Cabinetmaking (48.0703) T-Chart

Estimate and solve for markup and material cost	=	Choose level of accuracy appropriate to limitations on measurement when reporting quantities

Program Task: Estimate and solve for markup and material cost.

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

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

Program Associated Vocabulary:
MATERIAL COSTS, LABOR COSTS, MARKUP, PERCENTAGE

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

Program Formulas and Procedures:
A cabinetmaker is going to build a custom library for a customer. He/she estimates the materials needed below and goes to his supplier to obtain material prices to complete the project. The cabinetmaker also marks up the supplies 80% when billing a customer, and charges $40/hour for his 80 ½ hours of labor.

Formulas and Procedures:
It is often more practical to use estimation to solve problems so that a calculator is not necessary to solve the problem. 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:

Example: Estimate the cost of the supplies to the nearest whole dollar.
20 board feet of wood for shelves - $10 each
1 ½ sheets of plywood for backer - $60 per sheet
1 qt. stain – $10.50 per quart
1 qt. of polyurethane – $18.90 per quart
8 - 6' long upright shelving brackets at $ 8.50 each
16 – shelving bracket clips at $1.95 each

20 board feet	20 x $10 = $200.00
1 ½ sheets (must estimate 2)	2 x $60 = $120.00
Stain and Polyurethane	$10.50 + $18.90 = $29.40
Shelving	(8 x $8.50) + (16 x $1.95) $99.20
Total Cost (Est. to $)	**$ 449**

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 10s. 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.

Linear Equation:
Materials + Mark up on materials at 80% = 449 x 1.8 = $808.20
(100% + 80% = 180% in decimal format is 1.80.)

Estimate about 80 ½ labor hours in this project at $40 per hour. (80.5 x $40 = $ 3,220.00)
808.00 + $ 3,220.00 = $ 4,028.00
The total estimated cost of this project is $4,028.00

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 x 8 = 40

Approximately 40 cars should pass by his house.

Instructor's Script - Comparing and Contrasting

In 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 cabinet maker would need to take some accurate measurements of the project, but would need to estimate higher to assure the materials needed would be covered. Some materials need to be ordered as a whole. Estimation is limited in cabinetry 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. Also, estimates in labor hours need to be fairly accurate. Good recordkeeping from all jobs completed in the past allow for better estimates of these factors. Estimation is a strategy that good problem solvers use to solve problems quickly and accurately for customer satisfaction.

Common Mistakes Made By Students
Not taking the time to understand the limitations of estimating and how the situation determines the 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

Cabinetmakers need estimation skills in every facet of their career. It is important to be able to obtain estimates in 1-2 days for customers so that they do not choose to go elsewhere. If you estimate low on materials, you will run out of supplies and not make enough money on the job. If you estimate too high on supplies, you may overbid the job and risk losing the job to another contractor. In this economy, it is important to become an accurate estimator.

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	Problems	Occupational (Contextual) Math Concepts	Solutions
1.	A cabinet is constructed by various cabinetmakers earning $15.50 per hour, $25 per hour, and $45.75 per hour. All work equally on the project for 4 hours each. What is the average labor cost of the project?		
2.	A cabinetmaker estimates that it will take supplies costing $325.25 and 30 ¼ labor hours to complete a project. If 10 labor hours for the cabinetmaker are $45 per hour and the remaining labor hours are for his apprentice earning $25 per hour. Estimate the total cost of the project to the nearest dollar. (Round up to the whole dollar.)		
3.	Estimate the number of cans of stain needed to cover the top and bottom of 17 shelves that measure 5/8" x 1 ¼ ' x 2' (1 qt. covers 75 sq. ft. – 1 pint covers 37 ½ sq. ft.).		

	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 $1495. Round each price to the nearest hundred dollars to 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, 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	Occupational (Contextual) Math Concepts	Solutions
1.	A cabinet is constructed by various cabinetmakers earning $15.50 per hour, $25 per hour, and $45.75 per hour. All work equally on the project for 4 hours each. What is the average labor cost of the project?	Average Cost per hour = $15.50 + $25 + $45.75 = $86.25 $86.25 ÷ 3 cabinetmakers = $28.75 per hour $ 28.75 x 12 hours total (4 hrs. x 3) = $345.00 average labor cost for the project	
2.	A cabinetmaker estimates that it will take supplies costing $325.25 and 30 ¼ labor hours to complete a project. If 10 labor hours for the cabinetmaker are $45 per hour and the remaining labor hours are for his apprentice earning $25 per hour. Estimate the total cost of the project to the nearest dollar. (Round up to the whole dollar.)	Supplies -------- $325.25 Labor $45 x 10 = $450.00 Labor $ 25.00 x 20.25 = $506.25 Estimate of total project: $325.25 + $450.00 + $506.25 = $1,281.50, rounded up to $1,282.00	
3.	Estimate the number of cans of stain needed to cover the top and bottom of 17 shelves that measure 5/8" x 1 ¼ ' x 2' (1 qt. covers 75 sq. ft., 1 pint covers 37 ½ sq. ft.)	Tops measure 1.25 ft. x 2 ft. = 2.5 sq. ft. 2.5 sq. ft. x 17 shelves = 42.5 sq. ft. (≈ 43 sq. ft.) Bottoms measure the same ≈ 43 sq. ft. You need about 86 sq. ft. of coverage. You would need to buy 1 qt. and 1 pt. of stain. This would allow you some extra in the pint container.	

	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 $1495. Round each price to the nearest hundred dollars to 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 $\quad$ C = Total Cost x = # of days y = # of miles $\quad$ Equation: C = 37.99(x) + .39(y) $\quad$ Estimate Amounts: C= 40x + .40x $\quad$ Substitute and Solve: C = 40(4) + .40(100) $\qquad\qquad\qquad\qquad\qquad$ 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 hours = $ 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. 10% is $4. 20% is $8 A fair tip would be any dollar amount between $6 and $8.	