

Police Science

Applied Problem Booklet

General Math



Applied Problems Fractions

Note: Reduce all fractions to lowest terms.

1. The following is a weekly time report (Mon. – Fri.) for four workers:

Alex	$6\frac{1}{2}$	$4\frac{3}{4}$	$8\frac{1}{2}$	$5\frac{3}{4}$	$6\frac{1}{4}$	
Bob	8	8	$7\frac{1}{2}$	8	$7\frac{1}{2}$	
Carol	$8\frac{1}{2}$	$7\frac{3}{4}$	8	$8\frac{3}{4}$	$7\frac{1}{2}$	
David	$7\frac{3}{4}$	$8\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{3}{4}$	$8\frac{3}{4}$	
Totals:						

- a. Find the totals for each day and each worker. Enter each answer in the table into its proper cell. Write each answer as a mixed fraction and not as a decimal.
 - b. If a person earns overtime for time worked in each week past 40 hours, which workers got overtime and how many hours of overtime was worked by those people?
2. If it takes one person on average $\frac{3}{4}$ hour to interview one person, how long will it take to conduct 18 interviews?
 3. From point A to point B is $317\frac{3}{4}$ yards. How many yards is it midway from point A to point B? Write answer as a mixed number.
 4. From point A to point B is $317\frac{3}{4}$ yards. How many yards is it two thirds of the distance from point A to point B? Write answer as a mixed number.

5. On average, there are 2400 deaths and/or serious injuries per year at railroad highway crossings. In the first three months of this year there have been 650 death/injuries at railroad crossings. What fraction is this of the total expected for the year? (Reduce fraction to lowest terms.)

6. The 98 prisoners executed in the United States during 1999 were on death row an average of 11 years and 11 months, up sharply from 10 years and 10 months for the 68 inmates put to death in 1998 according to a Bureau of Justice Statistics. What is the fractional increase in time on death row from 1998 to 1999?

7. All 98 executed prisoners during 1999 were men, including 61 whites, 33 blacks, two American Indians and two Asians. What fraction represents non-white executed prisoners?

8. Ninety-four inmates died by lethal injection, three died by electrocution and one from lethal gas. What fraction, reduced to lowest terms, of these executions were death by electrocution?

9. During 1999, Texas led the states with 35 prisoners executed, followed by Virginia with 14, Missouri with nine, Arizona with seven and Oklahoma with six. If there were a total of 98 executions, what fraction of prisoners were executed in Texas? (Reduce fraction to lowest terms.)

10. In 1999, 272 new prisoners were sent to death row, down from 286 in 1998 according to the Bureau of Justice Statistics. What is the fractional decrease of death row sentences issued in 1999 from 1998? (Express in lowest terms.)
11. There were 3,525 prisoners on death row at the end of 1999 which included 50 women. What fraction of the death row prisoners were men?
12. Two-thirds of the population support the death penalty which is a decline from 1993 when four-fifths of the population supported capital punishment. What is the fractional drop in capital punishment support?
13. There are an average of 35,000 carjackings each year in the United States of which 18,200 are successful. Express the number of successful carjackings to the total number of carjackings as a fraction in lowest terms.

1. The blueprints were drawn to a scale of 1:24. If a length of a wall on the blueprint was 6 in., what was the length, in feet, of the actual wall in the house?
2. Bob is carving a model ship from balsa wood on a scale of 1:36. If the ship is 54 feet long, the model ship should be how many inches long?
3. Using the scale 2 feet = 1 inch, find the model dimension for a car with the bumper which is 5 feet long.
4. The 1:20 scale model of a rocket stood 54 inches high. What was the height, in feet, of the actual rocket?
5. Ted is making a model plane at a 1:36 scale. If the length of the actual plane is 60 feet, how many inches long should he make his model? (Hint: Begin by converting 60 feet to inches.)
6. Liza is drawing a floor plan of her house. On the plan, 1 inch equals 2 feet. What is the floor area of a room that measures 6 inches by $7\frac{1}{2}$ inches on the plan?

7. The car model was built on a 1:36 scale. If the length of the car is 180 inches, how many inches long is the model?

8. A crime scene was scaled out on paper with $1'' = 2'$. If one side of the crime scene drawing was 6'' long, how many feet was the side of the actual crime scene?

9. A state map has a scale of 1 inch = 30 miles. If two towns on the map are 4.25'' apart, how far apart are they in miles?

