Contents

Introduction

Math Mammoth Grade 7 Review Workbook is intended to give students a thorough review of seventh grade math, following the main areas of Common Core Standards for grade 7 mathematics and typical pre-algebra study topics. The book has both topical as well as mixed (spiral) review worksheets, and includes both topical tests and a comprehensive end-of-the-year test. The tests can also be used as review worksheets, instead of tests.

You can use this workbook for various purposes: for summer math practice, to keep the child from forgetting math skills during other break times, to prepare students who are going into eighth grade or algebra 1, or to give seventh grade students extra practice during the school year.

The topics reviewed in this workbook are:

- algebra
- integers
- one-step equations
- rational numbers
- equations and inequalities
- ratios and proportions
- percent
- geometry
- Pythagorean Theorem
- probability
- statistics

In addition to the topical reviews and tests, the workbook also contains many cumulative (spiral) review pages.

The content for these is taken from the *Math Mammoth Grade 7 Complete Curriculum*. However, the content follows a typical pre-algebra course, so this workbook can be used no matter which math curriculum you follow.

Please note this book does not contain lessons or instruction for the topics. It is not intended for initial teaching. It also will not work if the student needs to completely re-study these topics (the student has not learned the topics at all). For that purpose, please consider the *Math Mammoth Grade 7 Complete Curriculum*, which has all the necessary instruction and lessons.

> *I wish you success with teaching math!*
>
> *Maria Miller, the author*

The Language of Algebra Review

1. Find the value of these expressions.

a. $(6+4)^2 \cdot (12-9)^3$	**b.** $3 \cdot (5 - (7-5))$	**c.** $\dfrac{(5-3) \cdot 2}{2^3} + 7$

2. Name the property of arithmetic illustrated by the fact that $(5 \cdot z) \cdot 3$ is equal to $5 \cdot (z \cdot 3)$.

3. Evaluate the expressions.

a. $100 - 2x^2$, when $x = 5$	**b.** $\dfrac{2s}{s^3 + 3}$, when $s = 4$

4. Which equation matches the situation? *Hint: give the variable(s) some value(s) to test the situation.*

a. The shorter beam (length l_1) is 1.5 meters shorter than the longer beam (length l_2).

$l_1 = 1.5 - l_2$	$l_2 = 1.5 - l_1$	$l_2 = l_1 - 1.5$	$l_1 = l_2 - 1.5$

b. The dog lost 1/6 of its original weight (w), and weighs now 23 kg.

$\dfrac{w}{6} = 23$	$\dfrac{5w}{6} = 23$	$\dfrac{6w}{5} = 23$	$w - 1/6 = 23$	$w - 5/6 = 23$

5. Is subtraction commutative? In other words, is it true that $a - b$ has the same value as $b - a$, no matter what values we use for a and b? Explain your reasoning.

6. Write a SINGLE expression to match these situations.

a. A pair of jeans costs p dollars. The jeans are now discounted by 1/5 of that price.
Write an expression for the discounted price.

b. It costs Mandy $0.18 to drive her car one mile.
How much does it cost her to drive y miles? Write an expression.

c. The pet store sells dog food in bags of two different sizes: 3-kg and 8-kg.
What is the total weight of n of the smaller bags and m of the larger bags?

7. Simplify the expressions.

a. $x + 2 + x + x$	b. $x \cdot 2 \cdot x \cdot x \cdot x$	c. $8v + 12v$
d. $8v \cdot 12v$	e. $4z \cdot 9z \cdot z$	f. $f + 2f + 10g - f - 4g$

8. **a.** Sketch a rectangle that is $5x$ tall and $2x$ wide.

   b. What is its area?

   c. What is its perimeter?

9. Use the distributive property to multiply.

a. $12(v - 9)$	b. $3(a + b + 2)$	c. $3(0.5t - x)$

10. Draw a diagram of two rectangles to illustrate that the product $11(x + 7)$ is equal to $11x + 77$.

11. Fill in the table.

Expression	the terms in it	coefficient(s)	Constants
a^8			
$2x + 9y$			

12. The perimeter of a regular pentagon is $30s + 45$. How long is one side?

13. Factor these sums (write them as products). Think of divisibility!

a. $48x + 12 =$	b. $40x - 25 =$
c. $6y - 2z =$	d. $56t - 16s + 8 =$

Mixed Review 4

1. Find the root(s) of the equation $x^2 - x - 20 = 0$ in the set $\{-5, -4, -3, 3, 4, 5\}$.

2. Is division commutative? Explain your reasoning.

3. Solve.

a. $\quad \dfrac{x}{7} \;=\; -15$	**b.** $\quad 11 \;=\; \dfrac{x}{-12}$
c. $\quad 7 - x \;=\; -3$	**d.** $\quad 5 \cdot (-8) \;=\; -10x$

4. Interpret the absolute value in each situation.

   a. The temperature is $-4°C$. $|-4°C| =$ _____°C

   Here, the absolute value shows _____

   b. The mountain is 2,500 ft tall. $|2,500 \text{ ft}| =$ _____ ft

   Here, the absolute value shows _____

5. Find the average speed in the given unit.

   a. Amanda swims 1 kilometer in 35 minutes.
   Give her average speed in kilometers per hour.

   b. You walk a distance of 1200 feet in 4 minutes.
   What is your average speed in miles per hour?

6. Add.

a. $(-3) + (-6) + 5 + 1 = $ _____	**b.** $14 + (-20) + (-31) + 11 = $ _____

7. Divide and simplify if possible.

a. $12 \div (-5)$	**b.** $-33 \div 15$	**c.** $-2 \div (-9)$

8. **a.** Jerry's yard is a rectangle with one 500-ft side and a total area of 150,000 square feet.
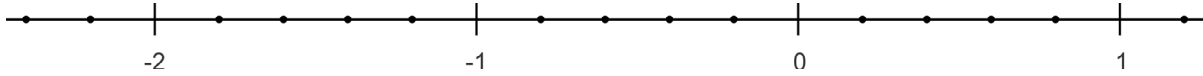   How long is the other side? Write an equation with an unknown and solve it.

   b. Sketch a square that is one yard long and wide. Use your sketch to
   figure out how many square feet are in one square yard.

   c. Lastly, convert the area of Jerry's yard into square yards.

Rational Numbers Test

1. Mark these numbers on the number line: $-\dfrac{2}{5}, \quad -1\dfrac{4}{5}, \quad -2\dfrac{1}{5}, \quad -\dfrac{1}{10}, \quad -1\dfrac{9}{10}$

```
      |     .     .   |   .     .   |   .     .   |   .     .     .   |
     -2               -1            0             1
```

2. Form a fraction (numerator and denominator) from the two given integers. Then give it as a decimal.

a. 5 and 4	**b.** −7 and 10	**c.** 9 and −100

3. Write the decimals as mixed numbers.

a. 5.001	**b.** −2.0482

4. Write the fractions as decimals.

a. $-\dfrac{47}{10,000}$	**b.** $\dfrac{787}{10}$	**c.** $-\dfrac{5,624}{100}$

5. Which is more, $0.\overline{6}$ or 0.6?
   How much more?

6. Write as decimals, using a line over the repeating part (if any). Use long division.

a. $\dfrac{7}{6}$	**b.** $\dfrac{5}{36}$

7. Add or subtract.

a. $-1.26 - (-3.45)$	**b.** $1.8 - 3.25$	**c.** $-0.42 + 10.7 + (-9.8)$

8. Add or subtract.

a. $\dfrac{5}{9} + \left(-\dfrac{2}{3}\right)$	**b.** $-\dfrac{1}{10} - \dfrac{6}{9}$

