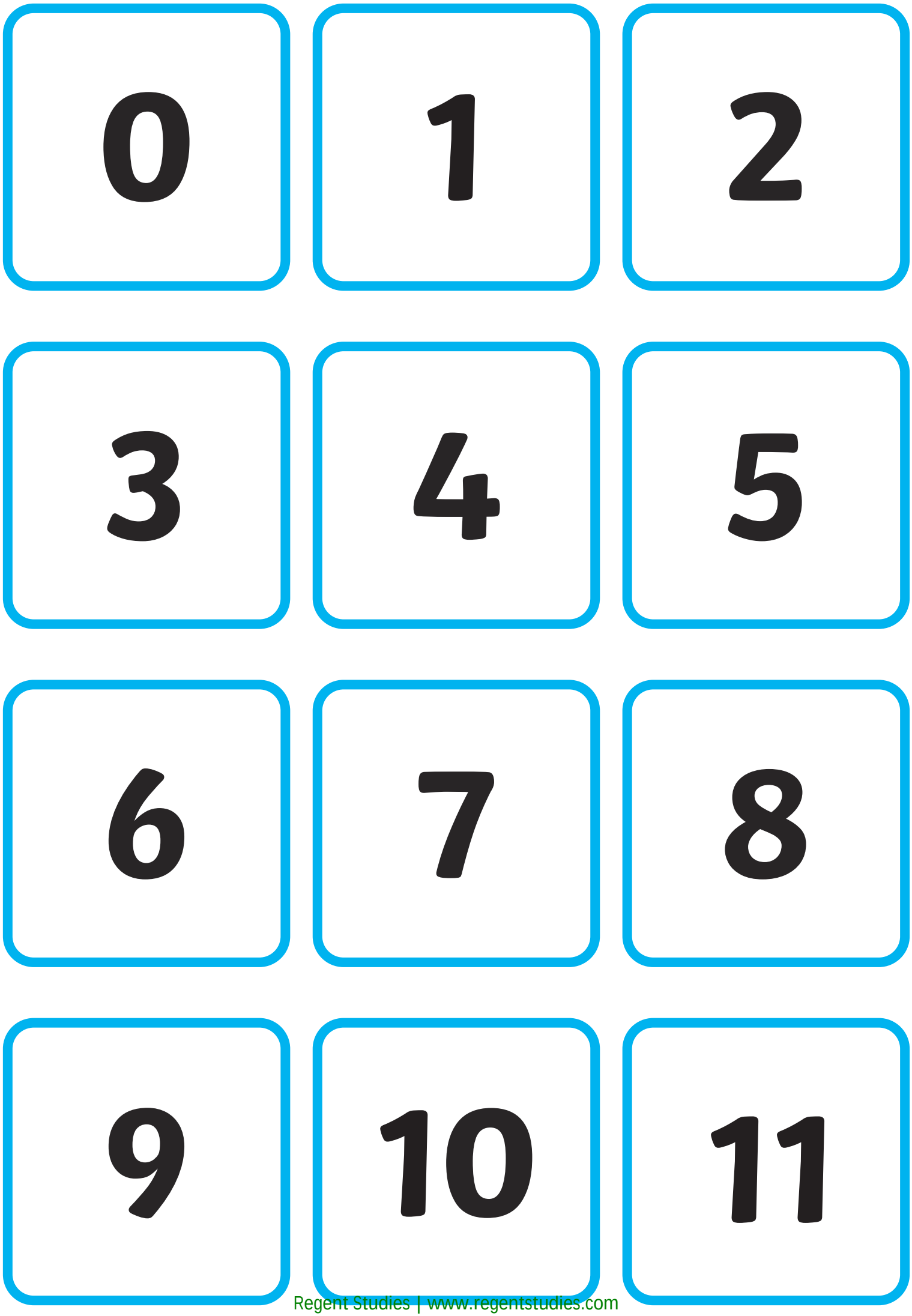
100 Square

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


0
1
2
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11

12

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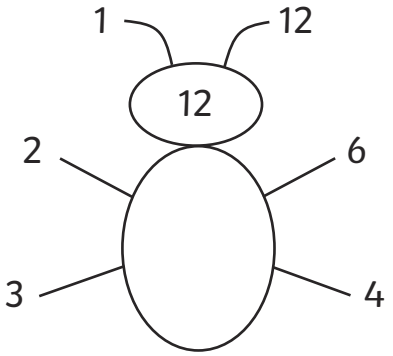
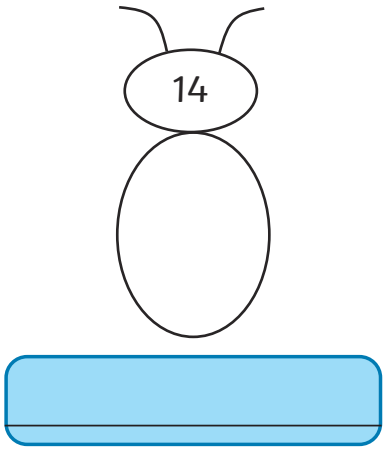
10

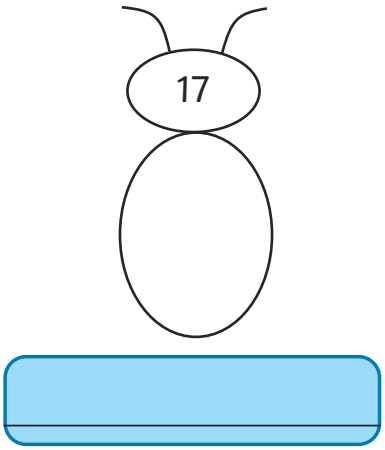
Factor Bugs

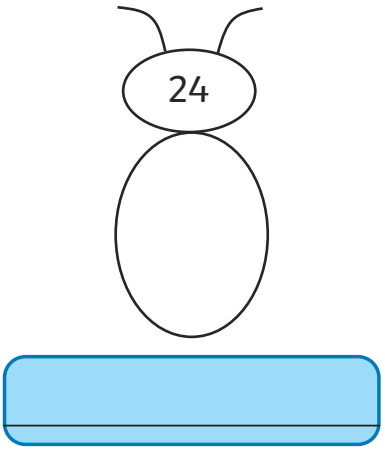
This is a completed factor bug. The antennae and legs shows a pair of factors of the product inside its head. For each of the factor bugs below, find all of the factors of that product and draw the correct number of legs, writing one factor next to each leg. Remember, if a product is a prime number, the factor bug may only need the factors completing on its antennae. It may help to think about all of the pairs of numbers that will multiply together to make the product on the factor bug's head. When you have finished, decide if the product in your factor bug's head is prime, composite or neither and then write this below each bug.

