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LESSON NOTE

Year 5 || Factors

Factor pairs, common factors, prime numbers and factor trees

Learning objectives

- Identify factors, including finding all the factor pairs of a number.
- Find the common factors of two numbers.
- Know and use the words prime number, composite number and prime factor.
- Decide whether a number up to 100 is prime, and recall the prime numbers up to 19.
- Use a factor tree to write a number as a product of its prime factors.

Lesson map

1. Concept 1 Factors and factor pairs
2. Concept 2 Common factors
3. Concept 3 Prime and composite numbers
4. Concept 4 Prime factors and factor trees
5. Answer key Worked solutions

Key vocabulary

Factor	A whole number that divides another number exactly.
Factor pair	Two factors that multiply to make the number, for example $3 \times 4 = 12$.
Multiple	The answer when you multiply a number by a whole number: 12, 24, 36 ...
Common factor	A factor shared by two or more numbers.
Prime number	A number with exactly two factors: 1 and itself.
Composite number	A number with more than two factors.
Prime factor	A factor that is also a prime number.
Factor tree	A diagram that splits a number into its prime factors.

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Concept 1 Factors and factor pairs

A **factor** is a whole number that divides into another number **exactly**, with no remainder.

Factors always come in **pairs** that multiply together to make the number. We call these **factor pairs**.

KEY IDEA

3 × 4 = 12, so **3** and **4** are both factors of 12. They are a factor pair.

THE PAIRS METHOD

1. Start with 1 × the number.
2. Test 2, 3, 4 and so on in order. If it divides exactly, write its partner.
3. Stop when the pairs meet in the middle.
4. Read the factors out in order.

WATCH OUT

Factors are not the same as multiples. The factors of 12 are 1, 2, 3, 4, 6 and 12. The multiples of 12 are 12, 24, 36 and so on. Factors are never bigger than the number itself; 1 and the number are always factors.

Worked examples

Example 1 **Find all the factors of 12.** [2 marks]

Step 1: Start with the pair for 1

1 × 12 = 12 ✓

Step 2: Test each whole number in order

12 ÷ 2 = 6 ✓ so 2 × 6 = 12

12 ÷ 3 = 4 ✓ so 3 × 4 = 12

Step 3: Know when to stop

The next number is 4, and 4 × 4 = 16, which is bigger than 12. The pairs have met, so we stop.

Step 4: Write the factors in order

Read down the left column, then back up the right column: 1, 2, 3, 4, 6, 12

ANSWER

Factors of 12: **1, 2, 3, 4, 6, 12**

Factor pairs: 1 × 12, 2 × 6, 3 × 4

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Example 2 **Find all the factors of 18.** [2 marks]

Step 1: Start with the pair for 1

$1 \times 18 = 18$ ✓

Step 2: Test each whole number in order

$18 \div 2 = 9$ ✓ so $2 \times 9 = 18$

$18 \div 3 = 6$ ✓ so $3 \times 6 = 18$

$18 \div 4 = 4$ r 2 ✗ 4 is not a factor

Step 3: Know when to stop

The next number is 5, and $5 \times 5 = 25$, which is bigger than 18. The pairs have met, so we stop.

Step 4: Write the factors in order

Read down the left column, then back up the right column: 1, 2, 3, 6, 9, 18

ANSWER

Factors of 18: **1, 2, 3, 6, 9, 18**

Factor pairs: 1×18, 2×9, 3×6

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Example 3 **Find all the factors of 36.** [2 marks]

Step 1: Start with the pair for 1

$1 \times 36 = 36$ ✓

Step 2: Test each whole number in order

$36 \div 2 = 18$ ✓ so $2 \times 18 = 36$

$36 \div 3 = 12$ ✓ so $3 \times 12 = 36$

$36 \div 4 = 9$ ✓ so $4 \times 9 = 36$

$36 \div 5 = 7$ r 1 ✗ 5 is not a factor

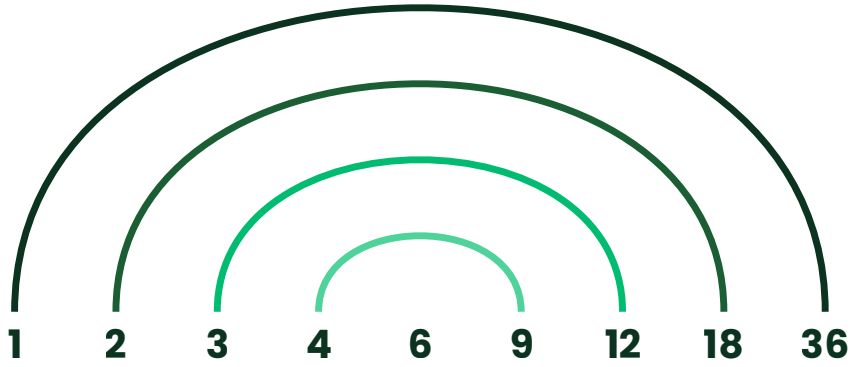
$36 \div 6 = 6$ ✓ so $6 \times 6 = 36$

Step 3: Know when to stop

$6 \times 6 = 36$. The pair has met itself, so we stop. 6 is written only once.

Step 4: Write the factors in order

Read down the left column, then back up the right column: 1, 2, 3, 4, 6, 9, 12, 18, 36



A factor rainbow: each arc joins a factor pair of 36.