9. Write the numbers in scientific notation.

a. 25,600,000	**b.** 7,810,000,000

10. Multiply or divide.

a. $-0.06 \cdot 0.05$	**b.** $(-0.5)^3$
c. $\dfrac{1}{3} \cdot \left(-5\dfrac{6}{11}\right)$	**d.** $-6\dfrac{1}{9} \div \left(-\dfrac{3}{4}\right)$

11. Divide *without* a calculator.

a. $1.5 \div 0.006$	**b.** $0.9 \div 0.011$

12. Give a real-life context for the calculation $\frac{1}{3} \cdot 12.75$. Then solve.

13. Find 15% of 3/4.

14. Two-thirds of a number is −5.66.
    What is the number?

15. Simplify these complex fractions.

a. $\dfrac{\frac{2}{5}}{4}$	**b.** $\dfrac{\frac{9}{10}}{\frac{1}{6}}$

Mixed Review 7

1. Find the missing numbers and terms.

a. _____ $(6x - 5) = 72x - 60$	**b.** $12(\_\_\_\_ - \_\_\_\_ + \_\_\_\_) = 108y - 36x + 4.8$

2. Write an expression with two terms: the coefficient of the first term is 5,
   its variable part is x cubed, and the second term is the constant $-1/2$.

3. **a.** Which equation matches the situation?

   A town of population p lost 2/3 of its population, and now it has 2,600 residents.

$p - 2/3 = 2600$	$\dfrac{2p}{3} = 2600$	$p - 1/3 = 2600$	$p - 2/3p = 2600$

   b. How many people lived in the town originally?

4. Add.

a. $(-14) + 7 + (-8) + 2 =$	**b.** $-3 + (-12) + 21 + (-19) + (-5) =$

5. Give a real-life context for each multiplication. Then solve.

   a. $1.4 \cdot 119$

   b. $(9/10) \cdot 14.30$

6. Change each subtraction into an addition, then add.

a. $-8 - (-7) - (-12) =$	b. $63 - (-11) + (-5) =$

7. **a.** Write an expression for the distance between x and 8.

   b. Evaluate your expression if $x = -52$.

8. Solve using both decimal and fraction arithmetic.

a. $0.24 \div 0.03$ **Decimal division:**   **Fraction division:**

b. $7.1 \cdot 0.5$ **Decimal multiplication:**   **Fraction multiplication:**

9. Solve.

$$\frac{5}{6} \cdot \frac{2}{3} \div \frac{4}{3}$$

10. Solve *without* a calculator.

a. 11% of $15	**b.** 90% of −12	**c.** 75% of −200 m

11. Solve *without* a calculator. Change the decimals into fractions or treat fractions as divisions.

a. $0.5 \cdot \frac{11}{12}$	**b.** $\frac{2}{5} \cdot (-0.8)$	**c.** $-\frac{5}{6} \cdot 0.2$

12. Rewrite each expression without parentheses.

a. $2 + (-g) =$	**b.** $15 - (-r) =$	**c.** $7x + (-2y) =$

13. Write the numbers in scientific notation.

a. 113,000   **b.** 45,980,000

14. Simplify the complex fractions.

a. $\dfrac{7}{\frac{8}{9}}$	**b.** $\dfrac{\frac{1}{2}}{\frac{1}{5}}$	**c.** $\dfrac{\frac{15}{21}}{\frac{2}{3}}$

Ratios and Proportions Review

1. Simplify the ratios and rates.

a. 164 km per 4 hours	**b.** $\dfrac{6 \text{ g}}{1600 \text{ ml}} =$	**c.** 52 : 156 = _____ : _____

2. A car traveled 348 miles in 6 hours. Fill in the table of equivalent rates.

Miles						348		
Hours	1	2	3	4	5	6	10	20

3. A mixture of salt and water contains 20 grams of salt and 1,200 grams of water.
   Write the ratio by weight of salt to water and simplify it.

4. Susan can jog 1 1/2 miles in 1/3 hour.
   Write a rate for her jogging speed and simplify it.

5. Solve the proportions. Round your answers to the nearest hundredth.

a. $\dfrac{16}{17} = \dfrac{109}{T}$	**b.** $\dfrac{1.5}{2.8} = \dfrac{M}{5}$

6. Write a proportion for the following problem and solve it.

12 kg of chicken feed costs $19.
How much would 5 kg cost?

$$\frac{}{} = \frac{}{}$$

7. On average, Gary makes a basket eight times out of every ten shots.
   How many baskets can he expect to make when he practices 25 shots?

8. Write the unit rate as a complex fraction, and then simplify it.

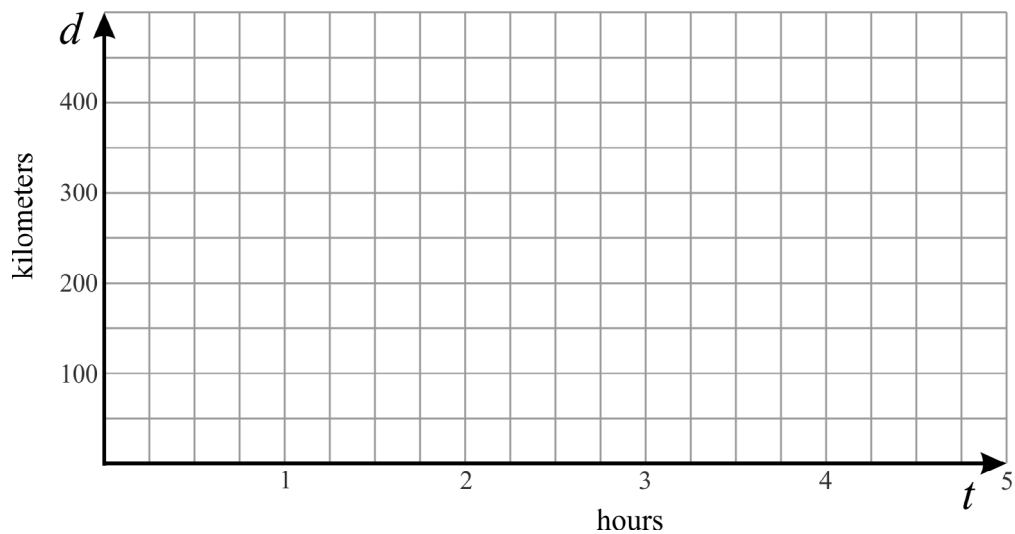| |
|---|
| **a.** Alex solved 2 1/2 pages of math problems in 1 1/4 hour. |
| **b.** Noah painted 2/3 of a room in 3/4 of an hour. |

9. A car is traveling at a constant speed of 75 km per hour.

   a. Write an equation relating the distance (*d*) and time (*t*) and plot it in the grid below.

   b. What is the unit rate?

   c. Plot the point that matches the unit rate in this situation.

   d. What does the point (0, 0) mean in terms of this situation?

   e. How far can the car travel in 55 minutes, driving at the same speed?
   Also, plot the point for the time *t* = 55 min.

   f. How long will the car take to travel 160 km? Give your answer in hours and minutes.
   Also, plot the point that matches the distance *d* = 160 km.

10. Using a pre-paid internet service you get a certain amount of bandwidth to use for the amount you pay. The table shows the prices for certain amounts of bandwidth.

