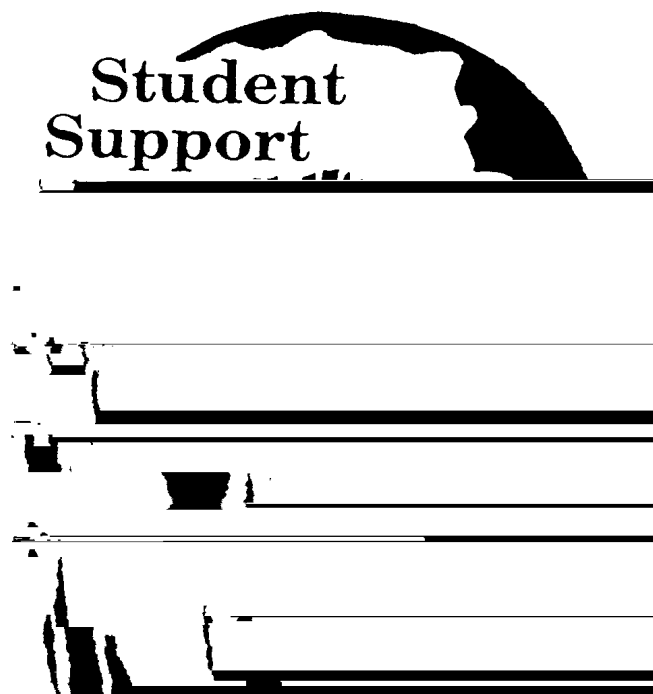


# DECIMAL COMPETENCY PACKET



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In this booklet arithmetic operations involving decimal numbers are explained. If you have not already reviewed the Fraction booklet, please do so before working through this one.

Calculators are not allowed when taking the Computerized Placement Test (CPT), nor in Fundamentals of Mathematics, Pre-Algebra, and Elementary Algebra; therefore, do not rely on a calculator when working the problems in this booklet.

To use this booklet, review the glossary, study the examples, then work through the exercises, and check your answers at the end of the booklet. When you find an unfamiliar word, check the glossary for a definition or explanation. The last several pages are Place Value Charts that will be helpful to you. Remove those pages for easier use.

If you have difficulty understanding any of the concepts, come to one of the Tutoring Centers located on the Lynn, Danvers Main and Danvers Hathorne Campuses. Hours are available at (978) 762-4000 x 5410. Additional Tutoring Center information can be found on the NSCC website at [www.northshore.edu/services/tutoring](http://www.northshore.edu/services/tutoring).

The Centers are closed when school is not in session, and Summer hours are limited.

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# Glossary

Decimal or Decimal Number	Any number that includes place value to the right of a decimal point.
Decimal Point	A dot or point that separates the decimal value from the integral value of a number.
Denominator	The bottom number of a fraction. It represents the number of pieces needed to make one whole. (See Fraction booklet for more information.)
Difference	The result when two numbers are subtracted. The order of subtraction is important. $A - B$ means that the number represented by B is subtracted from A, that is A is the "top number" in a vertical subtraction.
Digit	The symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 are the digits of the Base ten number system.
Division	<p>Arithmetic operation:</p> $Dividend \div Divisor = Quotient$ <p>Expressed as a fraction: <math>\frac{Dividend}{Divisor} = Quotient</math></p> <p>or using a "division house" <math>divisor \overline{)dividend}</math> <span style="margin-left: 20px;"><i>quotient</i></span></p>
Factor	Each of the numbers that are multiplied, i.e. in the product $7 \times 9 = 63$ the numbers 7 and 9 are factors.
Multiple	A number which is the product of a given number and another factor; Multiples are equal to or larger than the given number, i.e. the multiples of 3 are: 3,6,9,12,15, ...
Non-Repeating Decimal	A decimal representation that has no pattern of repetition in the digits after the decimal point.
Numerator	The top number of a fraction. It represents the number of pieces of a certain size considered for the expression. (See fraction booklet for more information)
Place Value	The position a digit holds in a number. It tells us the

value of the digit. (See chart page 7)

Product	The result when two numbers are multiplied.
Quotient	The result when two numbers are divided.
Repeating Decimal	A numerical representation that has a pattern of digits that repeats to infinity. $0.323232\dots$ is a repeating decimal, and can be written as $0.\overline{32}$
Sum	The result when two numbers are added.
Terminating Decimal	Every fraction can be written as a decimal by dividing the denominator into the numerator if there no remainder, the decimal will terminate.
Whole Numbers	Positive numbers with no fractional or decimal portion.

