

**Estimate printing costs = Choose a level of accuracy appropriate to limitations on measurement when reporting quantities**

**Program Task:** Estimate costs to meet printing customer requirements.

**Program Associated Vocabulary:**  
 ROUNDING, PLACE VALUE, MENTAL MATH, AVERAGE

**Program Formulas and Procedures:**  
 When talking with a customer it is important to give accurate estimates and respond to questions regarding the price of the printing order.

**Example:**  
 Mary at Printing Express gave a customer a quote for 500 books twice a year for \$1.28 per print. ABC printing has already given the same customer a quote for \$1.60 per print. Estimate how much money it would save the customer if the customer went with Printing Express for the year.

- Solution:**
- To estimate, round to the nearest 0.25's.
 

Printing Express	ABC Printing
$1.25 \times 500 = 625$	$1.5 \times 500 = 750$
$625 \times 2 = \$1250$	$750 \times 2 = \$1500$
  - Take the difference between the two:  $\$1500.00 - \$1250.00 = \$250.00$  to determine how much more the customer will save once a year.

**Example:**  
 It takes a printer 17.65 minutes to print 5 booklets, use estimation to determine if 130 booklets can be printed in an eight hour shift.

- Solution:**
- Round the time it take for 5 booklets to 20 minutes.
  - Divide to determine how long it takes for each booklet  
 $20/5 = 4$  minutes
  - $4$  minutes  $\times 140 = 560$  minutes  
 $8$  hours = 480 minutes  
 140 booklets cannot be printed in the 8 hour shift.

**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.

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

- Find the average of 4 and 6. Average =  $(4 + 6) \div 2 = 5$
- Multiply this by 8 hours:  $5 \times 8 = 40$   
 Approximately 40 cars should pass by his house.

### **Instructor's Script - Comparing and Contrasting**

Estimation is a strategy that good problem solvers employ.

When teaching estimation, there are many place values that students can round to and still obtain a reasonable answer. In the example provided in the Graphic Communications side of the T-Chart, the numbers were rounded to the closest 0.25. The amount of \$1.28 was rounded to \$1.25 and \$1.60 was rounded to \$1.50.

The purpose of rounding is to make mental math easier and to get a reasonable estimate. One could also round \$1.28 and \$1.60 to \$1.30 and \$1.60, respectively. This would yield a savings of \$300. The actual answer without estimation is a savings of \$320 so both methods yield an answer that is close enough to the actual to be reasonable.

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**

Students need to understand the limitations of estimating. For instance, if the cost per color copy is \$0.74/copy and 10,000 copies are made, rounding the price to an even dollar will yield an unreasonable answer. In this case, the estimate would produce a price of \$10,000 even though the actual price is only \$7,400.

### **CTE Instructor's Extended Discussion**

Estimating is an important skill for print shop owners to estimate time and materials needed among other things. If job estimates are too high, the business owner risks losing the job; if the estimates are too low, the business owner cuts into his/her profits or doesn't have enough materials for the job.

It is also important for students to know when not to follow the regular rules for rounding. For example, if it is determined that a graphic designer can cut 11.83 logos from a piece of vinyl. You would not round up to say that 12 logos could be cut from that piece of vinyl.

# Graphic Communication (10.0399) T-Chart

<b>Problems</b>	<b>Career and Technical Math Concepts</b>	<b>Solutions</b>
1. You quote a customer for their printing needs for one year or for two years. One year would cost \$1280 however two years would cost \$2490. Round each price to the nearest hundred dollars to estimate the savings for a two year commitment.		
2. A press can run at 8000 impressions at \$58.50/hr. Which is the best estimate of running the press for 5 hours? a) \$225 b) \$300 c) \$350 d) \$250		
3. A person can hand collate 300 sheets per hour at a cost of \$24.50 per hour. They work 6 hour days. What is your best estimate of how much it would cost in 5 days? a) \$450 b) \$375 c) \$300 d) \$400		
<b>Problems</b>	<b>Related, Generic Math Concepts</b>	<b>Solutions</b>
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		
<b>Problems</b>	<b>PA Core Math Look</b>	<b>Solutions</b>
7. A company is offering a salary of \$48,500 per year. If about 20% is taken from taxes, how much will a person make 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. You quote a customer for their printing needs for one year or for two years. One year would cost \$1280 however two years would cost \$2490. Round each price to the nearest hundred dollars to estimate the savings for a two year commitment.		Rounding off one year = \$1300, while two years = \$2500. $\$1300 \times 2 = \$2600$ $\$2600 - \$2500 = \$100$ The savings for the two year quote would be \$100.
2. A press can run at 8000 impressions at \$58.50/hr. Which is the best estimate of running the press for 5 hours? a) \$225 b) \$300 c) \$350 d) \$250		b) \$300 $60 \times 5 = \$300$
3. A person can hand collate 300 sheets per hour at a cost of \$24.50 per hour. They work 6 hour days. What is your best estimate of how much it would cost in 5 days? a) \$375 b) \$400 c) \$600 d) \$750		d) \$750 $6 \times \$25 = \$150$ $\$150 \times 5 = \$750$
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 $\approx$ \$800, while two years $\approx$ \$1,500. $\$1,500 / 2 = \$750$ per year, or a \$50 per year. The 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, \$70 is the 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 $C = \text{Total Cost}$ $x = \# \text{ of days}$ $y = \# \text{ of miles}$ 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, how much will a person make in 5 years after taxes?		\$50,000 salary estimate. 10% is \$5,000, so 20% is \$10,000. $5 \text{ years} \times \$10,000 \text{ tax/year} = \$50,000 \text{ taxes in 5 years.}$ $\$50,000 \text{ salary} \times 5 \text{ years} = \$250,000 \text{ estimated salary for 5 years}$ $\$250,000 \text{ (estimated salary)} - 50,000 \text{ (estimated taxes)} =$ $\$200,000 \text{ (estimated net, or after tax, income for 5 years)}$
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?		$45 = \text{Average of } 40\text{-}50$ $5 = \text{Average } 1.99 \text{ and } 7.99$ $45 \text{ items} \times \$5 = \$225 \text{ per hour}$ $\$225 \text{ per hour} \times 10 \text{ days} = \$ 2,250.00 \text{ per day.}$
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 \$6.00 and \$8.00.