Making Math Meaningful®

An 8th Grade Student's Workbook

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Catherine Douglas was a student at Shining Mountain Waldorf School when she designed the cover to this book. It is an impressive example of how equiangular spirals emerge from nested octagons.

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To the Student (and Parent)

This is the last year before high school! Compared to my seventh grade workbook, the homework sheets in this workbook are shorter, but more challenging. And this year, there are group worksheets that will stretch you to discover math more independently. Hard work this year will pay off when you study math in high school. Have you thought much about needing to be prepared for high school math? Remember that you need three things (1) basic math skills (learning the material in this workbook is more than adequate), (2) good study skills, and (3) enthusiasm for learning math.

Here are some tips on how to use this workbook successfully:

- Make sure your work is readable and easy to follow.
- If there isn't enough room on the worksheet, then show your work on a separate sheet of paper, making sure you write down the worksheet number and problem number, so you can easily find it later.
- Answers for division problems may be rounded to three significant digits, unless the problem states you should leave your answer as an exact decimal, in which case you must continue until it repeats or ends. For example, $2579 \div 56$ has an exact answer of $46.053\overline{571428}$. Rounding it to three significant digits means we go to the fourth digit (which is the second place after the decimal point, and is a 5 in this case), and then round up the previous digit for an answer of 46.1.
- Above all, homework is for learning! Try your best on every problem. Struggling and overcoming frustration are part of the process of doing math. Even if you don't get a problem correct, you will learn by trying it, and then later seeing how it should be done. Do not fall into the trap of doing the homework just to get it done.
- Learn from your mistakes! When you get a problem wrong, make sure you follow up on it; find your mistake, and learn how to do the problem correctly.
- At the back of this workbook, you will find several tables that will assist you in doing the homework.

Getting Help. The problems in this workbook are based upon the material found in our curriculum book, titled: *A Middle School Math Curriculum for Teachers and Parents*, which can be purchased at www.JamieYorkPress.com. The book has helpful explanations and examples, and is useful for parents (or tutors) who are helping their children with the worksheets in this workbook.

Number Bases – Group Worksheet #1

The Base-Ten and the Base-Eight Number Systems.

The way in which we count and the way our number system evolved, stems from the fact that people have ten fingers. Therefore, our number system is a base-ten (or decimal) number system, and there are ten digits in this system.

However, it didn't have to be that way. It is perfectly possible to develop a number system different from the one we are used to. That is what this unit will focus on.

We will start with a base-eight, or octal, number system. Imagine that you have a friend, Bob, who only knows this base-eight numbers system. This base-eight system is a place-value, or positional, number system, similar to our base-ten (decimal) system. Also all of its digits are digits that we also use, but it doesn't use some of the digits that we do.

1) Count in the base-eight (or octal) number system until you are ten past the point of needing three digits.

2) What are the digits used in the base-ten (decimal) system?

3) What are the digits used in the base-eight (octal) system?

4) Which digits does the base-ten system have that the base-eight system doesn't?

5) You and Bob are watching over a herd of sheep. You count the sheep in decimal and Bob counts the sheep in octal. Fill out the table, so that for each problem, your number and Bob's number are equivalent – i.e. your number and Bob's number each represent the same number of sheep.

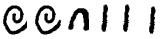
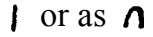
	Bob's number	**Your number**
a)	15	
b)	22	
c)	35	
d)	53	
e)	77	
f)	100	
g)	127	
h)	302	
i)		19
j)		9
k)		6
l)		56
m)		43
n)		94
o)		344

Number Bases – Homework #1

The Egyptian Number System.

(A non-positional number system)

= one	 = ten	 = 100
 = 1000	 = 10,000	= 100,000

Example: 213 can be written in the Egyptian system as  or as  or as . The position of the symbols does not matter.

1) Fill in the table.

