White Rose Maths

Autumn - Block 4

Multiplication & Division

Overview

Small Steps

- Multiples
- Factors
- Common factors
- Prime numbers
- Square numbers
- Cube numbers
- Multiply by 10, 100 and 1,000
- Divide by 10, 100 and 1,000
- Multiples of 10, 100 and 1,000

NC Objectives

Multiply and divide numbers mentally drawing upon known facts.

Multiply and divide whole numbers by 10, 100 and 1,000

Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers.

Recognise and use square numbers and cube numbers and the notation for squared (^{2}) and cubed (^{3})

Solve problems involving multiplication and division including using knowledge of factors and multiples, squares and cubes.

Know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers.

Establish whether a number up to 100 is prime and recall prime numbers up to 19

Multiples

Notes and Guidance

Building on their times tables knowledge, children will find multiples of whole numbers. Children build multiples of a number using concrete and pictorial representations e.g. an array. Children understand that a multiple of a number is the product of the number and another whole number.

Multiplying decimal numbers by 10, 100 and 1,000 forms part of Year 5 Summer block 1 .

Mathematical Talk

What do you notice about the multiples of 5? What is the same about each of them, what is different?

Look at multiples of other numbers, is there a pattern that links them to each other?

Are all multiples of 8 multiples of 4?

Are all multiples of 4 multiples of 8?

Varied Fluency

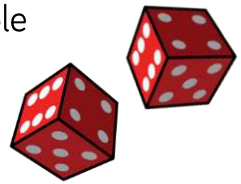
- Circle the multiples of 5

  25 32 54 175 554 3000

  What do you notice about the multiples of 5?

- 7,135 is a multiple of 5. Explain how you know.

- Roll 2 dice (1-6), and multiply the numbers the you roll.
  List all the numbers that this number is a multiple of.
  Repeat the dice roll.
  Use a table to show your results.
  Multiply the numbers you roll to complete the table.



Multiples

Reasoning and Problem Solving

Use 0 – 9 digit cards. Choose 2 cards and multiply the digits shown.

What is your number a multiple of?

Is it a multiple of more than one number?

Find all the numbers you can make using the digit cards.

Use the table below to help.

	0	1	2	3	4	5	6	7	8	9
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										

Always, Sometimes, Never

- The product of two even numbers is a multiple of an odd number.
- The product of two odd numbers is a multiple of an even number.

Always - all integers are multiples of 1, which is an odd number.

Never - Two odd numbers multiplied together are always a multiple of an odd number.

Eva's age is a multiple of 7 and is 3 less than a multiple of 8

She is younger than 40

How old is Eva?

Eva is 21 years old.

Factors

Notes and Guidance

Children understand the relationship between multiplication and division and use arrays to show the relationship between them. Children learn that factors of a number multiply together to give that number, meaning that factors come in pairs. Factors are the whole numbers that you multiply together to get another whole number (factor × factor = product).

Mathematical Talk

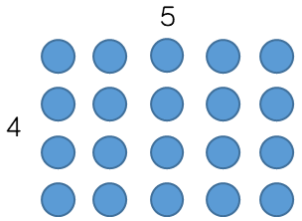
How can you work in a systematic way to prove you have found all the factors?

Do factors always come in pairs?

How can we use our multiplication and division facts to find factors?

Varied Fluency

- If you have twenty counters, how many different ways of arranging them can you find?



How many factors of twenty have you found by arranging your counters in different arrays?

- Circle the factors of 60

9, 6, 8, 4, 12, 5, 60, 15, 45

Which factors of 60 are not shown?

- Fill in the missing factors of 24

$1 \times \_\_\_$ $\_\_\_ \times 12$

$3 \times \_\_\_$ $\_\_\_ \times \_\_\_$

What do you notice about the order of the factors?

Use this method to find the factors of 42

Factors

Reasoning and Problem Solving

Here is Annie's method for finding factor pairs of 36

1	36
2	18
3	12
4	9
5	X
6	6

When do you put a cross next to a number?

How many factors does 36 have?

Use Annie's method to find all the factors of 64

If it is not a factor, put a cross.

