

18. [Multiples / Factors / Primes]

Skill 18.1 Finding the multiples of a number.

MMBlue 1 1 2 2 3 3 4 4
MMGreen 1 1 2 2 3 3 4 4

- Count by the number i.e. add the number to itself continuously.
- OR
- Multiply the number by 1, then 2, 3, 4, 5, etc. to get the multiples in order.

Q. List all the multiples of 5 up to 25.

A. $5 \cdot 1 = 5$
 $5 \cdot 2 = 10$
 $5 \cdot 3 = 15$
 $5 \cdot 4 = 20$
 $5 \cdot 5 = 25$
 $\Rightarrow 5, 10, 15, 20, 25$

a) List all the multiples of 8 up to 32.

$8 + 8 = 16, 16 + 8 = 24, 24 + 8 = 32$

keep adding 8

8, 16, 24, 32

b) List all the multiples of 2 up to 14.

c) List all the multiples of 10 up to 50.

d) List all the multiples of 3 up to 21.

e) List all the multiples of 6 up to 36.

f) List all the multiples of 11 up to 66.

g) List all the multiples of 8 up to 40.

h) List all the multiples of 9 up to 45.

i) List all the multiples of 4 up to 30.

j) List all the multiples of 7 up to 50.

Skill 18.2 Finding the common multiples of two numbers.

- List the multiples of each number.
- Compare the lists to find any numbers the same (common multiples).

Q. List the common multiples of 4 and 5 up to 50.

A. *Multiples of 4:*
4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52
Multiples of 5:
5, 10, 15, 20, 25, 30, 35, 40, 45, 50
Common multiples of 4 and 5 up to 50:
⇒ **20, 40**

a) List the common multiples of 3 and 6 up to 20.

3, 6, 9, 12, 15, 18 *multiples of 3*

6, 12, 18 *multiples of 6*

6, 12, 18

b) List the common multiples of 4 and 7 up to 30.

c) List the common multiples of 2 and 9 up to 60.

d) List the common multiples of 6 and 8 up to 50.

e) List the common multiples of 4 and 6 up to 32.

f) List the common multiples of 3 and 8 up to 60.

g) List the common multiples of 5 and 8 up to 90.

h) List the common multiples of 7 and 9 up to 100.

Skill 18.3 Finding the least common multiple (LCM) of two numbers.

- List the multiples of each number.
 - Compare the lists and find the lowest matching number (Least Common Multiple, LCM).
- Hints: If one number divides evenly into the other number then the LCM is the larger number.
If two numbers have 1 as their only common factor then the LCM is their product.*

Q. What is the least common multiple (LCM) of 10 and 12?

A. *Multiples of 10:*
10, 20, 30, 40, 50, 60, 70, 80
Multiples of 12:
12, 24, 36, 48, 60, 72, 84
Least Common Multiple (LCM):
60

a) What is the least common multiple (LCM) of 3 and 8?

3, 6, 9, 12, 15, 18, 21, 24, 27 multiples of 3

8, 16, 24, 32 multiples of 8

24

b) What is the least common multiple (LCM) of 4 and 7?

.....

c) What is the least common multiple (LCM) of 2 and 11?

.....

d) What is the least common multiple (LCM) of 5 and 9?

.....

e) What is the least common multiple (LCM) of 3 and 18?

.....

f) What is the least common multiple (LCM) of 4 and 20?

.....

g) What is the least common multiple (LCM) of 6 and 12?

.....

h) What is the least common multiple (LCM) of 6 and 8?

.....

i) What is the least common multiple (LCM) of 8 and 12?

.....

j) What is the least common multiple (LCM) of 9 and 15?

.....

Skill 18.4 Finding the factors of a number.

- To decide if a number is a factor of another number the first number must divide evenly into the second number, with no remainder.
Hint: A number always has at least 2 factors, 1 and the number itself.
- Use trial and error. Be systematic.
Divide 2 into the number. If 2 divides evenly then 2 and the result are factors of the number.
Divide 3 into the number. If 3 divides evenly then 3 and the result are factors of the number.
Divide 4 into the number. If 4 divides evenly then 4 and the result are factors of the number.
Continue until all possibilities are exhausted.