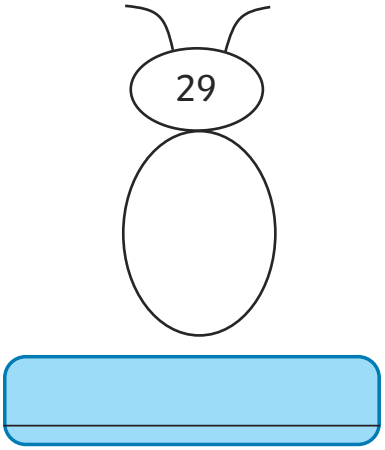


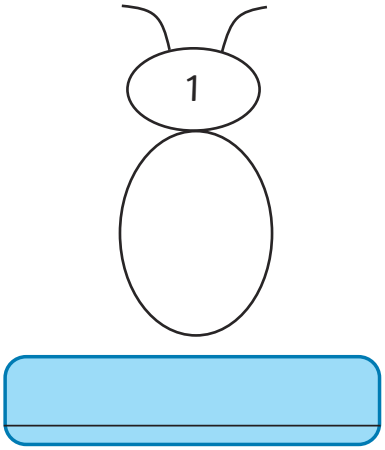
composite

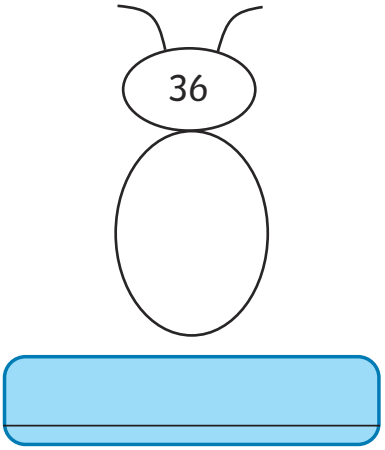




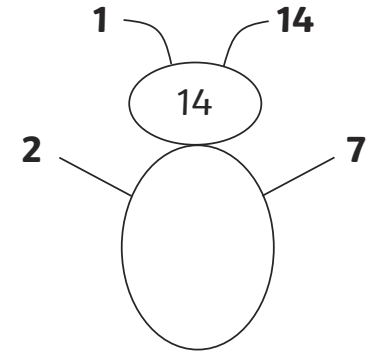




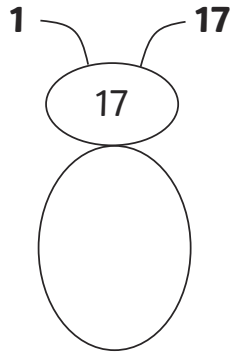




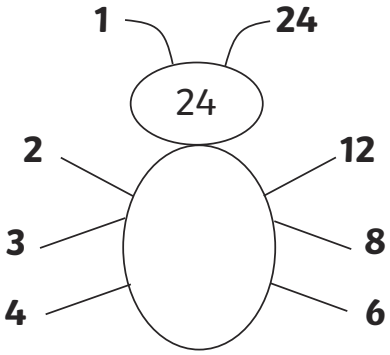
Factor Bugs **Answers**



composite



prime



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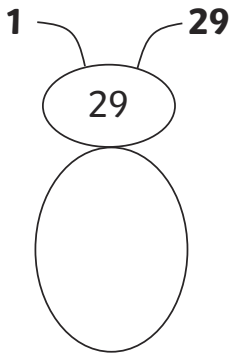
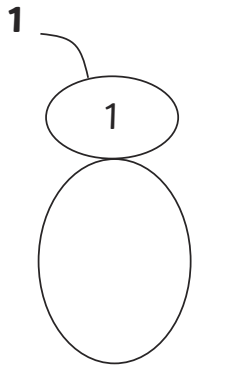
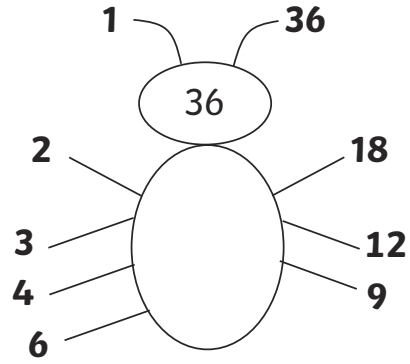


prime



neither



composite

100 S

1	2	3	4	5	
11	12	13	14	15	
21	22	23	24	25	
31	32	33	34	35	
41	42	43	44	45	

Square

	6	7	8	9	10
	16	17	18	19	20
	26	27	28	29	30
	36	37	38	39	40
	46	47	48	49	50

41	42	43	44	45
51	52	53	54	55
61	62	63	64	65
71	72	73	74	75
81	82	83	84	85
91	92	93	94	95

	46	47	48	49	50
	56	57	58	59	60
	66	67	68	69	70
	76	77	78	79	80
	86	87	88	89	90
	96	97	98	99	100

Adult:	Pupil/s:	Date:

Key Questions for Deepening Understanding	Comments
• What do we mean by the word factor? • How would you find all of the factors of the product 12? • Which numbers multiply together to make the product 12? • What do we mean by the word product? • Has anyone ever drawn a factor bug? • Where should I write the product? • How should I show the factors of the product 12 on the factor bug? • How can we be systematic to make sure we find all of the factors? • Which factors do we always start with as the pair of antennae? • Which other numbers will multiply together to make 12 so that we can make pairs of legs? • Is 2 a factor of 12? What do I multiply 2 by to make 12? • Is 3 a factor of 12? What do I multiply 3 by to make 12? • If 4 is already shown as a factor on the factor bug, do I need to write it again? • What do you notice about the factor bug for the product 11? • Why didn't your factor bug have any pairs of legs? • Which whole numbers multiply together to make 11? How many factors does 11 have? • Do you think there are any other similar products when the factor bug will have no legs?	

