

6-7 NONROUTINE PROBLEMS CHOOSING A CAR

Jerry is going to borrow a vehicle from a family member. He has to pay for gas, so he wants to choose the car with the best gas mileage to travel to and from school 5 days per week. His school is 25 miles from his home. The car choices are below.

1. Jerry's grandfather said he could borrow his old compact car. His grandfather just took a trip to the beach and used about half the gas tank capacity. The round trip was 207 miles.
 - a. If the tank can hold 18 gallons of gas, how many gallons did Grandpa use?
9 gallons
 - b. How many miles per gallon did the car get?
23 mpg
 - c. Jerry's grandfather paid \$3.75 per gallon. How much did he pay for his beach trip?
\$33.75
 - d. How much gas (in gallons) will Jerry need daily for school using this car?
About 2.2 gallons per day
2. His mother said Jerry could use her old truck. It goes 525 miles on a tank of gas, and the tank has a capacity of 21 gallons.
 - a. How many miles per gallon does the truck get?
25 mpg
 - b. Jerry's mom filled the gas tank for \$71.40. What is the current price of gas (per gallon)?
\$3.40 per gallon
 - c. How much gas (in gallons) will Jerry use daily for school using this truck?
2 gallons per day

6-7 NONROUTINE PROBLEMS

CHOOSING A CAR

Continued

3. Jerry's older sister said he can use her van to get to school. She said the van goes about 400 miles on a tank of gas. The van's gas tank holds 25 gallons of gas.

- How many miles per gallon does the van get?
16 mpg
- Jerry's sister said she bought a tank of gas the other day for \$81.25. How much did she pay per gallon?
\$3.25 per gallon
- How much gas (in gallons) will Jerry use daily for school with this van?
About 3.1 gallons per day

4. Based on the information above, which vehicle should Jerry use to go to school? Explain.
Probably his mom's truck. It gets the best mileage (25 mpg), so it will cost the least for gas.

6-7 NONROUTINE PROBLEMS

OPEN MIDDLE RATIO CHALLENGE

- Use the digits 1 – 9 at most once each to fill in the 9 missing cells on the entire page.
- Each table should contain equivalent ratios for each pair of entries in that table.
- Write column headings to make sense of each table's values, and explain the context.

Titles and contexts will vary. One example given for each.

1.

Number of Goals Scored	Number of Attempts
2	3
6	9
10	15
12	18

Context represented by the table:

Sunnie scored 2 goals for every 3 attempts.

2.

Number of Apples	Number of Oranges
7	5
14	10
28	20
42	30

Context represented by the table:

There are 7 apples for every 5 oranges in the bags.

3.

Cups of Lemon Juice	1	5	3	6	2
Cups of Water	4	20	12	24	8

Context represented by the table:

Ron used 1 cup of lemon juice for every 4 cups of water to make lemonade.

6-7 NONROUTINE PROBLEMS

ANIMALS CARD SORT

The next page is the Reproducible.

How much do some animals eat? What other fun facts might we learn? Your teacher will give you some cards to sort about animals. Work with one or more partners.

Cut out the cards. Identify the four animals and match cards to statements, tables, and fun facts about them.

Let d represent the number of days.

Let f represent an amount of food eaten per day.

1. Fill in the five columns of the chart. (Write card letters in columns II, III, and IV.)
Equations in Column V are in the form $f = \underline{\hspace{2cm}}$.

I	II	III	IV	V
Name of Animal	Table	Unit Rate (per day)	Fun Fact	Equation
Card A: bat	H	M	P	$f = 7,000d$
Card B: sun bear	E	J	R	$f = 60d$
Card C: anteater	G	K	N	$f = 30,000d$
Card D: giraffe	F	L	Q	$f = 75d$

2. Go to Desmos.com (<https://www.desmos.com/calculator>) and graph each of your equations above using the Desmos Graphing Calculator.

Answer the following using the graphs.

- Why is it difficult to see all of the graphs at one time?
If using the same scale, some values are very much more/less than others.
- Which animal's graph is the steepest line? Why is this true?
Anteater; it has the greatest unit rate (greatest increase per week, or per day)
- What does the point (0,0) represent for each animal?
No food eaten for 0 days.
- The graph of which animal intersects the point (3,180)? What does this ordered pair represent for this animal?
The Sun Bear eats 180 pounds of food in 3 days.

6-7 NONROUTINE PROBLEMS
REPRODUCIBLE: ANIMALS CARD SORT CARDS

Make single sided copy when distributing to partners/small groups.