10. Nigel builds a birdhouse. He first draws a scale drawing of the birdhouse, with a scale of 1:100. In his drawing, the bird house is 35mm in height. How tall, in meters, is the birdhouse going to be? [1000 mm = 1 meter]

11. The length of the thruway is 600 miles. If 0.5 inch represents 50 miles, what is the length of the thruway on the map?

12. The dimensions of a building are 250 feet by 120 feet. If 1 inch represents 20 feet on a scale drawing, what are the dimensions of the building on the drawing?

13. If one inch represents 10 feet, what dimensions would you use to make a scale drawing of a building 20 feet by 40 feet?
14. If on a scale drawing 48 feet are represented by 12 inches, then a scale of $\frac{1}{4}$ inch represents how many feet?
15. If 1 inch represents 75 miles on a map, then how many inches will represent 1500 miles?
16. The length of a stadium is 100 yards and its width is 75 yards. If 1 inch represents 25 yards, what would be the dimensions of the stadium drawn on a sheet of paper?

Applied Problems Decimals

1. After being ticketed \$163.40 for “driving too fast for conditions”, a driver pays the ticket with nine \$20 bills. How much change should they get back?
2. There were 3,527 prisoners on death row at the end of 1999, of whom 55.2% were white, 42.9 percent were black and the remainder other races. What percent comprise of the “other races?”
3. The average theft amount per incident was \$60.74 during 2000, up from \$58.43 as reported in the prior year. What is the average theft increase?
4. There are 0.2 carjacking deaths per 1,000 adults each year. If there were 4,233 deaths in Wisconsin last year, how many of these deaths would be expected from carjacking?
5. Men commit 87% of all carjackings. Six percent are committed by males and females together. Only 1% of all carjackings are committed by women alone. What percent of carjackings is undetermined by offenders’ sex?
6. Twenty-nine percent of carjackings take place in parking lots or garages and 45% occur in open areas such as on the street. Eighteen percent occur at or near the victim’s home. What percent of carjackings locations are undetermined?

Applied Problems Percents

Special Initial Amount Problems: To solve problems that ask you to find the initial (beginning) amount when you know the final amount and the percentage of increase (or decrease) between the initial amount and the final amount.

As examples:

- a. *This year there are 3750 employees, which is a 25% increase over last year. How many employees were there last year?*
- b. *This year there are 4500 employees, which is a 25% decrease from last year. How many employees were there last year?*

As review before we show the procedure to be used, consider this situation: You buy an object that costs \$4000.00. A 5% sales tax is added. What is your final cost?

You can solve the problem this way:

Find the amount of sales tax: $\$4000 \times 5\% = \$4000 \times .05 = \$200$

Add the sales tax to the original amount: $\$4000 + \$200 = \$4200$. Thus the final cost is \$4200.00

However, there is another way that it can be done:

1. Write the sales tax as a decimal ($5\% = 0.05$) and add this decimal to the number 1.00 (as in $100\% = 1.00$): $.05 + 1.00 = 1.05$
2. Multiply the original amount by this answer: $\$4000 \times 1.05 = \4200.00

The reason why this works is that you must add the sales tax (5% of the original amount) to the original amount (the original amount is 100% of itself.) If you add the percents first ($5\% + 100\% = 105\%$) and change that into a decimal, you get 1.05. Now, if you multiply by the original number, you will get the final cost.

Another example: You buy an object for \$3100.00 The sales tax rate is 6.75%. What is your final cost? Write the sales tax as a decimal and add this decimal to the number 1.00, getting 1.0675. Multiply this original amount by this number: $\$3100.00 \times 1.0675 = \3309.25 .

However, the new problems are the reverse. They look like this:

After paying 5% sales tax on a purchase, the final cost was \$4200.00. What was the original amount?

To solve this, realize that the final amount (\$4200) could have been calculated by multiplying the original number by 1.05. To go backwards from the final amount to the

original number, divide by 1.05. The original number can be found by $\$4200 \div 1.05 = \4000.00 .

Another example: After paying 6.75% sales tax on a purchase, the final cost was \$3309.25. What was the original amount?

Since the sales tax was 6.75%, divide \$3309.25 by 1.0675. $\$3309.25 \div 1.0675 = \3100.00 .

To solve question (a) above: *This year there are 3750 employees, which is a 25% increase over last year. How many employees were there last year?* Since it is an increase, write 25% as a decimal (0.25) and add it to the number 1.00 which is 1.25. Divide the final amount 3750 by this number $3750 \div 1.25 = 3000$. Thus, there were 3000 employees last year.