Adult:	Pupil/s:	Date:

Key Questions for Deepening Understanding	Comments
• What are the differences between your three factor bugs? Is there a factor bug without a pair of legs? • How many factors does 13 have? • Which other numbers have we found so far that only have two factors? • If 11 and 13 are prime numbers, can you describe what you think a prime number is? • What do you think makes a prime number special? • Which of these numbers have we already learned are prime numbers? • Which of these numbers have we already learned are not prime numbers? • Which of your factor bugs only had two factors? • What do we call these types of numbers? Can you circle the prime numbers? • Which factor bugs had more than two factors? What do we call these types of numbers? Can you cross out the composite numbers? • Did anyone have a number with fewer than two factors? • Do you think 1 is a prime or composite number? • What do you notice about the prime numbers circled? Are the prime numbers mostly odd or mostly even? • Can you explain what you think this rule means? How could we test if this rule is correct? • What does the word multiple mean?	

Adult:	Pupil/s:	Date:

Key Questions for Deepening Understanding	Comments
• What is the first prime number? (2) Can you think of a multiple of the first prime number? • Which of these numbers have we already learned are prime numbers? • Now that we know 2 is a prime number, which other multiples of 2 come after it? Can you find them all by counting up in steps of 2 from the first prime number 2? • What do you notice about all of the multiples of 2 that we have crossed out? Does the given rule appear to work for all multiples (below 20) of the prime number 2? • What is the next prime number we could test the rule with? (3) • What do you notice about all of the multiples of 3 that we have crossed out? Does the given rule appear to work for all multiples (below 20) of the prime number 3? • What is the next prime number we could test it with? (5) • What do you notice about all the multiples of 5 and 7 that we have crossed out? Does the given rule appear to work for all multiples (below 20) of the prime numbers 5 and 7? • Do you think this rule would work on the rest of the 100 square so we could find all the prime numbers under 100? • Can you find the first prime number on your 100 square? • How do you know it is a prime number? How many factors does it have? • What do we call the numbers we have crossed out? • How many factors do composite numbers have?	

Adult:	Pupil/s:	Date:

Key Questions for Deepening Understanding	Comments
• Which is the next prime number on our 100 square? • Can you cross out all the multiples of 3? • Why do you think some of the numbers were already crossed out? • Which multiples of 5 and 7 are also multiples of 2 or 3? • What did you notice when you tried to cross out all the multiples of 11 on your 100 square? Why do you think this happens? • What do you think would happen if you tried to find all the multiples of the prime number 13?	

Additional Notes

Same-Day Intervention: **Identifying Prime Numbers**

Children will learn strategies to establish whether a number, up to 100, is prime or composite.

Pre-Intervention Check

To access this intervention, can the children...

*Tick as appropriate.

...identify all factors of a given number?* ☐

...identify odd and even numbers?* ☐

Explaining the Gap in Mathematical Understanding

In year 5, children need to be able to correctly use the vocabulary of prime numbers and composite (non-prime) numbers. They should be able to identify all prime numbers up to 19, developing strategies to establish whether a number, up to 100, is prime or composite. Children should already have systematic methods in place to identify factors of all numbers and should be able to identify that some numbers only have two factors: one and the number itself. They should now know that prime numbers are whole numbers with only two factors and that non-prime numbers are called composite numbers. It is important for children to explore patterns between prime numbers and composite numbers to ensure they truly understand this particular property of numbers or assumptions can be made that may lead to errors.

For example, a child may learn that all even numbers, apart from 2, are composite numbers as they will all have 2 as a factor. This can lead children to incorrectly assuming that all odd numbers must be prime.

Children need to learn about the properties of numbers and understanding prime and composite numbers can support calculation methods. For example, arithmetic can be simplified if children can recognise that a number has other factors that can be used.

