

Math 708

Mathematics in Teaching

Math 708 takes us into the classroom of Eva Reimer. Eva teaches grades 4 through 7 at Gruenfeld Christian School. She has seven boys and eleven girls in her classroom. Among Eva's students is Nancy Friesen, a Down syndrome child who spends her afternoons in Eva's classroom. Eva's co-teachers, Mary Bergen and Henry Klassen, teach the twenty-nine students in the other grades.

This is Eva's fourth year in the classroom. She boards with the John Dyck family because her home is 95 kilometers from school. Eva is an avid reader, and she enjoys teaching her students about the wonders of God's Creation. Although she has always known the Canadian prairies as home, Eva is interested in other parts of the world, such as Europe and Mexico where her Mennonite ancestors once lived.


Besides teaching mathematics to her students, Eva uses math in many other aspects of her work. Learn along with her as you work through this LightUnit. God may some day call you to be a teacher too.



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Introduce the LightUnit

Hand each student LightUnit 708. Read page 1 and discuss the theme of this LightUnit. The theme appears in story problems and in the blackboard illustrations throughout the LightUnit.



Lesson 1

Multiplying Variables With Exponents

Whenever we multiply a variable by itself, we simply write the variable as a base, then write the exponent which shows how many times the variable is a factor.

$10 \cdot 10 = 10^2$	$n \cdot n = n^2$
$10 \cdot 10 \cdot 10 = 10^3$	$n \cdot n \cdot n = n^3$
$10 \cdot 10 \cdot 10 \cdot 10 = 10^4$	$n \cdot n \cdot n \cdot n = n^4$

When multiplying several variables with exponents, we add the exponents.

$n^2 \cdot n^3$ means $(n \cdot n) \cdot (n \cdot n \cdot n)$ or n^{2+3} Simplified: n^5

Exponents show how many times the base is used as a factor. n is used as a factor 2 times + 3 times, for a total of 5 times.

If we replace the variable n with the number 10, you can see why this works.

$10^2 \cdot 10^3$ means $(10 \cdot 10) \cdot (10 \cdot 10 \cdot 10)$

Simplified: 10^5 means 100,000

Remember that a number or variable with no exponent is the same thing as a number or variable with an exponent of 1.

$n = n^1$ and $10 = 10^1$

Therefore, $n \cdot n^2 \cdot n^3$ means $n \cdot (n \cdot n) \cdot (n \cdot n \cdot n)$ or n^{1+2+3}

Simplified: $n \cdot n^2 \cdot n^3 = n^6$

REMEMBER

Adding and multiplying variables are not the same thing.

$n + n + n = 3n$
but
 $n \cdot n \cdot n = n^3$

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Multiplying Variables With Exponents

Lesson Preparation

- LightUnit 708 for each student

Working in the LightUnit

What's New?

➔ **Multiplying Variables With Exponents.** Whenever we multiply a variable by itself, we simply write the variable as a base, then write the exponent which shows how many times the base is a factor. For example, $n \cdot n = n^2$, and $n \cdot n \cdot n = n^3$. But when multiplying several like variables that already have exponents, we add the exponents together to simplify the expression. For example, $n^2 \cdot n^3$ means $(n \cdot n) \cdot (n \cdot n \cdot n)$, or n^5 . Instead of writing out the full solution to multiply variables with exponents, just mentally add the exponents and keep the base. Think: $n^{(2+3)} = n^5$

Lesson 1

Simplify the expressions. Watch the signs!

- | | | | |
|--|----------------------------|-------------------------------------|--------------------------|
| 1. a. $x \cdot x \cdot x \cdot x$
x^4 | b. $x + x + x + x$
$4x$ | c. $y^2 \cdot y^2 \cdot y$
y^5 | d. $2a + 3a + a$
$6a$ |
| 2. a. $s \cdot s^3 \cdot s$
s^5 | b. $b^2 \cdot b$
b^3 | c. $z + z$
$2z$ | d. $c \cdot c$
c^2 |



We Remember

Convert. Round to the nearest whole.

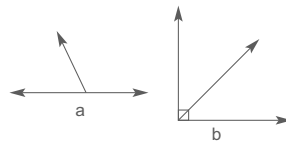
- | | | |
|---|--|--|
| 3. $75 \text{ m} \approx \underline{83} \text{ yd}$ | 3. $\frac{1 \text{ m}}{1.1 \text{ yd}} = \frac{75 \text{ m}}{n \text{ yd}}$
$1.1 \times 75 \div 1 \approx 83$ | 4. $\frac{1 \text{ m}}{1.1 \text{ yd}} = \frac{n \text{ m}}{115 \text{ yd}}$
$1 \times 115 \div 1.1 \approx 105$
$104.5 \approx 105$ |
| 4. $115 \text{ yd} \approx \underline{105} \text{ m}$ | 5. $12 \text{ cm} \approx \underline{5} \text{ in}$ | 6. $\frac{1 \text{ kg}}{2.2 \text{ lb}} \approx \frac{95 \text{ kg}}{n \text{ lb}}$
$2.2 \times 95 \div 1 \approx 209$ |
| 5. $12 \text{ cm} \approx \underline{5} \text{ in}$ | 6. $95 \text{ kg} \approx \underline{209} \text{ lb}$ | 7. $\frac{1 \text{ in}}{2.54 \text{ cm}} = \frac{n \text{ in}}{12 \text{ cm}}$
$1 \times 12 \div 2.54 \approx 5$ |

Write the products. Use decimals for negative exponents.

7. a. $10^7 = \underline{10,000,000}$ b. $10^0 = \underline{1}$ c. $10^{-4} = \underline{0.0001}$

Match.

8. b complementary angles
9. a supplementary angles



Simplify, solve, and check.

Number of steps in solutions may vary.

- | | |
|--|--|
| 10. a. $3 \cdot 5 + 11 = 3(x + 9) - 13$
$15 + 11 = 3x + 27 - 13$
$26 = 3x + 14$
$-14 \quad -14$
$\frac{12}{3} = \frac{3x}{3}$
$4 = x$ | b. $3 \cdot 5 + 11 = 3(4 + 9) - 13$
$15 + 11 = 3(13) - 13$
$26 = 39 - 13$
$26 = 26$ |
|--|--|

A number or variable with no exponent is the same as a number or variable with an exponent of 1. $10 = 10^1$, and $n = n^1$. Therefore, $n \cdot n^2 = n^3$.