Q. List all the factors of 10 in ascending order.

A. $10 \div 1 = 10$
 $10 \div 2 = 5$
 $10 \div 3 = 3 \text{ remainder } 1$
 $10 \div 4 = 2 \text{ remainder } 2$
 $10 \div 5 = 2$ ← Back to 5 & 2 so possibilities exhausted
 $\Rightarrow 1, 2, 5, 10$

a) Is 2 a factor of 471?

$471 \div 2 = 235 \text{ remainder } 1$

no

b) Is 6 a factor of 282?

$282 \div 6 =$

c) Is 3 a factor of 142?

d) Is 4 a factor of 212?

e) List all the factors of 25 in ascending order.

f) List all the factors of 28 in ascending order.

g) What is the smallest positive integer that has exactly three factors?

h) What is the smallest positive integer that has exactly nine factors?

i) The number 25 has exactly three factors: 1, 5, 25. Find the next number after 25 that has exactly three factors.

j) The number 12 has exactly six factors: 1, 2, 3, 4, 6 and 12. Find the next number after 12 that has exactly six factors.

Skill 18.5 Finding the common factors of two numbers.

- List the factors of each number.
- Compare the lists and find any matching numbers (Common Factors, CF).

Q. List all the common factors of 18 and 42.

A. *Factors of 18:*

1, 2, 3, 6, 9, 18

Factors of 42:

1, 2, 3, 6, 7, 14, 21, 42

Common factors of 18 and 42:

1, 2, 3, 6

a) List all the common factors of 8 and 36.

1, 2, 4, 8 *factors of 8*

1, 2, 3, 4, 6, 9, 12, 18, 36 *factors of 36*

1, 2, 4

b) List all the common factors of 12 and 15.

c) List all the common factors of 20 and 44.

d) List all the common factors of 20 and 50.

e) List all the common factors of 27 and 45.

f) List all the common factors of 15 and 50.

g) List all the common factors of 18 and 54.

h) List all the common factors of 28 and 70.

Skill 18.6 Finding the greatest common factor (GCF) of two numbers.

- List the factors of each number.
- Compare the lists and find the greatest matching number (Greatest Common Factor, GCF).

Q. What is the greatest common factor (GCF) of 24 and 60?

A. *Factors of 24:*

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

Factors of 60:

1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60

Greatest common factor (GCF):

⇒ 12

a) What is the greatest common factor (GCF) of 24 and 32?

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

1, 2, 4, 8, 16, 32 factors of 32

8

b) What is the greatest common factor (GCF) of 16 and 26?

.....

c) What is the greatest common factor (GCF) of 30 and 35?

.....

d) What is the greatest common factor (GCF) of 20 and 50?

.....

e) What is the greatest common factor (GCF) of 24 and 48?

.....

f) What is the greatest common factor (GCF) of 45 and 63?

.....

g) What is the greatest common factor (GCF) of 28 and 42?

.....

h) What is the greatest common factor (GCF) of 24 and 54?

.....

i) What is the greatest common factor (GCF) of 12 and 44?

.....

j) What is the greatest common factor (GCF) of 30 and 75?

.....

Skill 18.7 Recognizing prime and composite numbers.

- To decide if a number is prime, find all the factors of the number to determine if it has exactly 2 factors, 1 and itself. (see skill 18.4, page 146)
Hint: 0 and 1 are not prime or composite numbers.
- To decide if a number is composite, find all the factors of the number to determine if it has more than 2 factors.

Q. List the prime numbers between 7 and 14.

A. List the factors of each number:

| | |
|-------------------|--------------------------|
| 7 (1,7) | 11 (1,11) |
| 8 (1,8), (2,4) | 12 (1, 12), (2,6), (3,4) |
| 9 (1,9), (3,3) | 13 (1, 13) |
| 10 (1, 10), (2,5) | 14 (1,14), (2,7) |

Prime numbers (only 2 factors):

⇒ **7, 11, 13**

a) Choose the composite numbers:

0, 1, 2, 3, 4, 5, 6, 7

0 & 1 are not composite; 3, 5 & 7 are prime

2 is the only even prime; 4 & 6 are even

4, 6

b) Choose the composite numbers:

8, 9, 10, 11, 12, 13, 14, 15

c) What is the prime number just before 53?

d) What is the next prime number after 100?

e) What is the next prime number after 41?

f) What is the next prime number after 79?

g) List all the prime numbers between 40 and 50.

.....

.....

h) Choose the composite numbers: 16, 17, 18, 19, 20, 21, 22, 23

.....