Preparation	Key Vocabulary
• Paper and pencils • **Large 100 square** • **100 square** (1 per child) • **Digit cards 0-20** (1 set per pair) • **Factor bugs activity sheet**	• Prime number • Composite number • Factor • Product • Systematic • Multiple

Addressing the Gap

Children will begin by using a factor bug drawing to investigate the number of factors the product 12 has. Then, they will investigate drawing factor bugs for other numbers in order to explore the rule that a prime number is a number which has exactly two factors (one and itself) and that composite numbers have more than two factors. After that, children will use a 100 square to investigate the following rule: any multiple of a prime number cannot be prime. This will help children to develop a strategy to quickly establish whether or not a number, up to 100, is prime or not. To finish, they will play a prime numbers game in pairs.

Key Questions for Deepening Understanding

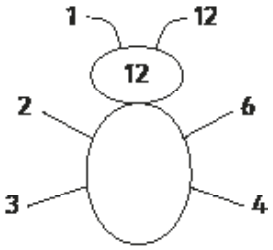
Explain to children that for today's learning we will need to be able to find all the factors of a number.

- **What do we mean by the word factor?**
- **How would you find all of the factors of the product 12?**

Establish that to help us find all the factors of 12 we are going to make a 'factor bug'.

- **Which numbers multiply together to make the product 12?**
- **What do we mean by the word product?**

Show children how to draw a 'factor bug', writing the product in the head. The factors of the product can then be added to the factor bug as a pair of antennae and then as pairs of legs (as shown).



- **Has anyone ever drawn a factor bug?**
- **Where should I write the product?**
- **How should I show the factors of the product 12 on the factor bug?**

Encourage children to be systematic when writing down the factors, starting with 1 and the number itself as the pair of antennae. Then, investigate if 2, 3 and then 4 are factors of 12. Although pairs of factors can be found by thinking about which numbers multiply together to make 12, it is important that children remember each factor should only be recorded once. (For those children who are struggling, you may wish to use counters to make arrays to help identify the factors.)

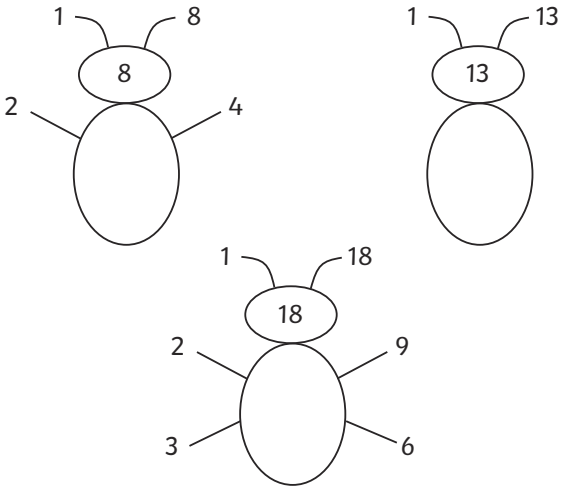
- **How can we be systematic to make sure we find all of the factors?**
- **Which factors do we always start with as the pair of antennae?**
- **Which other numbers will multiply together to make 12 so that we can make pairs of legs?**
- **Is 2 a factor of 12? What do I multiply 2 by to make 12?**
- **Is 3 a factor of 12? What do I multiply 3 by to make 12?**
- **If 4 is already shown as a factor on the factor bug, do I need to write it again?**

Children draw their own factor bug for the product 11.

- **What do you notice about the factor bug for the product 11?**
- **Why didn't your factor bug have any pairs of legs?**
- **Which whole numbers multiply together to make 11? How many factors does 11 have?**
- **Do you think there are any other similar products when the factor bug will have no legs?**

Key Questions for Deepening Understanding (Continued)

Ask children to investigate drawing factor bugs for the products 8, 13 and 18 (as shown).



- **What are the differences between your three factor bugs? Is there a factor bug without a pair of legs?**
- **How many factors does 13 have?**
- **Which other numbers have we found so far that only have two factors?**

Explain to children that the factor bugs without any legs have products that are special numbers and these are called prime numbers.