Tips for Struggling Students

→ Make sure students understand that adding variables and multiplying variables are not the same thing. For example, $n + n + n = 3n$, but $n \cdot n \cdot n = n^3$.

Board Work

→ Simplify the expressions. Watch the signs!

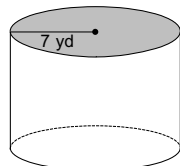
- | | | |
|--|-------------------------------------|-----------------------------|
| 1. a. $y \cdot y \cdot y \cdot y$
y^4 | b. $3b + b$
$4b$ | c. $g^2 \cdot g^5$
g^7 |
| 2. a. $y + y + y$
$3y$ | b. $h^5 \cdot h \cdot h^3$
h^9 | c. $7j + 4j$
$11j$ |

Lesson 1

11. Eva needs to calculate the total cost for the school trip to the zoo for her 18 students, herself, and 4 additional adult chaperones. Transportation will cost \$102. Zoo admission tickets cost \$6.75 for each adult and \$4.50 for each student. What will be the total cost for the trip? \$216.75

\$6.75	\$4.50
× 5	× 18
\$33.75	3600
	4500
	\$81.00
\$33.75	\$114.75
+ 81.00	+ 102.00
\$114.75	\$216.75

Use the formula to find the volume of the cylinder.

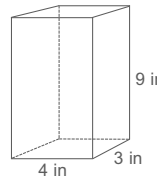


12. 1,538.6 yd³

$$\begin{aligned}
 V &= Bh \\
 V &= (\pi r^2)h && 3.14 \\
 V &= (3.14 \times 7 \times 7)10 && \times 49 \\
 V &= 153.86 \times 10 && \underline{2826} \\
 V &= 1,538.6 && \underline{12560} \\
 &&& 153.86
 \end{aligned}$$

Number of steps in solution may vary.

Find the surface area of the rectangular prism.



13. 150 in²

Top & Bottom	Front & Back	2 Sides	12
A = lw	A = lw	A = lw	12
A = 4 × 3	A = 9 × 4	A = 9 × 3	36
A = 12	A = 36	A = 27	36
			27
			+ 27
			150



You have learned that the **surface area** of a solid is the sum of all its faces.

To find the surface area of a cube that is 10 cm by 10 cm by 10 cm:



$$\begin{aligned}
 10 \times 10 &= 100 \text{ cm}^2 \text{ (area of one face)} \\
 100 \times 6 \text{ faces} &= 600 \text{ cm}^2
 \end{aligned}$$

Surface is measured in square units.



Volume is the number of cubic units a solid holds inside its faces.

This box can hold 1,000 cubic centimeters.

$$10 \times 10 \times 10 = 1,000 \text{ cm}^3$$

Volume is measured in cubic units.



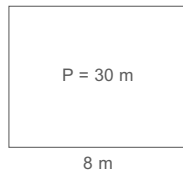
Teacher Notes:

Lesson 1

Mastery Drill

14. The middle number in an ordered list is the median.
15. A reflex angle measures between 180° and 360°.
16. An acute angle measures between 0° and 90°.
17. The number that occurs most often in a list is the mode.
18. The formula for finding the area of a triangle is $A = \frac{1}{2}bh$.
19. a. 1 gallon \approx 3.8 liters b. 1 kilogram \approx 2.2 pounds
20. a. Another name for *average* is mean. b. A straight angle measures 180°.
21. a. $2^3 =$ 8 b. $\frac{1}{8} =$ $12\frac{1}{2}$ % c. $\sqrt{225} =$ 15 d. $5^3 =$ 125

Use the perimeter formula to find the width of the rectangle.



$$\begin{aligned}
 P &= 2l + 2w \\
 30 &= 2 \times 8 + 2w \\
 30 &= 16 + 2w \\
 \frac{-16}{2} & \frac{-16}{2} \\
 \frac{14}{2} &= \frac{2w}{2} \\
 7 &= w
 \end{aligned}$$

22. The width is 7 m.

Match each kind of triangle with its definition.

- | | |
|-----------------------------------|---------------------------|
| 23. <u>b</u> equiangular triangle | a. two congruent sides |
| 24. <u>g</u> right triangle | b. three congruent angles |
| 25. <u>f</u> acute triangle | c. three congruent sides |
| 26. <u>d</u> obtuse triangle | d. one obtuse angle |
| 27. <u>c</u> equilateral triangle | e. no congruent sides |
| 28. <u>a</u> isosceles triangle | f. three acute angles |
| 29. <u>e</u> scalene triangle | g. one 90° angle |

Teacher Notes:

Lesson 1

+ - x Skill Builders

Write the repeating decimal with a bar.

30. a. $16 = \frac{x}{5} + 13$
 $\frac{-13}{-13} \frac{-13}{-13}$
 $3 = \frac{x}{5}$
 $3 \cdot 5 = \frac{x}{5} \cdot 5$
 $15 = x$

b. $16 + 6 \cdot 4 = 5n + 8 \div 2 \cdot 5$
 $16 + 24 = 5n + 4 \cdot 5$
 $40 = 5n + 20$
 $\frac{-20}{-20} \frac{-20}{-20}$
 $\frac{20}{5} = \frac{5n}{5}$
 $4 = n$

c. $4.2 \overline{)5.600} \approx 1.\overline{3}$
 $\begin{array}{r} 1.3\ 3 \\ 4\ 2 \overline{)5.6\ 0\ 0} \\ \underline{4\ 2} \\ 1\ 4\ 0 \\ \underline{1\ 2\ 6} \\ 1\ 4\ 0 \\ \underline{1\ 2\ 6} \\ 1\ 4 \end{array}$

Translate the sentences into equations using n as the variable.

31. The quotient of a number and twenty-five is six. $\frac{n}{25} = 6$

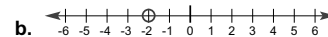
32. Twelve more than a number is sixteen. $n + 12 = 16$

33. The difference between a number and nine is sixteen. $n - 9 = 16$

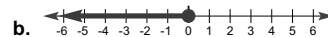
34. Twice a number is twenty-four. $2n = 24$

Solve. Then graph the solution.

35. a. $x - 2 = -4$
 $\frac{+2}{+2} \frac{+2}{+2}$
 $x = -2$



36. a. $x + 9 \leq 9$
 $\frac{-9}{-9} \frac{-9}{-9}$
 $x \leq 0$



Round to the nearest 10 to estimate. Then copy and solve.