Bandwidth	1G	2G	5G	10G	15G	20G	25G
Price	$10	$16	$23	$30	$37	$43	$50

   **a.** Are these two quantities in proportion?

   Explain how you can tell that.

   b. If so, write an equation relating the two and state the constant of proportionality.

11. In the year 2008 it was estimated that it cost $9,369 a year to drive a medium-sized car (a sedan) for 15,000 miles (a typical amount of use). Based on those same assumptions, how much would it cost, to the nearest dollar, to drive that car for 5 months?

12. The figures are similar. Find the length of the side labeled with x.

8 m

x

6 m

10 m

a.

8 in

5.6 in

13 in

x

b.
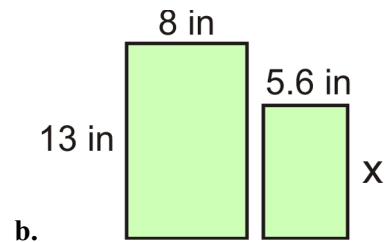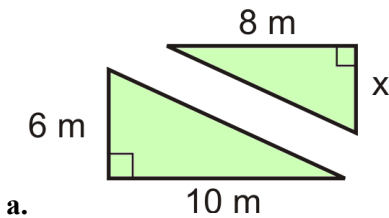
13. A house plan has a scale of 1 in : 6 ft. In the plan, one room measures 2 in × 2 ¾ in.
    What are the true dimensions of the room?

14. A freight truck fully loaded with cargo gets six miles to a gallon of diesel.

    a. What is the unit rate in this situation?

    b. Write an equation relating the mileage (M) to the amount of diesel fuel (*f*) in gallons.

    c. Plot your equation. Choose an appropriate scaling for the two axes.
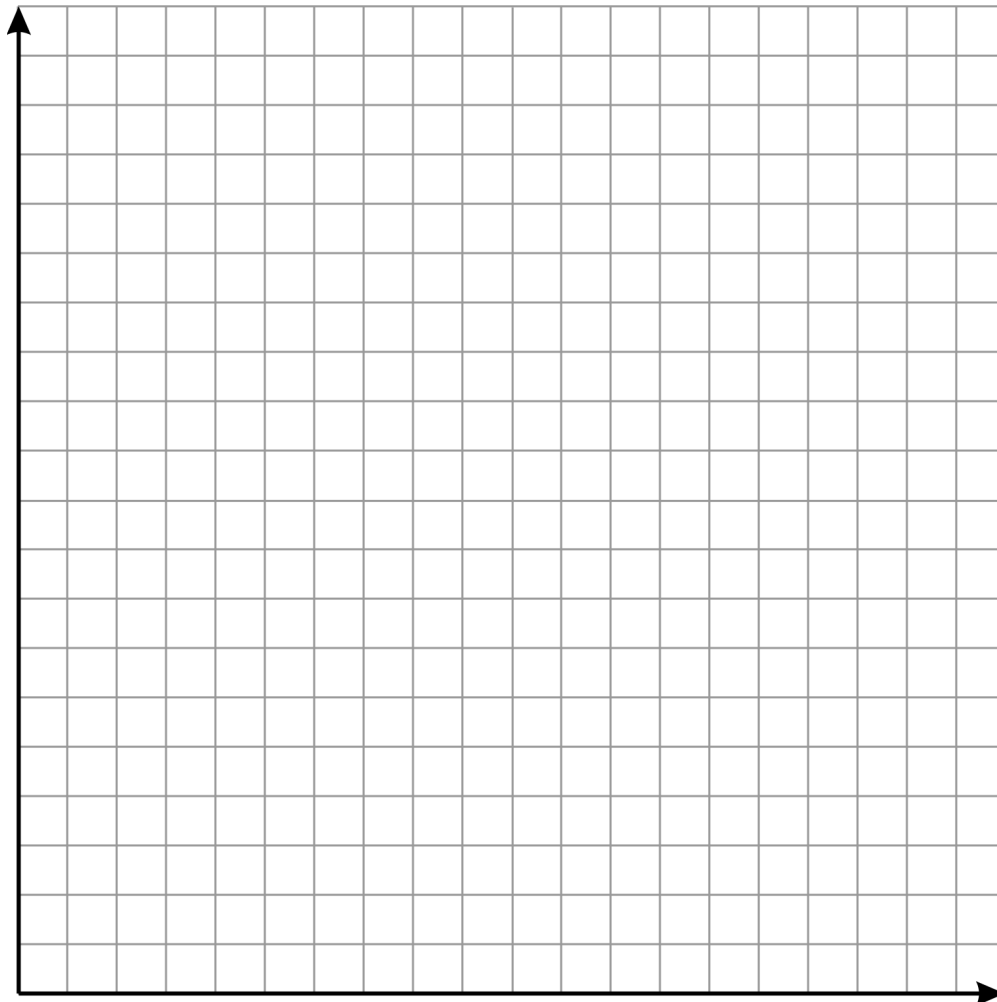
Percent Test

You may use a basic calculator for all the problems in this test.
If not otherwise specified, give your answers that are percentages to the tenth of a percent.

1. The price of these items is changing. Find the new price or the discount percentage.

a.	**b.**	**c.**
Price: $110	Price: $5,000	Price: $90
12% discount	2.4% increase	_____% discount
New price: $_____	New price: $_____	New price: $59

2. The Jefferson family bought three children's tickets and two adult's tickets to the county fair. They got a 5% discount on the total purchase price before tax. Lastly, a 6.2% sales tax was added to the total. If the normal price of a child's ticket is $10 and an adult's ticket is $20, find the cost of tickets for the family.

3. This year the college has 1,210 students—an increase of 6.6% from last year. How many students did the college have last year?

4. Mary's dog weighed 25 kg, but then it got sick and lost 2.3 kg.

   a. What percentage of body weight did the dog lose?

   b. Mary weighs 58 kg. If Mary lost the same percentage of her body weight as what the dog did, how much would Mary weigh?

5. A rectangular playground area measures 5 m by 6.5 m. It is enlarged so that it becomes 7.2 m by 10 m. What is the percentage of increase in its area?

6. In 2010, the United States had 10,779,264 males and 10,320,257 females that were 0 to 4 years old.
   It also had 10,827,017 males and 11,282,003 females that were 50 to 54 years old.

   a. How many percent more males than females are there in the age group 0-4 years?
   (Use relative difference/percentage difference.)

   b. How many percent more females than males are there in the age group 50-54 years?
   (Use relative difference/percentage difference.)

7. A 12″ pizza in Tony's Pizzeria costs $12.99 and in PizzaTown it costs $15.99.
   How many percent more expensive is the 12″ pizza in PizzaTown than in Tony's Pizzeria?

8. Jacqueline deposited $2,500 into a savings account that pays a yearly interest rate of 4.4%.
   Calculate how much her account will contain after three years.

