

INTEGRATING MATH IN THE REAL WORLD

# **THE MATH OF HOMES AND OTHER BUILDINGS**

Hope Martin and Susan Guengerich

J. WESTON  
**WALCH**  
PUBLISHER  
Portland, Maine

---

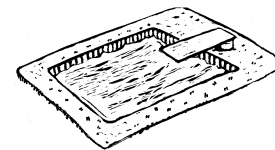
---

# Contents

---

---

<i>Introduction</i> .....	<i>iv</i>
<i>NCTM Standards Correlation</i> .....	<i>vi</i>
Our New House .....	1
The 25 Tallest Buildings in the World .....	9
My Front Door .....	16
The Mathematics of Nails .....	20
The Mathematics of Rafters .....	22
The Mathematics of Swimming Pools .....	24
The Mathematics of Windows .....	26
Column Construction .....	28
Problem Solving .....	32
Adjectives and Home Selection .....	38
Birdhouse Nets .....	40
Monthly Mortgage Payments .....	47
Monthly Mortgage Payments and Interest Rates .....	49
\$25,000 Decorate-Your-Dream-Bedroom Contest .....	52
Math and Poetry .....	56
Buying a House You Can Afford .....	60
Housing Opportunity Index .....	68
<i>Web Sites, Books, and Pamphlets</i> .....	<i>71</i>



# The Mathematics of Swimming Pools

## Areas of Study

Computation, volume conversion of measurement units, and rounding

## Concepts

Students will:

- calculate the volume of various shaped swimming pools
- convert cubic feet to gallons
- determine the cost to fill the pool
- round to the nearest gallon

## Materials

- The Mathematics of Swimming Pools handout
- calculator

## Procedures

Review the concepts of calculating volume with students. Discuss the volume of a swimming pool and the cost of filling it. Distribute handouts. Students may work in groups to find the volume in cubic feet and then convert the cubic feet to gallons. Round to the nearest gallon. Students will then calculate the price of filling the pool, using \$5 for 1,000 gallons. Round to the nearest cent.

## Solutions

<p><b>Diving pool</b> Cubic feet = 24,000 Gallons = 178,032 Cost = \$890.16</p>	<p><b>In-ground pool</b> Cubic feet = 11,700 Gallons = 86,791 Cost = \$433.95</p>	<p><b>Backyard pool</b> (semicircular ends) Cubic feet = 2,245 Gallons = 16,655 Cost = \$83.28</p>
<p><b>Backyard pool</b> (rectangular) Cubic feet = 3,200 Gallons = 23,738 Cost = \$118.69</p>	<p><b>Hot tub</b> Cubic feet = 314 Gallons = 2,329 Cost = \$11.65</p>	

## Assessment

1. Student product:
  - completed handout
2. Observation of student
3. Journal questions:
  - (a) What are some of the “other” expenses of owning a pool?
  - (b) Many communities require fences to surround all pools. How many feet of fence would be required to surround the

top of the backyard pool with the semicircular ends?

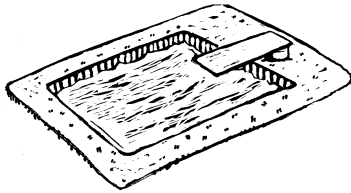
## Extensions

- Research the cost of water in your community and recalculate the cost of filling the pools.
- Research the size of a local public pool; then calculate its volume and the cost to fill it with water from your community.

# The Mathematics of Swimming Pools

Filling a swimming pool takes lots of water. Just how much water? Use the value 3.14 for  $\pi$  and calculate the volume of these swimming pools in cubic feet. Convert cubic feet to gallons and round to the nearest whole gallon. If water costs \$5 per 1,000 gallons, how much would it cost to fill the swimming pools?

**1 cubic foot = 7.418 gallons**



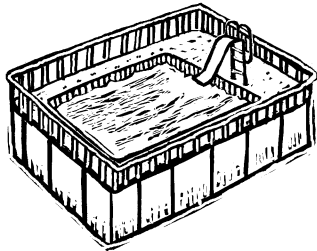
**Diving Pool**

Width 40 feet  
 Length 40 feet  
 Depth 15 feet  
 Cubic feet = \_\_\_\_\_  
 Gallons = \_\_\_\_\_  
 Cost to fill = \_\_\_\_\_



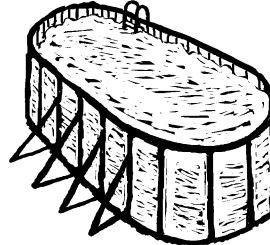
**Hot Tub**

Diameter 10 feet  
 Depth 4 feet  
 Cubic feet = \_\_\_\_\_  
 Gallons = \_\_\_\_\_  
 Cost to fill = \_\_\_\_\_