.....

i) What is the prime number just before 88?

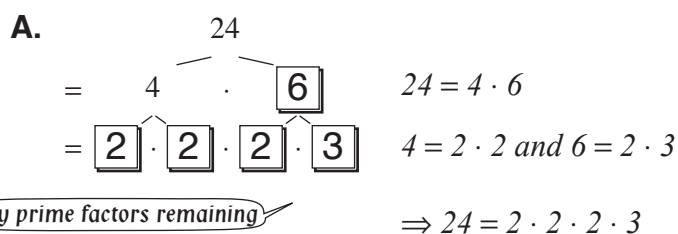
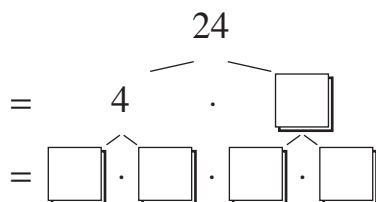
j) What is the next prime number after 90?

Skill 18.8 Expressing a number as a product of its prime factors using a factor tree (1).

MMBlue 11 22 33 44
MMGreen 11 22 33 44

- Write the number as a product of any two factors excluding 1 (not necessarily prime numbers).
- Then write each of these two numbers as a product of any two factors excluding 1.
- Continue in this way until only prime factors remain.

Q. Express 24 as a product of prime numbers by completing the factor tree.

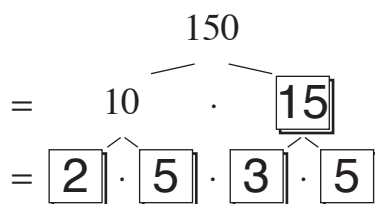


a) Express 150 as a product of prime numbers by completing the factor tree.

.....
 $150 = 10 \cdot 15$

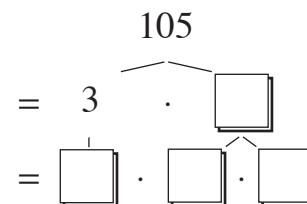
.....
 $10 = 2 \cdot 5$

.....
 $15 = 3 \cdot 5$



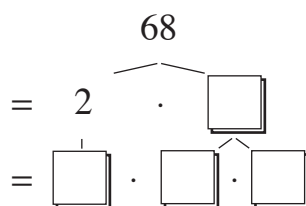
b) Express 105 as a product of prime numbers by completing the factor tree.

.....
 $105 = 3 \cdot$



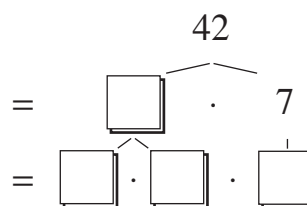
c) Express 68 as a product of prime numbers by completing the factor tree.

.....
 $68 =$



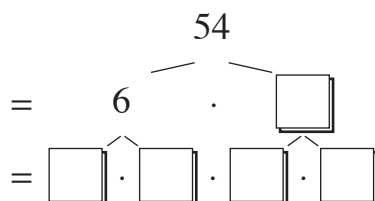
d) Express 42 as a product of prime numbers by completing the factor tree.

.....
 $42 =$



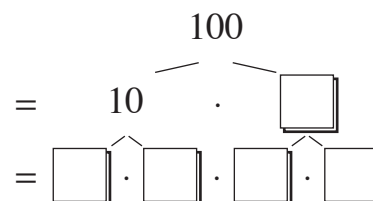
e) Express 54 as a product of prime numbers by completing the factor tree.

.....
 $54 =$



f) Express 100 as a product of prime numbers by completing the factor tree.

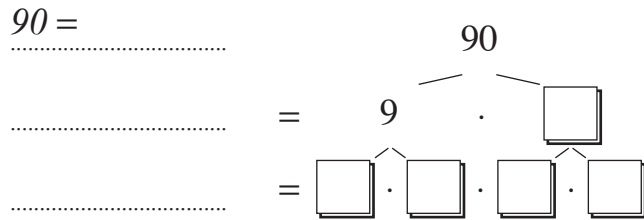
.....
 $100 =$



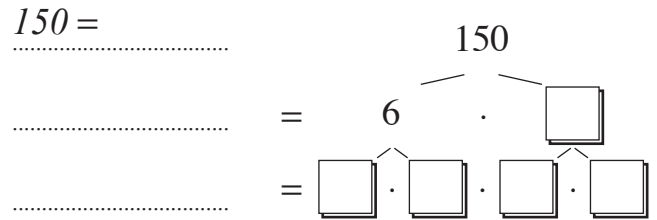
Skill 18.8 Expressing a number as a product of its prime factors using a factor tree (2).