ANSWER

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

Factor pairs: 1×36, 2×18, 3×12, 4×9, 6×6

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Example 4 **Find all the factors of 40.** [2 marks]

Step 1: Start with the pair for 1

$1 \times 40 = 40$ ✓

Step 2: Test each whole number in order

$40 \div 2 = 20$ ✓ so $2 \times 20 = 40$

$40 \div 3 = 13$ r 1 ✗ 3 is not a factor

$40 \div 4 = 10$ ✓ so $4 \times 10 = 40$

$40 \div 5 = 8$ ✓ so $5 \times 8 = 40$

$40 \div 6 = 6$ r 4 ✗ 6 is not a factor

Step 3: Know when to stop

The next number is 7, and $7 \times 7 = 49$, which is bigger than 40. The pairs have met, so we stop.

Step 4: Write the factors in order

Read down the left column, then back up the right column: 1, 2, 4, 5, 8, 10, 20, 40

ANSWER Factors of 40: **1, 2, 4, 5, 8, 10, 20, 40**
Factor pairs: 1×40, 2×20, 4×10, 5×8

Example 5 **Is 7 a factor of 56? Explain how you know.** [1 mark]

Step 1: Divide

$56 \div 7 = 8$

Step 2: Check the remainder

There is no remainder, so 7 divides 56 exactly.

Step 3: Check with multiplication

$7 \times 8 = 56$ ✓

ANSWER **Yes**, 7 is a factor of 56 because $7 \times 8 = 56$.

Example 6 **Is 6 a factor of 45? Explain how you know.** [1 mark]

Step 1: Divide

$45 \div 6 = 7$ r 3

Step 2: Check the remainder

There is a remainder of 3, so 6 does not divide 45 exactly.

Step 3: Check with multiplication

$6 \times 7 = 42$ and $6 \times 8 = 48$. 45 is in between, not in the 6 times table.

ANSWER **No**, 6 is not a factor of 45.

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Practice questions

Show all your working. Answers are in the answer key at the end.

Q1 **Find all the factors of 20.** [2 marks]

Q2 **Find all the factors of 30.** [2 marks]

Q3 **Find all the factors of 48.** [2 marks]

Q4 **Is 9 a factor of 72? Explain how you know.** [1 mark]

Q5 **Ada has 24 cupcakes. She wants to arrange them on a tray in equal rows with none left over. Write down every possible arrangement.** [3 marks]

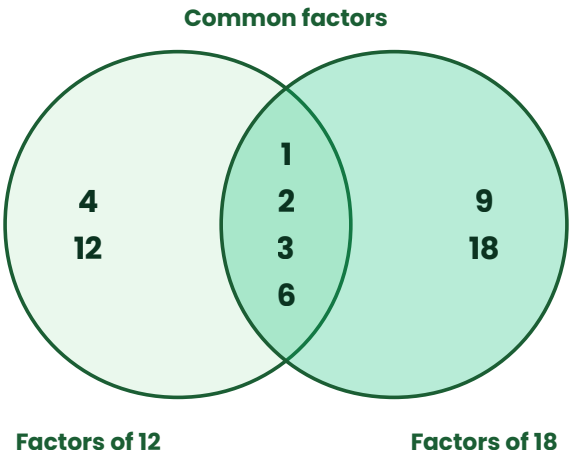
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Concept 2 Common factors

A **common factor** is a number that is a factor of two (or more) numbers at the same time.

KEY IDEA

List the factors of each number, then find the numbers that appear in **both** lists.



The overlap of the Venn diagram holds the common factors of 12 and 18.

WATCH OUT

1 is a common factor of every pair of numbers. Common factors are useful whenever things are shared into **equal groups with none left over**.

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Worked examples

Example 7 **Find the common factors of 12 and 18.** [2 marks]

Step 1: List the factors of 12

12: 1 × 12, 2 × 6, 3 × 4 → 1, 2, 3, 4, 6, 12

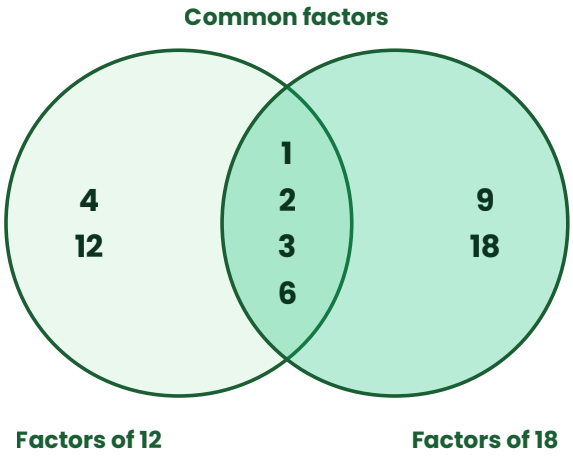
Step 2: List the factors of 18

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

Step 3: Find the numbers in both lists

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

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



ANSWER Common factors of 12 and 18: **1, 2, 3, 6**

Example 8 **Find the common factors of 16 and 24.** [2 marks]

Step 1: List the factors of 16

16: 1 × 16, 2 × 8, 4 × 4 → 1, 2, 4, 8, 16

Step 2: List the factors of 24

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

Step 3: Find the numbers in both lists

16: 1, 2, 4, 8, 16

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

ANSWER Common factors of 16 and 24: **1, 2, 4, 8**

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Example 9 **Find the common factors of 15 and 20.** [2 marks]