## General Decimal Information

- ◆ Our number system is a decimal system using the digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9, called the Base Ten Number System.
- ◆ Only positive numbers will be used in this booklet.
- ◆ Whole numbers are decimal numbers with no fractional part; a decimal point is assumed to be to the right of the whole number. ( i.e.,  $15 = 15.0$ )
- ◆ Numbers with no whole number component will be written with a zero preceding the decimal point. ( i.e.,  $0.23$ )
- ◆ Digits to the right of a decimal point represent fractional parts with a denominator of a multiple of ten.
- ◆ Digits to the left of the decimal point are separated into groups of three using commas.

# Place Value

The position of a digit in a number reflects the "place value" of that digit. In the following table, the number represented has value according to the place the digit "1" holds in each case. (Note the use of commas.)

In the following chart, note the similarity of place value names on both sides of the decimal. Those places to the right of the decimal end in "ths" indicating that they are fractional.

Whole Numbers									Decimal Fractions								
Etc.	Ten Millions	Millions,	Hundred Thousands	Ten Thousands	Thousands,	Hundreds	Tens	Units (Ones)	Decimal Point (and)	Tenths	Hundredths	Thousandths	Ten-Thousandths	Hundred-Thousandths	Millionths	Ten Millionths	Etc.
		1,	0	0	0,	0	0	0	.	0	0	0	0	0	1		
			1	0	0,	0	0	0	.	0	0	0	0	1			
				1	0,	0	0	0	.	0	0	0	1				
					1,	0	0	0	.	0	0	1					
						1	0	0	.	0	1						
							1	0	.	1							
								1	.	0							
								0	.	1							

In a spoken or written number, the word "**and**" reflects placement of a decimal point. Although each number uses the same digits, (ones and zeros), the value of each number in the chart above is very different. The numbers, in order of the chart, are read:

- one million **and** one millionth
- one hundred thousand **and** one hundred-thousandth
- ten thousand **and** one ten-thousandth
- one thousand **and** one thousandth
- one hundred **and** one hundredth
- ten **and** one tenth
- one **and** no tenths, or more commonly, one tenth





# Translating Numerical Expressions

To translate written numerical expressions, place the last written number in the correct place value.

**Example:**

Twenty and ninety-  
**six** thousandths

20.0**96**

20.**0**96

Six, (6) the last digit belongs in the thousandths place.  
(Third place to the right from the decimal point.)

Zero must be entered in the tenths place.

**Write the following using digits. (Use a chart if needed)**

- 1) four and five tenths
- 2) fourteen hundredths
- 3) one thousand nine hundred seventy-two ten thousandths
- 4) four hundred seven and three hundred twenty-eight thousandths
- 5) one tenth
- 6) seven and nine hundredths
- 7) one hundred seventy-two ten-thousandths
- 8) twenty-two and five tenths
- 9) twenty and four hundred ninety-six thousandths
- 10) three hundred and three hundredths

# Decimal Fractions

A decimal number is another way to write a fraction with a denominator of a multiple of ten, (i.e., denominators equal to 10; 100; 1,000; 10,000; etc.) To convert a fraction with a denominator of a multiple of ten to a decimal, read the fraction and write as a decimal number.

**Example:**

$$3\frac{7}{10}$$

$$3.7$$

# Comparing Decimals

To compare decimals, write the decimal numbers with the same number of decimal places and decide which is larger.

**Example:**

Which is greater:  
0.9 or 0.91?

0.90 ? 0.91

**Example:**

Write the following from  
smallest to largest:

0.78006, 0.7845,  
0.7851, 0.785, 0.78

0.78006, 0.78450,  
0.78510, 0.78500,  
0.78000

0.78000, 0.78006,  
0.78450, 0.78500,  
0.78510

To compare write both numbers with two decimal places. Note zeros may be added or deleted from the right and after the decimal point.

