RETURN TO MAIN MENU

RETURN TO MAIN MENU

exploring NUMBERS 3

The truth is out there in the numbers

Mathematics is sometimes said to be the universal language that we could use to prove to aliens that we are intelligent—but would it be a simple task?

What sort of mathematics could we send to aliens? We couldn't just send out some complicated number or number pattern. Our number system is based on tens—mainly because we have 10 fingers. So who knows what an alien society's number system is based on? A pattern in our number system might not be a pattern in another number system. The best numbers to send to show we are an intelligent people would be prime numbers—numbers such as 2, 3, 5, 7, 11 that have exactly two factors. Prime numbers will have this special property in any number system.

outcomes

After completing this chapter you will be able to:

- find multiples of numbers
- find factors of numbers
- express a number as a product of prime factors
- explore other groups of numbers, such as palindromes, Fibonacci numbers and triangular numbers
- find squares and square roots
- find cubes and cube roots
- use index notation.

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prepzone 3

Prepare for this chapter by attempting the following questions. If you have difficulty with a question, click on the Replay Worksheet icon on your *eMaths Zone* CD or ask your teacher for the Replay Worksheet.

Worksheet R3.1

1 Copy and complete these within three minutes.

(a)	$6 \times 7 =$	$6 \times 6 =$	$6 \times 4 =$	$6 \times 11 =$	$6 \times 8 =$
(b)	$7 \times 11 =$	$7 \times 7 =$	$7 \times 5 =$	$7 \times 2 =$	$7 \times 3 =$
(c)	$8 \times 7 =$	$8 \times 6 =$	$8 \times 4 =$	$8 \times 10 =$	$8 \times 8 =$
(d)	$9 \times 12 =$	$9 \times 3 =$	$9 \times 5 =$	$9 \times 11 =$	$9 \times 8 =$
(e)	$12 \times 7 =$	$12 \times 6 =$	$12 \times 12 =$	$12 \times 9 =$	$12 \times 11 =$

Worksheet R3.2

2 **(a)** List all the digits with which an even number can end.

(b) List all the digits with which an odd number can end.

Worksheet R3.3

3 **(a)** Rearrange the following numbers in ascending order (i.e. from smallest to largest).

567, 4500, 0, 74, 11 100, 6008, 12, 602

(b) Rearrange the following numbers in descending order (i.e. from largest to smallest).

110, 11 011, 1011, 111, 10, 1001, 1101, 10 111

Worksheet R3.4

4 Find:

(a) $3 \times 2 \times 3$
(b) $5 \times 3 \times 3 \times 2$
(c) $2 \times 2 \times 2$
(d) $10 \times 10 \times 10 \times 10$

Worksheet R3.5

5 Find:

(a) $50\,000 + 6000 + 800 + 90 + 5$

(b) $7 \times 1\,000\,000 + 2 \times 10\,000 + 5 \times 1000 + 7 \times 10 + 3$

KEY WORDS

base	expanded form	indices	square number
composite number	factor	multiple	square root
cube number	factor tree	palindrome	triangular number
cube root	Fibonacci numbers	power	
divisibility test	index	prime factor	
divisible	index form	prime number	

3.1 Multiples

Multiples of a number can be thought of as the answers to the 'times tables' for that number.

For example, the times table for 7 is:

$1 \times 7 = 7$
$2 \times 7 = 14$
$3 \times 7 = 21$
$4 \times 7 = 28$
$5 \times 7 = 35$
and so on.

7, 14, 21, 28, 35 are some of the multiples of 7.

Another way of finding multiples of 7 is to count by 7s:

7, 14, 21, 28, 35, …

The list of multiples for any number will continue forever.

To find out if a number is a multiple of another (smaller) number, just divide and see if the answer is a whole number. For example, 300 is a multiple of 12 because $300 \div 12 = 25$, a whole number.

dangerzone

The first multiple of any number is the number itself. No multiple of any number can be smaller than the number itself.

eTutorial

exercise 3.1 Multiples

Preparation: Prep Zone Q1

Core

1 Find the first five multiples of each of these.

(a) 2 (b) 3 (c) 4 (d) 8 (e) 6 (f) 5
(g) 9 (h) 11 (i) 14 (j) 15 (k) 16 (l) 19
(m) 20 (n) 50 (o) 100 (p) 2000