36 has 9 factors.

Factors of 64:

1	64
2	32
3	X
4	16
5	X
6	X
7	X
8	8

Always, Sometimes, Never

- An even number has an even amount of factors.
- An odd number has an odd amount of factors.

Sometimes, e.g. 6 has four factors but 36 has nine.

Sometimes, e.g. 21 has four factors but 25 has three.

True or False?

The bigger the number, the more factors it has.

False. For example, 12 has 6 factors but 13 only has 2

Common Factors

Notes and Guidance

Using their knowledge of factors, children find the common factors of two numbers.

They use arrays to compare the factors of a number and use Venn diagrams to show their results.

Mathematical Talk

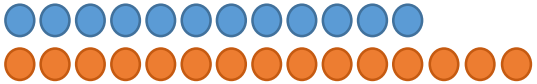
How can we find the common factors systematically?

Which number is a common factor of a pair of numbers?

How does a Venn diagram help to show common factors?
Where are the common factors?

Varied Fluency

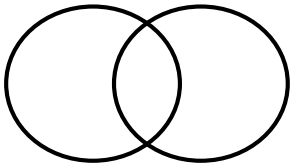
Use arrays to find the common factors of 12 and 15
Can we arrange each number in counters in one row?



Yes- so they have a common factor of one.
Can we arrange each number in counters in two equal rows?

We can for 12, so 2 is a factor of 12, but we can't for 15, so 2 is not a factor of 15, meaning 2 is not a common factor of 12 and 15
Continue to work through the factors systematically until you find all the common factors.

Fill in the Venn diagram to show the factors of 20 and 24



Where are the common factors of 20 and 24?
Use a Venn diagram to show the common factors of 9 and 15

Common Factors

Reasoning and Problem Solving

True or False?

- 1 is a factor of every number. — True
- 1 is a multiple of every number. — False
- 0 is a factor of every number. — False
- 0 is a multiple of every number. — True

I am thinking of two 2-digit numbers.

Both of the numbers have a digit total of six.

Their common factors are:

1, 2, 3, 4, 6, and 12

What are the numbers?

24 and 60

Prime Numbers

Notes and Guidance

Using their knowledge of factors, children see that some numbers only have two factors. They are taught that these are numbers called prime numbers, and that non-primes are called composite numbers. Children can recall primes up to 19 and are able to establish whether a number is prime up to 100. Using primes, they break a number down into its prime factors. Children learn that 1 is not a prime number because it does not have exactly two factors (it only has 1 factor).

Mathematical Talk

How many factors does each number have?

How many other numbers can you find that have this number of factors?

What is a prime number?

What is a composite number?

How many factors does a prime number have?

Varied Fluency

Use counters to find the factors of the following numbers.

5, 13, 17, 23

What do you notice about the arrays?

A prime number has exactly 2 factors, one and itself. A composite number can be divided by numbers other than 1 and itself to give a whole number answer.

Sort the numbers into the table.

2 3 5 9 15 24 29 30

	Prime	Composite
Exactly 2 factors (1 and itself)		
More than 2 factors		

Put two of your own numbers into the table.

Why are two of the boxes empty?

Would 1 be able to go in the tablet? Why or why not?

Prime Numbers

Reasoning and Problem Solving

Find all the prime numbers between 10 and 100, sort them in the table below.

End in a 1	End in a 3	End in a 7	End in a 9

Why do no two-digit prime numbers end in an even digit?

Why do no two-digit prime numbers end in a 5?

End in a 1	End in a 3
11, 31, 41, 61, 71,	13, 23, 43, 53, 73
End in a 7	**End in a 9**
17, 37, 47, 67, 97	19, 29, 59, 79, 89

Because all two-digit even numbers have more than 2 factors.

Because all two-digit numbers ending in 5 are divisible by 5 as well as 1 and itself, so have more than 2 factors.

Dora says all prime numbers have to be odd.

Her friend Amir says that means all odd numbers are prime, so 9, 27 and 45 are prime numbers.

Explain Amir's and Dora's mistakes and correct them.

