

Show your work. Be sure to include appropriate units.

1. (3) My faucet runs at a rate of 5 gallons a minute. How many quarts per hour is that? [One gallon equals four quarts.]

2. (10) Maggie takes three of her friends on a car trip. They travel 535 miles. Their gas cost \$2.05 per gallon. Their car has a gas mileage of about 35 miles per gallon. They drove for a total of 8 hours. Find the following.

a.) Number of gallons used

b.) Total cost of gas

c.) Passenger-miles

d.) Total cost per passenger-mile

e.) Average speed in miles per hour

3. (3) Consider the trip that Maggie and her friends took in the last question. In general, it is estimated to cost about 23 cents per mile to drive a car due to wear-and-tear (not including the gas). If she and her three friends want to share this cost for the trip, how much should each friend pay Maggie (not including that friend's portion for gas)?

4. (4) Kay wants to buy a new gas fireplace insert to replace her use of wood. She would normally burn two cords of wood in the winter. Wood costs \$260 per cord. She would like to know how much she can save by burning gas instead. Gas costs \$0.87 per 100,000 BTU. The fireplace insert would burn 30,000 BTU per hour. Kay figures she would need to turn on the fireplace for 6 hours per day for 120 days. The cost of installing the gas insert is \$120. How much will she save if she makes the switch? Show your work and include units along the way.

5. (12) Convert from metric to English or vice versa as indicated. The only metric-to-English conversions you are allowed to use are 1 meter equals 3.281 feet and 1 gallon equals 3.79 liters. Of course, you may use any English-to-English conversions such as 1 mile equals 5,280 feet and any metric-to-metric conversions such as 1,000 meters equals 1 kilometer. Also, remember 100 centimeters (cm) is equal to 1 meter and 4 quarts make a gallon.

a.) 35 m to feet

b.) 170 feet to meters

c.) 150 mi to kilometers

d.) 4 ft to centimeters

e.) 5 gallons to liters

f.) 16 L to quarts

6. (4) Your speedometer is broken. You notice it takes you 48 seconds to travel between one mile marker and the next on the highway. What is your speed in miles per hour? If the speed limit is 65, are you speeding?

7. (3) Find the sum of the numbers below.

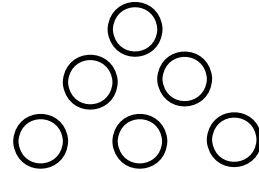
$$1 + 2 + 3 + \dots + 999 + 1,000$$

8. (3) Use estimation to find a quick answer to the question.

The city of Amberville has 33,542 citizens and it needs to build winter weather shelters. It wants to emulate a similar city to estimate the number of cots it needs. Their sister city has 52,678 citizens and has gotten by with 2,000 cots in its emergency shelters. How many cots should the city of Amberville provide? Show your work and explain your answer.

9. (4) Use physical manipulatives to solve this problem. I suggest ripping up six little pieces of paper, labeling them with the digits 1, 2, 3, 4, 5, and 6. Then you can easily rearrange the pieces to come up with your answer. [There is more than one correct answer, sort of.]

Here is a magic triangle. The sum of the digits forming each side of the triangle is 11. Use the digits 1, 2, 3, 4, 5, and 6 (once each) and find the proper locations for each.



10. (3) Use guess-and-check to answer the following question. Include a well-labeled table with a clear explanation as to what you did.

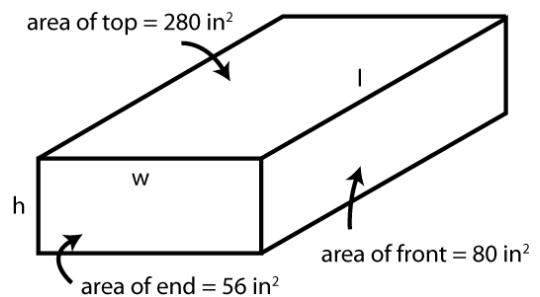
I accompanied a group of students to a play. Of the total number of students, 60% of them rode on a bus that had space for 75 students. If the bus was full, how many total students went to the play?

11. (3) Use guess-and-check to answer the following question. Include a well-labeled table with a clear explanation as to what you did.

