13. What happens to the pedaling when a person shifts into a higher gear? Does it get harder or easier?

14. What happens to the pedaling when a person rides uphill without changing gears?

15. Should a person shift into a higher gear to go uphill? Why or why not?

16. Would a person using a lower gear travel as far as someone using a higher gear if they pedal the same number of times?

17. What is the formula for finding a person's speed while riding a bicycle?

18. Find the speed in inches per minute Tom can ride his bike if he can pedal a 60 gear ratio at 112 rpm.

More Automotive Examples

19. What is the formula needed to figure a car's weight/power ratio?

20. If a car's curb weight is 3250 lbs. and its peak horsepower output is 180 hp @ 6000 rpm, what is its weight/power ratio?
RATIO AND PROPORTION

Quiz 1

Scale Models
Write a ratio for each. Simplify the answer whenever possible.

1. Wheels
   Model: 3/4 in. diameter
   Car: 18 in. diameter
   \( \frac{3}{4} : 8 = 1:24 \)

2. Headlights
   Model: 1 cm wide
   Car: 19 cm wide
   \( 1:19 \)

Complete the following proportions with the missing terms.

3. \( \frac{7}{8} = \frac{28}{32} \)
4. \( \frac{11}{10} = \frac{121}{110} \)
5. \( \frac{74}{37} = \frac{8}{4} \)
6. \( \frac{0.12}{0.6} = \frac{3}{15} \)

Write a proportion, then find the missing term.

7. 3 red cars out of 5 cars
   12 red cars out of how many?
   \( \frac{3}{5} = \frac{12}{x} \)

8. 3 dented fenders out of 4
   12 dented out of how many?
   \( \frac{3}{4} = \frac{12}{x} \)

Gear Ratios
Find the gear ratios of these bikes.

9. Front sprocket has 44 teeth
   Rear sprocket has 18 teeth
   Wheel diameter is 27 inches
   \( 66 \) gear ratio

10. Front has 49 teeth
    Rear has 18 teeth
    Wheel diameter is 24 inches
    \( 65 \) gear ratio

11. What is the formula used to find the distance covered by one
    pedal revolution of a bike in a particular gear?
    \[ \text{gear ratio} \times \frac{\pi}{2} = \text{distance in inches/revolution} \]

12. Find the distance traveled (in inches per pedal revolution) of a bike in
    a gear that has a ratio of 70.
    \( 220 \) in./rev.
13. What happens to the pedaling when a person shifts into a higher gear? Does it get harder or easier? **It gets harder**

14. What happens to the pedaling when a person rides uphill without changing gears? **The pedaling gets harder**

15. Should a person shift into a higher gear to go uphill? **No**
Why or why not? **The pedaling would get harder**

16. Would a person using a lower gear travel as far as someone using a higher gear if they pedal the same number of times? **No**

17. What is the formula for finding a person’s speed while riding a bicycle?

\[ \text{speed} = \left( \text{gear ratio} \times \pi \right) \times \text{rpm} \]

18. Find the speed in inches per minute Tom can ride his bike if he can pedal a 60 gear ratio at 112 rpm.

\[ 21,111.5 \text{ in./min.} \]

More Automotive Examples

19. What is the formula needed to figure a car’s weight/power ratio?

\[ \frac{\text{curb weight}}{\text{peak horsepower}} = \text{weight/power ratio} \]

20. If a car’s curb weight is 3250 lbs. and its peak horsepower output is 180 hp @ 6000 rpm, what is its weight/power ratio?

\[ 18.1 \]
RATES
Speed

PURPOSE: Students should learn what a rate is and how it can be applied to the automobile. Students should learn about rates of speed. Students should recognize labels of rates.

PREREQUISITE SKILLS: Knowledge of distance measurement (feet, miles, kilometers, meters) and time measurement (seconds, minutes, hours); understanding of previous lessons covering ratios and proportions

MATERIALS: No extra materials necessary

DEVELOPMENT AND METHODS:
A. Discuss ratios and rates.
   1. Ratios are a comparison of two quantities.
      a. 3 cars/10 cars  b. 1 out of every 4 tires
   2. Rates are ratios that compare quantities of different units.
      a. 1 car every 4 years  b. 60 mph
   3. Rates can be thought of in many ways: how often something happens, how fast something is done, or how much something costs.
      a. rate of speed
      b. how often a faucet drips (drips per minute)
      c. how much water flows down a river (gallons per day)
      d. price per pound
      e. price of toll per axle

B. Discuss speed of a car.
   1. It is a rate measured in miles/hour, km/h, ft/sec, and a variety of others.
   2. Rate of speed is written as a distance measurement over a time measurement.
      \[ \text{rate} = \frac{\text{distance}}{\text{time}} \]
   3. The earlier example of 60 mph is a rate of speed.
      a. 60 miles every 1 hour
      b. \[ \frac{60 \text{ miles}}{1 \text{ hour}} \]

B. Finding rate of speed
1. To find rate of speed, two measurements are needed: how far and how much time. (Ex- 165 miles in 3 hours)
2. Divide whatever the distance is by whatever the time is. (Ex- 165 miles/3 hours)
3. As with any fraction or ratio, rates should be simplified whenever possible.
   \[
   \frac{165 \text{ miles}}{3 \text{ hours}} = \frac{55 \text{ miles}}{1 \text{ hour}} \text{ or } 55\text{mph}
   \]
4. Notice the units do not simplify or go away. Units are necessary to understand what a rate is measuring. For example, 55 mph is quite different from 55 miles per day.
5. Example - A race car travels 180 miles in 1.5 hours. Find the car's speed.
   a. Write a ratio, can set up a proportion with hours=1.
      \[
      \frac{180 \text{ miles}}{1.5 \text{ hours}} = \text{speed}
      \]
   b. Divide miles by hours, or solve the proportion.
      \[
      \frac{180}{1.5} = 120 \quad \text{or} \quad 180 \times 1 = 180 \\
      180 \div 1.5 = 120
      \]
   c. Write answer with appropriate units.
      \[
      120 \text{ mph (miles/hour)}
      \]
6. Problem examples
   a. If a car traveled 100 miles in 2 hours at a constant rate of speed, what was that speed?
      \[
      \frac{100 \text{ miles}}{2 \text{ hours}} = 50 \text{ miles/hour} = 50 \text{ mph}
      \]
   b. If a car went 12 miles in 10 minutes, how far will it be in 1/2 hour (30 minutes)? (Can be done two ways.)
      (1) \[
      \frac{12 \text{ miles}}{10 \text{ min.}} = 1.2 \text{ miles/minute} \times 30 \text{ min.} = 36 \text{ miles}
      \]
      (2) \[
      \frac{12 \text{ miles}}{10 \text{ min.}} = \_? \_ \text{ (12 x 30) ÷ 10 = 36 miles}
      \]
ASSIGNMENT: Worksheet VII

RATES
Speed
Worksheet VII

NAME __________________

Answer the following problems accordingly. Round answers to the nearest tenth. Don’t forget to label your answers.

1. If a race car went 484 miles in 2 1/4 hours, what was the car’s average speed?

2. If a car went 327 miles in 4 4/5 hours, what was the car’s average speed?

3. If a car travels 242 miles in 4 hours, what is the average speed?

4. If a race car travels 239 km in 3/4 hours, what is the average speed?

5. Speed is a rate with distance divided by _____________.

6. Is 65 mph a rate of speed? ____________

7. Is 65 meters/second a rate of speed? ____________

8. Is 65 hours/km a rate of speed? ____________

9. Is 65 ft./mile a rate of speed? ____________

10. Is 65 km per day a rate of speed? ____________
RATES

NAME_ KEY

Speed

Worksheet VII

Answer the following problems accordingly. Round answers to the nearest tenth. Don’t forget to label your answers.