Dora is incorrect because 2 is a prime number (it has exactly 2 factors).

Amir thinks all odd numbers are prime but he is incorrect because most odd numbers have more than 2 factors.

E.g.
Factors of 9:
1, 3 and 9

Factors of 27:
1, 3, 9 and 27

Square Numbers

Notes and Guidance

Children will need to be able to find factors of numbers.
Square numbers have an odd number of factors and are the result of multiplying a whole number by itself.

Children learn the notation for squared is ^{2}

Mathematical Talk

Why are square numbers called 'square' numbers?

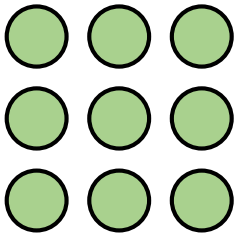
Are there any patterns in the sequence of square numbers?

Are the squares of even numbers always even?

Are the squares of odd numbers always odd?

Varied Fluency

- What does this array show you?
  Why is this array square?



- How many ways are there of arranging 36 counters in an array?
  What is the same about each array?
  What is different?

- Find the first 12 square numbers.
  Show why they are square numbers.
  How many different squares can you make using counters?
  What do you notice?
  Are there any patterns?

Square Numbers

Reasoning and Problem Solving

Teddy says,

Factors come in pairs so all numbers must have an even number of factors.

Do you agree?
Explain your reasoning.

No.

Square numbers have an odd number of factors (e.g. the factors of 25 are 1, 25 and 5).

How many square numbers can you make by adding prime numbers together?

Here's one to get you started:

$$2 + 2 = 4$$

Solutions include:

$2 + 2 = 4$
$2 + 7 = 9$
$11 + 5 = 16$
$23 + 2 = 25$
$29 + 7 = 36$

Whitney thinks that 4^2 is equal to 16

Do you agree?
Convince me.

Amir thinks that 6^2 is equal to 12

Do you agree?
Explain what you have noticed.

Children may use concrete materials or draw pictures to prove it.
Children should spot that 6 has been multiplied by 2
They may create the array to prove that $6^2 = 36$ and $6 \times 2 = 12$

Always, Sometimes, Never

A square number has an even number of factors.

Never. Square numbers have an odd number of factors because one of their factors does not have a pair.

Cube Numbers

Notes and Guidance

Children learn that a cube number is the result of multiplying a whole number by itself three times e.g. $6 \times 6 \times 6$

If you multiply a number by itself, then itself again, the result is a cube number.

Children learn the notation for cubed is ^{3}

Mathematical Talk

Why are cube numbers called 'cube' numbers?

How are squared and cubed numbers similar?

How are they different?

True or False: cubes of even numbers are even and cubes of odd numbers are odd.

Varied Fluency

Use multilink cubes to investigate how many are needed to make different sized cubes.

How many multilink blocks are required to make the first cube number? The second? Third?

Can you predict what the tenth cube number is going to be?

Complete the table.

		8
3^3	$3 \times 3 \times 3$	27
4^3		
5^3	$5 \times 5 \times 5$	
	$6 \times 6 \times 6$	

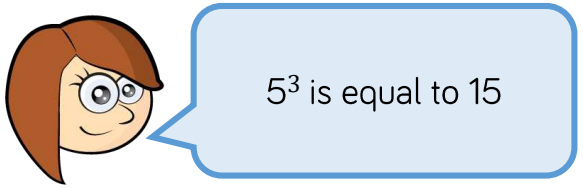
Calculate:

$4^3 =$ ___ $5^3 =$ ___

3 cubed = ___ 6 cubed = ___

Cube Numbers

Reasoning and Problem Solving

Rosie says,  Do you agree? Explain your answer.	Rosie is wrong, she has multiplied 5 by 3 rather than by itself 3 times. $5^3 = 5 \times 5 \times 5$ $5 \times 5 \times 5 = 125$
Here are 3 cards A B C On each card there is a cube number. Use these calculations to find each number. $A \times A = B$ $B + B - 3 = C$ Digit total of C = A	A = 8 B = 64 C = 125

Dora is thinking of a two-digit number that is both a square and a cube number. What number is she thinking of?	64
Teddy's age is a cube number. Next year his age will be a square number. How old is he now?	8 years old
The sum of a cube number and a square number is 150 What are the two numbers?	125 and 25

Multiply by 10, 100 and 1,000

Notes and Guidance

Children recap multiplying by 10 and 100 before moving on to multiplying by 1,000

They look at numbers in a place value grid and discuss the number of places to the left digits move when you multiply by different multiples of 10

Mathematical Talk

Which direction do the digits move when you multiply by 10, 100 or 1,000?