	Egyptian	Decimal	Scientific
a)			
b)		2405	
c)			$3.041 \cdot 10^5$
d)		20050	

2) Convert each number from *standard decimal form* to *expanded notation*.

a) 564

b) 2369

c) 2400

d) 56,000,000

e) 300,400

3) Convert each number from *expanded notation* to *standard decimal form*.

a) $7 \cdot 10^2 + 9 \cdot 10^1 + 8 \cdot 10^0$

b) $7 \cdot 10^5 + 3 \cdot 10^4 + 2 \cdot 10^3 + 1 \cdot 10^2 + 4 \cdot 10^1 + 5 \cdot 10^0$

c) $4 \cdot 10^8 + 6 \cdot 10^6 + 7 \cdot 10^4 + 9 \cdot 10^2 + 8 \cdot 10^0$

d) $4 \cdot 10^7 + 6 \cdot 10^6$

4) Convert to *scientific notation*.

a) 320,000,000

b) 6078.89

c) 700,000,000,000

d) 4 trillion

e) 20^{10}

5) Convert to *standard decimal form*.

a) $5.8 \cdot 10^6$

b) $2.4038 \cdot 10^3$

c) $1.83 \cdot 10^{14}$

d) $4 \cdot 10^1$

e) $4.39853 \cdot 10^9$

f) $7.43 \cdot 10^0$

Number Bases – Group Worksheet #2

1) Convert from octal to decimal. (If you get stuck, then try writing it in expanded notation first.)

a) 75_{oct}

b) 123_{oct}

c) 270_{oct}

d) 3046_{oct}

2) Convert from decimal to octal.

a) 28_{dec}

b) 70_{dec}

c) 73_{dec}

d) 94_{dec}

e) 164_{dec}

3) Add or subtract. Think only in octal. For example, with $6_{oct} + 4_{oct}$, *don't* think that 6+4 is 10 in decimal, and convert that into 12 in octal. But rather, count in octal four above six: 7, 10, 11, 12.

a) $45_{oct} + 57_{oct}$

b) $245_{oct} + 716_{oct}$

c) $73_{oct} - 27_{oct}$

d) $523_{oct} - 265_{oct}$

4) Fill in the octal multiplication table below. Look for patterns and similarity with the decimal multiplication table.

	0	1	2	3	4	5	6	7
0								
1								
2								
3								
4								
5								
6								
7								

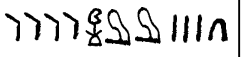
5) Use the above multiplication table in order to multiply. (Check your answer by casting out sevens!)

a) $45_{oct} \times 57_{oct}$

b) $573_{oct} \times 247_{oct}$

Number Bases – Homework #2

1) Fill in the table.

	Egyptian	Decimal	Scientific
a)			$6.02 \cdot 10^4$
b)		350	
c)			
d)			$3.041 \cdot 10^3$
e)		43,530	

2) Convert to standard decimal form.
   a) $5.03 \cdot 10^5$
   b) $5.03 \cdot 10^{-3}$
   c) $5.03 \cdot 10^{-9}$
   d) $5.03 \cdot 10^0$

3) Convert to scientific notation.
   a) 65200
   b) 700,000,000
   c) 0.0000063
   d) 0.000408
   e) 8.2

4) Convert to expanded notation.
   a) 652
   b) 8327
   c) 70,800

5) Convert to standard decimal form.
   a) $5 \cdot 10^2 + 4 \cdot 10^1 + 3 \cdot 10^0$
   b) $8 \cdot 10^6 + 3 \cdot 10^4$
   c) $7 \cdot 10^3 + 2 \cdot 10^2 + 6 \cdot 10^0$

6) Write down the four numbers that follow each octal (base-eight) number.
   a) 6_{oct}
   b) 25_{oct}
   c) 46_{oct}
   d) 52_{oct}
   e) 75_{oct}
   f) 65_{oct}
   g) 146_{oct}

7) Write each octal number in expanded notation.
   a) 73_{oct}
   b) 163_{oct}
   c) 345_{oct}

8) Convert from octal (base-eight) to decimal (base-ten).
   a) 37_{oct}
   b) 52_{oct}
   c) 5_{oct}
   d) 107_{oct}
   e) 234_{oct}

9) Convert from decimal to octal.
   a) 23_{dec}
   b) 39_{dec}
   c) 67_{dec}
   d) 80_{dec}