Carpentry (46.0201) T-Chart

Estimate roofing material	=	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities

Program Task: Estimate roofing material to the nearest foot.

Program Associated Vocabulary
ESTIMATE, LABOR COST, MATERIAL COST, SQUARE

Program Formulas and Procedures:
Carpenters are often asked by prospective clients, "how much will this job cost or how long will the job take?" As a future carpenter we must learn to estimate the amount of time a project will take and how much material will be needed to complete the construction project.

Carpenters often install shingles on a roof. When estimating product such as shingles a carpenter will always round up regardless of the rules for rounding. A "square" of shingles will cover 100 sq. ft. Three bundles are in a square; each bundle covers an area of 33.33 sq. ft.

Example: Estimate how many squares of shingles a carpenter would need for a gable roof that measures 17' 6" × 33' 4" and how much it would cost if one square costs $73.86.

A carpenter would round up the dimensions to the next foot and use 18' × 34' to determine how many square of shingles are needed.

Area: 18 × 34 = 612 sq. ft. × 2 for each side = 1224 sq. ft.

Squares of Shingles: 1224 ÷ 100 = 12.24 squares

Since each bundle covers 33.33 sq. ft., the total amount of shingles to be ordered is 12 1/3 sq. of shingles.

When estimating the job cost, 13 sq. of shingles would be used when determining cost. Carpenters will order the extra amount of shingles for waste, cuts and roof caps.

Cost: If one square of roofing shingles cost $73.86 a carpenter will round up the cost to $75.00.

13 sq. × $75.00 = $975.00

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 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 ten. 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 × 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. Take the number between 4 and 6. (5)
2. Multiply this by 8 hours: 5 × 8 = 40
   Approximately 40 cars should pass by his house.

Instructor's Script - Comparing and Contrasting

When teaching estimation, there are many ways that students can round and still obtain a reasonable answer. The purpose of rounding is to make mental math easier and to get a reasonable estimate quickly. For instance, the dimensions of the roof were rounded to the nearest foot to make the calculations easier. The amount that one can round is limited in carpentry because of the need for the estimated answer to be close to the actual answer. The closer the estimate, the less money wasted on unnecessary supplies.

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 so that the estimate can be used to check the validity of the answer.

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

Not only will carpenters estimate roofing material, they will also estimate other materials and labor cost. Examples include concrete, lumber, siding, drywall, trim, windows and doors. Efficient carpenters will know how much materials cost and they will also know how many hours a job will take to complete. This is a skill that comes with experience and knowledge in the trade. The more you estimate, the more effective and efficient you will become. The carpentry trade requires math skills to become successful at estimating and solving problems.

Carpentry (46.0201) T-Chart

Problems	Career and Technical Math Concepts	Solutions
1. **Estimate** the total number of 5/4" × 6" × 16' decking boards needed to cover a deck frame which measures 10' × 16'. Deck board = 1 ¼" × 5 ½" × 16'.		
2. A contractor needs to rent a concrete saw for a future project; he needs to include the rental price into the estimate. If the saw can be rented for $48.99/day plus $4.85/day for damage insurance, which of the following is the best **estimate** for renting the saw for 4 days? a) $185 b) $200 c) $220 d) $275		
3. Estimate the total labor cost of a project. The foreman will work ≈ 25 hours at a rate of $27.50 per hr. and two carpenters will work ≈ 20 hours each at a rate of $18.00 per hr. What is the **estimated** labor cost for this project?		
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 about 20% is taken from taxes, estimate how much 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?		

Problems	Career and Technical Math Concepts	Solutions
1.	**Estimate** the total number of 5/4" × 6" × 16' decking boards needed to cover a deck frame which measures 10' × 6'. Deck board = 1 ¼" x 5 ½" × 16'.	L' × W' ÷ sq. ft. of deck board (W')(L')= (10)(16) ÷ (6"/12)(16) = 160 ÷ 8 = 20 ⟶ 20 deck boards.
2.	A contractor needs to rent a concrete saw for a future project; he needs to include the rental price into the estimate. If the saw can be rented for $48.99/day plus $4.85/day for damage insurance, which of the following is the best **estimate** for renting the saw for 4 days? a) $185 b) $200 c) $220 d) $275	c) $220 50 × 4 = 200 5 × 4 = 20 200 + 20 = 220
3.	Estimate the total labor cost of a project. The foreman will work ≈ 25 hours at a rate of $27.50 per hr. and two carpenters will work ≈ 20 hours each at a rate of $18.00 per hr. What is the **estimated** labor cost for this project?	Formula: Hourly Rate × Labor Hours = Cost $30 × 25 hours ≈ $750 $20 × 20 hours x 2 carpenters ≈ $800.00 Labor cost ≈ $750 + $800 ≈ $1550

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 $50 per year savings, or a $100.00 savings for the 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?	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 + .40x 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 about 20% is taken from taxes, estimate how much 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 × $5 = $225 per hour $225 per hour × 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.