Hint
Worksheet C3.1

2 Find the first three multiples of each of these.

(a) 70 (b) 75 (c) 86 (d) 123 (e) 345 (f) 99
(g) 738 (h) 815 (i) 1250 (j) 1999 (k) 2005 (l) 3111
(m) 8410 (n) 9010 (o) 10 004 (p) 10 211

Hint

3 Choose the correct answer.

(a) Which one of the following numbers is not a multiple of 12?
A 564 **B** 346 **C** 780 **D** 1188

(b) Which of the following numbers is not a multiple of 23?
A 529 **B** 943 **C** 23 **D** 853

Calculator

Extension

4 Sharon and Ricardo start jogging around an oval at the same time but in opposite directions. Sharon takes 5 minutes to run each lap and Ricardo takes 4 minutes. After how many minutes running at that pace would they cross their starting point at the same time?

Animation
eQuestions

3.2 Divisibility

We often want to know if a smaller number will divide evenly into a larger number. If this occurs we say the larger number is **divisible** by the smaller number. For example, 10 is divisible by 5. On the other hand, 24 is not divisible by 9 because 24 ÷ 9 gives us a remainder. We can use a calculator to check this but often we can find out more quickly by using some mental shortcuts and **divisibility tests**.

exercise 3.2 Divisibility

Preparation: Ex 3.1

Core

Worksheet C3.2

1 **(a)** Which of these numbers are divisible by 5?
23, 65, 92, 10, 104, 234 625, 870, 88

(b) What sort of numbers are divisible by 5? Can you find a pattern?

2 **(a)** Which of these numbers are divisible by 10?
70, 71, 5, 640, 235, 41 960, 500

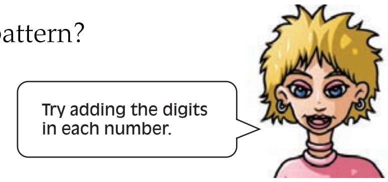
(b) What sort of numbers are divisible by 10? Can you find a pattern?

3 **(a)** Which of these numbers are divisible by 2?
19, 461, 2, 227, 56, 27 560, 24, 195, 768

(b) What sort of numbers are divisible by 2? Can you find a pattern?

4 **(a)** Which of these numbers are divisible by 3?
247, 21, 64, 783, 6732, 9076, 34, 56 342, 798, 1223

(b) What sort of numbers are divisible by 3? Can you find a pattern?



5 **(a)** Which of these numbers are divisible by 9?
81, 679, 2999, 82, 5634, 220 221, 87 984, 16 668, 562

(b) What sort of numbers are divisible by 9? Can you find a pattern?

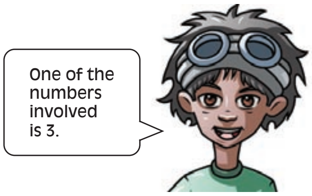
6 **(a)** Which of these numbers are divisible by 4?
516, 7612, 311, 608, 61, 64, 5364, 38 921, 500

(b) What sort of numbers are divisible by 4? Can you find a pattern?

7 The shortcut to test if a number is divisible by 6 is to see if it is divisible by *both* 2 *and* 3.

(a) Use the test to see which of these numbers are divisible by 6.
436, 321, 132, 741, 8760, 4529, 3528, 705 630, 11 112

(b) The shortcut for 12 is similar to the shortcut for 6. What do you think the pattern is for seeing if a number is divisible by 12?



8 Copy and complete the following divisibility tests:

Number	*Divisibility test*
2	Look at the ____ digit only. If it is ____ or zero then the original number is divisible by 2.
3	____ up all the digits and see if the ____ is divisible by 3. If it is then the original number is divisible by 3.
4	Look at the number formed by the last ____ digits only. If this number is divisible by 4, then the ____ number is divisible by 4.
5	Look at the ____ digit. If it is a ____ or a ____, then the number is ____ by 5.
6	Do two tests. See if the number is divisible by ____ and ____.
9	____ up all the ____ and see if the ____ is divisible by 9. If it is then the original number is ____ by ____.
10	Look at the ____ ____. If it is ____ then the number is ____ ____ ____.

