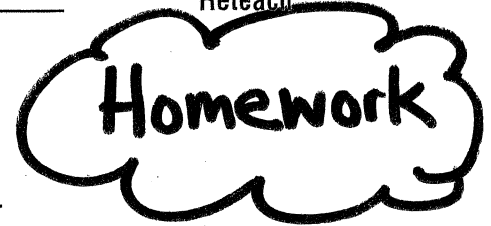# Exponents

An **exponent** tells how many times a number is used as a factor.

The **base** is the number being multiplied repeatedly.

For example, in 2^5, 5 is the exponent and 2 is the base.

$2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

Write the expression 4^5 using equal factors. Then find the value.

Step 1 Identify the base.

The base is 4.

Step 2 Identify the exponent.

The exponent is 5.

Step 3 Write the base as many times as the exponent tells you. Place a multiplication symbol between the bases.

$4 \times 4 \times 4 \times 4 \times 4$

You should have one less multiplication symbol than the value of the exponent.

Step 4 Multiply.

$4 \times 4 \times 4 \times 4 \times 4 = 1,024$

So, $4^5 = 1,024$.

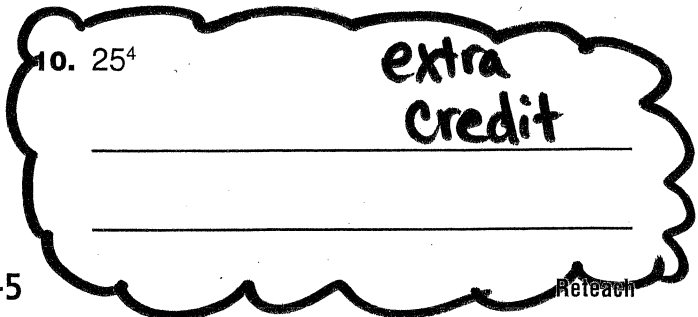**Write as an expression using equal factors. Then find the value.**

1. 3^4

2. 2^6

3. 4^3

4. 5^3

5. 10^4

6. 8^5

7. 11^4

8. 15^2

9. 10^7

10. 25^4

extra credit

Evaluate Expressions Involving Exponents

A **numerical expression** is a mathematical phrase that includes only numbers and operation symbols.

You **evaluate** the expression when you perform all the computations.

To evaluate an expression, use the **order of operations.**

Order of Operations
1. Parentheses
2. Exponents
3. Multiply and Divide
4. Add and Subtract

Evaluate the expression $(10 + 6^2) - 4 \times 10$.

Step 1 Start with the *parentheses*.
Use the order of operations for the computations inside the parentheses.

$10 + 6^2$
Find the value of the number with an *exponent*. Rewrite as multiplication:
$10 + 6^2 = 10 + 6 \times 6$
Multiply and divide from left to right:
$10 + 6 \times 6 = 10 + 36$
Add and subtract from left to right:
$10 + 36 = 46$

Step 2 Rewrite the original expression, using the value from Step 1 for the part in parentheses.

$(10 + 6^2) - 4 \times 10 = 46 - 4 \times 10$

Step 3 Now that the parentheses are cleared, look for *exponents*.

There are no more *exponents*, so go on to the next step in the order of operations.

Step 4 *Multiply and divide* from left to right.

$46 - 4 \times 10 = 46 - 40$

Step 5 *Add and subtract* from left to right.

$46 - 40 = 6$

So, $(10 + 6^2) - 4 \times 10 = 6$.

Evaluate the expression.

1. $8^2 - (7^2 + 1)$

2. $5 - 2^2 + 12 \div 4$

3. $8 \times (16 - 2^4)$

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4. $3^2 \times (28 - 20 \div 2)$

5. $(30 - 15 \div 3) \div 5^2$

6. $(6^2 - 3^2) - 9 \div 3$

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