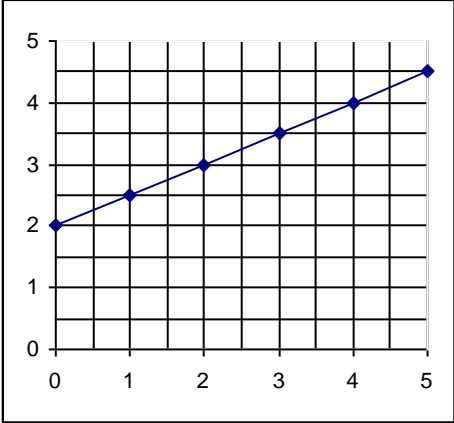Direct proportions such as I verses E will produce a linear graph with positive slope.

Problems	Career and Technical Math Concepts	Solutions

1. Create a list of three points from the graph to the right.

Ohm's Law (Voltage = 120 volts)

2. Create a table to show the value of amps, by using the other two known properties.

3. Use the graph to estimate the Amperage when the Resistance is 8 ohms.

Problems	Related, Generic Math Concepts	Solutions

4. Identify 3 ordered pairs from the graph to the right.

5. Complete the following table using estimation for the graph shown.

Speed	15		25
Time		6	

6. Which of the following is a solution to the function graphed to the right?
   a) Speed = 50, Time = 2
   b) Speed = 2, Time = 50
   c) Speed = 30, Time = 5
   d) Speed = 5, Time = 14

Problems	PA Core Math Look	Solutions

7. Using the graph of the function to the right, what is the x values when f(x) = 3?

8. Using the graph of the function to the right, what is f(3)?

9. Which of the following ordered pair is a solution to the function graphed to the right?
   a) (3.5, 4)
   b) (5,5)
   c) (2.5, 1)
   d) (1, 2.5)

Problems	**Occupational (Contextual) Math Concepts**	**Solutions**

1. Create a list of three points from the graph to the right.
   (2, 60),   (4, 30), (10, 12)

2. Create a table to show the value of amps, by using the other two known properties.

Ohms	2	3	6	12
Amps	60	40	20	10

3. Use the graph to estimate the Amperage when the Resistance is 8 ohms.

   When Resistance = 8 ohms the Amperage would be about 15amps.

Ohm's Law (Voltage = 120 volts)

(graph: Amperage (Amps) vs Resistance (Ohms))

Problems	**Related, Generic Math Concepts**	**Solutions**

4. Identify 3 ordered pairs from the graph to the right.

   (10,10), (15, 6.7), (20,5), (30, 3.33), (40,2.5), (50,2), (60,1.7)

5. Complete the following table using estimation for the graph shown.

Speed	15	17	25
Time	6.8 hrs.	6	4 hrs.

6. Which of the following is a solution to the function graphed to the right?

   a. Speed = 50, Time = 2
   b. Speed = 2, Time = 50
   c. Speed = 30, Time = 5
   d. Speed = 5, Time = 14

   Answer (a)
   Speed = 50, Time = 2
   would be a solution.

(graph: Time (in hours) vs Speed)

Problems	**PA Core Math Look**	**Solutions**

7. Using the graph of the function to the right, what is the x values when $f(x) = 3$?
   When $f(x) = 3$, $x=2$

8. Using the graph of the function to the right, what is $f(3)$?
   $f(3) = 3.5$

9. Which of the following ordered pair is a solution to the function graphed to the right?
   a) (3.5, 4)
   b) (5, 5)
   c) (2.5, 1)
   d) (1, 2.5)

   (1, 2.5) is a solution.

(graph: linear function)