9. Michael borrowed $35,000 for ten years. At the end of those years he paid the bank back $65,800.
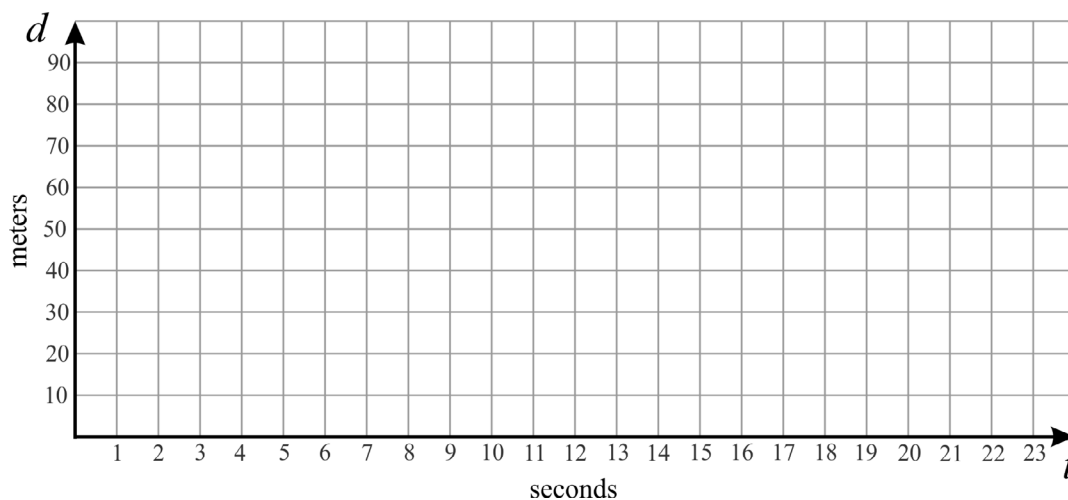   What was the interest rate?

Mixed Review 11

1. Evaluate the expressions. Give your answer as a fraction or mixed number.

a. $\dfrac{3x}{x+7}$, when $x = -4$	**b.** $\dfrac{1-x}{1+x}$, when $x = 7$

2. Eric walks at a constant speed of 2 m/s for eight seconds. Then he runs for the next ten seconds at a constant speed of 5 m/s.

   a. Plot a graph for the distance Eric runs.

   b. What is the total distance Eric advances?

3. Solve.

a. $\dfrac{6x}{7} = -1.2$	**b.** $6x - 7 = -1.2$

4. Are the expressions equal, no matter what values x and y have? If so, you don't need to do anything else. If not, provide a counterexample.

a. $\dfrac{x-y}{3}$ $\dfrac{x}{3} - \dfrac{y}{3}$	b. $x - 2y$ $y - 2x$

5. Evaluate the expression $|a - b|$ for the given values of a and b. Check that the answer you get is the same as if you had used a number line to figure out the distance between the two numbers.

a. a is −5 and b is 6	b. a is −2 and b is −11

6. **a.** Write an expression for the distance between x and 7.

   b. Evaluate your expression for $x = -3$.

7. Write using symbols, and simplify if possible.

   a. the opposite of −2   **b.** the absolute value of −80

   c. the opposite of the sum $6 + 7$ **d.** the absolute value of the sum $-4 + 5$
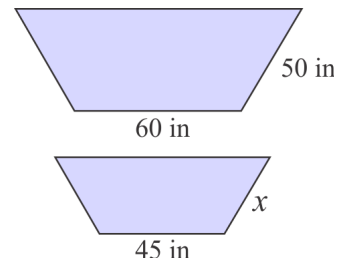
8. Solve the proportions by using cross-multiplication.

a. $\dfrac{14 \text{ mi}}{0.59 \text{ gal}} = \dfrac{100 \text{ mi}}{V}$	b. $\dfrac{P}{2000 \text{ lb}} = \dfrac{\$4.05}{3 \text{ lb}}$

9. If gasoline costs $3.14 per gallon and if your car gets 21 miles per gallon, find the cost of driving the car for 15 miles.

10. The two figures are similar. Find the length of the unknown side.

50 in

60 in

x

45 in

11. Solve using both decimal multiplication and fraction multiplication.

$0.6 \cdot 0.7$	**Decimal multiplication:**	**Fraction multiplication:**

12. Solve using both decimal division and fraction division.

|		
$0.24 \div 0.5$	**Decimal division:**	**Fraction division:**

Probability Review

1. The chart lists the favorite school subjects of the students in a 7th grade classroom.

    a. You choose one student randomly. What is the
probability that the student's favorite subject is
not math, English, or science?

    b. What is the probability that a randomly chosen
student's favorite subject is math?

    c. Now look at the boys only. If you choose one
boy randomly, what is the probability that his
favorite subject is math?

    d. If you choose a girl randomly from among the girls,
then what is the probability that her favorite subject is math?
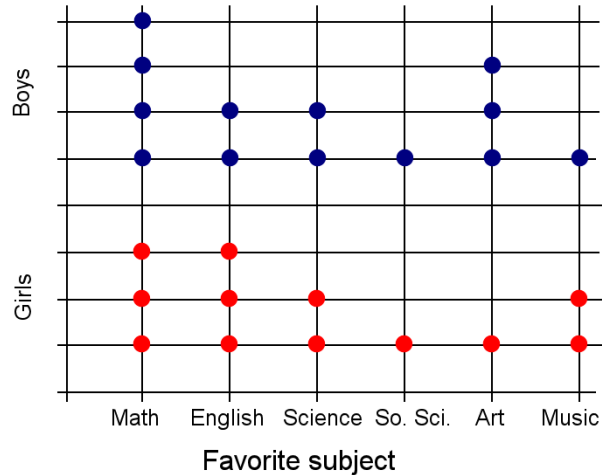
2. Abigail rolls two dice. Find the probabilities of these events:

    a. P(5, 6)

    b. P(even, even)

    c. P(at least 5, at least 5)

    d. P(at most 3, at most 2)

3. Julie and Jane experimented with rolling a die. They rolled
the die 60 times in a row and recorded the results:

    2 4 3 3 5 2 5 4 1 6 1 4 4 4 5 4 2 6 4 1 5 2 1 1 1 2 1 3 6 2
    4 2 2 3 3 5 2 3 6 4 4 4 1 3 2 6 6 4 5 6 4 6 5 6 5 6 5 6 5 3

    a. In this experiment, what was
the probability of rolling a 1?

    Rolling a 4?

    b. Why are those probabilities not 1/6?
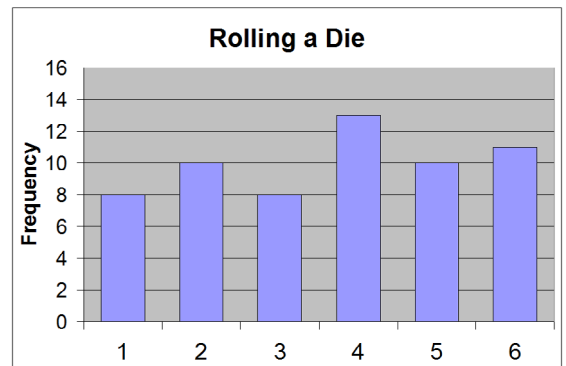
4. Andrew did an experiment where he tossed two coins 200 times and recorded the outcomes. The table below shows his results. "H" means "heads," and "T" means "tails," so "HH," for example, means both coins landed "heads."

a. Calculate the experimental and theoretical probabilities and fill in the table.

Outcome	Frequency	Experimental Probability (%)	Theoretical Probability (%)
HH	38		
HT	53		
TH	46		
TT	63		
TOTALS	**200**		

b. How would the experimental probabilities change if Andrew redid this experiment with 2,000 tosses?