Compare digits in hundredths place. 1 is greater than 0; therefore, 0.91 is greater. (hint: Consider money)

Write the list adding zeros to hundred thousandths place as needed.

Since the digits in the tenths and hundredths places are the same, compare the digits in the thousandths place first. Then compare the digits in the remaining places.

Re-write the list from smallest to largest.

**Write from smallest to largest:**

1) 12.34, 1.234, 0.1234

5) 0.935, 1.2, 0.6, 0.56

2) 0.1, 0.01, 1.001

6) 0.12, 0.16, 0.2, 0.48, 0.054

3) 3.1, 0.031, 0.331

7) 5.038, 5.0382, 50.382, 0.5382

4) 0.06, 0.4, 0.9

8) 0.08, 8.08, 8.808, 8.888, 0.088, 0.8

# Rounding

To round numbers for estimation:

1. Identify the place value to be rounded. All digits to the left of that place remain the same.
2. Check the number to the **immediate right** of the place to be rounded:
  - a. If the digit in that place is **5 or greater**, **add one** to the digit in the place to be rounded.
  - OR**
  - b. If the digit in that place is **4 or less**, **do not change** the digit in the place to be rounded.
3. Fill in the remaining place values to the right of the place to be rounded with zeros, or drop the digits after the decimal point.

**Example:**

Round 1792 to the **hundreds** place.

18 \_ \_

18 0 0

Identify the place value to be rounded, (7 hundred). Write the digit(s) to the left (1). Identify the number to the right (9).

9 is greater than 5; add one to 7, ( $7+1=8$ ), enter 8 in the hundreds place.

Fill in all the places to the right with zeros.

**Example:**

Round 73.64 to the **tenths** place.

73.6 \_

73.60 = 73.6

Identify the place value to be rounded, (6 tenths). Write the digits to the left (73). Identify the number to the right (4).

4 is less than 5, 6 remains in the tenths place.

It is not need to fill in all the places to the right with zeros; rounding to tenths place.

**Example:**

Round 49.897 to the **hundredths** place.

49. 8 <sup>1</sup>0 \_

49.(8+1) 0 \_

49.90

Identify the place value to be rounded, (9 hundredths). Write the digits to the left (49.8). Identify the number to the right, (7).

7 is greater than 5, add one to 9. Since  $9 + 1 = 10$ , a zero is entered in the hundredths place, and the 1 is carried to the tenths place.

The 1 is added to 8.

The zero is needed to represent the hundredths place.

**Round these numbers as indicated.**

- |                    |         |                     |         |
|--------------------|---------|---------------------|---------|
| 1) Tenths          | 62.87   | 9) Units            | 33.97   |
| 2) Units           | 14.45   | 10) Hundredths      | 49.995  |
| 3) Ten thousandths | 3.56906 | 11) Thousandths     | 5.0074  |
| 4) Tenths          | 3.1416  | 12) Thousandths     | 0.6739  |
| 5) Hundreds        | 459.326 | 13) Tenths          | 1.98    |
| 6) Tenths          | 19.77   | 14) Ten thousandths | 0.01704 |

5) Hundreds 10) 0.01704 97(T(389 13. T 974 Te162.2914 Tw(12))-802.[53 Tm55)0)

# Addition

To add decimals, write the numbers vertically with the decimal points directly under each other, then add the digits.

Note: When the decimal points are lined up, the digits are automatically lined up in the correct place value.

**Example:**

$$13.2 + 1.57$$

$$\begin{array}{r} 13.20 \\ + 1.57 \\ \hline 14.77 \end{array}$$

Write the problem vertically. Line up the decimal points.

Note the additional zero. Adding zeros to the right of the final digit after the decimal does not change the value of the number.

**Example:**

$$\$437 + \$41.56 + \$0.18$$

$$\begin{array}{r} \$437.00 \\ 41.56 \\ + 0.18 \\ \hline \$478.74 \end{array}$$

Dollar values are the most familiar decimal values.

Write the problem vertically. Line up the decimal points.

The additional zeros are optional, but help with placement. Note dollar sign use.