- **If 11 and 13 are prime numbers, can you describe what you think a prime number is?**
- **What do you think makes a prime number special?**

Establish that a prime number is a whole number which has exactly two factors – 1 and the number itself. Show children the numbers 1 to 20 on the **large 100 square**.

- **Which of these numbers have we already learned are prime numbers?**

Circle the numbers 11 and 13 to show that they are prime numbers.

- **Which of these numbers have we already learned are not prime numbers?**

Cross out 8, 12 and 18 to show they are not prime numbers. Explain that the numbers we have crossed out are called composite numbers, which means they have more than two factors (as shown).

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

○ = prime number / = composite number

☆ = neither

Set children the task of drawing factor bugs to investigate which of the remaining numbers between 1 and 20 are prime numbers and which are composite numbers. (Depending on the number of children in the group, assign each child approximately three or four different numbers to investigate.) Once completed, children feedback what they have found.

- **Which of your factor bugs only had two factors?**
- **What do we call these types of numbers? Can you circle the prime numbers?**
- **Which factor bugs had more than two factors? What do we call these types of numbers? Can you cross out the composite numbers?**
- **Did anyone have a number with fewer than two factors?**
- **Do you think 1 is a prime or composite number?**

Draw a star around 1 (as shown) and explain that 1 is special. It is unique as it is not a prime number because it does not have exactly two factors. It is also not a composite number because it does not have more than two factors. 1 only has one factor.

☆ 1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

○ = prime number / = composite number

☆ = neither

Key Questions for Deepening Understanding (Continued)

Ask children to look again at the prime numbers that are circled.

- **What do you notice about the prime numbers circled? Are the prime numbers mostly odd or mostly even?**

Establish that all prime numbers are odd, except for 2. Therefore, 2 is the only even prime number. Reveal the rest of the large 100 square and explain to children that they are going to investigate the truth behind a special rule that means that we may be able to find all of the other prime numbers on the 100 square without having to draw factor bugs for every number. On the board, write the following rule:

Any multiple of a prime number cannot be prime.

- **Can you explain what you think this rule means? How could we test if this rule is correct?**
- **What does the word multiple mean?**
- **What is the first prime number?** (2) **Can you think of a multiple of the first prime number?**

On the large number square, point to the number 2 and count up in steps of 2 (up to 20), pointing out that all of the multiples of 2 have already been crossed out as they are composite numbers, not prime numbers, e.g. 4, 6, 8, 12, 14, 16, 18 and 20.

- **Which of these numbers have we already learned are prime numbers?**
- **Now that we know 2 is a prime number, which other multiples of 2 come after it? Can you find them all by counting up in steps of 2 from the first prime number 2?**
- **What do you notice about all of the multiples of 2 that we have crossed out? Does the given rule appear to work for all multiples (below 20) of the prime number 2?**
- **What is the next prime number we could test the rule with?** (3)

Point at the rule again and read it aloud for emphasis. Then, count in steps of 3, from the second prime number 3, to show that all the multiples of 3 are also composite numbers and not prime numbers, e.g. 6, 9, 12, 15 and 18.

- **What do you notice about all of the multiples of 3 that we have crossed out? Does the given rule appear to work for all multiples (below 20) of the prime number 3?**
- **What is the next prime number we could test it with?** (5)

Repeat this process to establish the rule works with the prime numbers 5 and 7.

- **What do you notice about all the multiples of 5 and 7 that we have crossed out? Does the given rule appear to work for all multiples (below 20) of the prime numbers 5 and 7?**
- **Do you think this rule would work on the rest of the 100 square so we could find all the prime numbers under 100?**

Give each child a **100 square** and, temporarily, remove the large 100 square from view. Explain that we are going to see if we can find all of the prime numbers under 100 by exploring the same following rule:

Any multiple of a prime number cannot be prime.

- **Can you find the first prime number on your 100 square?**
- **How do you know it is a prime number? How many factors does it have?**

Ask children to circle 2 and then count up together in steps of 2, crossing out all of the multiples of 2 on the 100 square.

Key Questions for Deepening Understanding (Continued)

- **What do we call the numbers we have crossed out?**
- **How many factors do composite numbers have?**
- **Which is the next prime number on our 100 square?**

Allow children to continue investigating in this way, identifying the next prime number and then crossing out all of the multiples of that number on the 100 square.

