Math 171 Proficiency Packet on
Place Value

Section 1: Place Value

Our numeration system, called the Hindu-Arabic system, is a **base-ten system**. By just using ten digits; 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9, we can represent any number. The position of a digit in a multi-digit numeral determines its value. For example the 2 in the number 257 has a different value from the 2 in the number 324. In 257, the 2 represents 200, whereas in 324, it represents 20.

The **place values** in our number system are as follows: the first digit on the right is the ones column, the next digit to the left of the ones column is in the tens column, the next digit to the left is in the hundreds column. For a number like 257, the digit 2 is in the hundreds column, the 5 is in the tens column, and the 7 is in the ones column.

If we keep moving to the left, the columns increase in value by a factor of 10. The following diagram shows the name and value of the first seven columns in our number system:

Millions Column	Hundred Thousands Column	Ten Thousands Column	Thousands Column	Hundreds Column	Tens Column	Ones Column
1,000,000	100,000	10,000	1,000	100	10	1

Example 1: Give the place value of each digit in the number 208,145.

Solution: Starting with the digit at the right, we have:

5 is in the ones column, 4 is in the tens column, 1 is in the hundreds column, 8 is in the thousands column, 0 is in the ten thousands column, and 2 is in the hundred thousand column.

Example 2: Give the place value of each digit in the number 28,543.

Solution: 3 ones, 4 tens, 5 hundreds, 8 thousands, 2 ten thousands.

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Now You Try (Section 1)

Give the place value of the digit 6 in the following base-ten numbers.

a) 4,960 _____

b) 467,294 _____

c) 67,932,745 _____

Answers to **Now You Try** (Section 1) *are found on page 7.*

There are 3 ways to write base-ten numbers:

- Standard notation: 725
- Expanded notation: $700 + 20 + 5 = (7 \times 10^2) + (2 \times 10) + 5$
- In words: seven hundred twenty-five

Let's first turn our attention to expanded notation.

Section 2: Expanded Notation

We can use the idea of place value to write numbers in **expanded notation**. For example, the number 123 can be written in expanded notation as

$123 = 100 + 20 + 3$ or $(1 \times 100) + (2 \times 10) + (3 \times 1)$

because the 1 is in the hundreds column, the 2 is in the tens column, and the 3 is in the ones column.

Example 1: Write 3,947 in expanded notation.

Solution: $3{,}947 = (3 \times 1000) + (9 \times 100) + (4 \times 10) + (7 \times 1)$

Note that $10 = 10^1$, $100 = 10 \cdot 10 = 10^2$, and $1000 = 10 \cdot 10 \cdot 10 = 10^3$
so 3,947 could have been written in expanded notation as
$(3 \times 10^3) + (9 \times 10^2) + (4 \times 10) + 7$.

Example 2: Write 345,082 in expanded notation.

Solution: $345{,}082 = 300000 + 40000 + 5000 + 0 + 80 + 2$
$= (3 \times 10^5) + (4 \times 10^4) + (5 \times 10^3) + 0 + (8 \times 10) + 2$

Notice that there is a 0 in the hundreds column.
We do not even have to include the 0 hundreds, since $0 \cdot 100 = 0$.

Example 3: Write $(8 \times 10^4) + (5 \times 10^2) + (7 \times 10) + 4$ in standard notation.

Solution: First, expand each place value:

$8 \times 10^4 = 8 \times 10000 = 80000$

$5 \times 10^2 = 5 \times 100 = 500$

$7 \times 10 = 70$

$4 = 4$

Then add those numbers together: $80000 + 500 + 70 + 4 = 80{,}574$.

Now You Try (Section 2)

1. Write the following base-ten numbers in expanded form using exponents.

   a) 3,596

   _____

   b) 273,609

   _____

2. Write the following base-ten numbers in standard notation.

   a) $(5 \times 10^4) + (6 \times 10^3) + (1 \times 10^2) + (7 \times 10) + 9$ _____

   b) $(7 \times 10^3) + 6$ _____

Answers to **Now You Try** (Section 2) *are found on page 7.*

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Now, let's turn our attention to writing numbers in words.

Section 3: Writing Base-ten Numbers in Words

The idea of place value and expanded notation are used to help write the names of numbers. The following example gives the names of some two-digit numbers.