**Find the Sum (Add):**

1)  $0.03 + 0.4$

6)  $48 + 0.84$

2)  $0.3 + 0.03 + 0.003$

7)  $10 + 9.6 + 3.76 + 8.451$

3)  $2.05 + 0.561 + 43.9 + 17.32$

8)  $\$3.06 + \$2.13 + \$4.89$

4)  $\$4 + \$14.01$

9)  $2,134.07 + 306.5 + 2.109$

5)  $8.0632 + 0.234 + 0.81 + 0.064$

10)  $56.3701 + 0.268 + 4.2$

# Subtraction

# Multiplication

To multiply decimals, write the problem and multiply as you would a whole number multiplication problem. The product (answer) of two decimal numbers has the same number of decimal places after the decimal point as the total number of decimal places in the two numbers being multiplied.

**Example:**

$$0.19 \times 0.4$$

$$\begin{array}{r} 0.19 \\ \times 0.4 \\ \hline 0.076 \end{array}$$

Write vertically. (The decimal points do not have to line up.)

$$\begin{array}{r} 2 \text{ decimal places} \quad (\text{Decimal points not lined up.}) \\ + 1 \text{ decimal place} \\ \hline 3 \text{ decimal places} \end{array}$$

Count from right to left; add a zero before the decimal point.

**Example:**

$$\begin{array}{r} 708 \\ \times 0.32 \\ \hline 1416 \\ 21240 \\ \hline 226.56 \end{array}$$

$$\begin{array}{r} 0 \text{ decimal places} \quad (\text{Decimal points not lined up.}) \\ + 2 \text{ decimal places} \\ \hline 2 \text{ decimal places} \end{array}$$

Count from right to left to place decimal point.

**Find the Product (multiply):**

1) 
$$\begin{array}{r} 0.32 \\ \times 0.6 \\ \hline \end{array}$$

4) 
$$\begin{array}{r} 5.048 \\ \times 2.03 \\ \hline \end{array}$$

7) 7)point-

3 d






# Division by Multiples of 10

To divide by a multiple of ten, (10; 100; 1,000; etc.), move the decimal point to the **LEFT** as many places as there are zeros in the divisor.

**Example:**

$$\begin{array}{r} 78.2 \\ \hline \end{array} \div 10 =$$




$$= 7.82$$

There is **one zero** in the divisor (10), therefore the decimal point moves **left one place**.

**Example:**

$$\begin{array}{r} 0.32 \\ \hline \end{array} \div 1000 =$$



$$= 0.00032$$

There are **three zeros** in the divisor (1000), therefore the decimal point moves **left three places**.

Note the additional zeros.

**Divide:**

1)  $82.5 \div 100 =$

6)  $78.567 \div 10 =$

2)  $923.8 \div 1000 =$

7)  $54.87 \div 1000 =$

3)  $0.754 \div 10 =$

8)  $20.35 \div 10 =$

4)  $0.845 \div 100 =$

9)  $540.8 \div 100 =$

5)  $63.8 \div 100 =$

10)  $6200 \div 10,000 =$

## Division by Whole Numbers

To divide a decimal by a whole number, place the decimal point in the quotient directly above the decimal point in the dividend to ensure the correct place value. Divide as with whole numbers.



# Converting Fractions to Terminating Decimals

To convert a fraction to a decimal, divide. Some fractions will convert to a decimal representation with a remainder of zero, called a terminating decimal.

**Example:**

Convert to a Decimal

$$\frac{3}{12} = 12 \overline{)3.00} \begin{array}{r} 0.25 \end{array}$$

$$\frac{3}{12} = 0.25$$

**Example:**

Convert to a Decimal

$$\text{—} \quad \overline{) \quad \quad \quad}$$

# Converting to Repeating Decimals

To convert a fraction to a decimal, divide. Some fractions will convert to a decimal representation with pattern, called a repeating decimal.

**Example:**

$$\frac{2}{3} = 3 \overline{) 2.000...}$$

Divide two by three. Note that the remainder will continue to be two; therefore, the decimal answer is a repeating decimal.

$$0.666... = 0.\overline{6}$$

Repeating decimals are written with a bar over the repeating digits in the pattern.