1. If a race car went 484 miles in 2 1/4 hours, what was the car’s average speed?

   \[ \text{215.1 mph} \]

2. If a car went 327 miles in 4 4/5 hours, what was the car’s average speed?

   \[ \text{68.1 mph} \]

3. If a car travels 242 miles in 4 hours, what is the average speed?

   \[ \text{60.5 mph} \]

4. If a race car travels 239 km in 3/4 hours, what is the average speed?

   \[ \text{318.7 km/hr} \]

5. Speed is a rate with distance divided by \[ \text{time} \].

6. Is 65 mph a rate of speed? \[ \text{yes} \]

7. Is 65 meters/second a rate of speed? \[ \text{yes} \]

8. Is 65 hours/km a rate of speed? \[ \text{no} \]

9. Is 65 ft./mile a rate of speed? \[ \text{no} \]

10. Is 65 km per day a rate of speed? \[ \text{yes} \]
RATES
Miles Per Gallon

PURPOSE: Students should learn how to find average miles per gallon. Students should understand the difference between city and highway miles per gallon.

PREREQUISITE SKILLS: Ability to perform addition, subtraction, multiplication and division of decimals; familiarity with the fuel fill-up process of an automobile

MATERIALS: Sample ads of cars showing city/highway mpg

DEVELOPMENT AND METHODS:
A. Discuss gas mileage.
   1. Gas mileage is measured in average miles per gallon (mpg).
      a. It is a rate involving miles and gallons as units.
      b. It says that for every gallon of gas, the car can go an average of so many miles (x-number of miles).
      c. Do not forget to use the label.
   2. City mileage differs from Highway mileage.
      a. City driving involves a lot of stop-and-go traffic which uses up more gas. The engine is running, but the car is not going anywhere.
      b. Highway driving is more continuous. There is less stopping and waiting which wastes fuel.
      c. Would city mileage be less than or greater than highway mileage? Less
      d. Show examples from magazine ads.
         20/24 city/hwy mpg
   3. Similarly, winter mileage is worse than summer mileage because the car must sit with the engine running to warm up. Again, the engine is running, but the car is not going anywhere.
B. Demonstrate how to find (average) gas mileage.
   1. As mentioned earlier, mileage is measured in miles/gallon. What information is needed to find gas mileage and what is done to that information?
      a. Needed information includes the number of miles traveled and the number of gallons used.
      b. "Miles/gallon" implies that the number of miles is
2. The gas tank should be full before and filled after miles traveled to have an accurate measure of the number of gallons used.
   a. The tank should be full before the trip, so that after the trip, any new gas pumped into the tank will replace the gas used for the trip. This gives the fairly accurate count of the number of gallons used.
   b. If gas is added a few gallons at a time instead of all at once, then these amounts must be added to the number of gallons pumped during the next fill-up. The total number of gallons should be the amount of gas used. This way is less accurate.

3. The odometer plays an important role. It determines the number of miles traveled. (The odometer is the gauge on a car that keeps track of the total number of miles the car has driven.)
   a. Some cars have a trip odometer which can keep track of miles traveled between fill-ups or during a trip. It can be reset to 0 miles before a trip or when the car is filled with gas.
   b. Odometer readings should be recorded at every fuel fill-up. The difference in readings gives the number of miles traveled.

C. Sample problems
   1. If a car traveled 210 miles on 7.5 gallons, what was the average gas mileage?
      \[ \frac{210 \text{ miles}}{7.5 \text{ gallons}} = 28 \text{ mpg} \]
   2. If a car drove 263 miles and used 11.25 gallons, find the average gas mileage to the nearest tenth?
      \[ \frac{263 \text{ miles}}{11.25 \text{ gallons}} = 23.4 \text{ gallons} \]
   3. If a car's odometer read 4435.0 when filled with 10.45 gallons of gas and the last fuel fill-up was when it read 4178.0, find:
      a. the number of miles traveled.
         \[ 4435.0 - 4178.0 = 257 \text{ miles} \]
      b. the gas mileage to the nearest tenth.
         \[ \frac{257 \text{ miles}}{10.45 \text{ gallons}} = 24.6 \text{ mpg} \]
   4. The mileage on Dave's Chevy Cavalier was 7125.4 miles on a Sunday afternoon when he filled it with gas for the week. On
the following Saturday, he filled his car with 12.25 gallons as the odometer read 7459.8 miles.
a. Find the week's mileage.
   \[7459.8 - 7125.4 = 334.4 \text{ miles}\]
b. Find the mpg to the nearest tenth.
   \[334.4 \text{ miles}/12.25 \text{ gallons} = 27.3 \text{ mpg}\]
*c. (Bonus) Find the average miles per day Sunday-Saturday.
   \[334.4 \text{ miles}/7 \text{ days} = 47.8 \text{ miles/day}\]

D. Discussion - Fuel Economy
1. Is it cheaper to own a car with high gas mileage or one with low gas mileage? One with high gas mileage
   a. If one gallon costs $.94, which car will go further for that $.94? The one with high gas mileage, since a car which gets 27 mpg will go further on 1 gallon than a car which gets 20 mpg.
   b. The higher the gas mileage, the more fuel efficient the car is. For the same amount of gas, a high gas mileage car can go many miles farther than a low gas mileage car. This means the owner does not have to buy as much gas. This means the owner does not have to spend as much money!
2. If a car gets 32 mpg and gas costs $1.02/gallon, about how much money will be spent on gas for a trip of 256 miles?
   a. First, divide the trip miles by the mpg, which will provide the estimated number of gallons needed.
      \[256 \text{ miles}/32 \text{ mpg} = 8 \text{ gallons}\]
   b. Next, multiply the number of gallons by the cost per gallon. This will show the total cost of the gas needed.
      \[8 \text{ gallons} \times \$1.02/\text{gallon} = \$8.16\]
   c. Notice that the cost of the gas is a rate as well. It is written in dollars per gallon.
3. Activity: Have students monitor the gas mileage of their family car for a week or month.

ASSIGNMENT: Worksheet VIII
(Explain the chart on the worksheet for easier understanding.)
Complete the following chart with the correct figures. Enough information has been provided to fill-in the missing items. Round answers to the nearest tenth.

<table>
<thead>
<tr>
<th>Odometer Reading</th>
<th>Traveled Miles</th>
<th>Used Gallons</th>
<th>Avg. MPG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>After</td>
<td>Miles</td>
<td>Gallons</td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
<td>------</td>
<td>--------</td>
</tr>
<tr>
<td>1. 91057</td>
<td>91323</td>
<td>14.0</td>
<td></td>
</tr>
<tr>
<td>2. 88245</td>
<td>88623</td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>37588</td>
<td>478</td>
<td>18.4</td>
</tr>
<tr>
<td>4. 54321</td>
<td>281</td>
<td>16.5</td>
<td></td>
</tr>
<tr>
<td>5. 7106</td>
<td>7443</td>
<td>14.3</td>
<td></td>
</tr>
<tr>
<td>6. 73922</td>
<td>74371</td>
<td>15.4</td>
<td></td>
</tr>
<tr>
<td>7. 45605</td>
<td>376</td>
<td>15.7</td>
<td></td>
</tr>
<tr>
<td>8. 98244</td>
<td>98719</td>
<td>14.5</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>24984</td>
<td>429</td>
<td>33.5</td>
</tr>
<tr>
<td>10.</td>
<td>57668</td>
<td>265</td>
<td>25.0</td>
</tr>
</tbody>
</table>

11. If a car is known to get at least 23.5 mpg and has a 16.5 gallon tank, then how far can the car be expected to travel before needing more gas?

12. How much would it cost to fill the tank of the car in the problem above if gas costs $.98/gallon?
Complete the following chart with the correct figures. Enough information has been provided to fill-in the missing items. Round answers to the nearest tenth.