5. In a multi-player computer game, a computer chooses colors randomly for a girl's dress. The first color it chooses is the main color of the dress. The second color is for the bows and some layers of the skirt. The computer uses this list of colors: *red, blue, purple, pink, orange, yellow, mint.*

After choosing the main color, the computer removes it from the list and chooses the second color from the resulting list of six colors. That way the dress is sure to have two different colors.

a. What is the probability the computer chooses first purple, then orange?

b. What is the probability the computer chooses first red, then not pink?

c. Janet doesn't like mint. What is the probability her character gets a dress with no mint in it when she plays the game?

Grade 7 (Pre-algebra) End-of-Year Test

This test is quite long, because it contains lots of questions on all of the major topics covered in the *Math Mammoth Grade 7 Complete Curriculum*. Its main purpose is to be a diagnostic test—to find out what the student knows and does not know about these topics.

You can use this test to evaluate a student's readiness for an Algebra 1 course. In that case, it is sufficient to administer the *first four sections* (Integers through Ratios, Proportions, and Percent), because the topics covered in those are prerequisites for algebra or directly related to algebra. The sections on geometry, statistics, and probability are not essential for a student to be able to continue to Algebra 1. The Pythagorean Theorem is covered in high school algebra and geometry courses, so that is why it is not essential to master, either.

Since the test is so long, I recommend that you break it into several parts and administer them on consecutive days, or perhaps on morning/evening/morning/evening. Use your judgment.

A calculator is *not* allowed for the first three sections of the test: Integers, Rational Numbers, and Algebra.

A <u>basic</u> calculator *is* allowed for the last five sections of the test: Ratios, Proportions, and Percent; Geometry, The Pythagorean Theorem, Probability, and Statistics.

The test is evaluating the student's ability in the following content areas:

- operations with integers
- multiplication and division of decimals and fractions, including with negative decimals and fractions
- converting fractions to decimals and vice versa
- simplifying expressions
- solving linear equations
- writing simple equations and inequalities for word problems
- graphs of linear equations
- slope of a line
- proportional relationships and unit rates
- basic percent problems, including percentage of change
- working with scale drawings
- drawing triangles
- the area and circumference of a circle
- basic angle relationships
- cross-sections formed when a plane cuts a solid
- solving problems involving area, surface area, and volume
- using the Pythagorean Theorem
- simple probability
- listing all possible outcomes for a compound event
- experimental probability, including designing a simulation
- biased vs. unbiased sampling methods
- making predictions based on samples
- comparing two populations and determining whether the difference in their medians is significant

If you are using this test to evaluate a student's readiness for Algebra 1, I recommend that the student score a minimum of 80% on the first four sections (Integers through Ratios, Proportions, and Percent). The subtotal for those is 118 points. A score of 94 points is 80%.

I also recommend that the teacher or parent review with the student any content areas in which the student may be weak. Students scoring between 70% and 80% in the first four sections may also continue to Algebra 1, depending on the types of errors (careless errors or not remembering something, versus a lack of understanding). Use your judgment.

You can use the last four sections to evaluate the student's mastery of topics in Math Mammoth Grade 7 Curriculum. However, mastery of those sections is not essential for a student's success in an Algebra 1 course.

My suggestion for points per item is as follows.

Question #	Max. points	Student score
Integers		
1	2 points	
2	2 points	
3	3 points	
4	6 points	
5	2 points	
6	3 points	
subtotal		/ 18
Rational Numbers		
7	8 points	
8	3 points	
9	3 points	
10	2 points	
11	4 points	
subtotal		/ 20
Algebra		
12	6 points	
13	3 points	
14	12 points	
15	2 points	
16a	1 point	
16b	2 points	
17	3 points	
18	4 points	

Question #	Max. points	Student score
19a	2 points	
19b	1 point	
20	8 points	
21	2 points	
22a	2 points	
22b	1 point	
subtotal		/ 49
Ratios, Proportions, and Percent		
23	4 points	
24a	1 point	
24b	2 points	
24c	1 point	
24d	1 point	
25a	1 point	
25b	2 points	
26	2 points	
27	2 points	
28a	2 points	
28b	2 points	
29	2 points	
30	2 points	
31	2 points	
32	Proportion: 1 point Solution: 2 points	
33	2 points	
subtotal		/ 31
SUBTOTAL FOR THE FIRST FOUR SECTIONS:		**/118**

Question #	Max. points	Student score
Geometry		
34a	2 points	
34b	2 points	
35	3 points	
36	2 points	
37	2 points	
38	2 points	
39a	1 points	
39b	3 points	
40a	2 points	
40b	2 points	
41	2 points	
42	3 points	
43a	2 points	
43b	2 points	
44a	2 points	
44b	2 points	
45a	2 points	
45b	1 point	
46a	1 point	
46b	2 points	
	subtotal	/ 40
The Pythagorean Theorem		
47	2 points	
48	2 points	
49	2 points	
50	3 points	
	subtotal	/9

Question #	Max. points	Student score
Probability		
51	3 points	
52a	2 points	
52b	1 point	
52c	1 point	
52d	1 point	
53	3 points	
54	3 points	
	subtotal	/14
Statistics		
55	2 points	
56a	1 point	
56b	2 points	
56c	2 points	
57	2 points	
58a	1 point	
58b	1 point	
58c	1 point	
58d	3 points	
	subtotal	/15
SUBTOTAL FOR THE LAST FOUR SECTIONS:		**/78**
TOTAL		**/196**

Math Mammoth End-of-Year Test - Grade 7

Integers

A calculator is not allowed for the problems in this section.

1. Give a real-life situation for the sum $-15 + 10$.

2. Give a real-life situation for the product $4 \cdot (-2)$.
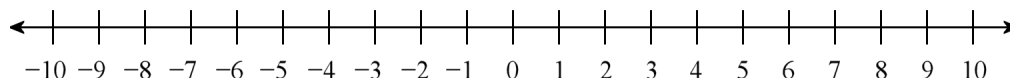
3. Represent the following operations on the number line.

a. $-1 - 4$
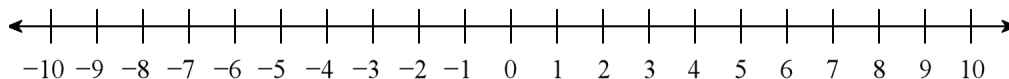
b. $-2 + 7$
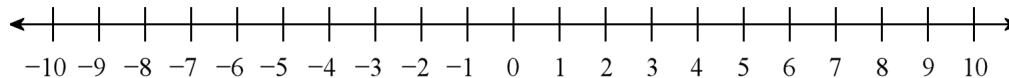
c. $-2 + (-7)$

4. Solve.

a. $-13 + (-45) + 60 =$ _____	**b.** $-8 - (-7) =$ _____	**c.** $2 - (-17) + 6 =$ _____
d. $-3 \cdot (-8) =$ _____	**e.** $48 \div (-4) =$ _____	**f.** $(-2) \cdot 3 \cdot (-2) =$ _____

5. The expression $|20 - 31|$ gives us the distance between the numbers 20 and 31.
   Write a similar expression for the distance between -5 and -15 and simplify it.

6. Divide. Give your answer as a fraction or mixed number in lowest terms.

a. $1 \div (-8)$	**b.** $-4 \div 16$	**c.** $-21 \div (-5)$

Rational Numbers

A calculator is not allowed for the problems in this section.