Example 1: Write the following numbers in words.

a) 24 b) 40 c) 83 d) 50

Solution: a) Twenty-four b) Forty c) Eighty-three d) Fifty

Notice that in the two digit numbers which **do not** end in 0, the tens and ones ` places are separated by a hyphen.

Example 2: Write the following numbers in words.

a) 542 b) 406 c) 3,567 d) 423,702

Solution: a) Five hundred forty-two

b) Four hundred six

(Many people would incorrectly place an "and" between the hundred and six. The word "and" is used to indicate where a decimal point is when writing the number in words.)

c) Three thousand, five hundred sixty-seven

↑

The comma separates the thousands from the hundreds.

d) Four hundred twenty-three thousand, seven hundred two

Example 3: Write each number in standard notation.

a) Sixty-five thousand, eighteen

b) Two million, four hundred five thousand, seven hundred eighty-nine

Solution: a) 65,018

b) 2,405,789

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Now You Try (Section 3)

1. Write the following numbers in words.

   a) 596 _____

   b) 3,841 _____

   c) 64,376 _____

   d) 204,840 _____

2. Write the following numbers in standard notation.

   a) Two thousand, seven _____

   b) Four million, thirty-five thousand, two hundred _____

   c) Eight million, two hundred three _____

Answers to **Now You Try** (Section 3) *are found on page 7.*

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Section 4: Rounding Base-ten numbers

The steps used in rounding are given below.

1. Locate the digit just to the right of the place you are to round to.
2. If the digit is less than 5, replace it and all digits to the right with zeros, the digit to its left remains the same.
3. If the digit is 5 or more, replace it and all digits to its right with zeros, and add 1 to the digit to its left.

Example 1: Round 4,279 to the nearest hundred.

Solution: The 2 is in the hundreds column. According to step 1 above, we look at the digit just to its right, which is 7. Since 7 is greater than 5, we add 1 to the 2, and replace the 7 and the 9 with zeros.

4,279 is 4, 3 **0 0** to the nearest hundred

↑ Greater than 5

↑ Add 1 to get 3

↑ Put zeros here

Note: The symbol ≈ means approximately equal to. So in the last example, we would write 4,279 ≈ 4,300.

Example 2: Round 4,279 to the nearest thousand.

Solution: The 4 is in the thousands column. According to step 1 above, we look at the digit just to its right, which is 2. Since 2 is less than 5, the 4 remains the same, and the 2, 7 and 9 get replaced with zeros.

4,279 is 4, **0 0 0** to the nearest thousand

↑ Less than 5

↑ Put zeros here

Example 3: Round 965,403 to the nearest ten thousand.

Solution: The 6 is in the ten thousands column. To the right is 5, so we add 1 to the 6 to get 7, and then replace the 5, 4, 0 and 3 with zeros.

965,403 ≈ 970,000 to the nearest ten thousand

↑ 5

↑ Add 1 to get 7

↑ Put zeros here

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Now You Try (Section 4)

1. Round 3,419 to the nearest ten. _____

2. Round 3,419 to the nearest thousand. _____

3. Round 15,399 to the nearest ten thousand. _____

4. Round 7,325,247 to the nearest hundred thousand. _____

Answers to **Now You Try** (Section 4) *are found on page 7.*

Exercises for Place Value

Do all problems on a separate piece of paper, showing all work.

1. Give the place value of each digit in the number 46,291.

2. Write the following numbers in expanded notation using exponents.

   a) 294 b) 6,305

   c) 25,008 d) 1,934,583

3. Write the following numbers in words.

   a) 906 b) 2,483

   c) 54,900 d) 20,050

4. Round 4,099 to the nearest hundred.

5. Round 56,498 to the nearest thousand.

6. Round 4,765,093 to the nearest ten thousand.

Answers to Now You Try

Section 1:

a) tens b) ten thousands c) ten millions

Section 2:

1. a) $(3 \times 10^3) + (5 \times 10^2) + (9 \times 10) + 6$

   b) $(2 \times 10^5) + (7 \times 10^4) + (3 \times 10^3) + (6 \times 10^2) + 9$

2. a) 56,179 b) 7006

Section 3:

1. a) five hundred ninety-six

   b) three thousand, eight hundred forty-one

   c) sixty-four thousand, three hundred seventy-six

   d) two hundred four thousand, eight hundred forty

2. a) 2,007 b) 4,035,200 c) 8,000,203

Section 4:

1. 3,420
2. 3,000
3. 20,000
4. 7,300,000