<table>
<thead>
<tr>
<th>Odometer Reading</th>
<th>Traveled Miles</th>
<th>Used Avg.</th>
<th>Avg. MPG</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Before</strong></td>
<td><strong>After</strong></td>
<td><strong>Miles</strong></td>
<td><strong>Gallons</strong></td>
</tr>
<tr>
<td>1. 91057</td>
<td>91323</td>
<td>266</td>
<td>14.0</td>
</tr>
<tr>
<td>2. 88245</td>
<td>88623</td>
<td>378</td>
<td>15.0</td>
</tr>
<tr>
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<td>37588</td>
<td>478</td>
<td>18.4</td>
</tr>
<tr>
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<td>281</td>
<td>16.5</td>
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<tr>
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<td>74371</td>
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<td>24984</td>
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<td>12.8</td>
</tr>
<tr>
<td>10. 57403</td>
<td>57668</td>
<td>265</td>
<td>10.6</td>
</tr>
</tbody>
</table>

11. If a car is known to get at least 23.5 mpg and has a 16.5 gallon tank, then how far can the car be expected to travel before needing more gas?
   
   **367.75 miles**

12. How much would it cost to fill the tank of the car in the problem above if gas costs $.98/gallon?
   
   **$16.17**
RATES
Distance-Rate-Time Formula

PURPOSE: Students should learn the formula for finding distance, rate, or time. Students should realize this formula has been used before in class. Students should understand the applications of the formula.

PREREQUISITE SKILLS: Ability to work with ratios, proportions, fractions, and decimals

MATERIALS: No extra materials necessary

DEVELOPMENT AND METHODS:
A. Discuss previous lesson on rate of speed (Activate background knowledge).
   1. Remember rate of speed? It was written as miles/hour or distance/time.
   2. If the speed of a car and its travel time were known, the distance traveled could be found.
      55 mph x 3 hours = 165 miles
   3. If the speed of a car and its traveled distance were known, then the travel time could be found.
      a. 165 miles/55 mph = 3 hours
      b. 200 miles/25 mph = 8 hours
   4. To solve these problems, we used a very common and easy formula.
B. Demonstrate Distance-Rate-Time Formula.
   1. We have used what is known as the Distance-Rate-Time Formula.
      a. $D = R \times T$ is the formula for finding distance.
      b. $R = \frac{D}{T}$ is the formula for finding the rate.
      c. $T = \frac{D}{R}$ is the formula for finding the time.
   2. This formula is much like a proportion using an understood 1.
      a. $\frac{R}{T} = \frac{D}{1\text{ hour}}$, such as $\frac{55 \text{ miles}}{1 \text{ hour}} = 165 \text{ miles}$
      b. $\frac{T}{R} = \frac{D}{1 \text{ hour}}$, such as $\frac{3 \text{ hours}}{1 \text{ hour}} = 165 \text{ miles}$
C. Practice Problems - Find the missing terms.
   1. 60 miles in 2 hours
      30 miles in 1 hour
2. \(40 \text{ km in } 3.2 \text{ hr}\)
\(100 \text{ km in 8 hr}\)
3. \(9 \text{ m in 27 sec}\)
\(.33 \text{ or } \frac{1}{3} \text{ m/sec}\)

ASSIGNMENT: Worksheet IX

RATES
Distance-Rate-Time Formula
Worksheet IX

Write a proportion for each.

1. 2 km in 30 min.
   6 km in 90 min.
   ____ = ____

2. 33.5 m in 1 min.
   67 m in 2 min.
   ____ = ____

Find each missing term. Write a proportion to help.

3. 23 km in 2 hr
   ____ km in 6 hr

4. 75 mi. in 1.5 hr
   100 mi. in ____ hr

5. 121 mi. in 2 hr
   ____ mi. in 3 hr

6. 4400 ft in 2.5 min.
   6248 ft in ____ min.

Find the missing term using the D-R-T Formula. Round answers to the nearest tenth. Do not forget to use labels.

7. Distance = 763 mi.
   Rate = 30 mph
   Time = ____

8. Distance = 517 km
   Rate = 47 km/hr
   Time = ____

9. Distance = 312 mi.
   Rate = ____
   Time = 4.8 hr

10. Distance = 2130 km
    Rate = ____
    Time = 30 hr

11. Distance = ____
    Rate = 63 km/hr
    Time = 3.5 hr

12. Distance = ____
    Rate = 61 mph
    Time = 23.7 hr

NAME________________
13. How far can Renee drive in 3.2 hours if she travels 112 miles in 2 hours?

14. Eric drove 110 miles to an amusement park. He left at 10 a.m. and returned at 6:30 p.m. If he drove 55 mph, how much time did he spend there?
   a. How long did it take to get to the park? 
   b. What time was it then?
   c. How many hours must it take to drive home?
   d. At what time must he have left the park?
   e. How much time did Eric spend at the park?

15. Kelly went to visit her sister in college. The college is 180 miles away. She left on a Friday at 3:30 p.m. and did not come back until Sunday at 4:00 p.m. If Kelly had an average speed of 54 mph, answer these questions.
   a. How long did it take her to get to the college?
   b. What time was it when she arrived?
   c. At what time must she have left to go back home?
   d. How many hours did she spend with her sister?
   Bonus: Approximately how many days is that?

16. What if the college was 216 miles away?
   a. How long did it take her to get to the college?
   b. What time was it when she arrived?
   c. At what time must she have left to go back home?
   d. How many hours did she spend with her sister?
   Bonus: Approximately how many days is that?
RATES
Distance-Rate-Time Formula
Worksheet IX

Write a proportion for each.

1. 2 km in 30 min.
   6 km in 90 min.
   \[
   \frac{2}{30} = \frac{6}{90}
   \]

2. 33.5 m in 1 min.
   67 m in 2 min.
   \[
   \frac{33.5}{1} = \frac{67}{2}
   \]

Find each missing term. Write a proportion to help.

3. 23 km in 2 hr
   \[
   \frac{69}{6} \text{ km in 6 hr}
   \]

4. 75 mi. in 1.5 hr
   \[
   \frac{100}{2} \text{ mi. in } \_\text{ hr}
   \]

5. 121 mi. in 2 hr
   \[
   \frac{181.5}{3} \text{ mi. in 3 hr}
   \]

6. 4400 ft in 2.5 min.
   6248 ft in \_\_\_\_\_ min.

Find the missing term using the D-R-T Formula. Round answers to the nearest tenth. Do not forget to use labels.

7. Distance = 763 mi.
   Rate = 30 mph
   Time = \_25.4 hrs._

8. Distance = 517 km
   Rate = 47 km/hr
   Time = \_11 hrs._

9. Distance = 312 mi.
   Rate = \_65 mph
   Time = 4.8 hr

10. Distance = 2130 km
    Rate = \_71 km/hr
    Time = 30 hr

11. Distance = \_220.5 km
    Rate = 63 km/hr
    Time = 3.5 hr

12. Distance = \_1445.7 miles
    Rate = 61 mph
    Time = 23.7 hr
13. How far can Renee drive in 3.2 hours if she travels 112 miles in 2 hours?
   __179.2 miles__

14. Eric drove 110 miles to an amusement park. He left at 10 a.m. and returned at 6:30 p.m. If he drove 55 mph, how much time did he spend there?
   a. How long did it take to get to the park? __2 hours__
   b. What time was it then? __12 noon__
   c. How many hours must it take to drive home? __2 hours__
   d. At what time must he have left the park? __4:30 pm__
   e. How much time did Eric spend at the park? __4.5 hours__

15. Kelly went to visit her sister in college. The college is 180 miles away. She left on a Friday at 3:30 p.m. and did not come back until Sunday at 4:00 p.m. If Kelly had an average speed of 54 mph, answer these questions.
   a. How long did it take her to get to the college? __3 hrs 20 min__
   b. What time was it when she arrived? __6:50 pm__
   c. At what time must she have left to go back home? __12:40 pm__
   d. How many hours did she spend with her sister? __41 hrs 50 min__
   Bonus: Approximately how many days is that? __1.75 days__

16. What if the college was 216 miles away?
   a. How long did it take her to get to the college? __4 hours__
   b. What time was it when she arrived? __7:30 pm__
   c. At what time must she have left to go back home? __12 noon__
   d. How many hours did she spend with her sister? __40.5 hours__
   Bonus: Approximately how many days is that? __1.33 days__
RATES
Quiz II

NAME____________________

Speed
State whether each of the following is a rate of speed (answer yes or no).

