
MODULE 1

1.1 Exponent and Rounding Whole Numbers

In this lesson, we will learn the concept of exponent, and then learn how to round numbers.

1.1.1 Exponent

Note the difference between these two equations:

- $2 \cdot 3 = 6$
- $2^3 = 8$

In 2^3 , the number 3 is the exponent. The expression 2^3 means: The number 2 multiplies itself 3 times, so we have:

$$2^3 = 2 \cdot 2 \cdot 2 = 8$$

We read 2^2 as "two to the second power", or "two squared".

We read 2^3 as "two to the third power", or "two cubed".

We read 2^4 as "two to the fourth power". Only the second power (squared) and third power (cubed) have special names, because they are regularly used.

Let's look at a few more examples.

- Example 1.1.1**
- $3^2 = 3 \cdot 3 = 9$
 - $2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$
 - $1^{100} = 1 \cdot 1 \cdot 1 \cdot \dots \cdot 1 = 1$
 - $0^{1000} = 0 \cdot 0 \cdot 0 \cdot \dots \cdot 0 = 0$

From the last two examples, we can see 0 raised to any power is still 0, and 1 raised to any power is still 1.

- Example 1.1.2**
- $2^1 = 2$
 - $3^1 = 3$

Any number to the first power is simply the number itself. We don't write "to the first power," as in 2^1 , except in special cases.

1.1.2 Place value

The number 1,234,567 is read: one million, two hundred thirty-four thousand, five hundred sixty-seven. We need to learn the name of each digit:

- 1 is in the millions place;
- 2 is in the hundred thousands place;
- 3 is in the ten thousands place;
- 4 is in the thousands place;
- 5 is in the hundreds place;
- 6 is in the tens place;
- 7 is in the units place.

You need to memorize the name of each place.

1.1.3 Rounding

Why do we need rounding? Assume Portland has 1,987,654 residents. When we talk about Portland's population, it's silly to say the exact number. Usually we would say Portland has approximately 2 million people. We rounded the number 1,987,654 to 2,000,000. Let me explain rounding with another example.

Assume you only have \$10.00 bills. You will purchase a product marked at \$11.00. Is it fair to pay \$10.00 or \$20.00?

Since you only have \$10.00 bills, it's fair to pay \$10.00, because the marked price \$11.00 is closer to \$10.00 than to \$20.00.

Similarly, if a product is marked at \$19.00, it's fair to pay \$20.00, because the marked price \$19.00 is closer to \$20.00 than to \$10.00.

What if the product is marked at \$14.00 or \$15.00? We will explain rounding rules with examples:

- To round 10, 11, 12, 13, or 14 to the tens place, the answer is 10.
- To round 15, 16, 17, 18, or 19 to the tens place, the answer is 20.

So, if you only have \$10.00 bills, to purchase a product marked at \$14.00, it's fair to pay \$10.00.

If you only have \$10.00 bills, to purchase a product marked at \$15.00, it's fair to pay \$20.00.

We will summarize rounding rules with an example. We will round 1,234 to the hundreds place.

1. Identify the place to be rounded to. It is 2 in 1,234.
2. Since we will round to the hundreds place, we either round up to 1,300, or round to 1,200.
3. Look at the digit after 2. In this example, we look at the digit 3.

- (a) If this digit is 0, 1, 2, 3 or 4, we don't round up. In this example, 1,234 is rounded to 1,200.
- (b) If this digit is 5, 6, 7, 8 or 9, we round up.

Again, why do we need to round 1,234 to 1,200? Assume you purchased a used car for \$1,234. If a friend asks you how much the car cost, you would most likely say it cost about \$1,200, instead of saying the exact number. You would assume your friend don't care about those extra \$34.00.

Let's look at some more examples.

Example 1.1.3 Round 1,234,567 to the thousands place.

- Solution**
1. Identify the place to be rounded to. The thousands place in 1,234,567 is 4.
 2. Since we will round to the thousands place, we either round up to 1,235,000, or round to 1,234,000.
 3. Look at the digit after the thousands place. In this example, we look at the digit 5. By rounding rules, 1,234,567 is rounded up to 1,235,000. ■

Be careful when we round up 9. Look at the following examples.

Example 1.1.4 Round 1,961 to the hundreds place.

- Solution**
1. Identify the place to be rounded to. The hundreds place in 1,961 is 9.
 2. Since we will round to the hundreds place, we either round up to 2,000, or round to 1,900.
 3. Look at the digit after the hundreds place. In this example, we look at the digit 6. By rounding rules, 1,961 is rounded up to 2,000. ■

Example 1.1.5 Round 1,995 to the tens place.

- Solution**
1. Identify the place to be rounded to. The tens place in 1,995 is 9 (the 9 in front of 5).
 2. Since we will round to the tens place, we either round up to 2,000, or round to 1,990.
 3. Look at the digit after the tens place. In this example, we look at the digit 5. By rounding rules, 1,995 is rounded up to 2,000. ■