<p>A A bat can eat up to 49,000 mosquitos in a week.</p>	<p>B A sun bear can eat up to 420 pounds of grapes in a week. It is one of their favorite foods.</p>																
<p>C An anteater eats about 60,000 ants and termites in two days. Impressive, because it's only awake 8 hours per day!</p>	<p>D A giraffe can eat up to 525 pounds of leaves in a week. Its favorite leaves are from acacia trees.</p>																
<p>E</p> <table border="1" data-bbox="213 713 768 868"> <tr> <td><i>d</i></td><td>14</td><td>2</td><td>10</td></tr> <tr> <td><i>f</i></td><td>840</td><td>120</td><td>600</td></tr> </table>	<i>d</i>	14	2	10	<i>f</i>	840	120	600	<p>F</p> <table border="1" data-bbox="882 713 1437 868"> <tr> <td><i>d</i></td><td>14</td><td>2</td><td>10</td></tr> <tr> <td><i>f</i></td><td>1,050</td><td>150</td><td>750</td></tr> </table>	<i>d</i>	14	2	10	<i>f</i>	1,050	150	750
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<p>J This animal eats 60 pounds of food per day.</p>	<p>K This animal consumes 30,000 insects per day.</p>																
<p>L This animal eats 75 pounds of food daily.</p>	<p>M This animal eats 7,000 insects each day.</p>																
<p>N These animals have tongues that can extend up to two feet long, but they have no teeth!</p>	<p>P These creatures can see in the dark and are the only mammal capable of sustained flight.</p>																
<p>Q These animals are the tallest land animals, can survive 2 – 3 days without water, and can reach speeds of 60 km/hr</p>	<p>R These mammals climb trees and make nests in them.</p>																

6-7 NONROUTINE PROBLEMS

WHAT'S MY RULE?

Some students in Mrs. Lovelace's math class were creating input/output tables but didn't finish. For each table:

- Determine the pattern started and complete the table.
- Fill in one more input/output of your choice at the bottom of the table.
- Write the rule in words for all problems describing the inputs and outputs; also write the rule in symbols for problems 3 and 4.

Accept all answers that are properly justified. Examples provided below.

1.

Input	Output
math	4
pattern	7
equation	8
dependent	9
independent	11
factor	6

Rule: Each input is a mathematical word. Each output is the number of letters in the input.

2.

Input	Output
finding	g
patterns	q
is	j
really	s
neat	o
dude	e

Rule: Each input is a word that is part of a silly phrase about finding patterns. Each output is the letter in the alphabet that follows the first letter of the input.

3.

Input (x)	Output (y)
2	1
8	4
12	6
7	3.5
4.5	2.25
1	0.5

Rule: Each input is a number. Each output is half the input; $y = 0.5x$

4.

Input (x)	Output (y)
3	1
12	4
15	5
30	10
1	$\frac{1}{3}$
2	$\frac{2}{3}$

Rule: Each input is a number. Each output is one-third the input; $y = \frac{1}{3}x$

6-7 NONROUTINE PROBLEMS MIXED PROBLEMS

1. The table to the right shows the speed of the T-shirt launchers at a hockey game. Who launched the most T-shirts per minute?

- a. Amir
- b. Betto
- c. Chuck
- d. Danisha

T-shirt Launcher	Number of Shirts Launched	Time (Minutes)
Amir	50	10
Betto	54	12
Chuck	22	5
Danisha	42	8

2. The table below shows the relationship between the number of gallons of gas purchased and its price at a gas station. Fill in the missing values to complete the table.

Price (\$)	3.20	16	22.40	28.80	32
Amount of gas (gal)	1	5	7	9	10

3. At the local zoo the caretakers cut and prepare 1,200 pounds of bamboo for the pandas each week. At this rate, select all of the following that must also be true.

- a. The amount of bamboo for a month (4 weeks) is 4,800 pounds
- b. The amount of bamboo for a day is about 171 pounds.
- c. The amount of bamboo for a day is about 240 pounds.
- d. The amount of bamboo for a year is about 14,400 pounds.

4. Jerome biked 16 miles in 4 hours. Susan biked 18 miles in 6 hours. Both biked at constant rates of speed.

a. Represent each person's trip with a graph.

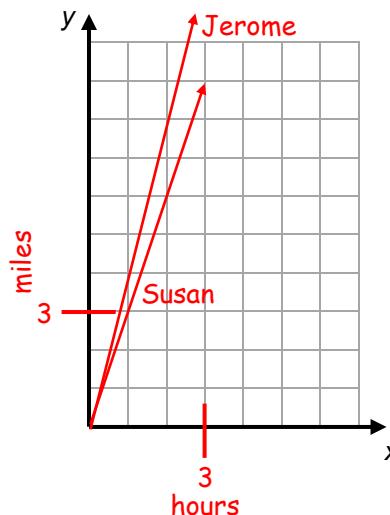
b. How far did each person go in 1 hour?

Unit rate for Jerome (1,4) \rightarrow Jerome biked 4 mph

Unit rate for Susan (1,3) \rightarrow Susan biked 3 mph

c. What about the lines graphed suggest that they are not going at the same speed?