37. $942 - 69 = \underline{873}$
 $\begin{array}{r} 942 \\ - 69 \\ \hline 873 \end{array}$
 $\underline{940} - \underline{70} = \underline{870}$

Simplify the expressions. Watch the signs!

38. a. $x \cdot x^3 \cdot x \cdot x^2$
 x^7

b. $6x + 2x + x$
 $9x$

c. $e \cdot e^3$
 e^4

Teacher Notes:

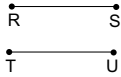
Lesson

2



Symbols for Perpendicular and Parallel

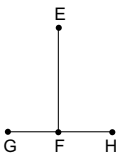
Lines and segments are **parallel** to each other if they never intersect. The symbol for *is parallel to* is \parallel .



Line segment RS is parallel to line segment TU.

With symbols: $\overline{RS} \parallel \overline{TU}$

Lines and segments are **perpendicular** to each other if they intersect at right angles. The symbol for *is perpendicular to* is \perp .



Line segment EF is perpendicular to line segment GH.

With symbols: $\overline{EF} \perp \overline{GH}$

Constructing Parallel Lines

You can use a compass and a straightedge to construct a line through point A that is parallel to \overleftrightarrow{CD} .



Match the points of the compass with points C and D on the line. Place the compass point on point A and draw an arc across from point A.



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Symbols for Perpendicular and Parallel; Constructing Parallel Lines

Lesson Preparation

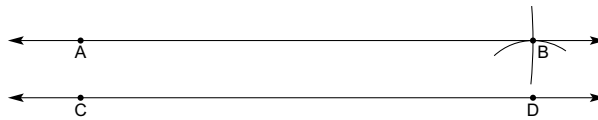
- Make sure each student has compasses and a straightedge for constructing parallel lines.
- Study the method used to construct parallel lines in this lesson, and be prepared to teach this method step-by-step to your students.

Lesson 2

Match the points of the compass with A and C. With the compass point on D, make an arc to cross your previous arc. Label the point of intersection B.



Draw a line through A and B using the straightedge.



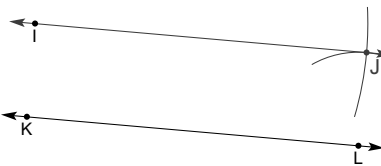
The words: Line AB is parallel to line CD.


The symbols: $AB \parallel CD$

Use a compass and a straightedge to construct $EF \parallel GH$.



Use a compass and a straightedge to construct $IJ \parallel KL$.



 **We Remember**

Simplify the expressions.

- | | | | |
|----------------------------|--------------------|---------------------------|---------------------|
| 3. a. $x \cdot x$
x^2 | b. $x + x$
$2x$ | c. $x^2 \cdot x$
x^3 | d. $2x + x$
$3x$ |
|----------------------------|--------------------|---------------------------|---------------------|

Working in the LightUnit

What's New?

→ **Symbols for Perpendicular and Parallel.** No doubt students will remember the definitions of *perpendicular* and *parallel*. Lines and segments are parallel to each other if they never intersect. The symbol for *is parallel to* is \parallel . Lines and segments are perpendicular to each other if they intersect at right angles to each other. The symbol for *is perpendicular to* is \perp .

→ **Constructing Parallel Lines.** Have your students watch as you demonstrate the use of the compass and straightedge to construct parallel lines. Or have them stand behind you at a table as you follow the steps in the LightUnit.

Lesson 2

+ **-** **x** Skill Builders

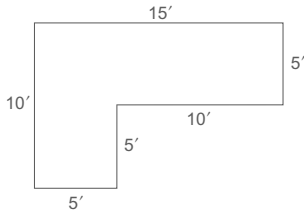
Annex 0's to complete.

4. a.
$$\begin{array}{r} 11' \\ 7 \overline{) 79' } \\ \underline{7} \\ 9 \\ \underline{7} \\ 2 \times 12 \end{array}$$

b.
$$\begin{array}{r} 9 \text{ lb} \quad 8 \text{ oz} \\ \times \\ \hline 63 \text{ lb} \quad 56 \text{ oz} = \\ 66 \text{ lb} \quad 8 \text{ oz} \end{array}$$

c.
$$\begin{array}{r} 1.04 \\ 62.5 \overline{) 65.000} \\ \underline{62.5} \\ 2500 \\ \underline{2500} \\ 0 \end{array}$$

Find the area. Show your work.



$A = s^2$ $A = lw$ 25
 $A = 5 \times 5$ $A = 15 \times 5$ $\frac{+75}{100}$
 $A = 25$ $A = 75$

5. 100 ft²

Solutions may vary.

Write the products or quotients.

6. a. $56 \div (-8) = \underline{-7}$

b. $\frac{-36}{9} = \underline{-4}$

c. $4 \overline{) -11} = \underline{-2.75}$

7. a. $-\frac{1}{6} \times \frac{1}{5} = \underline{-\frac{1}{30}}$

b. $6 \times (-3) = \underline{-18}$

c. $-12 \times (-6) = \underline{72}$

Solve the logic problem.

Kathryn and several classmates are practicing with a balance scale during free time at school. While weighing some of their school supplies they notice the following:

- the weight of 3 rulers + 1 glue stick = the weight of 12 new pencils
- the weight of 1 glue stick = the weight of 1 ruler + 8 new pencils

Now they are wondering how many pencils would equal the weight of a glue stick. Can you help them out?

☆ 8. 9 pencils = the weight of one glue stick.

Solution: Since 1 glue stick is equal to the weight of 1 ruler + 8 pencils, substitute one glue stick in the first equation with 1 ruler + 8 pencils.

