Electrical (46.0399) T-Chart

Estimate materials needed for a project	=	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities

Program Task: Estimate materials needed for a project.

Program Associated Vocabulary:
ESTIMATE, ASSESS, CALCULATE

Program Formulas and Procedures:
Electricians must be able to look at blueprints, and do a "take off" of the material that is required to complete the project. Unfortunately, electricians do not have the time to look at each page of the blueprint and study every dimension. For example, if the print is for a five story building, the electrician will make a rough estimate of how much wire, conduit, etc. will be needed for the first floor. Then they will multiply that number by five or six, depending if there is a basement, and come up with a material estimate.

This estimate is not final but it gives the tradesmen the material needed to start the job.

Example:
If the drawings show a five story building is 250 ft. wide by 100 ft. long, and is to be wired with metal clad cable, an electrician can estimate how many 1,000 ft. rolls of cable will be required.

250ft. x 100ft. = 25,000 sq. ft.

25,000 sq. ft. x 5 story building = 125,000 sq. ft.

125,000 sq. ft./1,000 ft. rolls of cable = 125

125 rolls of metal clad can be ordered to start the project.

PA Core Standard: CC.2.1.HS.F.5

Description: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Math Associated Vocabulary
ROUNDING, PLACE VALUE, MENTAL MATH, AVERAGE

Formulas and Procedures:
It is often more practical to use estimation to solve problems, using mental math, so that a calculator is not necessary. Usually the situations presented require you to either round to the nearest whole number, tens, hundreds, or thousands, or require you to take an average of the range of numbers given. The two examples below demonstrate specific situations where rounding and averaging are useful.

Rounding:
Henry just purchased a cell phone plan that will cost him $38.99 per month. His friend, Elizabeth, just purchased a cell phone plan that will cost her $59.99 per month. Estimate how much more money Elizabeth will spend on her cell phone plan in one year.

1. To estimate, round to the nearest tens. Henry will spend about $40/mo. and Elizabeth will spend $60/mo.
2. Take the difference between the two: $60 - $40 = $20 to determine how much more Elizabeth will spend in one month.
3. Multiply by 12. $20 x 12 = $240 more per year.

Averaging:
Billy notices that 4-6 cars pass by his house each hour. Estimate the number of cars that will pass by his house in 8 hours.

1. Find the average of 4 and 6. Average = (4 + 6) ÷ 2 = 5.
2. Multiply this by 8 hours: 5 x 8 = 40
   Approximately 40 cars should pass by his house.

Instructor's Script – Comparing and Contrasting
Estimation is a strategy that good problem solvers employ. Even if the question requires an exact answer, a mental estimate should be completed before the calculations are done so that the estimate can be used to check the validity of the answer. Students must be able to discern and apply good estimates.

Common Mistakes Made By Students
Problems arise when the students do not consider the limitations of estimating and how the situation determines when to estimate. For instance, it is not okay to round up 85 psi to 100 psi. However, if a faulty component will cost the customer $85, it would be okay to round it to $100 when estimating the cost.

CTE Instructor's Extended Discussion
Electricians estimate jobs every day; therefore, they must have accurate estimation skills. Having these precise skills enables the electricians to successfully order the materials needed to keep a job flowing and without the delays that would arise from a material shortage.

Problems	Career and Technical Math Concepts	Solutions
1. The labor rate for an electrician is $68.75 per hour. A job is going to take three electricians four weeks (working Monday-Friday) to complete. If they work forty hours per week, what is the estimated labor cost for this project?		
2. A 250' roll of 14/3 Romex cable costs $33.95. A project is going to require 200 rolls to complete the job. Which of the following is the best estimate for the cost of the wire? a) $5500 b) $7000 c) $6600 d) $5950		
3. An electrician and a helper can run about 47' of conduit an hour. Estimate how much conduit they will run in a forty hour work week? a) 2000' b) 1750' c) 1950' d) 1900'		

Problems	Related, Generic Math Concepts	Solutions
4. A software support contract is quoted for one or two years. One year would cost $795, but two years would cost $1,495. Round each price to the nearest hundred dollars and estimate the savings for a two year commitment.		
5. Students want to raise $500 for a field trip. With fundraising, they collected $127 on Monday, $130 on Tuesday, $84 on Wednesday, and $90 on Thursday. Approximately how much money will they need to collect on Friday to reach their goal?		
6. A car can be rented for $37.99/day plus $0.39/mile. Which of the following is the best estimate for the cost of renting the car for 4 days if you are driving 100 miles? a) $150 b) $160 c) $200 d) $250		