What about problems that have a decrease like (b) above? The idea is the same as with an increase, but subtract the percentage instead of adding it.

Example (b) was: *This year there are 4500 employees, which is a 25% decrease from last year. How many employees were there last year?* Solve it by changing the percentage (25%) into a decimal (0.25) and because it is a decrease, subtract it from 1.00. Since $1.00 - .25 = .75$, use 0.75 in the division problem. $4500 \div 0.75 = 6000$ employees

Problems:

1. This year there are 1284 employees, a 7% increase from last year. How many employees were there last year?
2. This year there are 1284 employees, a 3% decrease from last year. How many employees were there last year?
3. This year 4616 speeding tickets were written, a 12% increase from last year. How many speeding tickets were written last year?
4. This year 8125 crimes were reported in Wisconsin, a 1.2% decrease from last year. How many crimes were reported in Wisconsin last year?

5. I received a 3.5% per hour wage increase. I am now making \$12.53 per hour. What was I making before the raise?

6. I reduced the number of miles that I drove this year by 8.5%. This year, I drove 12,315 miles. How many miles did I drive last year?

7. On highway 61, 17 of 21 pickups were speeding. What percentage of pickups was NOT speeding?

8. Wisconsin has a 0.10 level for alcohol consumption for checking on driving while impaired. If Wisconsin's 1998 statistics show that for those drivers arrested for blood alcohol level's greater than 0.10, the average level was 0.185. What percent is this average level above the minimum level?

9. Illinois' blood alcohol level is 0.08 for determination for driving while impaired because of alcohol consumption. What percentage more alcohol can be consumed in Wisconsin than in Illinois and still not be considered impaired?

10. If felony crimes in a city rose from 381 in March to 401 in April, what was the percentage increase? (Round to nearest tenth of a percent.)

11. If felony crimes in a city fell from 401 in April to 381 in May, what was the percentage decrease? (Round to nearest tenth of a percent.)

12. Crimes fell 9.25% in December, 2000, compared to December 1999. If there were 1716 crimes in December 1999, how many crimes were there in December 2000?

13. Crimes fell 10.75% in June 2000 in comparison to June 1999. If there were 834 crimes in June 2000, how many crimes were there in June 1999?

14. For the following cities, which had the greatest percentage increase in crimes for the specified time and what is that percentage?

	February 1999	February 2000
City A	487	617
City B	82,116	81,416
City C	6,119	6,712
City D	132	216

15. If you are now making \$10.34 per hour and are scheduled to receive a 2.75% raise, what will be your new hourly wage (rounded to the nearest penny)?

16. If you are now making \$11.38 per hour and are forced to take a 3.25% decrease in salary, what will be your new hourly wage (rounded to the nearest penny)?

17. If your wage rate is \$8.74 and you receive a 25 cents per hour increase, what is your percentage of increase? (Round to nearest tenth of a percent.)

18. If a state's sales tax is 5.5%, what is the sales tax on an item that costs \$214.95?
19. A bill, including sales tax, was \$2,324.67. If the city and taxes totaled 8.25%, what was the cost of the purchase without any tax?
20. A person who weighs 125 pounds gains 15 pounds, what percentage weight gain is this?
21. A new recruit weighed 182 pounds when first starting his job, after a month of eating donuts during coffee break, he finds that he has gained 15 pounds, what percentage weight gain is this? (Round to nearest tenth of a percent.)
22. American Medical Association endorse a national moratorium on executions. Serious errors occur in nearly 70 percent of all trials leading to the death penalty, according to the study, which was recently conducted by New York's Columbia University Law School and based on a review of 4,600 cases. According to this study, how many cases had serious errors?
23. Carjacking, a type of robbery, is theft or attempted theft of a motor vehicle by force or threat of force. Between 1987 and 1992, carjackings accounted for 2% of the 1.9 million vehicle thefts per year that occurred nationwide. How many carjackings per year were there?

