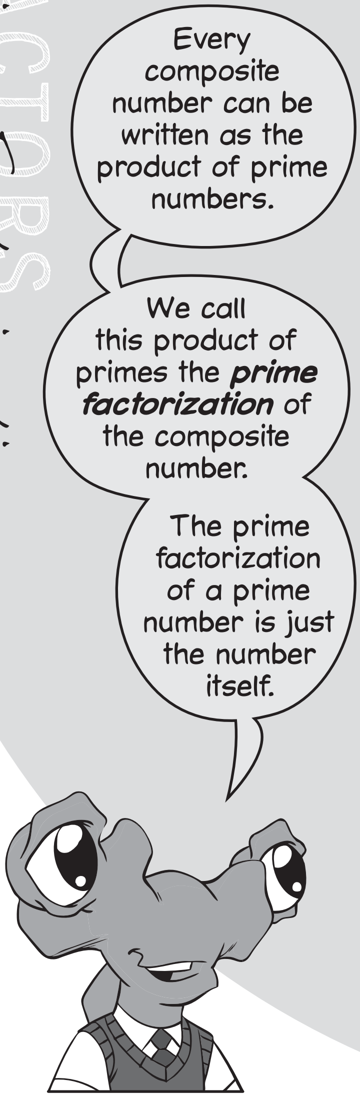
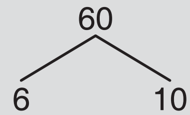
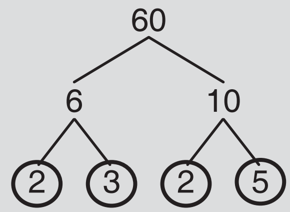


EXAMPLE What is the prime factorization of 60?

We create a factor tree to find all of the prime factors of 60.
We begin by factoring 60 into 6×10.



Next, we factor 6 into 2×3 and 10 into 2×5. We circle each of the prime factors at the bottom of the tree.



Since there are no composite numbers left to factor, we are finished! The prime factorization of 60 is 2×3×2×5.

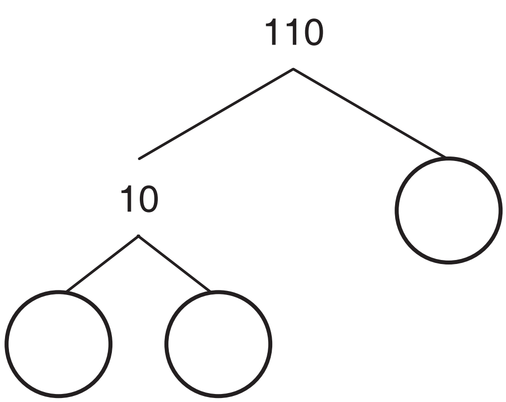
We generally order the factors from least to greatest: **2×2×3×5**.
We usually write prime factorizations using exponents: $\mathbf{2^2 \times 3 \times 5}$.

We check that the product equals 60:
$2^2 \times 3 \times 5 = 2 \times 2 \times 3 \times 5 = 60$.

Note that we could have begun by factoring 60 into 2×30, 3×20, 4×15, 5×12, or 6×10.
No matter how we begin our factor tree, we will always end up with the same prime factorization!

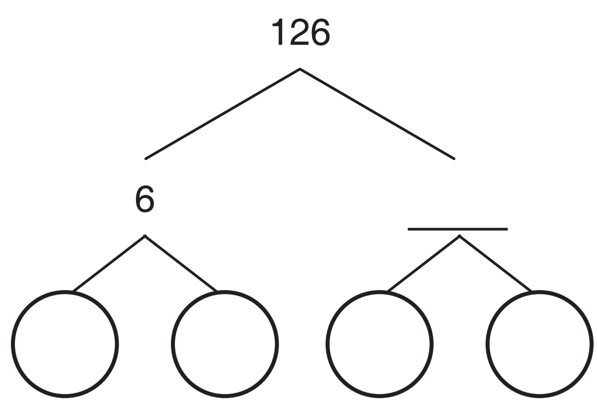
PRACTICE Fill in the missing numbers in each factor tree below to determine the prime factorization of each number.

69.



110 = ____________________

70.



126 = ____________________

PRACTICE Draw a factor tree to help you determine the prime factorization of each number below. Order the primes from least to greatest and use exponents for repeated factors, as in the example on the previous page.

71. 140 = ______________________

72. 72 = ______________________

73. 196 = ______________________

74. 465 = ______________________

PRACTICE | Draw a factor tree to help you determine the prime factorization of each number below. Order the primes from least to greatest and use exponents for repeated factors.

75. 600 = ________________________

76. 525 = ________________________

PRACTICE | Use the prime factorizations you found above to help you determine the prime factorization of each number below.

77. 1,800 = ________________________

78. 1,050 = ________________________

79. 6,000 = ________________________

80. 5,250 = ________________________

81. 300 = ________________________

82. 105 = ________________________

EXAMPLE | What is the prime factorization of 127?

We use division and our divisibility tests to look for factors of 127.

7 is not an even digit, so 127 is not divisible by 2.

$1+2+7=10$ is not a multiple of 3, so 127 is not divisible by 3.

Since $4=2\times2$, every number that has 4 as a factor also has 2 as a factor. 127 is not divisible by 2, so 127 is not divisible by 4.

Similarly, every composite number has at least one prime factor. So, we only need to check for ***prime*** factors!

127 does not end in 0 or 5, so 127 is not divisible by 5.

$127\div7$ has remainder 1, so 127 is not divisible by 7.

$127\div11$ has remainder 6, so 127 is not divisible by 11.

$127\div13$ has remainder 10, so 127 is not divisible by 13.

Then, since $13\times13=169$, any number that is ***larger*** than 13 has to be multiplied by a number that is ***smaller*** than 13 to get 127.

So, we don't need to check any more primes.
The only factors of 127 are 1 and 127.

Therefore, 127 is prime, and the prime factorization of 127 is just **127**.

PRACTICE | Write the prime factorization of each number on the line that follows. Order the primes from least to greatest, and use exponents for repeated factors.

83. 87 = ________________________

84. 113 = ________________________

85. 441 = ________________________

86. 910 = ________________________

87. 406 = ________________________

88. 357 = ________________________