(1) Find prime factors

Discussion/Activity

Concept p. 19

Have your student follow the steps on this page. Use a Hundred-chart such as the one on appendix p. a8. The textbook has the student just finding the prime numbers through 50; you can have your student do the same process with all 100 numbers on the Hundred-hart.

The numbers not crossed out if going to 100 are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, and 97.

Make sure your student understands the definition of a prime number. (It is not important to remember what a twin prime is.)

Tell your student that it is fairly easy to tell if a number less than 100 is prime. We can use divisibility rules. It is easy to check if a number is divisible by 3, 5, or 11, so once we know that it is not, all we have to check is if it is divisible by 7.

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47

Twin primes: 3 and 5, 5 and 7, 11 and 13, 17 and 19, 29 and 31, 41 and 43

~~1~~	2	3	~~4~~	5	~~6~~	7	~~8~~	~~9~~	~~10~~
11	~~12~~	13	~~14~~	~~15~~	~~16~~	17	~~18~~	19	~~20~~
~~21~~	~~22~~	23	~~24~~	~~25~~	~~26~~	~~27~~	~~28~~	29	~~30~~
31	~~32~~	~~33~~	~~34~~	~~35~~	~~36~~	37	~~38~~	~~39~~	~~40~~
41	~~42~~	43	~~44~~	~~45~~	~~46~~	47	~~48~~	~~49~~	~~50~~
~~51~~	~~52~~	53	~~54~~	~~55~~	~~56~~	~~57~~	~~58~~	59	~~60~~
61	~~62~~	~~63~~	~~64~~	~~65~~	~~66~~	67	~~68~~	~~69~~	~~70~~
71	~~72~~	73	~~74~~	~~75~~	~~76~~	~~77~~	~~78~~	79	~~80~~
~~81~~	~~82~~	83	~~84~~	~~85~~	~~86~~	~~87~~	~~88~~	89	~~90~~
~~91~~	~~92~~	~~93~~	~~94~~	~~95~~	~~96~~	97	~~98~~	~~99~~	~~100~~

Activity

Ask your student to list the factors of 24. Ask which ones are prime numbers.

Then ask your student to write 24 as a product of two of the factors other than 1. Remind her that 24 can be expressed as the product of more than two factors; all we have to do is express one of the current factors as the product of two factors. Continue writing 24 as the product of more factors other than 1 until it is no longer possible without using 1 as a factor. Point out that all the factors are now prime numbers. Tell her that we have found the *prime factorization* of 24.

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

24 = 4 x 6

24 = 2 x 2 x 6

24 = 2 x 2 x 2 x 3

Discussion

Tasks 1-3, p. 20

1. 1, 2, and 3
2. 12 = 2 x 2 x 3
3. 72 = 2 x 2 x 2 x 3 x 3

3: For Method 1 make sure your student understands that these are not number bonds but rather each branch shows factors. Point out that it does not matter which factors we use, (except not to use 1); eventually everything will be factored to the same set of prime factors. The numbers for the prime factors will be the final "leaves" of the tree. For Method 2, you may want to write down the steps in order so that your student sees that the quotient is going below each number. This is similar to a factor tree, except one of the factors is always a prime number. When the quotient is 1, then the prime factors are the numbers down the left side.

With the second method it is often easiest to start with the lowest prime number. If the number we are factoring is even, then we keep using 2 as one of the factors until it is no longer even. Then we can try 3, then 5, then 7, then 11, and so on for succeeding prime numbers. But it is not really necessary to start with 2. If we were doing the prime factorization of 88, we might start with 11.

Tell your student that customarily when we give the prime factorization of a number, we list the lowest prime numbers first.