Solve algebraically as shown. Since rulers and pencils are of equal weight, a glue stick equals 9 pencils.

$$\begin{array}{l} 3 \text{ rulers} + 1 \text{ glue stick} = 12 \text{ pencils} \\ 3 \text{ rulers} + (1 \text{ ruler} + 8 \text{ pencils}) = 12 \text{ pencils} \\ (3 \text{ rulers} + 1 \text{ ruler}) + 8 \text{ pencils} = 12 \text{ pencils} \\ 4 \text{ rulers} + 8 \text{ pencils} = 12 \text{ pencils} \\ \underline{-8 \text{ pencils} \quad -8 \text{ pencils}} \\ 4 \text{ rulers} = 4 \text{ pencils} \\ \underline{ \quad } \\ 1 \text{ ruler} = 1 \text{ pencil} \end{array}$$

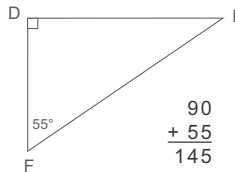
Teacher Notes:

Lesson 2

Mastery Drill

9. The *greater than or equal to* symbol is \geq .
10. Any number except 0 with an exponent of 0 equals 1.
11. Any number with an exponent of 1 equals the number itself.
12. The formula for finding the volume of a cylinder is $V = Bh$.
13. The sum of the measures of complementary angles equals 90°.
14. The sum of the measures of supplementary angles equals 180°.
15. The four angles made by two intersecting lines measure a total of 360°.
16. The formula for finding the perimeter of a rectangle or parallelogram is $P = 2l + 2w$.
17. a. 1 inch = 2.54 centimeters b. 1 meter \approx 1.1 yards
18. a. The repeating decimal for $\frac{1}{3}$ is 0.3. b. The repeating decimal for $\frac{2}{3}$ is 0.6.
19. a. $3^3 =$ 27 b. $\frac{1}{4} =$ 25 % c. $\frac{2}{3} =$ 66 $\frac{2}{3}$ % d. $2^5 =$ 32

Solve for the unknown angle measure.



20. $m\angle E =$ 35°

$$\begin{array}{r} 90 \\ + 55 \\ \hline 145 \end{array} \quad \begin{array}{r} 180 \\ - 145 \\ \hline 35 \end{array}$$

Convert. Round to the nearest whole.

- | | | | | |
|---------------------------------|--|---|--|--|
| 21. 70 m \approx <u>77</u> yd | 21. $\frac{1 \text{ m}}{1.1 \text{ yd}} = \frac{70 \text{ m}}{n \text{ yd}}$
$1.1 \times 70 \div 1 = 77$ | 1.1 \times <u>70</u>
<u>77.0</u> | 22. $\frac{1 \text{ m}}{1.1 \text{ yd}} = \frac{n \text{ m}}{40 \text{ yd}}$
$1 \times 40 \div 1.1 \approx 36$ | $\begin{array}{r} 36.3 \approx 36 \\ 1.1 \overline{)40.00} \\ \underline{33} \\ 70 \\ \underline{66} \\ 40 \\ \underline{33} \\ 70 \end{array}$ |
| 22. 40 yd \approx <u>36</u> m | 23. $\frac{1 \text{ gal}}{3.8 \text{ L}} \approx \frac{55 \text{ gal}}{n \text{ L}}$
$3.8 \times 55 \div 1 \approx 209$ | 55 \times <u>3.8</u>
<u>440</u>
<u>1650</u>
<u>209.0</u> | 24. $\frac{1 \text{ mile}}{1.6 \text{ km}} \approx \frac{55 \text{ miles}}{n \text{ km}}$
$1.6 \times 55 \div 1 \approx 88$ | $\begin{array}{r} 55 \\ \times 1.6 \\ \hline 330 \\ 880 \\ \hline 88.0 \end{array}$ |

Write as powers of 10.

25. a. 0.00001 = 10^{-5} b. 1,000,000 = 10^6 c. 1 = 10^0

Teacher Notes:

Lesson 2

26. Seventy-five percent of the 52 students at Gruenfeld Christian School have grandparents who emigrated from Mexico to Canada. How many students have grandparents who emigrated to Canada? Use a fractional equivalent of the percent to solve the problem. 39 students

$$75\% = \frac{3}{4}$$

$$\frac{3}{4} \times \frac{52}{1} = 39$$

27. Gruenfeld Christian School is planning to give a program for the parents and grandparents of the students. Eva's students, Grades 4-7, are planning to sing 3 songs and recite 2 poems and a Bible passage. The times in minutes and seconds for each song and recitation are as follows: 3:05, 1:45, 2:25, 1:35, 2:10, and 1:50. What is the total time in minutes and seconds for these six items?
12 minutes, 50 seconds

$$\begin{array}{r} 3:05 \\ 1:45 \\ 2:25 \\ 1:35 \\ 2:10 \\ + 1:50 \\ \hline 10:170 = 12:50 \end{array}$$

Choose the correct equation for the problem. Solve the problem.

28. The distance Eva drives to school is $\frac{1}{10}$ of the distance to her parents' home. Eva has 95 kilometers to her parents' home. How far does she have to school from her boarding place?

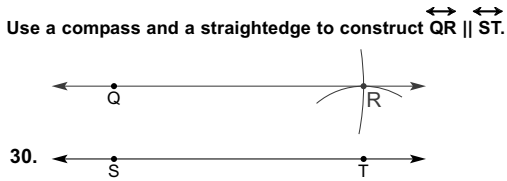
$$\frac{d}{10} = 95 \quad d = \frac{95}{10} \quad d + 10 = 95 \quad d = \frac{95}{10}$$

a. Equation: $d = \frac{95}{10}$ b. Answer: 9.5 kilometers $d = 9.5$

Convert.

29. a. 58 cm = 0.58 m b. 24 kg = 24,000 g c. 5.6 L = 5,600 mL

Use a compass and a straightedge to construct $QR \parallel ST$.



30.

Teacher Notes:

Lesson **3**



The Range of Data

The **range** of a list of data is the difference between the highest and the lowest numbers in the list. To find the range, subtract the smallest number from the largest.

On their last Math LightUnit test, Eva's seventh-graders made these scores:
90% 92% 78% 100% 87% 95%

To find the range of these grades, subtract 78% from 100%. The range of the student's math scores was 22%.



PRACTICAL USE OF MEAN AND MEDIAN

Mean is the most common way to summarize numerical data. But sometimes the mean can be misleading. This is especially true when the range is large and a few numbers are much higher or much lower than most of the others. If you were finding the mean value of the homes in your community, and there were several million-dollar homes there, the average may be quite a bit higher than most of the homes are really worth. In this case, the median might be a better measure of the worth of the homes in your area. The **median** is especially useful when the range of the data is large and the set of data is relatively small. It may also be useful because it is not generally affected by data that is extreme, as in the example of the expensive homes above.

Find the range for each list of numbers.

- 1. 93, 100, 97, 97, 100, 90, 100, 100, 97 range 10
- 2. 15°, 32°, 19°, 2°, 7°, 15°, 12°, 15°, 17°, 14°, 20° range 30°
- 3. \$35, \$90, \$88, \$78, \$67, \$96, \$44, \$61, \$96 range \$61

1. $\begin{array}{r} 100 \\ - 90 \\ \hline 10 \end{array}$	2. $\begin{array}{r} 32 \\ - 2 \\ \hline 30 \end{array}$	3. $\begin{array}{r} 96 \\ - 35 \\ \hline 61 \end{array}$
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The Range of Data

Working in the LightUnit

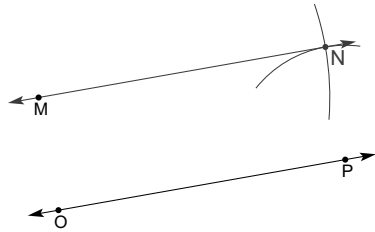
What's New?

