LESSON 4.1

Factors *and* Prime Factorization

Vocabulary

prime number, p. 175
composite number, p. 175

BEFORE You found the product of two or more numbers.

Now You'll write the prime factorization of a number.

WHY? So you can count ways to display a firefly collection, as in Ex. 56.

Prime and Composite Numbers A **prime number** is a whole number that is greater than 1 and has exactly two whole number factors, 1 and itself. A **composite number** is a whole number that is greater than 1 and has more than two whole number factors. The number 1 is neither prime nor composite.

Examples of Prime and Composite Numbers

Number	Factors	Prime or composite?
24	1, 2, 3, 4, 6, 8, 12, 24	Composite
41	1, 41	Prime
51	1, 3, 17, 51	Composite
89	1, 89	Prime
121	1, 11, 121	Composite

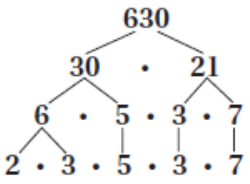
Prime Factorization When you write a number as a product of prime numbers, you are writing its **prime factorization**. You can use a diagram called a **factor tree** to write the prime factorization of a number.

Prime Factorization When you write a number as a product of prime numbers, you are writing its **prime factorization**. You can use a diagram called a **factor tree** to write the prime factorization of a number.

Example 2 *Writing a Prime Factorization*

Write the prime factorization of 630.

One possible factor tree:



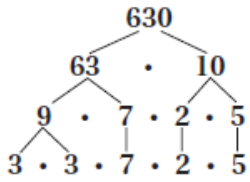
Write original number.

Write 630 as 30 • 21.

Write 30 as 6 • 5. Write 21 as 3 • 7.

Write 6 as 2 • 3.

Another possible factor tree:



Write original number.

Write 630 as 63 • 10.

Write 63 as 9 • 7. Write 10 as 2 • 5.

Write 9 as 3 • 3.

Both trees give the same result: $630 = 2 \cdot 3 \cdot 3 \cdot 5 \cdot 7 = 2 \cdot 3^2 \cdot 5 \cdot 7$.

Answer The prime factorization of 630 is $2 \cdot 3^2 \cdot 5 \cdot 7$.

Factoring Monomials A **monomial** is a number, a variable, or the product of a number and one or more variables raised to whole number powers.

Monomials	Not monomials
$7x$	$7 + x$
$25mn^2$	$25m - n^2$
$24y^3z^2$	$24 + y^3 + z^2$

To *factor* a monomial, write the monomial as a product of prime numbers and variables with exponents of 1.

LESSON 4.1

Name _____ Date _____

Practice A

For use with pages 173–178

Write all the factors of the number.

1. 18 **2.** 24 **3.** 40

4. 27 **5.** 33 **6.** 41

18: 1, 2, 3, 6, 9, 18

40: 1, 2, 4, 5, 8, 10, 20, 40

33: 1, 3, 11, 33

Tell whether the number is *prime* or *composite*.

7. 13 **8.** 15 **9.** 25

10. 19 **11.** 37 **12.** 53

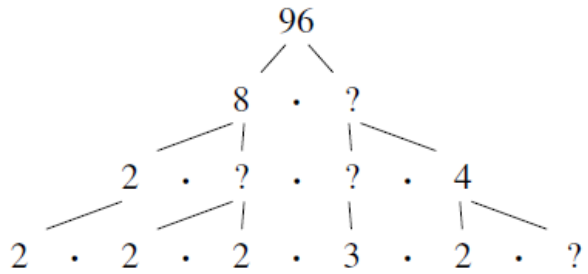
13 prime

15 comp

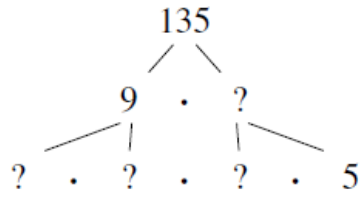
53 prime

Complete the factor tree. Then write the prime factorization of the number.

13.



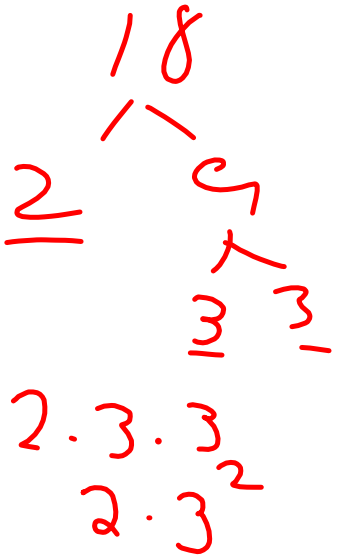
14.



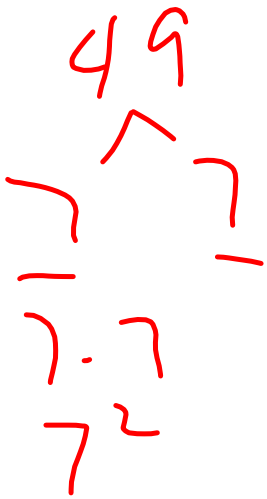
96
8 12
2 4 3 4
2 2 2 2
2·2·2·2·2·3
$2^5 \cdot 3$

Write the prime factorization of the number.