MMBlue 1 1 2 2 3 3 4 4
MMGreen 1 1 2 2 3 3 4 4

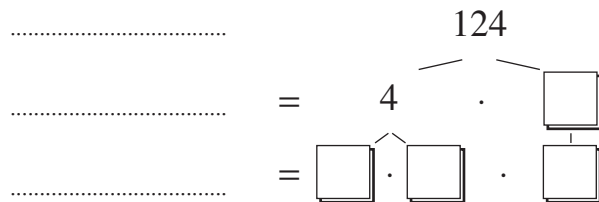
g) Express 90 as a product of prime numbers by completing the factor tree.



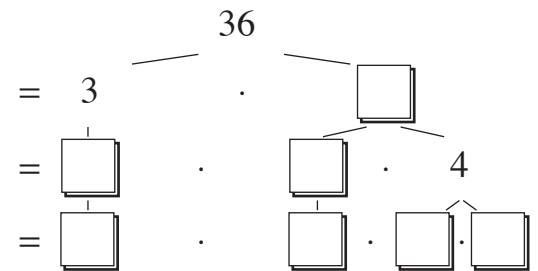
h) Express 150 as a product of prime numbers by completing the factor tree.



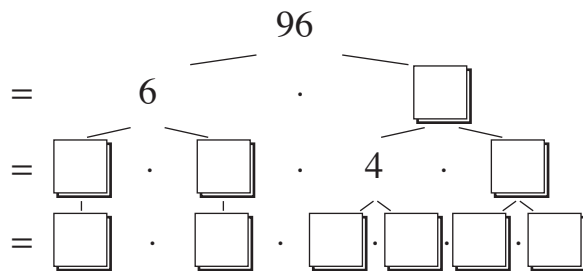
i) Express 124 as a product of prime numbers by completing the factor tree.



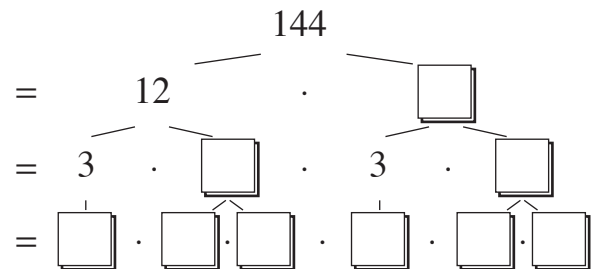
j) Express 36 as a product of prime numbers by completing the factor tree.



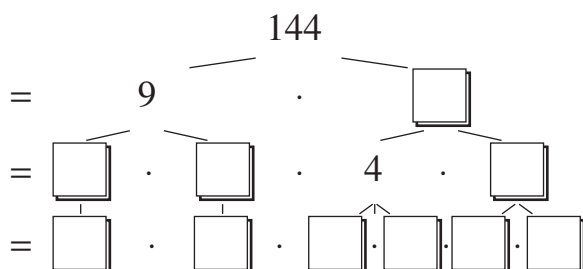
k) Express 96 as a product of prime numbers by completing the factor tree.



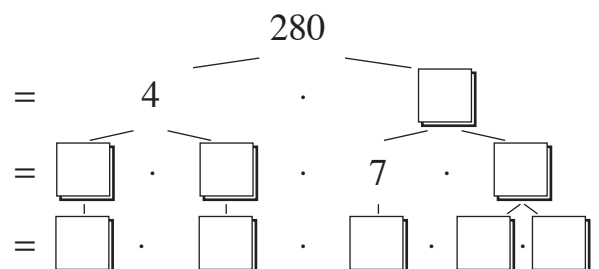
l) Express 144 as a product of prime numbers by completing the factor tree.



m) Express 144 as a product of prime numbers by completing the factor tree.



n) Express 280 as a product of prime numbers by completing the factor tree.



Skill 18.9 Expressing a number as a product of its prime factors using consecutive divisions.

- Find a prime number that divides evenly into the given number.
- Write this prime number next to the given number.
- Divide and write the result under the given number.
- Continue in this way until the result of the last division equals 1.
- Show all the resulting prime numbers as factors of the original number.