➔ **The Range of Data.** The *range* of a list of data is the difference between the highest and lowest numbers on the list. To find the range, subtract the smallest number from the largest. In future work with number data, students will find the range along with the mean, median, and mode of various groups of number data.



We Remember

Use a compass and a straightedge to construct $MN \parallel OP$.



4.

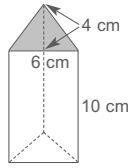
Simplify, solve, and check.

Number of steps in solutions may vary.

5. a. $4(x + 9) - 24 = 37 + 28 \div 4$
 $4x + 36 - 24 = 37 + 7$
 $4x + 12 = 44$
 $\frac{-12 \quad -12}{4 \quad 4}$
 $4x = 32$
 $x = 8$

b. $4(8 + 9) - 24 = 37 + 28 \div 4$
 $32 + 36 - 24 = 37 + 7$
 $68 - 24 = 44$
 $44 = 44$

Use the formula to find the volume.



$V = Bh$
 $V = (\frac{1}{2}bh)h$
 $V = (\frac{1}{2} \times 6 \times 4)10$
 $V = 12 \times 10$
 $V = 120$

6. 120 cm³ Number of steps in solution may vary.

Convert. Round to the nearest whole.

7. a. 85 days \approx 12 weeks
 $\frac{1 \text{ week}}{7 \text{ days}} = \frac{n \text{ week}}{85 \text{ days}}$
 $1 \times 85 \div 7 \approx 12$

$1 \ 2 \ . \ 1 \approx 12$
 $7 \overline{) 85.0}$
 $\underline{7}$
 15
 $\underline{14}$
 10
 $\underline{7}$
 3

b. 36 months = 3 years
 $\frac{1 \text{ year}}{12 \text{ months}} = \frac{n \text{ year}}{36 \text{ months}}$
 $1 \times 36 \div 12 = 3$

Board Work

→ Find the range for each list of numbers.

1. 78, 42, 56, 89, 37, 82, 105, 37, 87 **68**
2. 657, 954, 347, 261, 678 **693**
3. 12, 13, 15, 13, 13, 16, 11, 11, 11, 18 **7**

Lesson 3

Mastery Drill

8. The *less than or equal to* symbol is \leq .
9. The formula for finding the volume of a triangular prism is $V = Bh$.
10. The correct order of operations is Parentheses; Exponents; Multiplication and Division; Addition and Subtraction.
11. a. The fraction for $0.1\bar{6}$ is $\frac{1}{6}$. b. The fraction for $0.\bar{3}$ is $\frac{1}{3}$.
12. a. The *perpendicular* symbol is \perp . b. The *parallel* symbol is \parallel .
13. a. $1 \text{ yard}^3 = 27 \text{ feet}^3$ b. 1 millennium = 1,000 years
14. a. 1 kilometer $\approx \frac{5}{8}$ mile b. 1 mile ≈ 1.6 kilometers

Simplify the expressions.

15. a. $x \cdot x^2 \cdot x$ b. $x^3 \cdot x^2$ c. $s + s + 5s$
 x^4 x^5 $7s$

Write the product. Use fractions for those with negative exponents.

16. a. $2^0 = 1$ b. $8^1 = 8$ c. $5^{-3} = \frac{1}{125}$ d. $9^{-2} = \frac{1}{81}$

Change to decimal percents, then to decimals.

17. a. $2\frac{7}{10}\% = 2.7\% = 0.027$ b. $\frac{1}{2}\% = 0.5\% = 0.005$

Solve.

18. What is $2\frac{7}{10}\%$ of 79? 2.133 18. $\begin{array}{r} 79 \\ \times 0.027 \\ \hline 553 \\ 1580 \\ \hline 2.133 \end{array}$ 19. $\begin{array}{r} 46 \\ \times 0.005 \\ \hline 0.230 \end{array}$
19. What is $\frac{1}{2}\%$ of 46? 0.23 $\begin{array}{r} 46 \\ \times 0.005 \\ \hline 230 \\ \hline 0.23 \end{array}$

Solve. Round to the nearest dollar.

20. The price went up 40% from \$162.
 a. Amount of increase: \$65
 b. New price: \$227
21. 18% more than \$48 = \$57
18. a. $\begin{array}{r} 162 \\ \times 0.40 \\ \hline 64.80 \approx 65 \end{array}$ b. $\begin{array}{r} \$162 \\ + 65 \\ \hline \$227 \end{array}$
21. $\begin{array}{r} 1.18 \\ \times 48 \\ \hline 944 \\ 4720 \\ \hline 56.64 \approx \$57 \end{array}$

Teacher Notes:

Lesson 3

22. When the transmission went out on Mary's 12-year-old car, she borrowed \$2,500 from her brother to buy a newer used car. Her brother charged her a low interest rate of 2%. If Mary paid back the loan in $1\frac{1}{2}$ years, how much did she pay her brother altogether? \$2,575

$$\begin{array}{r} \$2,500 \\ \times 0.02 \\ \hline \$50.00 \end{array} \qquad \begin{array}{r} \$50.00 \\ \times 1.5 \\ \hline 25000 \\ \hline 50000 \\ \hline \$75.000 \end{array}$$

$$\begin{array}{r} \$2,500 \\ + 75 \\ \hline \$2,575 \end{array}$$

23. Eva's students enjoy monitoring the six bluebird nest boxes that are used by bluebirds and tree swallows on the school property. Two years ago, the bluebirds fledged 9 young; last year, 14 bluebirds were fledged. What was the percent of increase in the number of fledglings last year? Round to the nearest whole percent. 56%

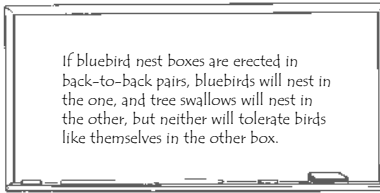
$$\frac{5}{9} = 9 \overline{)5.000} \approx 0.56$$

$$\begin{array}{r} 0.555 \\ 9 \overline{)5.000} \\ \underline{45} \\ 50 \\ \underline{45} \\ 50 \\ \underline{45} \\ 5 \end{array}$$

Find the sale price.