9 State TRUE or FALSE for the following.

Hint

(a) 346 is divisible by 3. **(b)** 6872 is divisible by 6.
(c) 548 348 is divisible by 2. **(d)** 552 is divisible by 4.
(e) 18 342 is divisible by 9. **(f)** 5 633 902 is divisible by 3.
(g) 4 332 112 is divisible by 5. **(h)** 56 432 is divisible by 2.
(i) 67 432 is divisible by 6. **(j)** 3935 is divisible by 5.

10 Copy the following table and do the divisibility tests. Circle the number if the original number is divisible by it. The first one has been done for you.

100 000	②	3	④	⑤	6	9	⑩
202 008	2	3	4	5	6	9	10
12 121 212	2	3	4	5	6	9	10
300 300 300	2	3	4	5	6	9	10
7 500	2	3	4	5	6	9	10
900 090	2	3	4	5	6	9	10
123 456 789	2	3	4	5	6	9	10
2 564	2	3	4	5	6	9	10
3 429	2	3	4	5	6	9	10

Extension

11 Write three numbers greater than 11 000 that are divisible by both 4 and 5.

12 The following numbers are divisible by 11.
187, 220, 385, 1056, 2915, 9262, 10 593

(a) For each number add every second digit together. For example, for 10 593, 1 + 5 + 3 = 9 and 0 + 9 = 9. Find the difference between each pair of numbers. What do you notice?

(b) Use your answers to part **(a)** to complete the following:
To check if a number is divisible by 11 add every second digit, then find the ______ between the numbers you get. If the difference is __ or __ then the original number is divisible by 11.

13 A number is divisible by 6 if it is divisible by 2 and 3. Follow the steps below to try to find the test for divisibility by 12.

(a) 2 and 3 multiply to give 6. What pairs of numbers multiply to give 12, apart from 12 and 1?

(b) 2 and 3 have no numbers that go into both of them. Which pairs found in part **(a)** have no numbers that go into both of them?

(c) Explain why you can't test divisibility by 12 by seeing if 2 and 6 go into the number.

(d) Copy and complete the following:
To see if a number is divisible by 12 you need to do two divisibility tests: one to see if the number is divisible by ___ and one to see if it is ________ by ___.

14 Following the rules found for divisibility by 6 and by 12, find a test for divisibility by 18.

Working mathematically

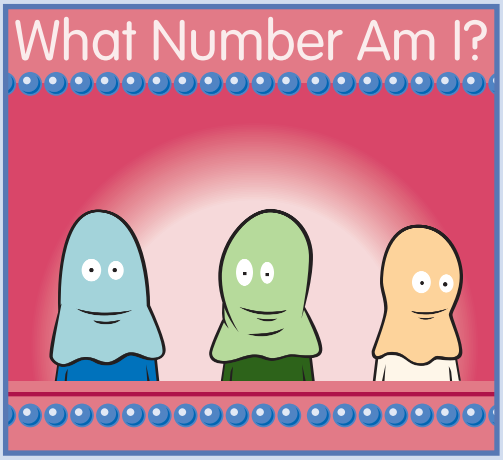
problem solving

What number am I?

You may like to work in pairs to solve these.

1 I have three digits.
I am divisible by 5.
I am odd.
The product of my digits is 15.
The sum of my digits is less than 10.
I am less than 12 × 12.
What am I?
What if I am greater than 12 × 12?

2 I have three digits.
My digits are all different.
The sum of my digits is 12.
My digits are all even.
The sum of my units and tens digits equals my hundreds digit.
I am divisible by 4.
What am I?



Break it into a series of smaller steps.

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3.3 Factors

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

For example, 2 is a factor of 12 since 2 'goes into' 12 (six times), with no remainder.

dangerzone

The largest factor of any number is the number itself. No number has any factors greater than the number itself.

One of the simplest ways to find all the factors of a number is to write all the pairs of numbers that multiply to give the original number.

worked example 1

Find all factors of 12.

Steps	Solution
1. Find all pairs of numbers which multiply to give the original number.	$1 \times 12 = 12$ $2 \times 6 = 12$ $3 \times 4 = 12$
2. List the factors in ascending order (from smallest to largest).	The factors of 12 are 1, 2, 3, 4, 6, 12.

worked example 2

Find all the factors of 110.