How many places do you move to the left?

When we have an empty place value column to the right of our digits what number do we use as a place holder?

Can you use multiplying by 100 to help you multiply by 1,000? Explain why.

Varied Fluency

Make 234 on a place value grid using counters.

HTh	TTh	Th	H	T	O
			○○	○○	○○

When I multiply 234 by 10, where will I move my counters?
Is this always the case when multiplying by 10?

Complete the following questions using counters and a place value grid.

$234 \times 100 = \_\_\_$

$100 \times 36 = \_\_\_$

$45{,}020 \times 10 = \_\_\_$

$\_\_\_ = 324 \times 100$

$1{,}000 \times 207 = \_\_\_$

$\_\_\_ = 3{,}406 \times 1{,}000$

Use <, > or = to complete the statements.

$71 \times 1{,}000$ ○ 71×100

100×32 ○ $16 \times 1{,}000$

48×100 ○ $48 \times 10 \times 10 \times 10$

Multiply by 10, 100 and 1,000

Reasoning and Problem Solving

Rosie has £300 in her bank account.

Tommy has 100 times more than Rosie in his bank account.

How much more money does Tommy have than Rosie?

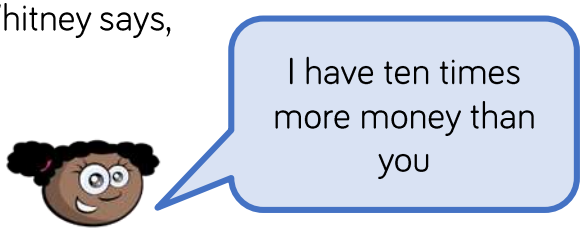
Tommy has £30,000

Tommy has £29,700 more than Rosie.

Whitney has £1,020 in her bank account.

Tommy has £120 in his bank account.

Whitney says,



Is Whitney correct? Explain your reasoning.

Whitney is incorrect, she would need to have £1,200 if this were the case (Or Tommy would need to be £102).

Jack is thinking of a 3-digit number.

When he multiplies his number by 100, the ten thousands and hundreds digit are the same.

The sum of the digits is 10

What number could Jack be thinking of?

181

262

343

424

505

Divide by 10, 100 and 1,000

Notes and Guidance

Children look at dividing by 10, 100 and 1,000 using a place value chart.

They use counters and digits to learn that the digits move to the right when dividing by powers of ten. They develop understanding of how many places to the right to move the counters to the right.

Mathematical Talk

What happens to the digits?

How are dividing by 10, 100 and 1,000 related to each other?

How are dividing by 10, 100 and 1,000 linked to multiplying by 10, 100 and 1,000?

What does 'inverse' mean?

Varied Fluency

HTh	TTh	Th	H	T	O
	●	● ●	● ● ●		

What number is represented in the place value grid?
Divide the number by 100
Which direction do the counters move?
How many columns do they move? How do you know how many columns to move?
What number do we have now?

Complete the following using a place value grid.

- Divide 460 by 10
- Divide 5,300 by 100
- Divide 62,000 by 1,000

Divide these numbers by 10, 100 and 1,000

80,000 300,000 547,000

Calculate 45,000 ÷ 10 ÷ 10
How else could you calculate this?

Divide by 10, 100 and 1,000

Reasoning and Problem Solving

Mo has £357,000 in his bank.

He divides the amount by 1,000 and takes that much money out of the bank.

Using the money he has taken out, he buys some furniture costing two hundred and sixty-nine pounds.

How much money does Mo have left from the money he took out?

Show your working out.