7. Multiply and divide. For problems with fractions, give your answer as a mixed number in lowest terms.

a. $-\dfrac{2}{7} \cdot \left(-3\dfrac{5}{8}\right)$	**b.** $27.5 \div 0.6$
c. $-0.7 \cdot 1.1 \cdot (-0.001)$	**d.** $(-0.12)^2$
e. $\dfrac{\dfrac{3}{4}}{\dfrac{5}{12}}$	**f.** $\dfrac{5\,\frac{1}{2}}{-\dfrac{7}{8}}$
g. $-\dfrac{1}{6} \cdot 1.2$	**h.** $-\dfrac{2}{5} \div (-0.1)$

8. Write the decimals as fractions.

a. 0.1748	**b.** −0.00483	**c.** 2.043928

9. Write the fractions as decimals.

a. $-\dfrac{28}{10,000}$	**b.** $\dfrac{2,493}{100}$	**c.** $7\dfrac{1338}{100,000}$

10. Convert to decimals. If you find a repeating pattern, give the repeating part. If you don't, round
    your answer to five decimals.

a. $\dfrac{7}{13}$	**b.** $1\dfrac{9}{11}$

11. Give a real-life context for each multiplication or division. Then solve.

a. $1.2 \cdot 25$

b. $(3/5) \div 4$

Algebra

A calculator is not allowed for the problems in this section.

12. Simplify the expressions.

a. $7s + 2 + 8s - 12$	**b.** $x \cdot 5 \cdot x \cdot x \cdot x$	**c.** $3(a + b - 2)$
d. $0.02x + x$	**e.** $1/3(6w - 12)$	**f.** $-1.3a + 0.5 - 2.6a$

13. Factor the expressions (write them as multiplications).

a. $7x + 14$ $=$	**b.** $15 - 5y$ $=$	**c.** $21a + 24b - 9$ $=$

14. Solve the equations.

a. $\quad 2x - 7 \; = \; -6$	**b.** $\quad 2 - 9 \; = \; -z + 4$
c. $\quad 120 \; = \; \dfrac{c}{-10}$	**d.** $\quad 2(x + \frac{1}{2}) \; = \; -15$
e. $\quad \dfrac{2}{3}x \; = \; 266$	**f.** $\quad x + 1\dfrac{1}{2} \; = \; \dfrac{3}{8}$

15. Chris can run at a constant speed of 12 km/h. How long will it take him to run from his home to the park, a distance of 0.8 km?

Remember to check that your answer is reasonable.

16. **a.** Which equation matches the situation?

A pair of binoculars is discounted by 1/5 of their original price (*p*), and now they cost $48.

$$\frac{p}{5} = 48 \qquad \frac{4p}{5} = 48 \qquad \frac{5p}{4} = 48 \qquad p - 1/5 = 48 \qquad p - 4/5 = 48 \qquad 5p - 4 = 48$$
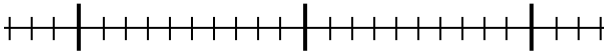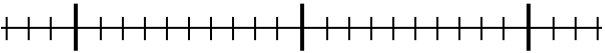
b. Solve the equation to find the original price of the binoculars.

17. The perimeter of a rectangle is 254 cm. Its length is 55 cm. Represent the width of the rectangle with a variable and write an equation to solve for the width. Then solve your equation.

18. Solve the inequalities and plot their solution sets on a number line. Write appropriate multiples of ten under the bolded tick marks (for example, 30, 40, and 50).

| **a.** $3x - 7 < 83$ | **b.** $2x - 16.3 \geq 10.5$ |

19. You need to buy canning jars. They cost $15 per box, and you only have $150 to spend. You also have a coupon for a $25 discount on your total. How many boxes can you buy at most?

a. Write an inequality for the problem and solve it.

b. Describe the solution of the inequality in words.

20. *Solve.

a. $9y - 2 + y = 5y + 10$	**b.** $2(x + 7) = 3(x - 6)$
c. $\dfrac{y + 6}{-2} = -10$	**d.** $\dfrac{w}{2} - 3 = 0.8$

21. *Draw a line that has a slope of 1/2 and
    that goes through the point (0, 4).

22. **a.** *Draw the line $y = -2x + 1$.

    b. *What is its slope?
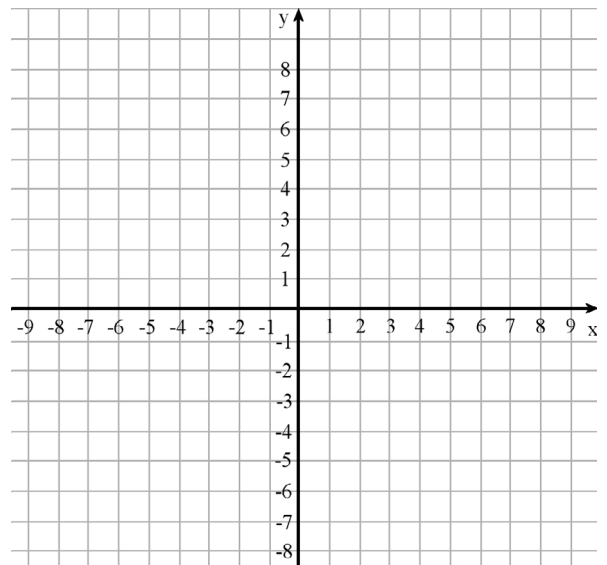
Ratios, Proportions, and Percent

You may use a basic calculator for all the problems in this section.

23. (1) Write a unit rate as a complex fraction. (2) Then simplify it. Be sure to include the units.

a. Lily paid $6 for 3/8 lb of nuts.

b. Ryan walked 2 ½ miles in 3/4 of an hour.

24. The graph below shows the distance covered by a moped advancing at a constant speed.
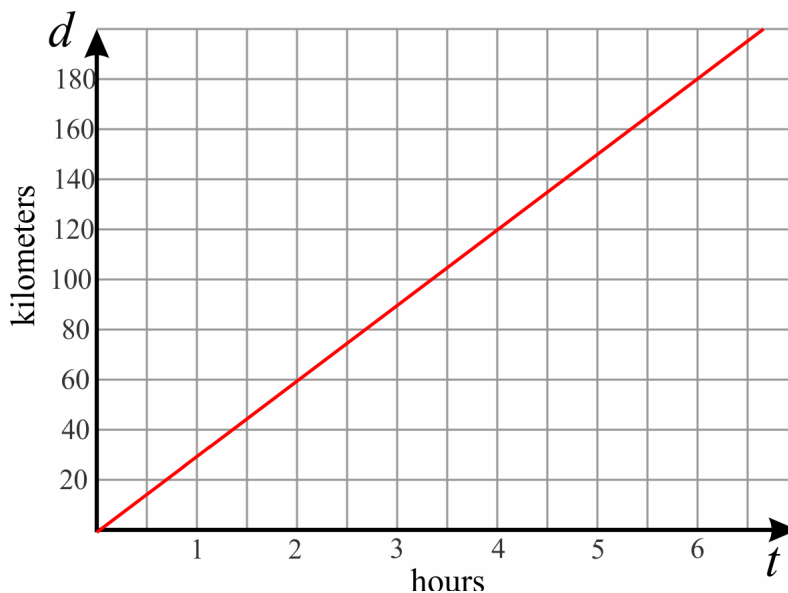
a. What is the speed of the moped?

b. Plot on the line the point that corresponds to the time $t = 4$ hours.
What does that point signify in this context?

c. Write an equation relating the quantities d and t.

d. Plot the point that corresponds to the unit rate in this situation.