Step 1: List the factors of 15

15: 1 × 15, 3 × 5 → 1, 3, 5, 15

Step 2: List the factors of 20

20: 1 × 20, 2 × 10, 4 × 5 → 1, 2, 4, 5, 10, 20

Step 3: Find the numbers in both lists

15: **1**, 3, **5**, 15

20: **1**, 2, 4, **5**, 10, 20

ANSWER Common factors of 15 and 20: **1, 5**

Example 10 **Find the common factors of 8 and 15.** [2 marks]

Step 1: List the factors of 8

8: 1 × 8, 2 × 4 → 1, 2, 4, 8

Step 2: List the factors of 15

15: 1 × 15, 3 × 5 → 1, 3, 5, 15

Step 3: Find the numbers in both lists

8: **1**, 2, 4, 8

15: **1**, 3, 5, 15

ANSWER Common factors of 8 and 15: **1**

1 is the only common factor.

Example 11 **Find the common factors of 24 and 36.** [2 marks]

Step 1: List the factors of 24

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

Step 2: List the factors of 36

36: 1 × 36, 2 × 18, 3 × 12, 4 × 9, 6 × 6 → 1, 2, 3, 4, 6, 9, 12, 18, 36

Step 3: Find the numbers in both lists

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

36: **1**, **2**, **3**, **4**, **6**, 9, **12**, 18, 36

ANSWER Common factors of 24 and 36: **1, 2, 3, 4, 6, 12**

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Example 12 **A shop has 20 apples and 30 oranges. They are packed into identical bags with no fruit left over. What is the greatest number of bags that can be made? How many of each fruit go in each bag?** [3 marks]

Step 1: Spot the maths

The number of bags must divide 20 and 30 exactly, so it must be a common factor of 20 and 30.

Step 2: List the factors of each number

20: 1×20, 2×10, 4×5 → 1, 2, 4, 5, 10, 20

30: 1×30, 2×15, 3×10, 5×6 → 1, 2, 3, 5, 6, 10, 15, 30

Step 3: Find the common factors

20: **1**, **2**, 4, **5**, **10**, 20

30: **1**, **2**, 3, **5**, 6, **10**, 15, 30

The greatest common factor is 10.

Step 4: Share the fruit

$20 \div 10 = 2$ apples in each bag

$30 \div 10 = 3$ oranges in each bag

ANSWER **10 bags**, each with 2 apples and 3 oranges.

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Practice questions

Show all your working. Answers are in the answer key at the end.

Q6 **Find the common factors of 10 and 15.** [2 marks]

Q7 **Find the common factors of 18 and 27.** [2 marks]

Q8 **Find the common factors of 14 and 21.** [2 marks]

Q9 **Find the common factors of 32 and 40.** [2 marks]

Q10 **Mr Okafor has 24 pencils and 16 rubbers. He makes identical packs using all of them. What is the greatest number of packs he can make, and what is in each pack?** [3 marks]

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Concept 3 Prime and composite numbers

A **prime number** has **exactly two** factors: 1 and itself.
A **composite number** has **more than two** factors.

LEARN BY HEART

The prime numbers up to 19 are **2, 3, 5, 7, 11, 13, 17, 19**.

TESTING A NUMBER UP TO 100

Try dividing by **2, 3, 5 and 7**. If none of them divides exactly, the number is prime. (Any composite number up to 100 has one of these as a factor, because 10 × 10 = 100.)

WATCH OUT

1 is not prime (it has only one factor). **2 is the only even prime.** Not every odd number is prime: 9, 15, 21, 27, 49, 51 and 91 are all composite.

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

Primes up to 100 are shaded green. 1 is outlined: it is neither prime nor composite.

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Worked examples

Example 13 **Is 13 a prime number? Show how you know.** [2 marks]

Step 1: Test the small primes 2, 3, 5 and 7

$13 \div 2 = 6$ r 1 ×

$13 \div 3 = 4$ r 1 ×

Step 2: Explain why we can stop

We only need to test up to the prime whose square is bigger than the number.

Step 3: Count the factors

The only factors of 13 are 1 and 13.

ANSWER **Yes**. 13 is prime. Its only factors are 1 and 13.

Example 14 **Is 21 a prime number? Show how you know.** [2 marks]

Step 1: Test the small primes 2, 3, 5 and 7

$21 \div 2 = 10$ r 1 ×

$21 \div 3 = 7$ ✓ 3 is a factor

Step 2: Find a factor pair other than 1 and the number

$3 \times 7 = 21$

Step 3: Count the factors

21 has factors 1, 3, 7 and 21 (at least), so it has more than two factors.

ANSWER **No**. 21 is composite because $3 \times 7 = 21$.

Example 15 **Is 1 a prime number?** [2 marks]

Step 1: List the factors

The only factor of 1 is 1.

Step 2: Compare with the rule

A prime number has exactly two factors. 1 has only one factor.

ANSWER **No**. 1 is not prime and not composite. It has only one factor.

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Example 16 **Is 2 a prime number?** [2 marks]

Step 1: List the factors

$1 \times 2 = 2$. The factors of 2 are 1 and 2.