1. 55 km/hr
2. 55 in./ft.
3. 55 days/km
4. 55 mph
5. 55 km/mi.
6. 55 ft./sec.
7. If a car traveled 780 miles in 13.2 hours, what was its average speed?
8. Speed is a rate with ___________ divided by ___________.

Gas mileage
9. Gas mileage is a rate with ___________ divided by ___________.

Answer the following to the nearest tenth.

10. If a car drove 232 miles on 10.4 gallons of gas, what was its average gas mileage?
11. If a car's odometer read 5166.7 when filled with 9.7 gallons of gas and read 4912.7 the time before that, find (a) the number of miles traveled and (b) the gas mileage.
   a. ______________
   b. ______________
12. A car's odometer read 8217.3 before a trip and read 8509.8 after the trip. If it used 11.9 gallons during this trip, what was the car's average gas mileage? _________

If gas cost $.92/gallon, how much did it cost to make the trip? _________

Distance=Rate×Time

Fill in the blanks with the appropriate word or number. Don't forget labels.

13. Distance = ___________ x ___________

14. Rate = ___________ ÷ ___________

15. Time = ___________ ÷ ___________

16. Distance = 500 miles
   Rate = 55 mph
   Time = ___________

17. Distance = ___________
   Rate = 49 km/hr
   Time = 11 hours

18. Distance = ___________
   Rate = 43 mph
   Time = 2.5 hours

19. Distance = 212 miles
   Rate = ___________
   Time = 3.2 hours
RATES

Quiz II

Speed
State whether each of the following is a rate of speed (answer yes or no).

1. 55 km/hr __________________________ yes
2. 55 in./ft. __________________________ no
3. 55 days/km __________________________ no
4. 55 mph __________________________ yes
5. 55 km/mi. __________________________ no
6. 55 ft./sec. __________________________ yes

7. If a car traveled 780 miles in 13.2 hours, what was its average speed? __59 mph______________

8. Speed is a rate with __________ divided by __________.

Gas mileage
9. Gas mileage is a rate with ______ divided by ______.

Answer the following to the nearest tenth.

10. If a car drove 232 miles on 10.4 gallons of gas, what was its average gas mileage?

11. If a car's odometer read 5166.7 when filled with 9.7 gallons of gas and read 4912.7 the time before that, find (a) the number of miles traveled and (b) the gas mileage.

   a. __254 miles_________
   b. __26.2 mpg_________
12. A car's odometer read 8217.3 before a trip and read 8509.8 after the trip. If it used 11.9 gallons during this trip, what was the car's average gas mileage?  
   24.6 mpg

If gas cost $.92/gallon, how much did it cost to make the trip?  
   $10.95

Distance-Rate-Time Formula
Fill in the blanks with the appropriate word or number. Don't forget labels.

13. Distance = _____ Rate _____ x _____ Time ______

14. Rate = _____ Distance _____ ÷ _____ Time ______

15. Time = _____ Distance _____ ÷ _____ Rate ______

16. Distance = 500 miles  
   Rate = 55 mph  
   Time = 9.1 hours

17. Distance = 539 km  
   Rate = 49 km/hr  
   Time = 11 hours

18. Distance = 107.5 miles  
   Rate = 43 mph  
   Time = 2.5 hours

19. Distance = 212 miles  
   Rate = 66.3 mph  
   Time = 3.2 hours
MAP READING AND PLANNING ROUTES
Small Scale Situations

PURPOSE: Students should realize that the shortest distance between two points (locations) is a straight line. Students should learn to drive the straightest/shortest route possible. Students should be able to determine distances on one type of map.

PREREQUISITE SKILLS: Ability to add and compare decimals

MATERIALS: An overhead projector, transparencies of included diagrams

DEVELOPMENT AND METHODS:
A. Introduce with a basic, general picture of one child going to meet another at the playground. Discuss how the child should get to the meeting place.
   1. Will he walk around the park on the sidewalks? Will he walk across the park in a relatively straight line?
   2. What if the park has a fence around it? What if the park has an enclosed tennis court between the house and the playground?
   3. Discuss routes. Which is the shortest? Discuss reasoning.
B. Discuss more advanced situation. Which way to the mall? You're at home and you want to go to the mall. How do you get there? You can't drive through yards; you must stay on the roads.
   1. Students should want to go as straight and as short a route as possible.
   2. Road and traffic considerations are sometimes necessary.
   3. Students could come up to the overhead to draw the route of their choice. Different students may see different routes. Compare!
C. Discuss a larger scale situation. A state map that shows straight highways to and from major cities can make route decisions easier.
   1. Choice of highway becomes obvious if the shortest route is a straight highway to the destination.
   2. However, this is not a real map. This might be the more ideal for people in a hurry.
   3. Discuss benefits of highway system like this.
      a. Shortest distance between cities is a major highway.
      b. Driving time is reduced.
   4. Discuss drawbacks of this system.
a. It’s expensive for state and federal governments to pave direct highways between major cities.

b. Who decides which cities should be connected? Surely, not every city could possibly be included in this system.

c. The routes would be boring and may put drivers to sleep because they are so straight.

D. Practice finding distance between cities (points).

1. On some maps, distances between some points (cities, exits) are shown in miles or kilometers.

2. Using these numbers, you can determine how many miles or km a trip will be.

a. How far is it from M to T?
   16.1 miles

b. How far is it from M to T with a stop at N?
   17 miles

c. Which is the shortest route from P to M? P-T-M
   How long is it? 27.1 miles

All distances are in miles

ASSIGNMENT: Worksheet X
MAP READING AND PLANNING ROUTES

Small Scale Situations
Worksheet X

Use the diagram to answer each of the following. Don’t forget the labels.

1. Find the distance between pt. C and pt. D.

2. Find the distance from pt. A to pt. E.


4. Using yours answers for #2 and #3, which route is best?

   Why?


7. Using your answers from #5 and #6, which route is best?

   Why?

8. If Carol wants to drive to pt. F from pt. E, which route should she take?

9. (Bonus) If Carol drives 45 mph, how much time will the best route take? (Hint: Write a proportion)
MAP READING AND PLANNING ROUTES

Small Scale Situations
Worksheet X

Use the diagram to answer each of the following. Don’t forget the labels.

1. Find the distance between pt. C and pt. D. 
   \[11.7 \text{ miles}\]

2. Find the distance from pt. A to pt. E. 
   \[27.3 \text{ miles}\]

   \[32.6 \text{ miles}\]

4. Using yours answers for #2 and #3, which route is best?
   Point A straight to point E
   Why? It is shorter

   \[28.5 \text{ miles}\]

   \[16.8 \text{ miles}\]

7. Using your answers from #5 and #6, which route is best?
   Point C to point D to point F
   Why? It is shorter

8. If Carol wants to drive to pt. F from pt. E, which route should she take? Point E to point D to point F

9. (Bonus) If Carol drives 45 mph, how much time will the best route take? (Hint: Write a proportion) \[0.4 \text{ hours or } 24 \text{ minutes}\]
MAP READING AND PLANNING ROUTES
Real Map Situations

PURPOSE: Students should be able to read distances on a real map. Students should be able to find shortest, most convenient routes. Students should understand some benefits and drawbacks of highway system.