Problems	PA Core Math Look	Solutions
7. A company is offering a salary of $48,500 per year. If 20% is taken from taxes, how much will a person have made in 5 years after taxes?		
8. Every hour, the store sells between 40-50 items that range from $1.99 - $7.99. What would be a good estimate for the amount of money the store generates in a 10 hour day?		
9. Two friends went to dinner. Their bill came to $37.79. If a fair tip is between 15 and 20 percent, what would be a fair tip to leave their waiter?		

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pennsylvania
DEPARTMENT OF EDUCATION

	Problems	**Career and Technical Math Concepts**	**Solutions**
1.	The labor rate for an electrician is $68.75 per hour. A job is going to take three electricians four weeks (working Monday-Friday) to complete. If they work forty hours per week, what is the estimated labor cost for this project?		Rounding off one hour of labor = $70 $70 x 3 electricians = $210 per/hr. 4 weeks @ 40 hours a week = 160 hours 160 hours x $210/hour = $33,600 is the estimated cost
2.	A 250' roll of 14/3 Romex cable costs $33.95. A project is going to require 200 rolls to complete the job. Which of the following is the best estimate for the cost of the wire? a) $5500 b) $7000 c) $6600 d) $5950		First you will round off $33.95 to $35 The project will require approx. 200 rolls 200 rolls x $35/per roll = $7,000 The best answer would be (b).
3.	An electrician and a helper can run about 47' of conduit an hour. Estimate how much conduit they will run in a forty hour work week? a) 2000' b) 1750' c) 1950' d) 1900'		Rounding off the 47' = 50' an hour 50' of conduit an hour x 40 hours per week = 2000' per week The workers will run approximately 2000' of conduit/week The best answer would be (a).

	Problems	**Related, Generic Math Concepts**	**Solutions**
4.	A software support contract is quoted for one or two years. One year would cost $795, but two years would cost $1,495. Round each price to the nearest hundred dollars and estimate the savings for a two year commitment.		Rounding: One year = $800, while two years = $1,500. $1,500 / 2 = $750 per year, or a $50 per year savings. Savings for the two year commitment is $100.00.
5.	Students want to raise $500 for a field trip. With fundraising, they collected $127 on Monday, $130 on Tuesday, $84 on Wednesday, and $90 on Thursday. Approximately how much money will they need to collect on Friday to reach their goal?		Rounding the amounts to the nearest ten, 130 + 130 + 80 + 90 = 430 500 (their goal) – 430 (the approx. amt. collected) = $70 is approximate amount they would need to collect on Friday
6.	A car can be rented for $37.99/day plus $0.39/mile. Which of the following is the best estimate for the cost of renting the car for 4 days if you are driving 100 miles? a) $150 b) $160 c) $200 d) $250		c) $200 (Answer) C= Total Cost x = # of days y = # of miles Equation: C = 37.99(x) + .39(y) Estimate Amounts: C= 40x + .40y Substitute and Solve: C = 40(4) + .40(100) C = 160 + 40 = $ 200

	Problems	**PA Core Math Look**	**Solutions**
7.	A company is offering a salary of $48,500 per year. If 20% is taken from taxes, how much will a person have made in 5 years after taxes?		$50,000 salary estimate. 10% is $5,000, so 20% is $10,000. 5 years x $10,000 tax/year = $50,000 taxes in 5 years. $50,000 salary x 5 years = $250,000 estimated salary for 5 years $250,000 (estimated salary) – 50,000 (estimated taxes) = $200,000 (estimated net, or after tax, income for 5 years)
8.	Every hour, the store sells between 40-50 items that range from $1.99 - $7.99. What would be a good estimate for the amount of money the store generates in a 10 hour day?		45= Average of 40-50 5 = Average 1.99 and 7.99 45 items x $5 = $225 per hour $225 per hour x 10 days = $2,250.00 per day.
9.	Two friends went to dinner. Their bill came to $37.79. If a fair tip is between 15 and 20 percent, what would be a fair tip to leave their waiter?		Estimate a $40 bill. 15% is $6 and 20% is $8, so a fair tip would be any amount between 6 and 8.