Step 2: Compare with the rule

2 has exactly two factors, so it is prime.

Every other even number can be divided by 2, so 2 is the only even prime.

ANSWER **Yes**. 2 is prime. It is the only even prime number.

Example 17 **Is 51 a prime number? Show how you know.** [2 marks]

Step 1: Test the small primes 2, 3, 5 and 7

$51 \div 2 = 25$ r 1 ×

$51 \div 3 = 17$ ✓ 3 is a factor

Step 2: Find a factor pair other than 1 and the number

$3 \times 17 = 51$

Step 3: Count the factors

51 has factors 1, 3, 17 and 51 (at least), so it has more than two factors.

ANSWER **No**. 51 is composite because $3 \times 17 = 51$.

Example 18 **Is 89 a prime number? Show how you know.** [2 marks]

Step 1: Test the small primes 2, 3, 5 and 7

$89 \div 2 = 44$ r 1 ×

$89 \div 3 = 29$ r 2 ×

$89 \div 5 = 17$ r 4 ×

$89 \div 7 = 12$ r 5 ×

Step 2: Explain why we can stop

Any number up to 100 that is not prime has a factor of 2, 3, 5 or 7, because $10 \times 10 = 100$.

Step 3: Count the factors

The only factors of 89 are 1 and 89.

ANSWER **Yes**. 89 is prime. Its only factors are 1 and 89.

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Practice questions

Show all your working. Answers are in the answer key at the end.

Q11 Is 17 a prime number? Show how you know. [2 marks]

Q12 Is 27 a prime number? Show how you know. [2 marks]

Q13 Is 91 a prime number? Show how you know. [2 marks]

Q14 List all the prime numbers between 20 and 40. [2 marks]

Q15 Sort these numbers into prime and composite: 2, 9, 15, 23, 31, 49 [3 marks]

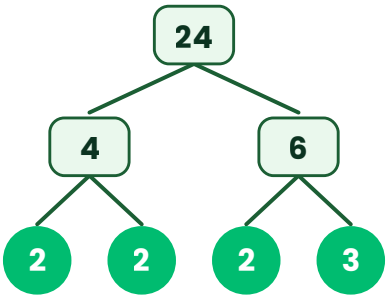
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Concept 4 Prime factors and factor trees

Every composite number can be built by multiplying prime numbers together. These primes are its **prime factors**. A **factor tree** helps us find them.

HOW TO DRAW A FACTOR TREE

1. Write the number at the top.
2. Split it into any factor pair (not 1 × the number).
3. If a branch is prime, circle it. That branch is finished.
4. Keep splitting every branch that is not prime.
5. Multiply all the circled primes together to check you get back to the start.



24 = 2 × 2 × 2 × 3. Green circles are prime: the branch stops there.

WATCH OUT

It does not matter which factor pair you start with. Every factor tree for the same number ends with the **same primes**.

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Worked examples

Example 19 **Use a factor tree to write 12 as a product of prime factors.** [3 marks]

Step 1: Split 12 into a factor pair

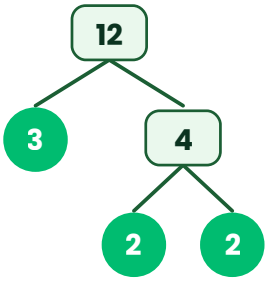
$12 = 3 \times 4$

Step 2: Keep splitting every branch that is not prime

$4 = 2 \times 2$

Step 3: Circle the primes at the ends of the branches

Primes: 3, 2, 2



Step 4: Write the product, smallest first, and check

$12 = 2 \times 2 \times 3$

Check: $2 \times 2 = 4$, $4 \times 3 = 12$ ✓

ANSWER $12 = \mathbf{2 \times 2 \times 3}$

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Example 20 **Use a factor tree to write 30 as a product of prime factors.** [3 marks]

Step 1: Split 30 into a factor pair

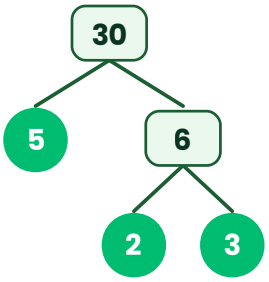
$30 = 5 \times 6$

Step 2: Keep splitting every branch that is not prime

$6 = 2 \times 3$

Step 3: Circle the primes at the ends of the branches

Primes: 5, 2, 3



Step 4: Write the product, smallest first, and check

$30 = 2 \times 3 \times 5$

Check: $2 \times 3 = 6$, $6 \times 5 = 30$ ✓

ANSWER $30 = \mathbf{2 \times 3 \times 5}$

Example 21 **Use a factor tree to write 36 as a product of prime factors.** [3 marks]

Step 1: Split 36 into a factor pair

$36 = 4 \times 9$

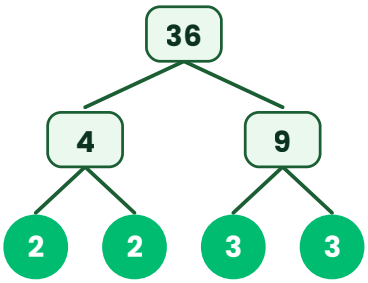
Step 2: Keep splitting every branch that is not prime