15. 14 **16.** 18 **17.** 20

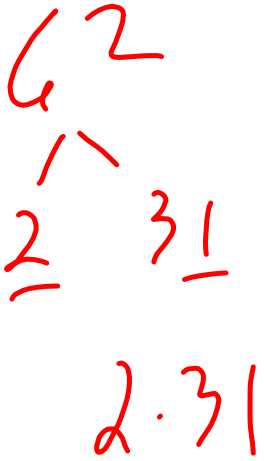


18. 49



19. 54

20. 62



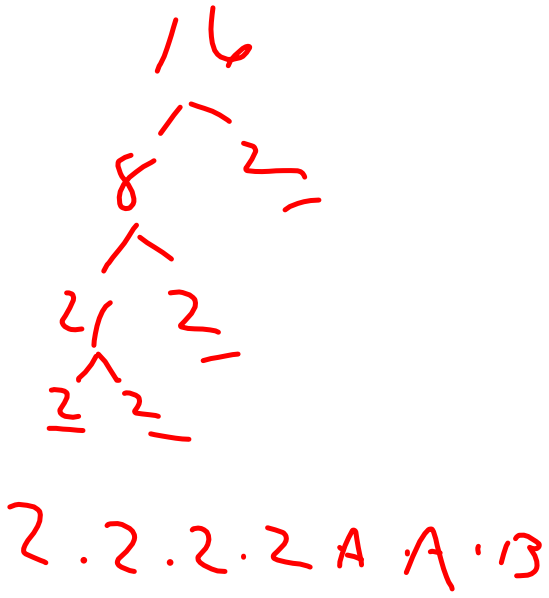
21. 64

22. 72

23. 80

Factor the monomial.

24. $8xy$ **25.** $16a^2b$ **26.** $5z^7$



27. $27g^2h^3$

28. $32rs^3$

29. $45m^3n$

27

9 3

3 3

$3 \cdot 3 \cdot 3 \cdot g \cdot g \cdot h \cdot h \cdot h$

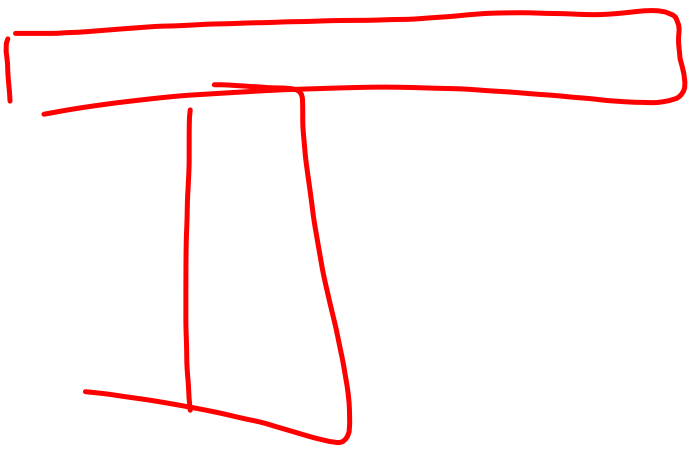
$45m^3n$

30. You are designing a web page to show 50 pictures. You want the pictures to form a rectangle. How many ways can you arrange the pictures on the web page?

50: 1, 2, 5, 10, 25, 50

6

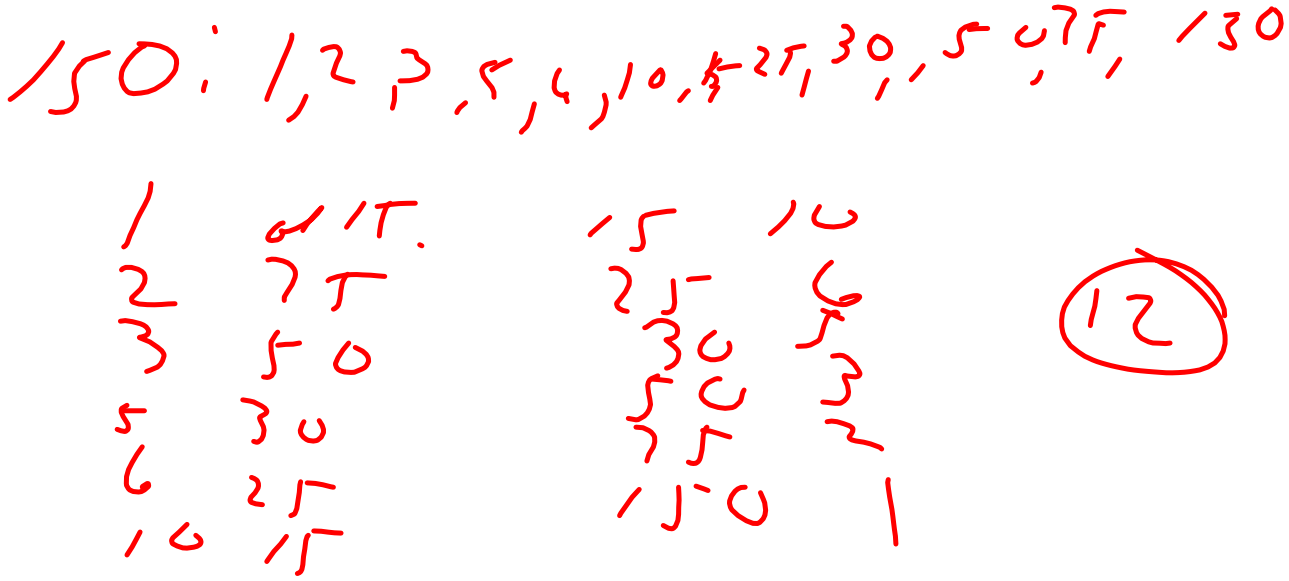
1 x 50
2 x 25
5 x 10
10 x 5
25 x 2
50 x 1



5
00000 0
2 00000 0

10
1 0000000000

31. There are 150 students volunteering to help at a community fair. The students must be divided into groups of equal size. How many ways can the students be divided into the groups?



32. The area of a rectangular pen is 24 square feet. The length and width are whole numbers of feet. Find all possible dimensions of the pen. How many dimensions have a length of more than 3 feet and less than 10 feet?

24 1, 2, 3, 4, 6, 8, 12, 24

4 x 6

6 x 4

2 ways