Applied Problems Formulas

1. Given a rectangular-shaped room that is 16.5 ft long and 10.25 feet wide, determine the perimeter of the room by using the formula: $P = 2L + 2W$.
2. Determine the amount of interest a person can earn if she invests \$250 in a savings account for 2.75 years that pays 3.3% simple interest.
Use the formula: $I = PRT$
3. Black cars are ten times as likely to be involved in an accident as white cars. If there have been 1723 black cars in accidents, how many white cars should you expect to have accidents?
4. Four posts are set at the corners of a rectangular-shaped crime scene. The dimensions are 125 feet by 95.5 feet. How much polyethylene ribbon will be left from a new roll of 3 inch wide by 1000 feet long after marking off this crime scene? (Assume no loss to tying off or wrapping around posts.)
5. A knifing occurred in the city park. You are directed to mark off a circular crime scene that has a diameter of 108 ft. What minimum amount of ribbon will be needed? ($C = \pi d$) (Round answer to one decimal point.)

6. Perimeters are normally established and marked with yellow crime scene tape. In the case of a shooting, you can expect the outer perimeter to be quite large, since spent ammunition must be accounted for and found. A shooting has occurred in a rectangular shaped park that is 410 ft. by 675 ft. Yellow, polyethylene ribbon comes in 1000 ft. rolls. How many whole rolls will be needed to mark off the outer perimeter and how much ribbon will be left over?

7. To recall the exact location of evidence, impressions and other items at a crime scene, evidence markers are used in photographs. From a certain vender, 50 markers cost \$34.00 and 99 markers cost \$57.00. Which is the better buy and what is the savings per marker?

8. Hydroplaning is the result of your tires moving fast across a wet surface—so fast they they do not have sufficient time to channel the water away from the center of the tire. The result is that the tire is lifted by the water away from the road and all traction is lost. Assuming at least 0.2” of water on the road, determine the speed at which you will hydroplane if your tire pressure is 35 psi.
[Formula: hydroplaning speed (mph) = $10.27 * \sqrt{\text{tire pressure}}$]

9. Using the information above, determine the speed at which you will hydroplane if your tire pressure is 41 psi.

10. The high school biology teacher reported that his dog came home with a human tibia (shinbone.) Predict the height of an adult given the length of the tibia is 18”.
[Height (inches) = $2.6 * \text{length of tibia (inches)} + 25.5$]

Use the following information and data table for exercises 11-12:

There is a relationship between how much gas your car consumes and how fast you drive. It is a curve and the peak is around 55 mph. When you are going too fast or too slow, you use more gas. The table below shows the speed vs. the gas mileage for cars.

EPA data: Gas Mileage vs. Speed

Model	Speed = 40 mph	Speed = 50 mph	Speed = 60 mph
	Gas mileage (mpg)	Gas mileage (mpg)	Gas mileage (mpg)
Sub-compact	35	36	29
Compact	28	30	27
Midsize	21	22	20
Van	15	17	13
Luxury	13	14	12

$$\text{(Amount of gas)(Gas mileage) = Miles traveled}$$

11. Mary is driving a van with a 15 gallon tank in a rural area. The closest gas station is 125 miles away. She has half a tank of gas and she is traveling at 60 mph. Will she have enough gas to get to the next gas station? Can she get there if she slowed down to 50 mph? 40 mph?
12. Josh is driving a Ford mid-size car at 40 mph in the desert. The road sign shows that the next gas station is 100 miles away. He has half a tank of gas in the 20-gallon tank. Will he reach the next gas station?

Use the following information to solve problems 13-14:

One important factor in driving a car is stopping safely. The time to stop a car safely depends on the speed the car is moving when we want to stop. It takes the average driver about 0.75 of a second to react before actually stepping on the brake pedal. Once the brake has been depressed, it takes additional time before the car comes to a complete and safe stop.

The table below shows the minimum stopping distances for various car speeds. It shows the number of feet traveled due to reaction time and the distance in feet to safely stop the car. Finally, a total stopping distance is shown.

There are three equations to calculate these distances:

$$\text{RT (reaction-time distance in feet)} = 1.1 * \text{speed (mph)}$$

$$\text{BD (braking distance in feet)} = 0.06 * [\text{speed (mph)}]^2$$

$$\text{TSD (total stopping distance (ft))} = \text{RT} + \text{BD}$$

Speed (mph)	Reaction Distance (ft)	Brake Distance (ft)	Total Stopping Distance (ft)
10	11	6	17
20	22	24	46
30	33	54	87
40	44	96	140

13. Calculate the stopping distances for 50 mph using the above equations.

14. Calculate the stopping distances for 60 mph.

15. From City A to City B, it is 5 inches on the map. Each inch equals 13 miles. How many miles is the actual distance?

16. In 1994, Michigan logged 56,666 collisions involving deer and motor vehicles. An average repair cost for a vehicle vs. deer crash is \$2000. What was the total cost of damage done by deer collisions in 1994? [Price = Number of items * cost per item]