PREREQUISITE SKILLS: Ability to use scales and proportions; ability to choose the best route

MATERIALS: Highway maps of Indiana, examples of map legends

DEVELOPMENT AND METHODS:
A. Activate background knowledge.
   1. Discuss topic of previous lesson.
   2. Lead into use of real maps instead of others used in class.
B. Discuss a real map.
   1. Look at a real road map of Indiana noting roads are not between every city.
   2. Point out state and county roads usually form a grid.
      a. This provides an organized system that is easy to understand.
      b. This also provides as many routes as possible without having roads everywhere.
   3. Discuss the benefits of this system.
      a. The routes are not as boring. Curves in the road require drivers to be more alert. This means drivers should not fall asleep as easily. Also, drivers and their passengers may choose the most scenic route.
      b. Roads are built where they are needed based on the amount of traffic that goes by.
      c. Interstate highways have higher speed limits.
      d. They have very few if any stoplights or signs.
      e. These highways are wider and usually well maintained.
   4. Discuss drawbacks of the system.
      a. Routes must be planned before beginning a trip so as not to waste gas or time going out of your way.
      b. Some direct routes include state roads.
         (1) These roads are not as well maintained as
interstate highways.

(2) These roads have lower speed limits.
(3) These roads have stop signs and lights and go through small towns. This means more stopping.

c. There is usually no direct route from where you are to where you want to go.

5. Sample situation - The drive from Gary to Muncie can be done several ways. Each way uses different types of roads. Find one of these ways.
a. I-65, I-465, I-69
c. U.S. 30, I-69
d. I-65, S.R. 26, I-69

C. Discuss map legends.
1. The legend is the box that explains all the symbols. (Show actual examples.)

2. Most maps have different types of roads in different colors and types of lines.
a. multilane, divided highway
b. 2 lane, paved
c. county road
d. toll road

3. Most maps have a variety of symbols that are used to represent things like hospitals, airports, parks, universities, small towns, large towns, and big cities. (Show examples of some of these symbols.)

4. Maps must also have a scale describing (like the car models) the proportion between the map and the land. It is usually in inches to miles.
a. If 1/4 in. represents 60 miles, then how many miles does 3/4 in. represent? 1/4 in. = 60 miles
   \[ \frac{3}{4} \text{ in.} \] ? miles
   \[ \Rightarrow \frac{3}{4} \times 60 = 45 \]
   \[ \Rightarrow 45 \div \frac{1}{4} = 180 \text{ miles} \]
b. Suppose 1.5 in. represents 25 miles, how many inches would 80 miles be on the map? 1.5 in. = 25 miles
   \[ ? \text{ in.} \]
   \[ \Rightarrow 1.5 \times 80 = 120 \]
   \[ \Rightarrow 120 \div 25 = 4.8 \text{ in.} \]
D. Many maps also include a grid system for locating points of interest.
   1. The left and right edges may be lettered A to whatever and the top and bottom edges may be numbered 1 to whatever.
   2. To find a city from a given coordinate of B5:
      a. Locate the B row.
      b. Look across map until the 5 column.
      c. The city should be in this B5 area.

E. Involve the students in a classroom activity.
   1. Divide the class into groups of three or four for a group activity.
   2. Have students use maps to answer a worksheet of questions.
   3. Should have several maps available so that each group has access to one.

ASSIGNMENT: Classroom activity using Worksheet XI or some other map activity. (May need to explain map legends used in class activity.)

Use a map of the state of Indiana to answer the following.

1. Find a route from your hometown to Indianapolis.

2. How long is this route?

3. Find the letter-number coordinates for Evansville.

4. Find Rushville and Connersville. How far apart are these two towns?

5. What U.S. Route runs North and South of Kokomo?

6. Find Tipton and Frankfort. How many miles apart are they?

7. What special symbols are around Greencastle?

8. What state park is near Mitchell?

9. How many miles away from I-69 is Huntington?

10. In which county is Muncie located?
MAP READING AND PLANNING ROUTES

NAME_KEY

Real Map Situation
Worksheet XI

Use a map of the state of Indiana to answer the following. MOST ANSWERS WILL VARY

1. Find a route from your hometown to Indianapolis.

2. How long is this route?

3. Find the letter-number coordinates for Evansville.

4. Find Rushville and Connersville. How far apart are these two towns?

5. What U.S. Route runs North and South of Kokomo?

6. Find Tipton and Frankfort. How many miles apart are they?

7. What special symbols are around Greencastle?

8. What state park is near Mitchell?
   Spring Mill State Park

9. How many miles away from I-69 is Huntington?

10. In which county is Muncie located?
    Delaware County
MAP READING AND
PLANNING ROUTES
Quiz III

Small Scale Situation
Use the diagram to answer each of the following. Don't forget the labels.

1. Find the distance between pt. R and pt. T.
2. Find the distance from pt. R to pt. F through pt. A.
3. Find the distance from pt. R to pt. F through pt. Y.
4. Using your answers for #2 and #3, which route is best? ________________________ Why? ________________________
5. If someone wanted to drive from pt. F to pt. C, which route would be the best choice? ________________________ How long is this route? ________________________

Real maps
Match the symbol with the appropriate item.

6. [ ] _______ a. county road
7. [ ] _______ b. campground
8. [ ] _______ c. multilane, divided hwy
9. [ ] _______ d. airport
10. [ ] _______ e. park
11. [ ] _______ f. 2 lane, paved road
12. [ ] _______ g. hospital
MAP READING AND PLANNING ROUTES
Quiz III

Small Scale Situation
Use the diagram to answer each of the following. Don’t forget the labels.

1. Find the distance between pt. R and pt. T.
   8.5 miles
2. Find the distance from pt. R to pt. F through pt. A.
   14.3 miles
3. Find the distance from pt. R to pt. F through pt. Y.
   13 miles
4. Using your answers for #2 and #3, which route is best?
   Pt. R to Pt. Y to Pt. F
   Why? It’s shorter
5. If someone wanted to drive from pt. F to pt. C, which route would be the best choice?
   Pt. F to Pt. Y to Pt. C
   How long is this route? 19.7 miles

Real maps
Match the symbol with the appropriate item.

6. [ ] g
   a. county road
7.  d
   b. campground
8.  e
   c. multilane, divided hwy
9.  a
   d. airport
10.  c
    e. park
11.  f
    f. 2 lane, paved road
12.  b
    g. hospital
CHART READING
Estimated Range and Engine Displacement

PURPOSE: Students should learn how to use a chart to find information, should be able to compare information on charts, should be able to find useful information from charts, and should be able to verify some information on a chart. Students should become familiar with the volume of a cylinder. Students may have fun using the calculator.

PREREQUISITE SKILLS: Ability to convert millimeters to centimeters; familiarity with π (pi); calculator skills; knowledge of the previous lesson on compression ratio, which includes the terms compression stroke, piston, and cylinder

MATERIALS: Charts comparing car information (provided); calculators

DEVELOPMENT AND METHODS:
A. Discuss need for understanding charts.
   1. Reader may be misled with false interpretation.
   2. Not every chart in a newspaper is a good one. It may not use the proper information to support an article's statements.

B. Estimated Range
   1. To find the estimated range, the distance a car is able to travel, of a car on one tank of gas:
      a. Locate the fuel capacity of the car's gas tank.
      b. Locate the gas mileage (mpg) for city or highway driving.
      c. Multiply fuel capacity (gallons) by gas mileage.
         Fuel capacity (gal.) x Gas mileage (mpg) = Estimated range (miles).
   2. Example:
      a. fuel capacity = 22.5 gallons
      b. city/hwy mpg = 16/22 mpg
      c. 22.5 gal. x 16 mpg = 360 miles (city)
         22.5 gal. x 22 mpg = 295 miles (hwy)
   3. Students can verify the chart's figures with their calculations.