$4 = 2 \times 2$

$9 = 3 \times 3$

Step 3: Circle the primes at the ends of the branches

Primes: 2, 2, 3, 3



Step 4: Write the product, smallest first, and check

$36 = 2 \times 2 \times 3 \times 3$

Check: $2 \times 2 = 4$, $4 \times 3 = 12$, $12 \times 3 = 36$ ✓

ANSWER $36 = \mathbf{2 \times 2 \times 3 \times 3}$

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Example 22 **Use a factor tree to write 60 as a product of prime factors.** [3 marks]

Step 1: Split 60 into a factor pair

$60 = 2 \times 30$

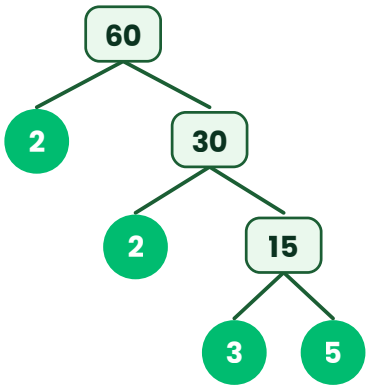
Step 2: Keep splitting every branch that is not prime

$30 = 2 \times 15$

$15 = 3 \times 5$

Step 3: Circle the primes at the ends of the branches

Primes: 2, 2, 3, 5



Step 4: Write the product, smallest first, and check

$60 = 2 \times 2 \times 3 \times 5$

Check: $2 \times 2 = 4$, $4 \times 3 = 12$, $12 \times 5 = 60$ ✓

ANSWER $60 = \mathbf{2 \times 2 \times 3 \times 5}$

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Example 23 **Draw two different factor trees for 48. Do they give the same prime factors?** [3 marks]

Step 1: Split 48 into a factor pair

48 = 6 × 8

Step 2: Keep splitting every branch that is not prime

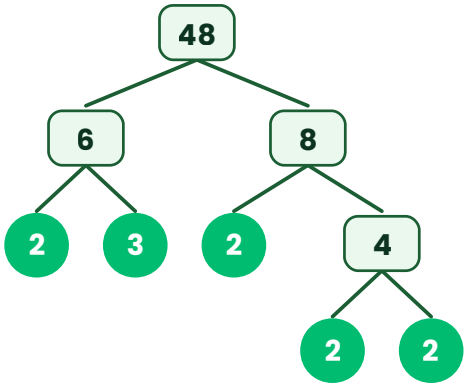
6 = 2 × 3

8 = 2 × 4

4 = 2 × 2

Step 3: Circle the primes at the ends of the branches

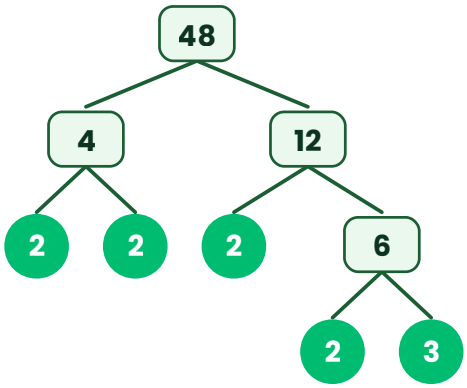
Primes: 2, 3, 2, 2, 2



Step 4: Try a different first split

48 = 4 × 12; 4 = 2 × 2; 12 = 2 × 6; 6 = 2 × 3

Primes: 2, 2, 2, 2, 3. The same primes appear, just in a different order.



Step 5: Write the product, smallest first, and check

48 = 2 × 2 × 2 × 2 × 3

Check: 2 × 2 = 4, 4 × 2 = 8, 8 × 2 = 16, 16 × 3 = 48 ✓

ANSWER 48 = **2 × 2 × 2 × 2 × 3**

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Example 24 **Use a factor tree to write 84 as a product of prime factors.** [3 marks]

Step 1: Split 84 into a factor pair

84 = 7 × 12

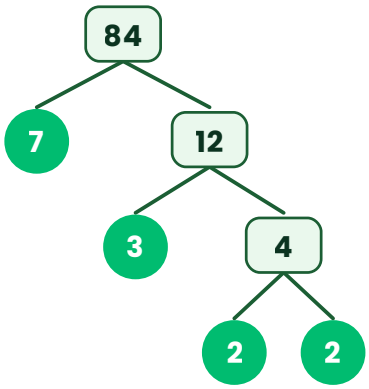
Step 2: Keep splitting every branch that is not prime

12 = 3 × 4

4 = 2 × 2

Step 3: Circle the primes at the ends of the branches

Primes: 7, 3, 2, 2



Step 4: Write the product, smallest first, and check

84 = 2 × 2 × 3 × 7

Check: 2 × 2 = 4, 4 × 3 = 12, 12 × 7 = 84 ✓

ANSWER 84 = **2 × 2 × 3 × 7**

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Practice questions

Show all your working. Answers are in the answer key at the end.