Use the following information to solve questions 17 & 18:

Power (P) can be found by dividing work done (W) by time (t). [$P = W \div t$] Work can be found by multiplying force (F) and distance (d). [$W = F * d$]

Therefore, power (P) can be found by $P = (F * d) \div t$. {Power units are foot-pounds per second (ft-lb/sec) and 550 ft-lb/sec = 1 horsepower (hp).}

17. Wisconsin State Patrol candidates must be able to move objects of different sizes to simulate removal from hazard and administration of first aid. During candidate try-outs, a 30 lb. first aid kit must be moved 60 feet in 18 seconds or less. What is the least amount of horsepower needed to meet the objective?

18. At a whistle, a state patrol candidate must remove a dummy weighing 165 lbs from a car. The dummy must then be moved 60 feet within 49 seconds. What minimum horsepower is needed to accomplish this simulation?

Basic Formulas Used in Traffic Accident Investigation

Speed of a vehicle determined from skidmarks are calculated using the formula:

$$S = \sqrt{30d(F \pm f)} = 5.5 \sqrt{d(F \pm f)}$$

Where S = speed of vehicle

d = distance or length of skid

(F ± f) = drag factor ± grade or slope*

*Subtract for down hill or add for uphill.

To determine combined speed (Cs): $Cs = \sqrt{S_1^2 + S_2^2}$

Where Cs = combined speed

S₁ = first speed

S₂ = second speed

For Example:

Investigation of a traffic accident revealed a skidmark of 120 feet with a drag factor of 0.62 for a level surface.

$$d = 120, F = 0.62, f = 0$$

Speed of the vehicle (S) will be:

$$\begin{aligned} S &= 5.5 \sqrt{d(F \pm f)} \\ &= 5.5 \sqrt{(120)(0.62 + 0)} \\ &= 5.5 \sqrt{(120)(0.62)} \\ &= 5.5 \sqrt{74.4} \\ &= (5.5)(8.626) \\ &= 47.4 \end{aligned}$$

Therefore, approximately 47 mph is the minimum estimated speed for the vehicle at the start of slide.

It is estimated that the vehicle was traveling 15 mph at the point of collision. To estimate the speed prior to applying the brakes, the combined speed formula is used:

$$Cs = \sqrt{S_1^2 + S_2^2}$$

where S₁ = first speed = 47.4 mph and S₂ = second speed = 15 mph

$$Cs = \sqrt{47.4^2 + 15^2} = \sqrt{2247 + 225} = \sqrt{2472} = 49.7 \text{ mph}$$

Therefore, the combined speed prior to braking: 49.7 mph.

The combined speed formula may be used to determine minimum speed from skid marks on two different types of road services.

For example:

There were skid marks at the scene of an accident representing 45 mph on the concrete surface and 28 mph on the asphalt surface. The combined speed is...

$$C_s = \sqrt{S_1^2 + S_2^2} = \sqrt{45^2 + 28^2} = \sqrt{2025 + 784} = \sqrt{2809} = 53 \text{ mph}$$

19. a. Calculate the minimum speed of a vehicle with 212 feet of skidmarks, 0.48 drag factor and 0.1 slope, downhill. [Remember: Subtract the slope to the drag factor since it is downhill.]
- b. The vehicle was traveling 10 mph at the point of collision. Using the answer from 19a., find the estimated speed prior to applying the brakes.
20. a. Calculate the minimum speed of a vehicle with 175 feet of skidmarks, 0.57 drag factor and 0.13 slope, downhill.
- b. The vehicle was traveling 30 mph at the point of collision. Using the answer from problem 20a., find the estimated speed prior to applying the brakes.

21. If skid marks at the scene of an accident indicate a speed of 70 mph on concrete and 55 mph on gravel for a vehicle. Find the combined speed of the vehicle prior to applying the brakes.

22. If skid marks at the scene of an accident indicate a speed of 50 mph on asphalt and 20 mph on gravel for a vehicle. Find the combined speed of the vehicle prior to applying the brakes.