25. A Toyota Prius is able to go 565 miles on 11.9 gallons of gasoline (highway driving).
A Honda Accord can travel 619 miles on 17.2 gallons of gasoline (highway driving).
(Source: Fueleconomy.gov)

a. Which car gets better gas mileage?

b. Calculate the difference in costs if you drive a distance of 300 miles with each car,
if gasoline costs $3.19 per gallon.

26. Sally deposits $2,500 at 8% interest for 3 years.
How much can she withdraw at the end of that period?

27. A ticket to a fair initially costs $10. The price is increased by 15%. Then, the price
is decreased by 25% (from the already increased price). What is the final price of the ticket?

28. In December, Sarah's website had 72,000 visitors. In December of the previous
year it had 51,500 visitors.

a. Find the percentage of increase to the nearest tenth of a percent in the number of visitors
her website had for that year.

b. If the number of visitors continues to grow at the same rate, about how many visitors
(to the nearest thousand) will her site have in December of the following year?

29. Alex measured the rainfall on his property to be 10.5 cm in June, which he calculated to be
a 35% increase compared to the previous month. How much had it rained in May?

30. A square with sides of 15 cm is enlarged in a ratio of 3:4. What is the area of the resulting square?

31. How long is a distance of 8 km if measured on a map with a scale of 1:50,000?

32. Write a proportion for the following problem and solve it.

600 ml of oil weighs 554 g.
How much would 5 liters of oil weigh?

$$\frac{}{} = \frac{}{}$$

33. A farmer sells potatoes in sacks of various weights. The table shows the price per weight.

Weight	5 lb	10 lb	15 lb	20 lb	30 lb	50 lb
Price	$4	$7.50	$9	$12	$15	$25

a. Are these two quantities in proportion?

Explain how you can tell that.

b. If so, write an equation relating the two and state the constant of proportionality.

Geometry

You may use a basic calculator for all the problems in this section.

34. The rectangle you see below is Jayden's room, drawn here at a scale of 1:45.

    a. Calculate the area of Jayden's room in reality, in square meters.
    Hint: measure the dimensions of the rectangle in centimeters.

    b. Reproduce the drawing at a scale of 1:60.
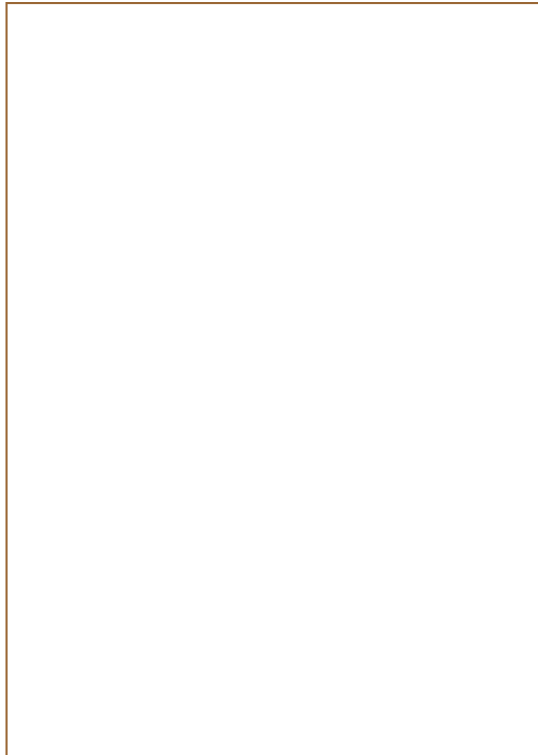
Scale 1:45

35. A room measures 4 ¼ in. by 3 ½ in. in a house plan with a scale of 1 in : 3 ft.
    Calculate the actual dimensions of the room.

36. Calculate the area of a circle with a diameter of 16 cm.

37. Calculate the circumference of a circle with a radius of 9 inches.

38. Draw a triangle with sides 8 cm, 11 cm, and 14.5 cm using a compass and a ruler.

39. A triangle has angles that measure 36°, 90°, and 54°, and a side of 8 cm.

   a. Does the information given determine a unique triangle?

   b. If so, draw the triangle. If not, draw several different triangles that fit the description.

40. **a.** Write an equation for the measure of angle *x*, and solve it.
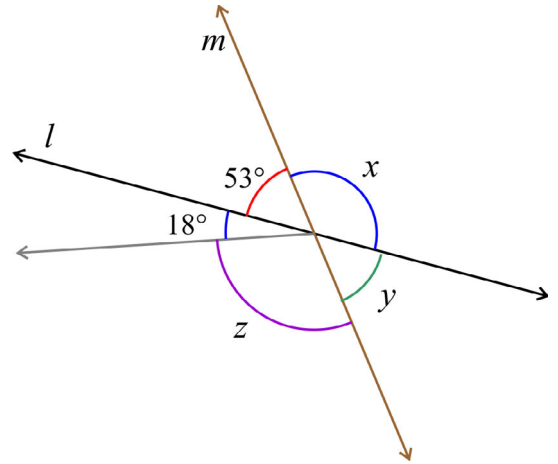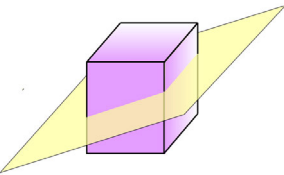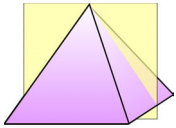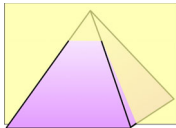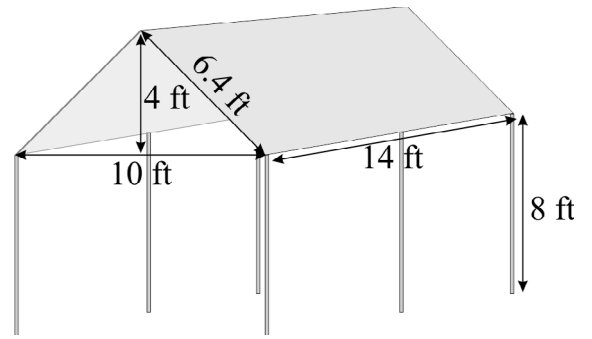
b. Write an equation for the measure of angle *z*, and solve it.

41. Calculate the measure of the unknown angle *x*.
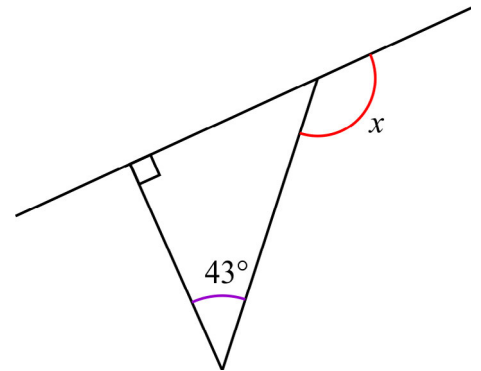
42. Describe the cross sections formed by the intersection of the plane and the solid.

a.

The cross section is

_____.

b.

The cross section is
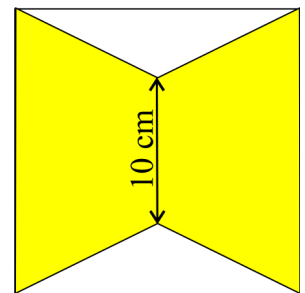
_____.

c.

The cross section is

_____.

43. **a.** Calculate the volume enclosed by
the roof (the top part).

4 ft

6.4 ft

10 ft

14 ft

8 ft

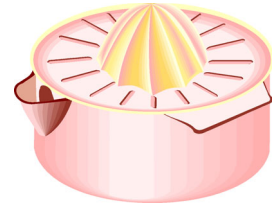**b.** Calculate the total volume enclosed by the canopy.