24. The regular price was \$14.42. The sale is 12% off. The sale price is \$12.69.

$$\begin{array}{r} \$14.42 \\ \times 0.88 \\ \hline 11536 \\ \hline 115360 \\ \hline 12.6896 \approx \$12.69 \end{array}$$



Solve.

25. 9 is $\frac{3}{5}$ of what number? 15

26. 39 is what fraction of 52? $\frac{3}{4}$

25. $\frac{9}{n} = \frac{3}{5}$

$9 \times 5 \div 3 = 15$

26. $\frac{39}{52} = n$

Reduces to $\frac{3}{4}$

27. $\frac{n}{51} = \frac{1}{3}$

$51 \times 1 \div 3 = 17$

$$\begin{array}{r} 17 \\ 3 \overline{)51} \\ \underline{3} \\ 21 \\ \underline{21} \\ 0 \end{array}$$

27. What is $\frac{1}{3}$ of 51? 17

Simplify the expressions.

28. a. $2^2 \cdot 3^2 \cdot 11$
 $4 \cdot 9 \cdot 11$
 $36 \cdot 11$
 396

b. $7 \cdot \frac{33}{11} - 6 + 3$
 $7 \cdot 3 - 6 + 3$
 $21 - 6 + 3$
 $15 + 3$
 18

c. $5^3 - (9 - 4) \cdot \sqrt{25}$
 $5^3 - 5 \cdot \sqrt{25}$
 $125 - 5 \cdot 5$
 $125 - 25$
 100

d. $3 \cdot 8n$
 $24n$

Number of steps in solutions may vary.

Teacher Notes:

Lesson 3

+⁻x Skill Builders

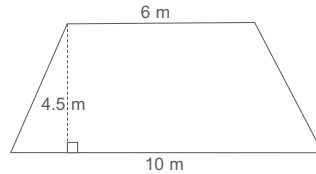
Round to the nearest hundredth.

29. a. $6 = 8x - 11$
 $+11 \quad +11$
 $\frac{17}{8} = \frac{8x}{8}$
 $2\frac{1}{8} = x$

b. $69 \overline{)3.980}$
 $\underline{345}$
 530
 $\underline{483}$
 47

c. $3(n + 4) = 7 + 12 \cdot 3$
 $3n + 12 = 7 + 36$
 $3n + 12 = 43$
 $\underline{-12 \quad -12}$
 $\frac{3n}{3} = \frac{31}{3}$
 $n = 10\frac{1}{3}$

Use the formula to find the area of the trapezoid.



30. $\underline{36 \text{ m}^2}$

$A = \frac{1}{2}(b_1 + b_2)h$
 $A = \frac{1}{2}(6 + 10)4.5$
 $A = \frac{1}{2}(16)4.5$
 $A = 36 \quad \frac{4.5}{36.0}$

Find the commission.

31. A salesperson receives 9% commission on sales of \$10,345. $\underline{\$931.05}$
 $\$10,345$
 $\times \quad 0.09$
 $\$931.05$

Convert to decimals. Write the repeating decimals with a bar.

32. $\frac{5}{9} = \underline{0.\overline{5}}$

32. $0.55 = 0.\overline{5}$
 $9 \overline{)5.00}$
 $\underline{45}$
 50
 $\underline{45}$
 5

33. $0.1818 \approx 0.\overline{18}$
 $11 \overline{)2.0000}$
 $\underline{11}$
 90
 $\underline{88}$
 20
 $\underline{11}$
 90
 $\underline{88}$
 2

33. $4\frac{2}{11} = \underline{4.\overline{18}}$

Find the mean, median, mode, and range. Round to the nearest whole.

34. 5, 7, 5, 7, 4, 7, 1, 6, 6, 4

- a. mean $\underline{5}$ b. median $\underline{6}$ c. mode $\underline{7}$ d. range $\underline{6}$
 a. $5 + 7 + 5 + 7 + 4 + 7 + 1 + 6 + 6 + 4 = 52 \div 10 = 5.2 \approx 5$
 b. c. 1, 4, 4, 5, 5, 6, 6, (7), (7) d. $7 - 1 = 6$
 $5 + 6 = 11 \div 2 = 5.5 \approx 6$

Teacher Notes:

Lesson

4



Calculating Interest for Months

The interest formula, $i = prt$, is used for calculating interest on savings and loans. In this formula, i stands for *interest*, p stands for *principal*, r stands for *rate*, and t stands for *time* in years. However, interest on savings is often calculated by the month rather than the year, and the length of many short-term loans is expressed in months, such as a 42-month CD (certificate of deposit). In this case, we must convert months to fractions of a year or the decimal equivalents of these fractions.

Note the following equivalents when using business years:

1 month = $\frac{1}{12}$ year	7 months = $\frac{7}{12}$ year
2 months = $\frac{1}{6}$ year	8 months = $\frac{2}{3}$ year
3 months = $\frac{1}{4}$ year (or 0.25 year)	9 months = $\frac{3}{4}$ year (or 0.75 year)
4 months = $\frac{1}{3}$ year	10 months = $\frac{5}{6}$ year
5 months = $\frac{5}{12}$ year	11 months = $\frac{11}{12}$ year
6 months = $\frac{1}{2}$ year (or 0.5 year)	12 months = 1 year

To find interest on \$1,200 of a 7-month CD earning 4.25%, first convert 7 months to a fraction. Then use the simple interest formula, $i = prt$.

Convert months to years: 7 months = $\frac{7}{12}$ year

Use the formula: $i = prt$

Substitute numbers for the variables: $i = \$1,200 \times 0.0425 \times \frac{7}{12}$

Solve: $i = \$29.75$

The CD will earn \$29.75 in seven months.

Add the principal and the interest to find out how much the CD will be worth when it matures.

$$\$1,200 + 29.75 = \$1,229.75$$

Calculator Hint

When using a calculator for fractions of a month, multiply the whole numbers, and the numerator of the fraction. Then divide that answer by the denominator of the fraction.

Example

\$500 loaned out at 2% for 5 months
 $500 \times 0.02 \times \frac{5}{12}$
 $(500 \times 0.02 \times 5) \div 12 = \4.17

17

Calculating Interest for Months

Working in the LightUnit**What's New?**

➔ **Calculating Interest for Months.** In the interest formula, $i = prt$, t stands for *time*, where the standard unit of time is one year. So far students have worked with years or fractions of years that could be easily converted to decimals before multiplying. However, interest on savings is often calculated by the month rather than the year, and the length of many short-term loans is expressed in months, such as a 42-month certificate of deposit. In this case, convert months to fractions of years, or the decimal equivalents of these fractions.