Q16 **Use a factor tree to write 18 as a product of prime factors.** [2 marks]

Q17 **Use a factor tree to write 40 as a product of prime factors.** [3 marks]

Q18 **Use a factor tree to write 45 as a product of prime factors.** [2 marks]

Q19 **Use a factor tree to write 100 as a product of prime factors.** [3 marks]

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Q20 **A number written as a product of primes is $2 \times 3 \times 3 \times 5$. What is the number?** [2 marks]

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Answer key Practice questions

Answer summary

Q	Concept	Final answer
Q1	1	Factors of 20: **1, 2, 4, 5, 10, 20** Factor pairs: 1 × 20, 2 × 10, 4 × 5
Q2	1	Factors of 30: **1, 2, 3, 5, 6, 10, 15, 30** Factor pairs: 1 × 30, 2 × 15, 3 × 10, 5 × 6
Q3	1	Factors of 48: **1, 2, 3, 4, 6, 8, 12, 16, 24, 48** Factor pairs: 1 × 48, 2 × 24, 3 × 16, 4 × 12, 6 × 8
Q4	1	**Yes**, 9 is a factor of 72 because 9 × 8 = 72.
Q5	1	1 row of 24, 24 rows of 1, 2 rows of 12, 12 rows of 2, 3 rows of 8, 8 rows of 3, 4 rows of 6, 6 rows of 4 (**8 arrangements**)
Q6	2	Common factors of 10 and 15: **1, 5**
Q7	2	Common factors of 18 and 27: **1, 3, 9**
Q8	2	Common factors of 14 and 21: **1, 7**
Q9	2	Common factors of 32 and 40: **1, 2, 4, 8**
Q10	2	**8 packs**, each with 3 pencils and 2 rubbers.
Q11	3	**Yes**. 17 is prime. Its only factors are 1 and 17.
Q12	3	**No**. 27 is composite because 3 × 9 = 27.
Q13	3	**No**. 91 is composite because 7 × 13 = 91.
Q14	3	**23, 29, 31, 37**
Q15	3	Prime: **2, 23, 31** Composite: **9, 15, 49**
Q16	4	18 = **2 × 3 × 3**
Q17	4	40 = **2 × 2 × 2 × 5**
Q18	4	45 = **3 × 3 × 5**
Q19	4	100 = **2 × 2 × 5 × 5**
Q20	4	The number is **90**

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Full worked solutions

Q1 **Find all the factors of 20.** [2 marks]

Step 1: Start with the pair for 1

$1 \times 20 = 20$ ✓

Step 2: Test each whole number in order

$20 \div 2 = 10$ ✓ so $2 \times 10 = 20$

$20 \div 3 = 6$ r 2 ✗ 3 is not a factor

$20 \div 4 = 5$ ✓ so $4 \times 5 = 20$

Step 3: Know when to stop

The next number is 5, and $5 \times 5 = 25$, which is bigger than 20. The pairs have met, so we stop.

Step 4: Write the factors in order

Read down the left column, then back up the right column: 1, 2, 4, 5, 10, 20

ANSWER

Factors of 20: **1, 2, 4, 5, 10, 20**

Factor pairs: 1×20, 2×10, 4×5

Q2 **Find all the factors of 30.** [2 marks]

Step 1: Start with the pair for 1

$1 \times 30 = 30$ ✓

Step 2: Test each whole number in order

$30 \div 2 = 15$ ✓ so $2 \times 15 = 30$

$30 \div 3 = 10$ ✓ so $3 \times 10 = 30$

$30 \div 4 = 7$ r 2 ✗ 4 is not a factor

$30 \div 5 = 6$ ✓ so $5 \times 6 = 30$

Step 3: Know when to stop

The next number is 6, and $6 \times 6 = 36$, which is bigger than 30. The pairs have met, so we stop.

Step 4: Write the factors in order

Read down the left column, then back up the right column: 1, 2, 3, 5, 6, 10, 15, 30

ANSWER

Factors of 30: **1, 2, 3, 5, 6, 10, 15, 30**

Factor pairs: 1×30, 2×15, 3×10, 5×6

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Q3 **Find all the factors of 48.** [2 marks]

Step 1: Start with the pair for 1

$1 \times 48 = 48$ ✓

Step 2: Test each whole number in order

$48 \div 2 = 24$ ✓ so $2 \times 24 = 48$

$48 \div 3 = 16$ ✓ so $3 \times 16 = 48$

$48 \div 4 = 12$ ✓ so $4 \times 12 = 48$

$48 \div 5 = 9$ r 3 ✗ 5 is not a factor

$48 \div 6 = 8$ ✓ so $6 \times 8 = 48$

Step 3: Know when to stop

The next number is 7, and $7 \times 7 = 49$, which is bigger than 48. The pairs have met, so we stop.

Step 4: Write the factors in order

Read down the left column, then back up the right column: 1, 2, 3, 4, 6, 8, 12, 16, 24, 48

ANSWER Factors of 48: **1, 2, 3, 4, 6, 8, 12, 16, 24, 48**
Factor pairs: 1×48, 2×24, 3×16, 4×12, 6×8

Q4 **Is 9 a factor of 72? Explain how you know.** [1 mark]

Step 1: Divide

$72 \div 9 = 8$

Step 2: Check the remainder

There is no remainder, so 9 divides 72 exactly.

Step 3: Check with multiplication

$9 \times 8 = 72$ ✓

ANSWER **Yes**, 9 is a factor of 72 because $9 \times 8 = 72$.

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Q5 **Ada has 24 cupcakes. She wants to arrange them on a tray in equal rows with none left over. Write down every possible arrangement.** [3 marks]

Step 1: Spot the maths

Equal rows with none left over means rows × cupcakes in each row = 24. We need the factor pairs of 24.