Applied Problems Statistics

1. In 1999, the youngest death row inmate was 18 years old while the oldest was 84. What is the range of ages of prisoners on death row?
2. The average theft amount per shoplifting incident during 1999 was \$60.74. There were 134 shoplifting reports in Grant County during the year. Given this information, how much total money would be expected to have been stolen?
3. Radar gun readings for motorists passing an intersection are (in mph): 51.7, 57.7, 63.0, 55.1, 72.6, 59.9, 56.3, 57.2, 59.9, and 58.7
Find the mean, median and mode.

4. Deaths from motor vehicle crashes:

	Year End Total Figures				
County	2000	1999	1998	1997	1996
Richland	1	2	2	5	6
Iowa	3	5	9	9	7
Grant	6	9	14	10	8

- a. Find the mean, median, and mode for each county.
- b. Which of the three measures of central tendencies (mean, median or mode) would you use to argue the case for wearing seat belts and why?

Applied Problems Answer Key

Fractions

1a. Horizontal: $30\frac{3}{4}$, 29, $32\frac{1}{2}$, $31\frac{1}{4}$, 30;
Vertical: $31\frac{3}{4}$, 39, $40\frac{1}{2}$, $42\frac{1}{4}$

b. Carol: $\frac{1}{2}$ hr; David: $2\frac{1}{4}$ hrs.

- 13 $\frac{1}{2}$ hrs
- 158 $\frac{7}{8}$ yds
- 211 $\frac{5}{6}$ yds
- $\frac{13}{48}$
- $\frac{1}{10}$
- $\frac{37}{98}$
- $\frac{3}{98}$
- $\frac{5}{14}$
- $\frac{7}{143}$
- $\frac{139}{141}$
- $\frac{2}{15}$
- $\frac{13}{25}$

Scale Drawings

- 12'
- 18"
- 2.5"
- 90'
- 20"
- 12' x 15'
- 5"
- 12'
- 127.5 mi
- 3.5 m
- 6"
- 12.5" x 6"
- 2" x 4"
- 1'
- 20"
- 4" x 3"

Decimals

- \$16.60
- 1.9%
- \$2.31
- approx. 9
- 6%
- 8%

Percents

- 1200
- 1324
- 4121
- 8224
- \$12.11
- 13,459
- 19%
- 85%

- 20%
- 5.2%
- 5.0%
- 1557
- 934
- City D, 63.6%
- \$10.62
- \$11.01
- 2.9%
- \$11.82
- \$2,147.50
- 12%
- 8.2%
- 3220
- 38,000

Formulas

- 53.5 ft
- \$22.69
- 172
- 559
- 339.3'
- 3 rolls, 830' leftover
- 99 markers @ \$57.00;
\$.10 savings/marker
- 60.8 mph
- 65.8 mph
- 72.3 inches
- no, yes, no
- yes
- 205 ft
- 282 ft
- 65 mi
- \$113,320,000
- .18 hp
- .37 hp
- a. 49.2 mph b. 50.2 mph
- a. 48.1 mph b. 56.7 mph
- 89.0 mph
- 53.9 mph

Statistics

- 66
- \$8,139.16
- Mean: 59.2; median: 58.2; mode: 59.9
- a. Richland: mean-3.2, median-2;
mode-2
Iowa: mean-6.6, median-7, mode-9
Grant: mean-9.4, median-9, no
mode
b. Mean (largest overall values) If
more motorists wore belts, there would
be less
fatalities.

Police Science Application Quiz

1. Officer Pate averages $\frac{1}{4}$ hour per traffic stop. Seventeen traffic stops will take approximately how much time (in hours and minutes)?
2. There were four traffic fatalities in Grant County in the first twelve days of 2003. Express the ratio of fatalities to days as a fraction in lowest terms.
3. The maximum security prison in Boscobel has 462 inmates. If the facility can house 510 prisoners, express the current use to capacity as a fraction in lowest terms.
4. A crime scene measures $12.5'$ x $25'$. If a scale for a drawing of the scene is $1 \text{ foot} = \frac{1}{2} \text{ inch}$, find the dimensions for the drawing.
5. A rectangular area on a map measures $6 \frac{1}{4}''$ x $10''$. Using the map scale of $1'' = 1 \text{ foot}$, find the actual measures of the area.
6. A vehicle measures $5 \frac{1}{2}'$ wide by $11 \frac{3}{4}'$ long. An accident report form uses a scale of $\frac{1}{2}'' = 1.5 \text{ feet}$. Find the dimensions of the vehicle drawn on the report.