44. Two identical trapezoids are placed inside a 15 cm by 15 cm square.

a. Calculate their area.

10 cm

b. What percentage of the square do the trapezoids cover?

45. **a.** *Find the volume of the cylindrical part of the juicer, if its bottom diameter is 12 cm and its height is 4.5 cm.

   b. *Convert the volume to milliliters and to liters, considering that 1 ml = 1 cm^3.

46. **a.** *How many cubic inches are in one cubic foot?

   b. *The edges of a cube measure 3 ¼ ft. Calculate the volume of the cube in cubic inches.

The Pythagorean Theorem

You may use a basic calculator for all the problems in this section.

47. ***a.** What is the area of a square, if its side measures $\sqrt{5}$ m?

  *b. How long is the side of a square with an area of 45 cm^2?

48. *Determine whether the lengths 57 cm, 95 cm, and 76 cm form a right triangle. Show your work.

49. *Solve for the unknown side of the triangle to the nearest tenth of a centimeter.
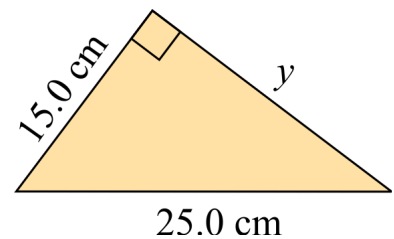
50. *You and your friends are at a river at point A. You suddenly remember you need something from home, which is at point C. So you decide to go home (distance AC) and then walk along the road (distance CB) to meet your friends, who will walk along the riverside from A to B.
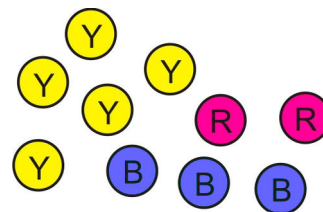
If ABC is a right triangle, AC = 120 m, and CB = 110 m, how much longer distance (in meters) will you walk than your friends?
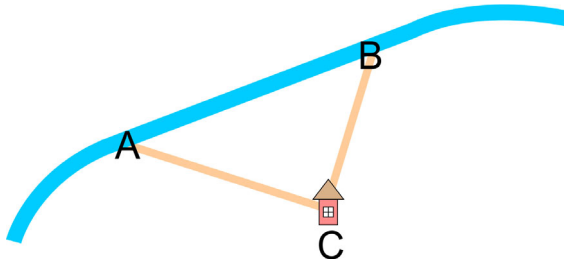
Probability

You may use a basic calculator for all the problems in this section.

51. You randomly pick one marble from these marbles.
    Find the probabilities:

    a. P(not red)

    b. P(blue or red)

    c. P(green)

52. A cafeteria offers a main dish with chicken or beef. The customer then chooses a portion of rice, pasta, or potatoes, and a side dish of green salad, green beans, steamed cabbage, or coleslaw.

    a. Draw a tree diagram or make a list of all the possible meal combinations.

    A customer chooses the parts of the meal randomly. Find the probabilities:

    b. P(beef, rice, coleslaw)

    c. P(no coleslaw nor steamed cabbage)

    d. P(chicken, green salad)

53. John and Jim rolled a die 1,000 times. The bar graph shows their results. Based on the results, which of the following conclusions, if any, are valid?

(a) This die is unfair.

(b) On this die, you will always get more 1s than 6s.

(c) Next time you roll, you will not get a 4.

A Thousand Die Rolls
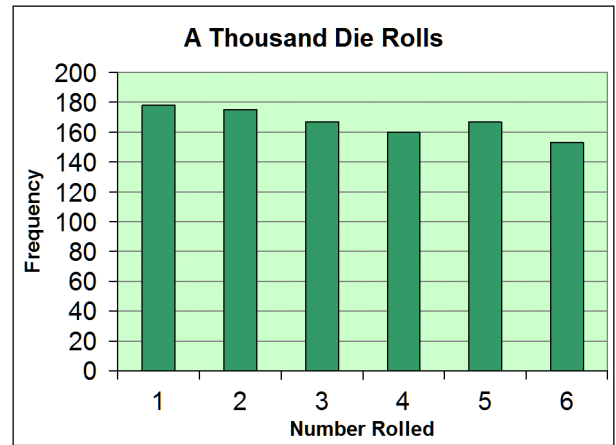
54. Let's assume that when a child is born, the probability that it is a boy is 1/2 and also 1/2 for a girl. One year, there were 10 births in a small community, and nine of them were girls. Explain how you could use coin tosses to simulate the situation, and to find the (approximate) probability that out of 10 births, exactly nine are girls. (You do not have to actually perform the simulation—just explain how it would be done.)

Statistics

You may use a basic calculator for all the problems in this section.

55. To determine how many students in her college use a particular Internet search engine, Cindy chose some students randomly from her class, and asked them whether they used that search engine.

    Is Cindy's sampling method biased or unbiased?

    Explain why.

56. Four people are running for mayor in a town of about 20,000 people. Three polls were conducted, each time asking 150 people who they would vote for. The table shows the results.

 | | Clark | Taylor | Thomas | Wright | Totals |
    |--------|-------|--------|--------|--------|--------|
    | **Poll 1** | 58 | 19 | 61 | 12 | 150 |
    | **Poll 2** | 68 | 17 | 56 | 9 | 150 |
    | **Poll 3** | 65 | 22 | 53 | 10 | 150 |

    a. Based on the polls, predict the winner of the election.

    b. Assuming there will be 8,500 voters in the actual election, estimate to the nearest hundred votes how many votes Thomas will get.

    c. Gauge how much off your estimate might be.

57. Gabriel randomly surveyed some households in a small community to determine how many of them support building a new highway near the community. Here are the results:

If the community contains a total of 2,120 households, predict how many of them would support building the highway.

Opinion	Number
Support the highway	45
Do not support it	57
No opinion	18

58. Researchers compared two different methods for losing weight by assigning 50 overweight people to use each method. The side-by-side boxplots show how many pounds people in each group lost.
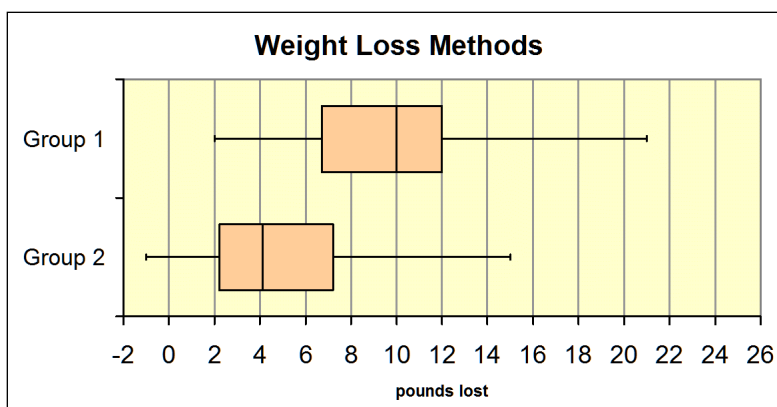
a. Just looking at the two distributions, which group, if any, appears to have lost more weight?

b. Which group, if any, appears to have a greater variability in the amount of weight lost?

c. In Group 2, there is one person whose weight loss was −1 pound. What does that mean?

d. Is one of the weight loss methods significantly better than the other?

If so, which one?

Justify your reasoning.