Practice

Task 4, p. 20

4. (a) $15 = 3 \times 5$
   (b) $50 = 2 \times 5 \times 5$
   (c) $36 = 2 \times 2 \times 3 \times 3$

Discussion

Tasks 5-7, p. 21

5. $72 = 2^3 \times 3^2$

6. (a) 16
   (b) $4^3 = 4 \times 4 \times 4 = 64$

7. (a) $3^3 = 3 \times 3 \times 3 = 27$
   (b) $7^2 = 7 \times 7 = 49$
   (c) $3^3 \times 7^2 = 3 \times 3 \times 3 \times 7 \times 7 = 1323$
   (d) $1^7 = 1$

Point out that your student has seen exponents before. We use them for units of area and volume. The unit cm^2 means that a measurement in centimeters was multiplied by another measurement in centimeters, and cm^3 means that 3 different measures in centimeters were multiplied together. However, using exponents of 2 or 3 with numbers has nothing to do with area or volume per se. We could feasibly say that the area of something is 2^3 cm^2. This simply means that the area is 8 cm^2 and tells us nothing about the sides or even the shape of the figure. Just because the exponent on the number is 3 does not mean we are measuring volume, it is only the exponent on the centimeters that tells us it is a measurement of an area.

6(b): Even though exponents are being taught in the context of prime factorization, the base does not have to be a prime number.

7(d): Point out that 1 to any power is 1.

Practice

Tasks 8-9, p. 21

8. (a) $2^3 \times 5^3$
   (b) $3^2 \times 5^2 \times 7$
   (c) $7^2 \times 11^2$

9. (a) $2^2 \times 3 \times 5$
   (b) $2^3 \times 3$
   (c) $2^2 \times 5^2$

Workbook

Exercise 5, pp. 14-15 (answers p. 23)

(2) Practice

Practice

Practice B, p. 22

Reinforcement

Extra Practice, Unit 1, Exercise 4, pp. 23-24

Tests

Tests, Unit 1, 4A and 4B, pp. 15-18

Enrichment

Have your student work on the following problems (appendix p. a11) and then discuss solutions.

1. A square number is a number that is a product of two factors that are the same. Since 5 x 5 = 25, 25 is a square number. Find the smallest whole number that 180 must be multiplied by so that the product is a square number.

   First find the prime factorization of 180. 180 = 2^2 x 3^2 x 5. So if we multiply 180 by 5, the new number, 900, is a square number. 900 = 2^2 x 3^2 x 5^2 = 30^2.

2. What is the smallest possible number which, when divided by 2, 3, 4, 5, 6, or 7, will give a remainder of 1, 2, 3, 4, 5, and 6, respectively.

   The remainder is 1 less than the divisor. If we add 1 to the number, there will be no remainder when it is divided by 2, 3, 4, 5, 6, and 7. So 1 more than the number is the lowest common multiple of 2, 3, 4, 5, 6, and 7, which is 420. The number is 419.

3. The prime factorization of two numbers are 3^3 x 5 x 7 and 2 x 3^2 x 7^2. Give 3 common factors of the two numbers other than 3 and 7.

   Common factors are 9 (3 x 3), 21 (3 x 7), and 63 (3 x 3 x 7).

1. (a) 1, 2, 4, 7, 8, 14, 28, 56
   (b) 1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72
   (c) 1, 2, 3, 4, 6, 9, 12, 18, 27, 36, 54, 108
   (d) 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 24, 30, 40, 60, 120
2. (a) 12 (b) 3 (c) 12
3. (a) 5, 10, 15, 20
   (b) 7, 14, 21, 28
   (c) 8, 16, 24, 32
   (d) 9, 18, 27, 36
4. (a) 15 (b) 24 (c) 36
5. (a) 14 (b) 24
   (c) 33 (d) 15
   (e) 29 (f) 22
6. (a) and (c) (42 and 128)
7. (b) and (c) (69 and 252)
8. (a), (c), and (d) (40, 195, and 660)
9. (a) 5^2 x 11^3 (b) 2^3 x 13^2 x 31
   (c) 2 x 3^2 x 5^2 x 19^2
10. (a) 432 (b) 196 (c) 1089
11. (a) 28 = 2^2 x 7
    (b) 54 = 2 x 3^3
    (c) 88 = 2^3 x 11
    (d) 108 = 2^2 x 3^3