

## Warmup:

**1.** Write the names of each place value in the decimal number system.

\_\_\_\_\_ ones

**2.** Simplify:

$10^0 = \underline{\hspace{2cm}}$

$10^1 = \underline{\hspace{2cm}}$

$10^2 = \underline{\hspace{2cm}}$

$10^3 = \underline{\hspace{2cm}}$

$10^4 = \underline{\hspace{2cm}}$

**3.** Simplify:

$2^0 = \underline{\hspace{2cm}}$

$2^4 = \underline{\hspace{2cm}}$

$2^1 = \underline{\hspace{2cm}}$

$2^5 = \underline{\hspace{2cm}}$

$2^2 = \underline{\hspace{2cm}}$

$2^6 = \underline{\hspace{2cm}}$

$2^3 = \underline{\hspace{2cm}}$

$2^7 = \underline{\hspace{2cm}}$

## I. The Base-2 or Binary Number System

The digits in the base-10 number system are: \_\_\_\_\_

The digits in the base-2 number system are: \_\_\_\_\_

Why is the number 234 read two hundred thirty-four? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Base-10 Number System**

**Base-2 Number System**

**To convert binary numbers to decimal numbers:**

|       |       |       |       |       |       |  |
|-------|-------|-------|-------|-------|-------|--|
|       |       |       |       |       |       |  |
| $2^5$ | $2^4$ | $2^3$ | $2^2$ | $2^1$ | $2^0$ |  |
| 32    | 16    | 8     | 4     | 2     | 1     |  |

When there is a 1, add the place value to the final answer.

Determine the decimal value of the binary number 1011

Determine the decimal value of the binary number 10001

**4.** Fill in the blanks with numbers to make a true statement.

The binary number system has \_\_\_\_\_ digits, they are \_\_\_\_\_ and \_\_\_\_\_.

**5.** When a place value for a base-2 number has a \_\_\_\_\_, meaning it is \_\_\_\_\_.  
Use the place value in the number.

**6.** Determine the decimal value of the binary number 11001

**7.**

## II. Writing Decimal Numbers as a Binary or Base-2 Number

**To convert decimal numbers to binary numbers:**

1. Determine the largest place value that is less than or equal to the decimal number. Write a one in this place value.
2. Subtract the place value from the decimal number.
3. Write a one in the largest place value possible with the remaining amount, then subtract it from the remaining decimal amount
4. Continue this process until the remaining amount is zero.

|       |       |       |       |       |       |       |       |       |  |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|
|       |       |       |       |       |       |       |       |       |  |
| $2^8$ | $2^7$ | $2^6$ | $2^5$ | $2^4$ | $2^3$ | $2^2$ | $2^1$ | $2^0$ |  |
| 256   | 128   | 64    | 32    | 16    | 8     | 4     | 2     | 1     |  |

|                         |                         |                         |                         |                         |                         |                         |                         |                         |
|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| <b><math>2^8</math></b> | <b><math>2^7</math></b> | <b><math>2^6</math></b> | <b><math>2^5</math></b> | <b><math>2^4</math></b> | <b><math>2^3</math></b> | <b><math>2^2</math></b> | <b><math>2^1</math></b> | <b><math>2^0</math></b> |
| 256                     | 128                     | 64                      | 32                      | 16                      | 8                       | 4                       | 2                       | 1                       |

Write the decimal number 17 as a base-2 number.

Write the decimal number 75 as a base-2 number.

Complete the table by writing the decimal numbers as binary numbers.

| Decimal Number | Work Area | Binary Number |
|----------------|-----------|---------------|
| 2              |           |               |
| 3              |           | <b>8.</b>     |
| 4              |           | <b>9.</b>     |
| 5              |           | <b>10.</b>    |
| 6              |           | <b>11.</b>    |
| 7              |           | <b>12.</b>    |
| 8              |           | <b>13.</b>    |
| 9              |           | <b>14.</b>    |
| 10             |           | <b>15.</b>    |
| 11             |           | <b>16.</b>    |
| 12             |           | <b>17.</b>    |

**18.** Convert the decimal number 26 to a base-2 number.

**19.** Anna wants to express her math test score as a binary number. She scored a 100%. Write 100 as a binary number.

#### IV. Practice

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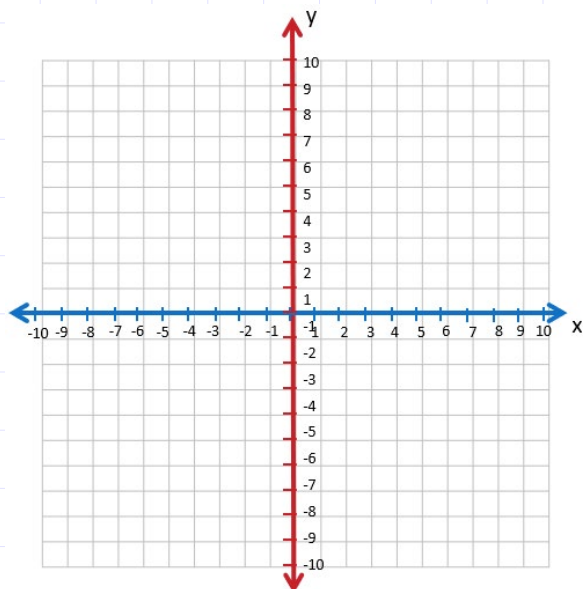
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