Step 2: Find the factor pairs of 24

24 ÷ 1 = 24 ✓
24 ÷ 2 = 12 ✓
24 ÷ 3 = 8 ✓
24 ÷ 4 = 6 ✓
24 ÷ 5 = 4 r 4 ×
5 × 5 = 25 is bigger than 24, so stop.

Step 3: Turn each pair into rows

Each pair can be turned around: 4 rows of 6 or 6 rows of 4.

ANSWER 1 row of 24, 24 rows of 1, 2 rows of 12, 12 rows of 2, 3 rows of 8, 8 rows of 3, 4 rows of 6, 6 rows of 4 (**8 arrangements**)

Q6 **Find the common factors of 10 and 15.** [2 marks]

Step 1: List the factors of 10

10: 1 × 10, 2 × 5 → 1, 2, 5, 10

Step 2: List the factors of 15

15: 1 × 15, 3 × 5 → 1, 3, 5, 15

Step 3: Find the numbers in both lists

10: 1, 2, 5, 10
15: 1, 3, 5, 15

ANSWER Common factors of 10 and 15: **1, 5**

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Q7 **Find the common factors of 18 and 27.** [2 marks]

Step 1: List the factors of 18

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

Step 2: List the factors of 27

27: 1×27, 3×9 → 1, 3, 9, 27

Step 3: Find the numbers in both lists

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

27: **1**, **3**, **9**, 27

ANSWER Common factors of 18 and 27: **1, 3, 9**

Q8 **Find the common factors of 14 and 21.** [2 marks]

Step 1: List the factors of 14

14: 1×14, 2×7 → 1, 2, 7, 14

Step 2: List the factors of 21

21: 1×21, 3×7 → 1, 3, 7, 21

Step 3: Find the numbers in both lists

14: **1**, 2, **7**, 14

21: **1**, 3, **7**, 21

ANSWER Common factors of 14 and 21: **1, 7**

Q9 **Find the common factors of 32 and 40.** [2 marks]

Step 1: List the factors of 32

32: 1×32, 2×16, 4×8 → 1, 2, 4, 8, 16, 32

Step 2: List the factors of 40

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

Step 3: Find the numbers in both lists

32: **1**, **2**, **4**, **8**, 16, 32

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

ANSWER Common factors of 32 and 40: **1, 2, 4, 8**

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Q10 **Mr Okafor has 24 pencils and 16 rubbers. He makes identical packs using all of them. What is the greatest number of packs he can make, and what is in each pack?** [3 marks]

Step 1: Spot the maths

The number of packs must be a common factor of 24 and 16.

Step 2: List the factors of each number

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

16: 1×16, 2×8, 4×4 → 1, 2, 4, 8, 16

Step 3: Find the common factors

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

16: **1**, **2**, **4**, **8**, 16

The greatest common factor is 8.

Step 4: Share the items

$24 \div 8 = 3$ pencils in each pack

$16 \div 8 = 2$ rubbers in each pack

ANSWER **8 packs**, each with 3 pencils and 2 rubbers.

Q11 **Is 17 a prime number? Show how you know.** [2 marks]

Step 1: Test the small primes 2, 3, 5 and 7

$17 \div 2 = 8$ r 1 ×

$17 \div 3 = 5$ r 2 ×

Step 2: Explain why we can stop

We only need to test up to the prime whose square is bigger than the number.

Step 3: Count the factors

The only factors of 17 are 1 and 17.

ANSWER **Yes**. 17 is prime. Its only factors are 1 and 17.

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Q12 **Is 27 a prime number? Show how you know.** [2 marks]

Step 1: Test the small primes 2, 3, 5 and 7

27 ÷ 2 = 13 r 1 ×

27 ÷ 3 = 9 ✓ 3 is a factor

Step 2: Find a factor pair other than 1 and the number

3 × 9 = 27

Step 3: Count the factors

27 has factors 1, 3, 9 and 27 (at least), so it has more than two factors.

ANSWER **No**. 27 is composite because 3 × 9 = 27.

Q13 **Is 91 a prime number? Show how you know.** [2 marks]

Step 1: Test the small primes 2, 3, 5 and 7

91 ÷ 2 = 45 r 1 ×

91 ÷ 3 = 30 r 1 ×

91 ÷ 5 = 18 r 1 ×

91 ÷ 7 = 13 ✓ 7 is a factor

Step 2: Find a factor pair other than 1 and the number

7 × 13 = 91

Step 3: Count the factors

91 has factors 1, 7, 13 and 91 (at least), so it has more than two factors.

ANSWER **No**. 91 is composite because 7 × 13 = 91.

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Q14 **List all the prime numbers between 20 and 40.** [2 marks]

Step 1: Cross out the even numbers

Every even number above 2 has 2 as a factor, so 22, 24, … , 38 are not prime.

Step 2: Test the odd numbers with 3 and 5

21 = 3 × 7 ×
23: not divisible by 2, 3 or 5 ✓ prime
25 = 5 × 5 ×
27 = 3 × 9 ×
29: not divisible by 2, 3 or 5 ✓ prime
31: not divisible by 2, 3 or 5 ✓ prime
33 = 3 × 11 ×
35 = 5 × 7 ×
37: not divisible by 2, 3 or 5 ✓ prime
39 = 3 × 13 ×

Step 3: Explain why we can stop testing at 5

7 × 7 = 49 is bigger than 40, so any composite number below 40 has a factor of 2, 3 or 5.