Jerome's line is steeper, showing that he covered more distance over time (more miles each hour).



6-7 NONROUTINE PROBLEMS
MIXED PROBLEMS
Continued

5. Kris is buying pinto beans. She went to the store and found three options.

- The dry pinto beans cost \$1.80 and serves 12. How much is the cost per serving?
\$0.15 per serving
- The national-brand canned pinto beans cost \$1.80 and serves 4. How much is the cost per serving?
\$0.45 per serving
- The store-brand canned pinto beans cost \$1.20 and serves 4. How much is the cost per serving?
\$0.30 per serving
- What is the same and what is different about part a and part b?
The cost is the same, but the number of servings is different.
- What is the same and what is different about part b and part c?
The amount served is the same, but the cost is different.
- Which type of pinto beans are the cheapest? Explain.
Dry pinto beans are the cheapest (cost the least per serving).

6. An ostrich can run 21 miles in 30 minutes.

- Knowing ostriches can keep their pace over enormous distances, how long would it take an ostrich to run 31.5 miles? **45 minutes**
- At this rate, how far could an ostrich run in 2 hours? **84 miles**

7. A store sells 4 avocados for \$5. Based on this rate, which of the following statements are true?

- The cost of an avocado is \$0.80.
- Each avocado is \$1.25. **(Circled)**
- The amount of avocado for \$1 is 0.8 lb.
- The amount of avocado for \$1 is 1.25 lbs.

6-7 NONROUTINE PROBLEMS
MIXED PROBLEMS
Continued

8. A local vendor at the Farmer's Market sells peaches for \$9 per 3 pounds.

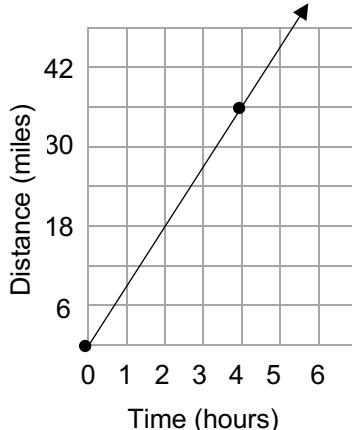
- How much are the peaches per pound? **\$3.00**
- If the average peach weighs 5 ounces, how many peaches can you get per pound? (There are 16 ounces in a pound.) **About 3 peaches**
- About how much will each peach cost? **About \$1.00**

9. This graph shows the relationship between the number of miles Jesse rode his bike and the amount of time elapsed.

- What does (0,0) represent in this situation?
0 miles traveled in 0 hours
- How many miles does Jesse travel per hour? Explain.
He travels 9 miles per hour. The ordered pair (4,36) means he travels 36 miles in 4 hours. The unit rate is the value $\frac{36}{4} = 9$.
- How far does Jesse travel in 6 hours?
54 miles

10. The table below shows the relationship between the number of burgers and the number of hot dogs sold from a food truck. Fill in the missing values if the ratio of burgers to hotdogs remains constant. Then select all of the statements below that are true.

Burgers	25	5	10	20	15	30
Hot Dogs	10	2	4	8	6	12
a.	More hot dogs than burgers were sold.					
b.	More burgers than hot dogs were sold.					
c.	For every 100 hot dogs sold, there were 40 burgers sold.					
d.	For every 100 burgers sold, there were 40 hot dogs sold.					
e.	For every burger sold, there were 2.5 hot dogs sold.					



6-7 NONROUTINE PROBLEMS FROM THE MATH OLYMPIAD

1. A group consists of 2 girls for every boy. Later, 24 more girls joined the group. There are now 5 girls for every boy. How many boys are in the group?

Suggestion: make a table and look for a pattern.

Number of boys	1	2	3	...	?
Number of girls (at first)	2	4	6	
Number of girls (later)	5	10	15	...	
Number of girls joining	3	6	9	...	24

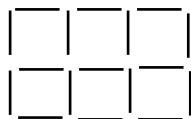
Comparing the fourth row to the first row, the number of boys is one-third the number of girls. Since 24 girls joined there must be 8 boys in the group.

2. Bryan can buy cookies at a rate of 4 for 50 cents and can sell them at a rate of 3 for 50 cents. How many cookies must Bryan sell in order to make a profit of \$5.00?

If he bought 12 cookies (LCM of 4 and 3), it would cost \$1.50 and he would earn \$2.00. That would be a profit of \$0.50. If he does this 10 times, $(10)(12 \text{ cookies}) = 120 \text{ cookies}$ and this is $10(\$0.50 \text{ profit})$

Therefore, he must buy and sell 120 cookies to make a \$5.00 profit.

3. In the diagram below, 17 toothpicks are used to form a 2-square by 3-square rectangle. How many toothpicks would be needed to form a 6-square by 8-square rectangle?



There would be 54 vertical toothpicks and 56 horizontal toothpicks, for a total of 110 toothpicks.