Lesson 4

To find interest on \$1,500 in a 42-month CD earning 5.25%, first convert 42 months to years by dividing by 12. Then use the simple interest formula, $i = prt$.

Convert months to years: $42 \div 12 = 3.5$ years

Use the formula: $i = prt$

Substitute numbers for the variables: $i = \$1,500 \times 0.0525 \times 3.5$

Solve: $i = \$275.63$

The CD will earn \$275.63 in forty-two months.

Add the principal and the interest to find out how much the CD will be worth when it matures.
 $\$1,500 + 275.63 = \$1,775.63$



Applying the associative property to the interest formula will often simplify the calculations so you can solve part of the problem mentally.

Find the interest due on \$40,000 borrowed at 8% interest for 6 years.

Think: $\frac{1}{8}$ of 8% is 1%, or 0.01

Find 1% of \$40,000

$$0.01 \times 40,000 = 400$$

Calculate: $\$400 \times 6 = \$2,400$

Find the interest due on \$12,000 borrowed at $5\frac{1}{2}\%$ for 3 months.

Convert months to years:

$$\frac{3}{12} = \frac{1}{4}$$

(Think: $\frac{1}{4}$ of 12,000 is 3,000.)

Calculate:

$$3,000 \times 0.055 = \$165$$

Find the interest gained on \$250 in a savings account earning $2\frac{3}{4}\%$ for 3 years.

Use the formula:

$$i = prt$$

Substitute numbers for the variables:

$$i = \$250 \times 0.0275 \times 3$$

(Think: 3 times 250 is 750.)

Calculate:

$$750 \times 0.0275 \approx \$20.63$$



1. At the end of Eva's first year of teaching, she put \$1,000 into a 30-month CD earning 4.5%. She is planning to use the money this summer to travel to Costa Rica to volunteer for six weeks in an orphanage. How much will the CD be worth when it matures? \$1,112.50

$$i = prt$$

$$30 \div 12 = 2.5$$

$$\$1,000 \times 0.045 \times 2.5 = \$112.50$$

$$\$1,000 + 112.50 = \$1,112.50$$



2. Eva put \$1,407.32 in a savings account that pays 2% interest. How much interest did the account earn in one month? \$2.35

$$i = prt$$

$$\$1,407.32 \times 0.02 \times \frac{1}{12} = \$2.35$$

If using a calculator to figure the interest for a number of months, multiply the other numbers in the formula along with the numerator of the fraction expressing time. Then divide the product by the denominator of the fraction for the final amount. Here is an example:

\$1,200 in savings at $1\frac{1}{2}\%$ interest for 5 months

$1200 \cdot 0.015 \cdot 5 \div 12 \approx 7.5$ The interest after five months is \$7.50.

Board Work

→ Find the interest due. (Allow students to use their calculators.) Round to the nearest cent.

1. \$500 loan at $11\frac{1}{4}\%$ interest for 11 months $500 \cdot 0.1125 \cdot 11 \div 12 \approx \51.56

2. \$400 savings at $2\frac{1}{4}\%$ interest for 18 months $400 \cdot 0.0225 \cdot 18 \div 12 \approx \13.50

3. \$2,250 loan at 12% interest for 4 months $2,250 \cdot 0.12 \cdot 4 \div 12 \approx \90.00

Lesson 4



We Remember

Find the range for each set of numbers.

3. 36, 38, 40, 45, 37, 10, 39 range 35 3. $\begin{array}{r} 45 \\ -10 \\ \hline 35 \end{array}$ 4. $\begin{array}{r} 98 \\ -84 \\ \hline 14 \end{array}$
4. 96, 84, 90, 91, 90, 98, 85, 89 range 14



Find the mean, median, mode, and range for each list. Round to the nearest whole.

5. $46^\circ, 57^\circ, 64^\circ, 66^\circ, 61^\circ, 70^\circ, 59^\circ, 51^\circ, 50^\circ, 59^\circ, 69^\circ$
- a. mean 59° b. median 59° c. mode 59° d. range 24°
 a. $46 + 57 + 64 + 66 + 61 + 70 + 59 + 51 + 50 + 59 + 69 = 652 \div 11 \approx 59.27 \approx 59$
 b. c. 46, 50, 51, 57, 59, 59, 61, 64, 66, 69, 70 d. $70 - 46 = 24$
6. 91, 86, 90, 95, 80, 95, 88, 93, 82, 97
- a. mean 90 b. median 91 c. mode 95 d. range 17
 a. $91 + 86 + 90 + 95 + 80 + 95 + 88 + 93 + 82 + 97 = 897 \div 10 \approx 89.7 \approx 90$
 b. c. 80, 82, 86, 88, 90, 91, 93, 95, 95, 97 d. $97 - 80 = 17$
 $90 + 91 = 181 \div 2 = 90.5 \approx 91$

Simplify and solve. Number of steps in solutions may vary.

7. a. $4(x + 3) - 6 = 27 \div 3 + 5$ b. $12 + 6 \cdot 8 = 6(x + 7)$ c. $7n + 37 + n - 5 = 8 \cdot 5$
- $4x + 12 - 6 = 9 + 5$ $12 + 48 = 6x + 42$ $8n + 32 = 40$
- $4x + 6 = 14$ $60 = 6x + 42$ $\begin{array}{r} -32 \\ 8n + 32 = 40 \\ \hline 8n = 8 \end{array}$
- $\begin{array}{r} -6 \\ 4x + 6 = 14 \\ \hline 4x = 8 \\ \hline \frac{4x}{4} = \frac{8}{4} \\ x = 2 \end{array}$ $\begin{array}{r} -42 \\ 60 = 6x + 42 \\ \hline 18 = 6x \\ \hline \frac{18}{6} = \frac{6x}{6} \\ 3 = x \end{array}$ $\begin{array}{r} 8n = 8 \\ \hline \frac{8n}{8} = \frac{8}{8} \\ n = 1 \end{array}$

Solve.