ANSWER **23, 29, 31, 37**

Q15 **Sort these numbers into prime and composite: 2, 9, 15, 23, 31, 49** [3 marks]

Step 1: Look for a factor pair other than 1 and the number

2: factors 1, 2 only ✓ prime
9 = 3 × 3 × composite
15 = 3 × 5 × composite
23: not divisible by 2, 3 or 5 ✓ prime
31: not divisible by 2, 3 or 5 ✓ prime
49 = 7 × 7 × composite

Step 2: Check the trap

49 is odd and does not end in 5, but 7 × 7 = 49, so it is composite.

ANSWER Prime: **2, 23, 31** Composite: **9, 15, 49**

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Q16 **Use a factor tree to write 18 as a product of prime factors.** [2 marks]

Step 1: Split 18 into a factor pair

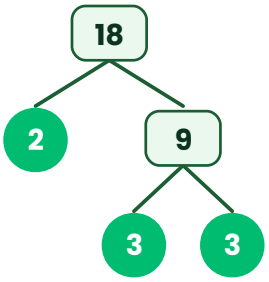
$18 = 2 \times 9$

Step 2: Keep splitting every branch that is not prime

$9 = 3 \times 3$

Step 3: Circle the primes at the ends of the branches

Primes: 2, 3, 3



Step 4: Write the product, smallest first, and check

$18 = 2 \times 3 \times 3$

Check: $2 \times 3 = 6$, $6 \times 3 = 18$ ✓

ANSWER $18 = \mathbf{2 \times 3 \times 3}$

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Q17 **Use a factor tree to write 40 as a product of prime factors.** [3 marks]

Step 1: Split 40 into a factor pair

$40 = 4 \times 10$

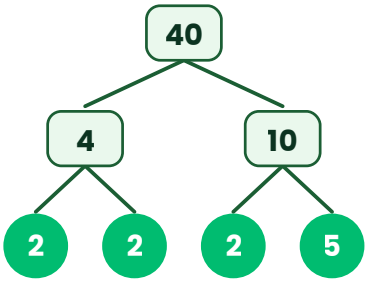
Step 2: Keep splitting every branch that is not prime

$4 = 2 \times 2$

$10 = 2 \times 5$

Step 3: Circle the primes at the ends of the branches

Primes: 2, 2, 2, 5



Step 4: Write the product, smallest first, and check

$40 = 2 \times 2 \times 2 \times 5$

Check: $2 \times 2 = 4$, $4 \times 2 = 8$, $8 \times 5 = 40$ ✓

ANSWER $40 = \mathbf{2 \times 2 \times 2 \times 5}$

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Q18 **Use a factor tree to write 45 as a product of prime factors.** [2 marks]

Step 1: Split 45 into a factor pair

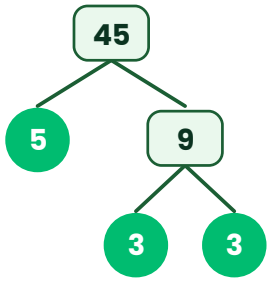
45 = 5 × 9

Step 2: Keep splitting every branch that is not prime

9 = 3 × 3

Step 3: Circle the primes at the ends of the branches

Primes: 5, 3, 3



Step 4: Write the product, smallest first, and check

45 = 3 × 3 × 5

Check: 3 × 3 = 9, 9 × 5 = 45 ✓

ANSWER 45 = **3 × 3 × 5**

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Q19 **Use a factor tree to write 100 as a product of prime factors.** [3 marks]

Step 1: Split 100 into a factor pair

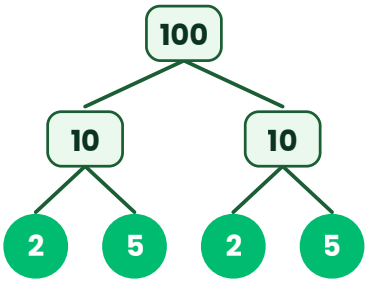
100 = 10 × 10

Step 2: Keep splitting every branch that is not prime

10 = 2 × 5

Step 3: Circle the primes at the ends of the branches

Primes: 2, 5, 2, 5



Step 4: Write the product, smallest first, and check

100 = 2 × 2 × 5 × 5

Check: 2 × 2 = 4, 4 × 5 = 20, 20 × 5 = 100 ✓

ANSWER 100 = **2 × 2 × 5 × 5**

Q20 **A number written as a product of primes is 2 × 3 × 3 × 5. What is the number?** [2 marks]

Step 1: Multiply from the left

2 × 3 = 6

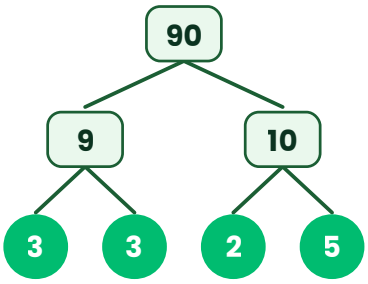
6 × 3 = 18

18 × 5 = 90

Step 2: Check with a factor tree

90 = 9 × 10, 9 = 3 × 3, 10 = 2 × 5

Primes: 2, 3, 3, 5 ✓



ANSWER The number is **90**

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