- **Can you cross out all the multiples of 3?**

Children should discover that when they begin to cross out the multiples of the prime numbers 5 and 7, some will already be crossed out.

- **Why do you think some of the numbers were already crossed out?**
- **Which multiples of 5 and 7 are also multiples of 2 or 3?**

When they reach the prime number 11, they will find that all of the multiples of 11 are already crossed out. Encourage children to discover for themselves that they do not need to investigate any multiples of the prime numbers after this point because they will have already been crossed out.

- **What did you notice when you tried to cross out all the multiples of 11 on your 100 square? Why do you think this happens?**
- **What do you think would happen if you tried to find all the multiples of the prime number 13?**

Come together as a group and compare 100 squares, checking to see if they are correct (as shown). If time allows, complete the large 100 square as a group using the children's 100 squares.

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

○ = prime number ／ = composite number

☆ = neither

Prime Numbers Game

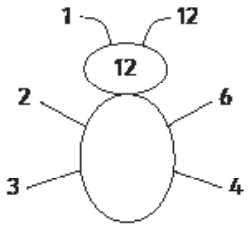
Give each pairs a shuffled set of **digit cards 1-20** and ask them to place them, face down, on the table. Then, children take it in turns to turn over a card. If they find a prime number, they keep it. If they do not find a composite number (non-prime), they place it in a non-prime number pile. Play continues until there are no cards left on the table. The winner is the player who has managed to collect the most prime numbers.

Additional Opportunities to Reinforce Learning

Ask children to complete the **factor bugs activity sheet**. The antennae and legs each show a factor of the product inside its head. For each of the factor bugs below, draw on the correct number of legs by finding all the factors of that number. Remind children that if a number is prime, it may only need the factors completing on its antennae. Explain to children that it may help to think about all the pairs of numbers that will multiply together to make the product on the factor bug's head. When they have finished, ask them to decide if the product in each factor bug's head is prime, composite or neither and write it below.

Home Learning Slip

Today, at school, your child has been learning how to find out whether a number, up to 100, is prime or composite. They have been drawing 'factor bugs' and investigating prime numbers (numbers which have exactly two factors – 1 and the number itself) and composite numbers (numbers which have more than two factors). A factor is a number that divides into another number exactly and without leaving a remainder. In order to support your children with this, you could draw 'factor bugs' for various numbers under 100. Start by writing a number in the head and then add the factors of that number to the bug as a pair of antennae and pairs of legs (as shown).

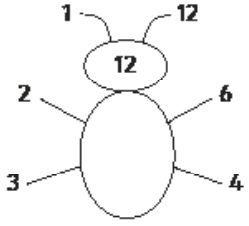


Your child should be systematic in writing down the factors, starting with 1 and the number itself on the antennae and then investigating if 2, 3, 4, etc, are factors of the number. Although pairs of factors can be found by thinking about which numbers multiply together to make your number, it is important your child remembers each factor should only be written down once. When you have completed your factor bugs, write if the number is prime or composite under each bug (remembering that number 1 is unique and is neither).

Thank you for your support with this. Your help will really make a difference to your child.

Home Learning Slip

Today, at school, your child has been learning how to find out whether a number, up to 100, is prime or composite. They have been drawing 'factor bugs' and investigating prime numbers (numbers which have exactly two factors – 1 and the number itself) and composite numbers (numbers which have more than two factors). A factor is a number that divides into another number exactly and without leaving a remainder. In order to support your children with this, you could draw 'factor bugs' for various numbers under 100. Start by writing a number in the head and then add the factors of that number to the bug as a pair of antennae and pairs of legs (as shown).



Your child should be systematic in writing down the factors, starting with 1 and the number itself on the antennae and then investigating if 2, 3, 4, etc, are factors of the number. Although pairs of factors can be found by thinking about which numbers multiply together to make your number, it is important your child remembers each factor should only be written down once. When you have completed your factor bugs, write if the number is prime or composite under each bug (remembering that number 1 is unique and is neither).

Thank you for your support with this. Your help will really make a difference to your child.