EITHER

- Use divisibility tests. (see Glossary, page 328)

Hints: All even numbers are divisible by 2

All numbers ending in 0 are divisible by 10 (2×5)

OR

- Use a factor tree.

(see skill 18.8, page 150)

Q. Express 84 as a product of its prime factors.

A. $84 \div 2 = 42$ Even numbers divide by 2 $84 \begin{array}{l} 2 \\ 2 \\ 3 \\ 7 \\ 1 \end{array}$

$42 \div 2 = 21$

$21 \div 3 = 7$ 21 divides evenly by 3

$\Rightarrow 84 = 2 \cdot 2 \cdot 3 \cdot 7$

a) Express 110 as a product of its prime factors.

$110 \div 2 = 55$

$55 \div 5 = 11$

| | |
|-----|----|
| 110 | 2 |
| 55 | 5 |
| 11 | 11 |
| 1 | |

$110 = 2 \cdot 5 \cdot 11$

b) Express 65 as a product of its prime factors.

| | |
|-------|--|
| 65 | |
| | |
| | |

$65 =$

c) Express 69 as a product of its prime factors.

| | |
|-------|--|
| 69 | |
| 69 | |
| | |

$69 =$

d) Express 27 as a product of its prime factors.

| | |
|-------|--|
| 27 | |
| | |
| | |

$27 =$

e) Express 124 as a product of its prime factors.

| | |
|-------|--|
| | |
| | |

$124 =$

f) Express 198 as a product of its prime factors.

| | |
|-------|--|
| | |
| | |

$198 =$

g) Express 81 as a product of its prime factors.

| | |
|-------|--|
| 81 | |
| | |
| | |

$81 =$

h) Express 40 as a product of its prime factors.

| | |
|-------|--|
| 40 | |
| | |
| | |

$40 =$

Skill 18.10 Expressing a number as a product of its prime factors using exponential notation.

- Express the number as a product of its prime factors. (see skill 18.8, page 150 and skill 18.9, page 152)
- Group like factors in ascending order.
- Use exponential notation to simplify like factors. (see skill 15.1, page 117)

Q. Express 126 as a product of its prime factors using exponential notation.

A. $126 \div 2 = 63$ ← 126 divides evenly by 2
 $63 \div 3 = 21$ ← 21 divides evenly by 3
 $21 \div 3 = 7$
 $126 = 2 \cdot 3 \cdot 3 \cdot 7$
 $\Rightarrow 126 = 2 \cdot 3^2 \cdot 7$

$$\begin{array}{r|l} 126 & 2 \\ 63 & 3 \\ 21 & 3 \\ 7 & 7 \\ 1 & \end{array}$$

a) Express 136 as a product of its prime factors using exponential notation.

$$\begin{array}{l} 136 = 4 \cdot 34 \\ \dots\dots\dots \\ 4 = 2 \cdot 2 \\ \dots\dots\dots \\ 34 = 2 \cdot 17 \\ \dots\dots\dots \\ 136 = 2 \cdot 2 \cdot 2 \cdot 17 \end{array}$$

$$126 = 2^3 \cdot 17$$

b) Express 200 as a product of its prime factors using exponential notation.

$$\begin{array}{r|l} 200 & \\ \dots\dots\dots & \\ \dots\dots\dots & \\ \dots\dots\dots & \end{array}$$

$$200 =$$

c) Express 360 as a product of its prime factors using exponential notation.

$$\begin{array}{l} \dots\dots\dots \\ \dots\dots\dots \\ \dots\dots\dots \\ \dots\dots\dots \end{array}$$

$$360 =$$

d) Express 64 as a product of its prime factors using exponential notation.

$$\begin{array}{l} \dots\dots\dots \\ \dots\dots\dots \\ \dots\dots\dots \\ \dots\dots\dots \end{array}$$

$$64 =$$

e) Express 900 as a product of its prime factors using exponential notation.

$$\begin{array}{l} \dots\dots\dots \\ \dots\dots\dots \\ \dots\dots\dots \\ \dots\dots\dots \end{array}$$

$$900 =$$

f) Express 576 as a product of its prime factors using exponential notation.

$$\begin{array}{l} \dots\dots\dots \\ \dots\dots\dots \\ \dots\dots\dots \\ \dots\dots\dots \end{array}$$

$$576 =$$