8. \$4,500 borrowed at 12% interest for 2 years. a. $i = prt$
- a. Amount of interest owed: \$1,080 $\$4,500 \times 0.12 \times 2 = \1080.00
- b. Total amount to repay: \$5,580 $\begin{array}{r} 4,500 \\ \times 0.12 \\ \hline 9000 \end{array}$ $\begin{array}{r} 540 \\ \times 2 \\ \hline 1,080 \end{array}$ b. $\begin{array}{r} 4,500 \\ + 1,080 \\ \hline 5,580 \end{array}$
- $\begin{array}{r} 45000 \\ + 10800 \\ \hline 55800 \end{array}$

Find the percent of increase or decrease to the nearest percent.

9. A change from 40 to 110 is an increase of 175%. 9. $\begin{array}{r} 175 \\ 40 \overline{)7000} \\ \underline{400} \\ 3000 \\ \underline{3000} \\ 000 \end{array}$ 10. $5.5 \approx 6$
10. A change from 90 to 85 is a decrease of 6%. $\begin{array}{r} 450 \\ 90 \overline{)5000} \\ \underline{450} \\ 5000 \\ \underline{4500} \\ 500 \end{array}$
9. $\frac{110 - 40}{40} = \frac{n}{100}$ 10. $\frac{90 - 85}{90} = \frac{n}{100}$
- $\frac{70}{70} \cdot \frac{70}{70} \cdot 100 \div 40 \approx 175$ $\frac{-85}{5} \cdot \frac{5}{5} \cdot 100 \div 90 \approx 6$

Teacher Notes:

Lesson 4

Mastery Drill

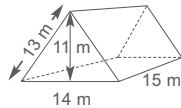
11. The middle number in an ordered list is the median.
12. The number that occurs most often in a list is the mode.
13. The sum of the measures of supplementary angles equals 180°.
14. The sum of the measures of complementary angles equals 90°.
15. The difference between the least and greatest numbers in a list is the range.
16. a. 1 inch = 2.54 centimeters b. 1 gallon ≈ 3.8 liters
17. a. Another name for *average* is mean. b. 1 meter ≈ 1.1 yards
18. a. The *perpendicular* symbol is ⊥. b. The *parallel* symbol is ∥.
19. a. $2^6 =$ 64 b. $\frac{5}{6} =$ $83\frac{1}{3}$ % c. $\sqrt{144} =$ 12 d. $2^4 =$ 16

Convert. Round to the nearest whole.

20. $70 \text{ yd} \approx$ 64 m 20. $\frac{1 \text{ m}}{1.1 \text{ yd}} = \frac{n \text{ m}}{70 \text{ yd}}$ 21. $\frac{1 \text{ m}}{1.1 \text{ yd}} = \frac{85 \text{ m}}{n \text{ yd}}$
 21. $85 \text{ m} \approx$ 94 yd $1 \times 70 \div 1.1 \approx 64$ $1.1 \times 85 \div 1 \approx 94$
 22. $72 \text{ in} \approx$ 183 cm 22. $\frac{1 \text{ in}}{2.54 \text{ cm}} \approx \frac{72 \text{ in}}{n \text{ cm}}$ See solutions in the teacher's notes.
- $2.54 \times 72 \div 1 \approx 183$



Find the surface area of the triangular prism.



23. 754 m²

2 Triangular Faces	2 Congruent Rectangle Faces	Bottom Rectangle	77
$A = \frac{1}{2}(bh)$	$A = lw$	$A = lw$	77
$A = \frac{1}{2}(14 \times 11)$	$A = 15 \times 13$	$A = 15 \times 14$	195
$A = \frac{1}{2}(154)$	$A = 195$	$A = 210$	+ 210
$A = 77$			754

Solutions may vary.

Choose the correct equation for the problem. Solve the problem.

24. The number of problems Eva's seventh grade students had on a math quiz was two less than one-third the number of problems on their previous lesson. The lesson had forty-five problems. How many problems were on the quiz?

$$q - 2 = \frac{45}{3} \quad q = \frac{45}{3} - 2 \quad q = 3(45 - 2)$$

$$q = \frac{45}{3} - 2$$

$$q = 15 - 2$$

- a. Equation: $q = \frac{45}{3} - 2$ b. Answer: 13 problems $q = 13$

$$20. \quad \begin{array}{r} 63.6 \approx 64 \\ 1.1 \overline{)70.00} \\ \underline{66} \\ 40 \\ \underline{33} \\ 70 \\ \underline{66} \\ 4 \end{array}$$

$$21. \quad \begin{array}{r} 85 \\ \times 1.1 \\ \hline 85 \\ 850 \\ \hline 93.5 \approx 94 \end{array}$$

$$22. \quad \begin{array}{r} 2.54 \\ \times 72 \\ \hline 508 \\ 17780 \\ \hline 182.88 \approx 183 \end{array}$$

Teacher Notes:

Lesson 4

— $\frac{+}{-} \times$ Skill Builders —

25. a. $\frac{3}{4} \times \frac{5}{9} \times \frac{4}{5} = \frac{1}{3}$

$$\frac{\cancel{3}}{\cancel{4}} \times \frac{\cancel{5}}{\cancel{9}} \times \frac{\cancel{4}}{\cancel{5}} = \frac{1}{3}$$

b. $\frac{7}{8} \div \frac{2}{3} = \frac{3}{16}$

$$\frac{7}{8} \div 4\frac{2}{3}$$

$$\frac{7}{8} \div \frac{14}{3}$$

$$\frac{7}{8} \times \frac{3}{14} = \frac{3}{16}$$

Translate the phrases into equations using n as the variable. Variables may vary.

26. Seven added to a number is twenty-three. $n + 7 = 23$

27. A number less eight is five. $n - 8 = 5$

28. The product of a number and nine is thirty-six. $9n = 36$

29. A number divided into twenty-one is seven. $\frac{21}{n} = 7$

Use a compass and a straightedge to construct $UV \parallel WX$.



31. Due to an extended period of dry weather, the school's well went dry in October. The contractor who drilled a new well for the school agreed to accept \$500 as a down payment and then be paid the remainder 9 months later plus 6% interest on the unpaid balance. The original cost of the new well before interest was added was \$1,275.

Solutions may vary.

- a. On how much of the original amount did the school owe interest? $\underline{\$775.00}$

a. $\$1,275 - 500 = \775

- b. How much interest did the school owe after 9 months? $\underline{\$34.88}$

b. $\$775 \times 0.06 \times \frac{3}{4} \approx \34.88

- c. Including the interest, how much did the school pay for the well? $\underline{\$1,309.88}$

c. $\$775 + 500 + 34.88 = \$1,309.88$

21

Teacher Notes:
