

# 4-4 Prime Factorization (Pages 184–188)

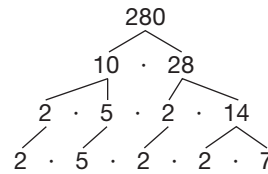
A **prime number** is a whole number greater than one that has *exactly* two factors, 1 and itself. A **composite number** is a whole number greater than one that has more than two factors. A composite number can always be expressed as a product of two or more primes. When you express a positive integer (other than 1) as a product of factors that are all prime, this is called **prime factorization**. A monomial can be factored as the product of prime numbers,  $-1$ , and variables with no exponents greater than 1. For example,  $-14cd^2 = -1 \cdot 2 \cdot 7 \cdot c \cdot d \cdot d$ .

<p><b>Finding the Prime Factorization</b></p>	<ul style="list-style-type: none"> <li>• The numbers 0 and 1 are neither prime nor composite.</li> <li>• Every number is a factor of 0. The number 1 has only one factor, itself.</li> <li>• Every whole number greater than 1 is either prime or composite.</li> <li>• One way to find the prime factorization of a number is to use a <b>factor tree</b> such as the one shown in the Example.</li> </ul>
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## EXAMPLE

Factor 280 completely.

Use a factor tree like the one shown at the right. The factors are prime. List the prime factors from least to greatest:  $280 = 2 \cdot 2 \cdot 2 \cdot 5 \cdot 7$ .



## Try These Together

1. Is 13 prime or composite?

2. Is 33 prime or composite?

*HINT: You only need to test divisors that are less than half of the number, since a larger divisor would mean that there is also a smaller factor.*

## PRACTICE

Determine whether each number is prime or composite.

3. 18

4. 37

5. 49

6. 4539

Factor each number or monomial completely.

7. 44

8. 12

9. 90

10.  $-18$

11.  $-24$

12. 28

13. 23

14.  $-25$

15.  $8xy^2$

16.  $-16ab^3c$

17.  $42mn$

18.  $50p^2$



19. **Standardized Test Practice** Which of the following is a prime number?

A 8

B 9

C 13

D 15

<p>Answers: 1. prime 2. composite 3. composite 4. prime 5. composite 6. prime 7. <math>2 \cdot 2 \cdot 11</math> 8. <math>2 \cdot 2 \cdot 3</math> 9. <math>2 \cdot 3 \cdot 3 \cdot 5</math> 10. <math>-1 \cdot 2 \cdot 3 \cdot 3</math> 11. <math>-1 \cdot 2 \cdot 2 \cdot 2 \cdot 3</math> 12. <math>2 \cdot 2 \cdot 7</math> 13. prime 14. <math>-1 \cdot 5 \cdot 5</math> 15. <math>2 \cdot 2 \cdot 2 \cdot 2 \cdot x \cdot y \cdot y</math> 16. <math>-1 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot a \cdot b \cdot b \cdot c</math> 17. <math>2 \cdot 3 \cdot 7 \cdot m \cdot n</math> 18. <math>2 \cdot 5 \cdot 5 \cdot d \cdot d</math> 19. C</p>
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