C. Displacement
   1. Description - An engine's displacement is how many cubic inches (or cubic cm) of fuel that the pistons would push out of the cylinders if they could. We know from before that the
2. Information needed to find displacement. Displacement is a measurement of volume, so we need the dimensions of the filled cylinders before and after the compression stroke. (May need to review the compression stroke.)
   a. the area of the Bore (the base of the cylinder)
   b. the Stroke (the height of the cylinder)
   c. the number of cylinders in the engine

![Diagram of engine cylinder with bore and stroke]

3. Demonstrate how to find displacement (use a chart example).
   a. The chart shows a bore x stroke in in./mm.
      
      \[3.66 \times 3.26/93.0 \times 82.7\]
   b. Divide the bore number by 2.
      \[3.66 \div 2 = 1.83 \text{ in.}\]
   c. Square the result (multiply by itself).
      \[1.83 \times 1.83 = 3.3489 \approx 3.35\]
   d. Multiply this result by \(\pi\) (pi).
      \[3.35 \times \pi = 10.52\]
   e. This is the area of the bore.
   f. Multiply the area of the bore by the stroke.
      \[10.52 \times 3.26 = 34.298 \text{ (cubic inches)}\]
   g. This is the displacement of one cylinder.
   h. Multiply the displacement of one cylinder by the number of cylinders in the engine.
      \[34.298 \times 8 \text{ cylinders} = 274.38 \text{ (cubic inches)}\]
   i. This end result is the engine's displacement. Be sure to use the correct units (inches or cm) in every step.
j. Answer can be rounded to the nearest whole number.
k. Verify answer with the chart's figure.

4. This procedure is much like finding the volume of a cylinder in geometry. The formula is $V = \pi r^2 h$.

5. When people talk about cars having "a 302", "a 5.7 liter", or "a 2300", they are referring to the engine displacement.
a. "302" - The engine has 302 cubic inches of displacement.
b. "5.7 liter" - The engine has 5.7 liters of displacement.
c. "2300" - The engine has 2300 cubic cm of displacement.

ASSIGNMENT: Worksheet XII


Use the given charts of information to answer the following. Round answers to the nearest tenth.

1. The chart shows the estimated range of the Pontiac to be 429 miles. Is this range found from city or highway mileage?

2. The chart shows the Ford to have a 331-mile estimated range for city mileage. What two numbers are needed to get that figure?

3. If the Dodge Spirit R/T had a larger fuel tank, would its estimated range increase or decrease? Check your answer by using a larger and a smaller number of gallons than the fuel capacity listed to find the estimated range.

4. What is the bore of the Pontiac in inches? ________________
in mm? ________________ in cm? ________________

5. What is the area of the bore of the Pontiac in square inches?
   ________________

6. What is the stroke of the Pontiac's engine in inches?
   ________________

7. What is the displacement of one cylinder in the Pontiac (in cubic inches)?
   ________________

8. How many cylinders does the Pontiac have?
   ________________

9. What is the Pontiac's total engine displacement in cubic inches?
   ________________

10. What is the bore of the Nissan's engine in mm? ________________ in cm? ________________
11. What is half the bore in cm? 

12. What is the area of the bore in square cm? 

13. What is the stroke of the Nissan’s engine in cm? 

14. What is the displacement of one cylinder? 

15. How many cylinders are in this engine? 

16. What is the Nissan engine’s displacement? (Answer must be to the nearest tenth) 

17. The formula for finding a car’s estimated range (in words) is... 

18. The formula for finding one cylinder’s displacement is... 

19. To find the area of the bore, use this formula...

\[(\frac{\text{bore diameter}}{2})^2 \times \text{bore length} = \text{Area of Bore}\]
Use the given charts of information to answer the following. Round answers to the nearest tenth.

1. The chart shows the estimated range of the Pontiac to be 429 miles. Is this range found from city or highway mileage?
   Highway

2. The chart shows the Ford to have a 331-mile estimated range for city mileage. What two numbers are needed to get that figure?
   18 mpg and 18.4 gals

3. If the Dodge Spirit R/T had a larger fuel tank, would its estimated range increase or decrease? Check your answer by using a larger and a smaller number of gallons than the fuel capacity listed to find the estimated range.
   Increase

4. What is the bore of the Pontiac in inches? 3.62 inches
   in mm? 92.0 mm
   in cm? 9.2 cm

5. What is the area of the bore of the Pontiac in square inches?
   10.29 sq inches

6. What is the stroke of the Pontiac's engine in inches?
   3.31 inches

7. What is the displacement of one cylinder in the Pontiac (in cubic inches)?
   34.1 cu inches

8. How many cylinders does the Pontiac have?
   6 cylinders

9. What is the Pontiac's total engine displacement in cubic inches?
   204.4 cu inches

10. What is the bore of the Nissan's engine in mm? 87.0 mm
    in cm? 8.7 cm
11. What is half the bore in cm? 4.35 cm
12. What is the area of the bore in square cm? 59.45 sq cm
13. What is the stroke of the Nissan’s engine in cm? 8.3 cm
14. What is the displacement of one cylinder? 493.4 cu cm
15. How many cylinders are in this engine? 6 cylinders
16. What is the Nissan engine’s displacement? (Answer must be to the nearest tenth) 2960.4 cu cm
17. The formula for finding a car’s estimated range (in words) is...
   fuel capacity x miles per gallon = estimated range
18. The formula for finding one cylinder’s displacement is...
   area of bore x stroke = cylinder displacement
19. To find the area of the bore, use this formula...
   \[ \left( \frac{\text{bore}}{2} \right)^2 \times \pi = \text{Area of Bore} \]
## General

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Dodge Spirit R/T</th>
<th>Ford Taurus SHO</th>
<th>Pontiac Grand Prix STE</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-dr, 5-pass.</td>
<td>Front engine/ front drive</td>
<td>Front engine/ front drive</td>
<td>Front engine/ front drive</td>
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<tr>
<td>Base price</td>
<td>$17,820</td>
<td>$22,740</td>
<td>$19,984</td>
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<td>Price as tested</td>
<td>$19,849</td>
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<td>Overhead convenience package, $363; power door locks, $245; power driver's seat, $296; premium cassette upgrade, $490; destination, $465; discounts, $50</td>
<td>Preferred equipment package 211, $1224; leather seating surfaces, $489; power moonroof, $776; Ford JBL audio system, $528; CD, $491; clearance paint, $186; California emissions, $100; destination, $480; discounts, $500; power seat delete, $48</td>
<td>Twin Cam Cam V-6, $995; transmission oil cooling, $75; California emissions, $100; destination, $505</td>
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## Engine

<table>
<thead>
<tr>
<th>Type</th>
<th>Inline 4, liquid cooled, cast iron block, cast aluminum head</th>
<th>80° V-8, liquid cooled, cast iron block, cast aluminum heads</th>
<th>80° V-8, liquid cooled, cast iron block, cast aluminum heads</th>
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</thead>
<tbody>
<tr>
<td>Bore x stroke, in/mm</td>
<td>3.44 x 3.62/ 87.5 x 92.0</td>
<td>3.50 x 3.15/ 82.0 x 80.0</td>
<td>3.62 x 3.31/ 92.0 x 84.0</td>
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<tr>
<td>Displacement, ci/cc</td>
<td>135/2213</td>
<td>182/2986</td>
<td>204/3350</td>
</tr>
<tr>
<td>Compression ratio</td>
<td>7.8:1</td>
<td>9.6:1</td>
<td>9.3:1</td>
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<td>Valve gear</td>
<td>DOHC, 4 valves per cylinder, turbo/intercooled</td>
<td>DOHC, 4 valves per cylinder</td>
<td>DOHC, 4 valves per cylinder</td>
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<td>Fuel/induction system</td>
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<td>EFI</td>
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<tr>
<td>Horsepower, hp @ rpm, SAE net</td>
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<td>220 @ 5200</td>
<td>200 @ 5200</td>
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<tr>
<td>Torque, lb-ft @ rpm, SAE net</td>
<td>217 @ 2800</td>
<td>200 @ 4800</td>
<td>215 @ 4000</td>
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<td>Horsepower/liter</td>
<td>101.2</td>
<td>73.7</td>
<td>58.7</td>
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<td>Redline, rpm</td>
<td>6500</td>
<td>7000</td>
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<td>Recommended fuel</td>
<td>Unleaded premium</td>
<td>Unleaded premium</td>
<td>Unleaded regular</td>
</tr>
</tbody>
</table>