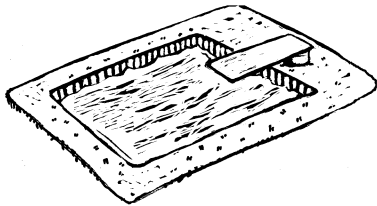
**Backyard Pool (rectangular)**

Width 20 feet  
 Length 40 feet  
 Depth 4 feet  
 Cubic feet = \_\_\_\_\_  
 Gallons = \_\_\_\_\_  
 Cost to fill = \_\_\_\_\_



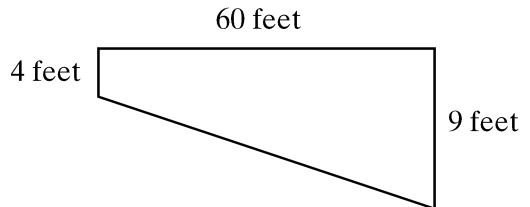
**Backyard Pool (semicircular ends)**

Width 12 feet  
 Length 40 feet  
 Depth 5 feet  
 Cubic feet = \_\_\_\_\_  
 Gallons = \_\_\_\_\_  
 Cost to fill = \_\_\_\_\_



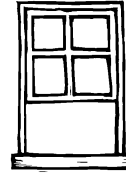
**In-Ground Pool**

Width 30 feet  
 Length 60 feet  
 Depth 4 feet to 9 feet  
 Cubic feet = \_\_\_\_\_  
 Gallons = \_\_\_\_\_  
 Cost to fill = \_\_\_\_\_



Use area of trapezoid multiplied by the width of the pool to find the volume in cubic feet.

# The Mathematics of Windows



## Areas of Study

Area, perimeter, converting units of measurement, and reading charts

## Materials

- The Mathematics of Windows handout
- calculator

## Concepts

Students will:

- read window codes and convert the codes to feet and inches
- convert feet and inches to total inches
- calculate the perimeter and area

## Procedures

Give each student a copy of the handout and discuss the variety of windows found in buildings. Discuss some problems that builders and contractors might have when purchasing windows. Explain the code used to classify a window's width and height. Use the example on the student page to show the calculations needed to complete the handout.

## Solution

Window Code	Window Width	Window Height	Width in Inches	Length in Inches	Perimeter in Inches	Area in Inches
2846	2'8"	4'6"	32	54	172	1,728
3444	3'4"	4'4"	40	52	184	2,080
3852	3'8"	5'2"	44	62	212	2,728
4468	4'4"	6'8"	52	80	264	4,160
2646	2'6"	4'6"	30	54	168	1,620
3268	3'2"	6'8"	38	80	236	3,040
32410	3'2"	4'10"	38	58	192	2,204
8068	8'0"	6'8"	96	80	352	7,680

## Assessment

1. Student product:
  - completed handout
2. Observation of students
3. Journal questions:
  - (a) Compare a 3268 window to a 6832 window. What are the perimeters and areas?
  - (b) Why would a heating and air conditioning installer need to know the size and number of windows?
  - (c) The standard door is 6'8", or 80 inches. List basketball players or other famous

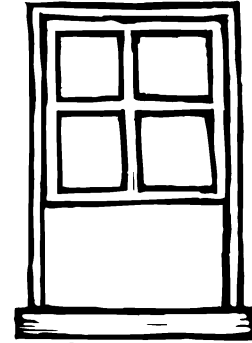
people who would have trouble entering a standard door.

## Extensions

- Have students measure and write the window code for windows found in the classroom or in their homes.
- Measure windows in students' homes and find the mean, mode, median, and range for the widths and heights.
- A window has a perimeter of 188 inches and an area of 2,040 square inches. What are the dimensions of the window? Write the window code for this window.

## The Mathematics of Windows

What size are the windows of your classroom? Are the classroom windows the same size as the windows in your home? Are all the windows where you live the same size? Windows are manufactured in many sizes and styles. A builder must be able to communicate the size windows needed. A classification system has been developed to help builders and window suppliers.



Windows are assigned a code number that corresponds to the size of a window. The code gives the width of the window and then the height. A window might be 2846. This is read as 2 feet 8 inches as the width of the window and 4 feet 6 inches as the height of the window. The 2846 window is called a two eight, four six. (Do not confuse 2846 to mean 28 inches by 46 inches.)

In the chart below, determine the width and height of a window in feet and inches. Change feet and inches to inches and calculate the area and the perimeter of the window.

Window Code	Window Width	Window Height	Width in Inches	Length in Inches	Perimeter in Inches	Area in Inches
2846	2'8"	4'6"	32	54	172	1,728
3444						
3852						
4468						
2646						
3268						
32410						
8068						