7. A scale of $\frac{1}{4}'' = 2$ feet is used to show a room with actual measurements of $10.5' \times 13'$. Find the measurements of the room on the drawing.

8. Skid marks from a motor vehicle accident measure 27 feet long. How long are they in the drawing if a scale of $\frac{1}{2}'' = 2$ feet is used?

9. A map has a scale of $\frac{1}{2}'' = 18$ miles. If two locations are $7\frac{1}{4}''$ apart, how far apart are they in miles?

10. A model airplane with wingspan of 72' is being built on a 1:48 scale. What will the length of the wingspan be on the model?

11. After seven hours of drinking, a 170 pound man has an alcohol concentration of 0.190 at 1:00 AM. Since alcohol leaves the blood at 0.015 per hour, what is his alcohol level at 7:00 AM when he leaves for work?

12. The average alcohol concentration in most drunk driving arrests is 0.175. If a driver is stopped with an alcohol concentration of 0.201, how much is this over the average?

13. The mixed drink, Long Island Iced Tea, contains five 1.25 ounce shots of alcohol in each drink. How many total ounces of alcohol are in one of these drinks?

14. A vehicle is stopped with both the driver and passenger possessing an open alcoholic beverage container. \$212 is fined for the driver with an open container, \$150.50 for a passenger with an open container, and \$161.63 for speeding. Find the total fine.

15. On highway 61, 13 out of 18 cars were speeding. What percentage of the cars were speeding?

16. 31,000 people were convicted for OWI during one year in Wisconsin. If 65% of the OWI convicted were first time offenders, how many is this?

17. If your hourly wage is \$9.05 and you receive a \$.21/hour increase, what is your percentage of increase? (Round to nearest tenth.)

18. A global positioning device, (GPS), may be purchased for \$113.97. What is the total purchase amount if 5.5% sales tax is charged?

19. If felony crimes in a city dropped from 797 one year to 719 the next, what is the percentage decrease?

20. A city has 249 reported burglaries in 2002. If the city's intent is to reduce the number of burglaries by 15%, what is the maximum number of burglaries that the city can have and still reach their goal?

21. You now earn \$9.25 per hour. You will receive a 2.9% increase. What will be your new wage? (Round answer to the nearest penny.)

22. The ratio of cars to trucks passing by a checkpoint was 5 to 2. If 3500 cars passed the checkpoint, how many were trucks?

23. Nearly one in five drivers arrested for OWI is involved in a crash. If 31,000 people were arrested in one year, how many were involved in crashes?

24. a. Calculate the minimum speed of a vehicle with 75 feet of skidmarks, 0.98 drag factor and a 0.08 slope, uphill.
- b. The vehicle was traveling 35 mph at the point of collision. Using the answer from problem 24a., find the estimated speed prior to applying the brakes.
25. If skid marks at the scene of an accident indicate a speed of 58 mph on concrete and 40 mph on gravel for a vehicle, find the combined speed of the vehicle prior to applying the brakes.
26. You have been ordered to tape off a residential lot where a murder has occurred. The lot measures 110' x 155'. What is the minimum amount of tape needed to tape off the perimeter, disregarding length needed for tying tape?
27. A safe landing zone needs to be established for MedFlight to land at the scene of an accident. They require a level, hard surfaced area of 5625 square feet free from overhead high lines. What minimum sized square should be marked off to provide the necessary landing area?

28. In 2003, Grant county's sheriff's department full-time deputies had the following number of years of service: 15, 29, 28, 16, 13, 15, 23, 13, 12, 11, 8, 8, 7, 7, 6, 5, 5, 5, 5, 5, 4, 4, 3.

- a. Find the mean
- b. Find the median
- c. Find the mode

29. Grant county has 2077 miles of highway. Sixteen officers are on duty each day. If it were possible not to overlap highways travel, find the minimum number of miles each officer needs to travel to ensure all highways in the county have been patrolled at least once during the day.

30. An officer is the first on scene of a 10-50. The vehicle is on it's top and the driver is unconscious. Because of the strong odor of gasoline, the officer decides urgent removal of the driver is necessary and pulls the 130 lb. driver from the car through the open side window, keeping the driver's spine in line. He drags the driver to safety 30 feet from the car in 21 seconds. How much horsepower is needed to accomplish this act?

31. An officer assists EMTs at the scene of an accident by helping carry the stretch up out of a ravine. The officer lifts 40 pounds a distance of 34 feet in 15 seconds. How much horsepower has she used?