## Dimensions

| Wheelbase, in/mm      | 103.5                                                      | 106.0/2683                   | 107.5/2730                              |
| Track, in/mm          | 57.8/57.2/1463/1453/61.8/60.5/1565/1537/59.5/58.0/1512/1472 | 61.8/60.5/1565/1537/59.5/58.0/1512/1472 |
| Length, in/mm         | 181.2                                                      | 168.4/4786                   | 194.5/4941                              |
| Width, in/mm          | 68.1/1731                                                  | 70.9/1789                    | 71.9/1825                               |
| Height, in/mm         | 53.8/1358                                                  | 54.1/1374                    | 54.8/1391                               |
| Ground clearance, in/mm | 4.5/118                                                  | 5.5/130                      | 5.9/149                                 |
| Curb weight, lb       | 3086                                                       | 3608                        | 3607                                     |
| Weight distribution, lb | 63/37                                               | 63/37                       | 66/34                                    |
| Cargo capacity, cu ft | 14.4                                                      | 17.0                        | 15.5                                     |
| Fuel capacity, gal    | 14.0                                                      | 18.4                        | 16.5                                     |
| Weight/power ratio, lb/hp | 13.8                                               | 16.4                        | 17.2                                     |

## Fuel Economy

<table>
<thead>
<tr>
<th>EPA city/hwy., mpg</th>
<th>19/27</th>
<th>18/26</th>
<th>17/26</th>
</tr>
</thead>
<tbody>
<tr>
<td>Est. range, city/hwy., miles</td>
<td>286/378</td>
<td>331/478</td>
<td>281/429</td>
</tr>
<tr>
<td></td>
<td><strong>Dodge Stealth ES</strong></td>
<td><strong>Nissan 300ZX 2+2</strong></td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>---------------------</td>
<td>---------------------</td>
<td></td>
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<tr>
<td>Importer</td>
<td>Chrysler Motors</td>
<td>Nissan Motor Corp., USA, Gardena, Calif.</td>
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<tr>
<td>Body style</td>
<td>2-door, 4-passenger</td>
<td>2-door, 4-passenger</td>
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<td>Drivetrain layout</td>
<td>Front engine/front drive</td>
<td>Front engine/rear drive</td>
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<td>$21,866</td>
<td>$33,640</td>
<td></td>
</tr>
<tr>
<td>Options included</td>
<td>Air conditioning, S846; Option Group D (includes power locks/windows, cruise control, rear wiper/washer, Ultimate Sound system, ABS, anti-theft, floormats), $2438; destination, $328</td>
<td>Leather package (includes leather seating surfaces, power driver's seat), $1500; driver-side airbag, $500; California emissions, $70; destination, $300</td>
<td></td>
</tr>
</tbody>
</table>

### ENGINE

<table>
<thead>
<tr>
<th></th>
<th><strong>60° V-8, liquid cooled, cast iron block, cast aluminum heads</strong></th>
<th><strong>60° V-8, liquid cooled, cast iron block, cast aluminum heads</strong></th>
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</thead>
<tbody>
<tr>
<td>Bore x stroke, in./mm</td>
<td>3.59 x 3.89/91.1 x 99.0</td>
<td>3.43 x 3.28/87.0 x 83.0</td>
</tr>
<tr>
<td>Displacement, ci/cc</td>
<td>181/2672</td>
<td>181/2672</td>
</tr>
<tr>
<td>Compression ratio</td>
<td>10.0:1</td>
<td>10.5:1</td>
</tr>
<tr>
<td>Valve gear</td>
<td>DOHC, 4 valves per cylinder</td>
<td>DOHC, 4 valves per cylinder</td>
</tr>
<tr>
<td>Fuel/induction system</td>
<td>EFI</td>
<td>EFI</td>
</tr>
<tr>
<td>Horsepower, hp @ rpm, SAE net</td>
<td>222 @ 6000</td>
<td>222 @ 6400</td>
</tr>
<tr>
<td>Torque, lb/ft @ rpm, SAE net</td>
<td>201 @ 4500</td>
<td>198 @ 4800</td>
</tr>
<tr>
<td>Horsepower/tier</td>
<td>74.7</td>
<td>75.0</td>
</tr>
<tr>
<td>Redline, rpm</td>
<td>7000</td>
<td>7000</td>
</tr>
<tr>
<td>Recommended fuel</td>
<td>Unleaded premium</td>
<td>Unleaded premium</td>
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</table>

### DIMENSIONS

<table>
<thead>
<tr>
<th></th>
<th><strong>Wheelbase, in./mm</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>97.2/2470</td>
</tr>
<tr>
<td></td>
<td>101.2/2570</td>
</tr>
<tr>
<td>Track, in./mm</td>
<td>61.4/62.2/1560/1580</td>
</tr>
<tr>
<td>Length, in./mm</td>
<td>178.9/4545</td>
</tr>
<tr>
<td>Width, in./mm</td>
<td>72.4/1840</td>
</tr>
<tr>
<td>Height, in./mm</td>
<td>49.1/1247</td>
</tr>
<tr>
<td>Ground clearance, in./mm</td>
<td>4.1/104</td>
</tr>
<tr>
<td>Tilt's curb weight, lb</td>
<td>3292</td>
</tr>
<tr>
<td>Weight distribution, t/r</td>
<td>81/39</td>
</tr>
<tr>
<td>Cargo capacity, cu ft</td>
<td>11.0</td>
</tr>
<tr>
<td>Fuel capacity, gal</td>
<td>19.8</td>
</tr>
<tr>
<td>Weight/power ratio, lb/hp</td>
<td>14.8</td>
</tr>
</tbody>
</table>

CHART READING
Quiz IV

Estimated Range
1. Beth's new car gets 26.3 mpg. It also has a 11.7-gallon tank. What is the estimated range of Beth's car?

<table>
<thead>
<tr>
<th></th>
<th>city mpg</th>
<th>hwy mpg</th>
<th>fuel (gal.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beth's</td>
<td>26.3</td>
<td>28.7</td>
<td>11.7</td>
</tr>
</tbody>
</table>

2. If Beth's car had a smaller fuel tank, would its estimated range increase or decrease?

3. Joel bought a car that can get 23.8 mpg on the highway. This car has a 15-gallon fuel tank. What is the estimated range for Joel's car?

4. A car's estimated range is given to be 312 miles. If it has a 12.5-gallon fuel tank, what is its average number of miles per gallon?

Engine Displacement
Use the chart on the other page to answer these questions to the nearest hundredth.

5. What is the bore in inches of the Ford Taurus SHO?

6. What is the area of the bore in sq. in.?

7. What is the stroke of the Ford?

8. What is the displacement of one cylinder in cubic in.?

9. How many cylinders does the Ford have?

10. What is the total engine displacement of the Ford Taurus SHO?
11. What is the bore in mm of the Dodge Stealth ES? in cm?