**Example:**

$$\frac{34}{11} = 11 \overline{) 34.0000 ...}$$

Divide 34 by 11. Since 11 does not divide 10, there is a need to bring down . Since 11 does not divide 10, there is a need to bring down 0. Since 11 does not divide 10, there is a need to bring down 0. Since 11 does not divide 10, there is a need to bring down 0.

$$3.0909... = 3.\overline{09}$$

# Converting Decimals to Fractions

To convert a terminating decimal to a fraction, write the decimal with the place value multiple of ten as a denominator and reduce to simplest terms.

**Example:**

$$3.2 = 3\frac{2}{10}$$

$$3\frac{2}{10} = 3\frac{1}{5}$$

The decimal fraction portion of the number terminates in the tenths place; therefore the denominator will be 10.

This fraction is not in lowest terms, therefore must be reduced. Divide numerator and denominator by 2.

To convert a repeating decimal to a fraction, use a value of 9 as the denominator.

**Example:**

$$3.\overline{09} = 3\frac{9}{99}$$

$$3\frac{9}{99} = 3\frac{1}{11}$$

The repeating pattern ends in the hundredths place, therefore the denominator will have two nines, or be 99.

This fraction is not in lowest terms, therefore must be reduced. Divide numerator and denominator by 9

**Convert:**

1) 7.85

6)  $34.0\overline{102}$

2)  $10.\overline{3}$

7)  $7.\overline{7}$

3) 2.08

8) 10.425

4)  $0.\overline{45}$

9) 0.006

5) 0.360

10)  $2.\overline{360}$

# Word Problems

To solve a word problem, read the problem and express what you are trying to learn in your own words. Identify the operation to be used, (addition, subtraction, multiplication, or division). Translate the problem from words to math symbols, (i.e. write an equation). Solve the equation.

**Example:**

Carlos bought one pair of shoes for \$19.95, two neckties for \$3.95 each, three





- 5) A garden is 33.75 feet long and 21.6 feet wide. Draw a diagram of the garden with the lengths written on all four sides. What is the total distance around the garden?
- 6) A car traveled at 50 miles an hour for 2.5 hours. How far did it go?
- 7) A can of ham weighing 7.75 pounds costs \$ 11.86. What does the ham cost per pound? (Round to the nearest cent.)
- 8) A park is 4.6 miles long and 2.7 miles wide.  
a. What is the total distance around the park?  
b. If a racecar drove 50 times around the park, how far will it have to go?

# Answers to Exercises

## Page 8

1. Twenty and fifteen hundredths
2. Forty-five and twenty-one hundredths
3. Fifteen and one hundred ninety-six thousandths
4. Two thousand, forty-nine and nine thousandths

## Page 9

## Page 13

- Page 15**
1. 1.05
  2. 3.8
  3. \$11.25
  4. \$12.37
  5. 2.708
  6. 59.612
  7. 30.54
  8. 82.223
  9. 16.32
  10. 3.96
  11. 1.527
  12. \$19.11

- Page 16**
1. 0.192
  2. 0.095
  3. 68.00
  4. 10.24744
  5. 0.0225
  6. 0.0312
  7. 0.4050
  8. 108.9
  9. 21.9132

- Page 18**
1. 0.825
  2. 0.9238
  3. 0.0754
  4. 0.00845
  5. 0.638
  6. 7.8567
  7. 0.05487
  8. 2.035
  9. 5.408
  10. 0.6200

- Page 19**
1. 0.3
  2. 0.21
  3. 0.012
  4. 0.066
  5. 0.44
  6. 0.008
  7. 0.064
  8. 6.9
  9. 0.745

- Page 21**
1. 0.5
  2. 0.5
  3. 0.375
  4. 0.45
  5. 0.26
  6. 0.475
  7. 1.5
  8. 5.1
  9. 77.175
  10. 47.74

- Page 22**
1.  $\overline{0.09}$
  2.  $\overline{0.03}$
  3.  $\overline{0.4}$
  4.  $\overline{-}$

**Page 23**

1.  $7\frac{17}{20}$

2.  $10\frac{1}{3}$

3.  $2\frac{2}{25}$

4.  $\frac{5}{11}$

5.  $\frac{9}{25}$

6.  $34\frac{34}{3333}$

7.  $7\frac{7}{9}$

8.  $10\frac{17}{40}$

9.  $\frac{3}{500}$

10.  $\frac{403}{111}$

**Page 25-26**





## Place Value Chart