357,000 ÷ 1,000 = 357

If you subtract £269, he is left with £88

Here are the answers to some problems:

5,700	405	397	6,203

Can you write at least two questions for each answer involving dividing by 10, 100 or 1,000?

Possible solutions:

3,970 ÷ 10 = 397

57,000 ÷ 10 = 5,700

397,000 ÷ 1,000 = 397

40,500 ÷ 100 = 405

620,300 ÷ 100 = 6,203

Multiples of 10, 100 and 1,000

Notes and Guidance

Children have been taught how to multiply and divide by 10, 100 and 1,000

They now use knowledge of other multiples of 10, 100 and 1,000 to answer related questions.

Mathematical Talk

If we are multiplying by 20, can we break it down into two steps and use our knowledge of multiplying by 10?

How does using multiplication and division as the inverse of the other help us to use known facts?

Varied Fluency

- $36 \times 5 = 180$

  Use this fact to solve the following questions:

  $36 \times 50 =$ ___ $\quad 500 \times 36 =$ ___

  $5 \times 360 =$ ___ $\quad 360 \times 500 =$ ___

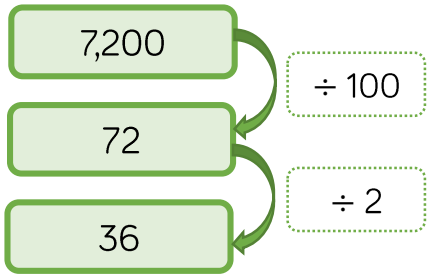
- Here are two methods to solve 24×20

Method 1	Method 2
$24 \times 10 \times 2$ $= 240 \times 2$ $= 480$	$24 \times 2 \times 10$ $= 48 \times 10$ $= 480$

  What is the same about the methods, what is different?

- The division diagram shows $7{,}200 \div 200 = 36$

  Use the diagram to solve:



$3{,}600 \div 200 =$ ☐

$18{,}000 \div 200 =$ ☐

$5{,}400 \div$ ☐ $= 27$

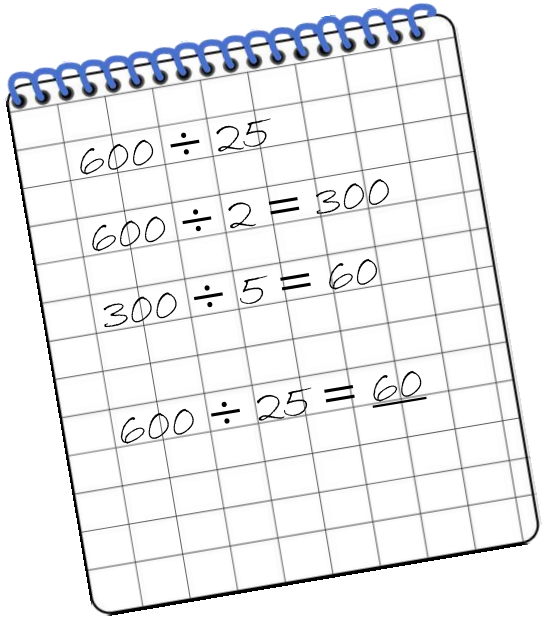
☐ $= 6{,}600 \div 200$

Multiples of 10, 100 and 1,000

Reasoning and Problem Solving

Tommy has answered a question.

Here is his working out.



Is he correct?

Explain your answer.

Tommy is not correct as he has partitioned 25 incorrectly.

He could have divided by 5 twice.

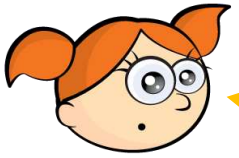
The correct answer should be 24

$6 \times 7 = 42$

Alex uses this multiplication fact to solve

$420 \div 70 = \_\_\_$

Alex says,



The answer is 60 because all of the numbers are 10 times bigger.

Do you agree with Alex?

Explain your answer.

Alex is wrong; both numbers (the dividend and divisor) are 10 times bigger than the numbers in the multiplication so the answer is 6.

$6 \times 70 = 420$, therefore $420 \div 70 = 6$