12. What is the area of the bore in sq. cm?

13. What is the stroke of this car's engine in mm? in cm?

14. What is the cylinder displacement in cubic cm?

15. How many cylinders are in the Stealth's engine?

16. What is the engine displacement in cubic cm?

Need some help?

Area of Bore = \((\text{Bore}/2)^2 \times \pi\)

Cylinder Displacement = Area of Bore \times \text{Stroke}

Engine Displacement = Cylinder Displacement \times \text{Number of Cylinders}
Estimated Range

1. Beth's new car gets 26.3 mpg. It also has a 11.7-gallon tank. What is the estimated range of Beth's car? 307.7 miles

<table>
<thead>
<tr>
<th></th>
<th>city</th>
<th>hwy</th>
<th>fuel (gal.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beth's</td>
<td>26.3</td>
<td>28.7</td>
<td>11.7</td>
</tr>
</tbody>
</table>

2. If Beth's car had a smaller fuel tank, would its estimated range increase or decrease? decrease

3. Joel bought a car that can get 23.8 mpg on the highway. This car has a 15-gallon fuel tank. What is the estimated range for Joel's car? 357 miles

4. A car's estimated range is given to be 312 miles. If it has a 12.5-gallon fuel tank, what is its average number of miles per gallon? 24.96 mpg or 25 mpg

Engine Displacement

Use the chart on the other page to answer these questions to the nearest hundredth.

5. What is the bore in inches of the Ford Taurus SHO? 3.50 in.

6. What is the area of the bore in sq. in.? 9.62 sq in.

7. What is the stroke of the Ford? 3.15 in.

8. What is the displacement of one cylinder in cubic in.? 30.31 cu. in.

9. How many cylinders does the Ford have? 6 cylinders

10. What is the total engine displacement of the Ford Taurus SHO? 181.84 cu. in.
11. What is the bore in mm of the Dodge Stealth ES? 
   in cm?  
   91.1 mm  
   9.11 cm

12. What is the area of the bore in sq. cm? 
   65.18 sq cm

13. What is the stroke of this car's engine in mm? 
   in cm?  
   76 mm  
   7.6 cm

14. What is the cylinder displacement in cubic cm?  
   495.38 cu cm

15. How many cylinders are in the Stealth's engine? 
   6 cylinders

16. What is the engine displacement in cubic cm? 
   2972.29 cu cm

Need some help?

Area of Bore = \((Bore/2)^2 \times \pi\)
Cylinder Displacement = Area of Bore \times Stroke
Engine Displacement = Cylinder Displacement \times Number of Cylinders
LOGIC

PURPOSE: Students should practice logical thinking. Students should learn strategies for solving logic problems. Students may enjoy these logic puzzles.

PREREQUISITE SKILLS: Average reading ability

MATERIALS: An overhead projector, transparencies of the logic problems

DEVELOPMENT AND METHODS:
A. Introduce with a discussion on logical thinking.
   1. Describe to students the importance of logical thinking.
      (It can help people solve everyday problems.)
   2. Offer examples of characters which use logic.
      a. Spock from Star Trek
      b. Sherlock Holmes
      c. police detectives
      d. others?
   3. Point out that answers to problems, even solutions to crimes, can be found using logical deductions.

B. Solve the first logic problem.
   1. Read it together in class.
   2. Can have students work in groups to share reasonings and deductions.
   3. Ask students if they are writing anything on paper to help find the solution.
   4. Suggest that a chart or a number of charts might help.
      \[
      \begin{array}{ccc}
      & x & y & z \\
      a & & & \\
      b & & & \\
      c & & & \\
      \end{array}
      \]
   5. Discuss helpful clues.
      a. What else is given besides the obvious?
      b. What matches can be eliminated?
   6. Discuss helpful strategies and solution.
      a. A grid usually works best.
         (1) fill in information
         (2) cross out "can't be's"
      b. Suggest reading through the clues several times.
c. Ask which item students solved first.
d. Ask how known pieces of the puzzle help solve (eliminate) other parts.
e. Solution - Kathey rented the red car; John rented the white one; Melissa rented the blue car; and Brian rented the green car.

<table>
<thead>
<tr>
<th></th>
<th>Red</th>
<th>Green</th>
<th>Blue</th>
<th>White</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kathey</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>John</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>Melissa</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Brian</td>
<td>no</td>
<td></td>
<td>no</td>
<td>no</td>
</tr>
</tbody>
</table>

C. Solve the second logic problem.
1. Again discuss strategies to help find solution.
   a. A grid again seems to work best.
      (1) a row for each person
      (2) a column for each car
   b. Read the clues one at a time.
   c. Mark logical deductions onto grid.
   d. Re-read clues several times.
   e. Look for hidden clues.
2. Allow students to discuss clues, deductions, and ideas.
3. Solution - Louise bought the Jaguar; Marie bought the Ferrari; Ralph bought the Acura; John bought the Renault; and Betty bought the BMW.

D. Solve the third logic problem.
1. Discuss strategies.
   a. Ask students if a square grid will work here. Ask if it will be enough.
   b. How many items must be matched? Three (But a square only has two dimensions)
   c. In this case, more than one square grid or a combined grid might work.
      (1) a row for each person
      (2) a column for each car and for each color
      (3) a row for each color to match each car
      (4) Explain usage.
2. Discuss clues.
   a. Ask why order of rentals is important.
   b. Remind students to read whole sentence.
c. Have students/groups share deductions.

3. Solution - Amy has the blue hatchback; Claude has the yellow sedan; Susan has the gray convertible; and Tom has the red station wagon.

<table>
<thead>
<tr>
<th></th>
<th>conv.</th>
<th>h.b.</th>
<th>sedan</th>
<th>st. w.</th>
<th>red</th>
<th>blue</th>
<th>gray</th>
<th>ylw.</th>
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<tbody>
<tr>
<td>Amy</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>no</td>
<td>no</td>
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<tr>
<td>Claude</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Susan</td>
<td></td>
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<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
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</tr>
<tr>
<td>Tom</td>
<td></td>
<td>no</td>
<td>no</td>
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<td>no</td>
<td>no</td>
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<td></td>
</tr>
</tbody>
</table>

4. May choose to have students work on this as homework or carry over to next day.

E. If students show interest in doing more logic problems, find some more! Perhaps one per week or chapter could be arranged. Logic problems could be used as incentives for getting other work done and/or could be used for extra credit.

ASSIGNMENT: All or part of problem 3; any other available logic problem.

LOGIC PROBLEM 1

Four different people (Kathey, John, Melissa, and Brian) rented four different colored cars (red, green, blue, and white). Use these clues to determine who rented which car.

(1) A girl rented the blue car.

(2) Brian did not rent the white car.

(3) The person who rented the white car washed it with his friends.

(4) Kathey rented the red sports car.
LOGIC PROBLEM 2

Louise, Marie, Ralph, John, and Betty each bought a different brand of car (Ferrari, BMW, Acura, Jaguar, and Renault). Betty and Ralph will meet the people who bought the Jaguar and the Renault next week. The person who bought the Ferrari and Betty each would rather have bought the Acura. Louise did not buy the Ferrari, nor did the two men. John and the person who bought the Jaguar think the person who bought the Ferrari is frugal. Who bought what?

LOGIC PROBLEM 3

Tom, Susan, Claude, and then Amy (in that order) came to rent the last few cars at Bugle Rent-A-Car. There was one of each model available: a convertible, a hatchback, a sedan, and a station wagon. There was a red car, a blue car, a gray car, and a yellow car. Use the clues to match the color and model of the car with the person who rented it.

1. Amy did not want the hatchback, but she did not have a choice.
2. After Tom left, he wished he had rented the blue car or the convertible.
3. When Susan left, the sedan was still there.
4. Susan rented either the gray car or the hatchback.
5. Claude rented the yellow car.

BIBLIOGRAPHY