A taxi will charge me \$2.35 plus \$0.45 per quarter-mile. If I have \$10 and want to give the driver a \$2 tip, how far (to the nearest quarter-mile) can I go? [You may have some leftover change.]

12. (4) List the **sub-problems** needed to answer the following problem. Then answer the problem. You do not need to use a particular method to solve the problem.

I have drawn a rectangular box with its width, height, and length labeled for consistency among solutions. Notice the end of this box has an area of 56 square inches (width times height). The top of this box is 280 square inches (width times length). The front of this box is 80 square inches (height times length). Assume all measurements are whole numbers. What is the volume of the box? [Remember that volume is length times width times height.] A picture of this box is provided.

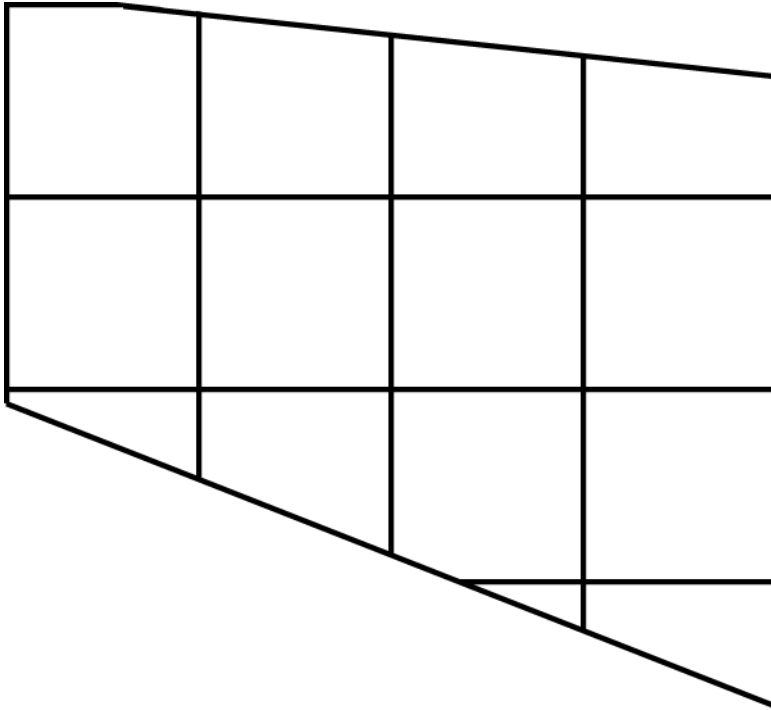


13. (3) Use guess-and-check to answer the following question. Include a well-labeled table with a clear explanation as to what you did.

Joe skated 5 hours at an unknown rate. Marie took the same route (so skated an equal distance) but traveled for 3 hours at 4 miles per hour faster than Joe. Find both Joe's and Marie's rates. [Hint: Distance equals rate times time. Normal skating speeds range from 5 mph to about 20 mph.]

14. (3) My faucet drips one drop every two seconds. How many gallons of water does this leak waste in a year? [One quart of water is equal to about 18,927 drops. One gallon is equal to four quarts.]

15. (3) Estimate the area of the figure below. The grid lines are spaced every 1 inch. Explain your answer.



16. (3) Solve the mixture problem below. You may use any method you choose but a guess-and-check table is started for you. If you choose guess-and-check, complete the table or develop your own. If you make your own table, please label it explicitly. **Write your answer in a complete sentence with the appropriate units.**

Becca has 20 gallons of 40% salt solution. How much 70% salt solution should she add to make a 60% salt solution?

*[Hint: In the final mixture, there will be an **unchanging** 8 gallons of pure salt from the 20 gallons of 40% solution. Find that amount within column 3 below. There will also be an **unchanging** 20 gallons of “stuff” (water and salt) from that 40% solution. Find that amount within column 4 below. These values **remain constant** through the table.]*

Number of gallons of 70% solution added	Amount of salt coming from 70% solution (gallons)	Amount of salt in final mixture (gallons)	Total amount of stuff (water and salt) in final mixture (gallons)	Percentage of final mixture (decimal form)	Rating
20	$.7 \cdot 20 = 14$	$8 + 14 = 22$	$20 + 20 = 40$	$22 / 40 = .55$	too low