Steps	Solution
1. Find all pairs of numbers which multiply to give the original number. Write the pairs underneath each other.	$1 \times 110 = 110$ $2 \times 55 = 110$ $5 \times 22 = 110$ $10 \times 11 = 110$ No more to find as 10 leads on to 11.
2. List the factors in ascending order (from smallest to largest).	The factors of 110 are 1, 2, 5, 10, 11, 22, 55, 110.

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Sometimes a factor will be multiplied by itself to give the original number. For example $7 \times 7 = 49$. We include 7 only once in the list of factors for 49. If we reach such a pair, this also tells us we have finished finding the pairs of numbers.

eTutorial

exercise 3.3 Factors

Preparation: Ex 3.2

Core

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Hint

Worksheet C3.3

1 Find all the factors of each of the following numbers.

(a) 4	**(b)** 5	**(c)** 7	**(d)** 8
(e) 10	**(f)** 9	**(g)** 13	**(h)** 11
(i) 16	**(j)** 18	**(k)** 19	**(l)** 23
(m) 20	**(n)** 24	**(o)** 32	**(p)** 36
(q) 30	**(r)** 60	**(s)** 77	**(t)** 55

2 Choose the correct answer.

Hint

(a) Which of the following is a factor of 17?
A 7 **B** 14 **C** 34 **D** 17

(b) Which of the following is a factor of 25?
A 3 **B** 5 **C** 50 **D** 250

(c) Which of the following is a factor of 34?
A 4 **B** 12 **C** 17 **D** 8

(d) Which of the following is a factor of 47?
A 1 **B** 9 **C** 94 **D** 3

3 Choose the correct answer.

Hint

(a) Which of the following is *not* a factor of 15?
A 3 **B** 1 **C** 15 **D** 30

(b) Which of the following is *not* a factor of 22?
A 22 **B** 4 **C** 1 **D** 11

(c) Which of the following is *not* a factor of 14?
A 4 **B** 2 **C** 14 **D** 1

(d) Which of the following is *not* a factor of 21?
A 1 **B** 7 **C** 3 **D** 14

(e) Which of the following is *not* a factor of 33?
A 11 **B** 33 **C** 22 **D** 3

(f) Which of the following is *not* a factor of 42?
A 14 **B** 8 **C** 7 **D** 6

(g) Which of the following is *not* a factor of 50?
A 10 **B** 15 **C** 50 **D** 2

(h) Which of the following is *not* a factor of 63?
A 63 **B** 21 **C** 3 **D** 13

Homework 3.1

eQuestions

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Working mathematically

investigation

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The sieve of Eratosthenes

Eratosthenes was a Greek mathematician who lived from 276 BC to 195 BC. He taught at the University of Alexandria in Egypt. One of the things he was famous for was his 'sieve'. See if you can copy what he did.

Copy the following table and follow the instructions.

~~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

1. Cross out the number 1.
2. Go to the next number, which is 2, and circle it. Then cross out all the multiples of 2 (i.e. cross out 4, 6, 8, …).
3. Go to the next number that isn't crossed out. This should be 3. Circle it. Then cross out all the multiples of 3.
4. Go to the next number that isn't crossed out. This should be 5. Circle it. Then cross out all the multiples of 5.
5. Repeat for the next number that isn't crossed out. Keep repeating until there is no 'next number'.

Now see if you can answer the following questions.

1 Write the factors of each of the circled numbers.

2 Write the factors of any five of the crossed out numbers, except for 1.

3 What do you notice about the number of factors for each group of numbers, that is circled numbers and numbers crossed out?

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3.4 Prime and composite numbers

From our work in previous exercises we know that numbers can have 1, 2, or more factors. We give special names to numbers depending on how many factors they have. A **prime number** has exactly two factors: itself and 1. A **composite number** has more than two factors. Between them prime numbers and composite numbers cover every whole number except for 1. We consider 1 to be a special number—it is neither prime nor composite.

A prime number has exactly two factors: itself and 1.

exercise 3.4 Prime and composite numbers

Preparation: Ex 3.3

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Hint

Core

1 **(a)** Find the factors of each of the numbers from 1 to 20.
(b) List the prime numbers from this list.

2 Why isn't 1 a prime number?

3 How many single-digit prime numbers are there?

4 List all the primes between 40 and 60.

5 How many even primes are there?

6 Explain why it is easy to tell that 4 567 278 is a composite number.

7 **(a)** What is the next prime number after 60?
(b) What is the next composite number after 60?
(c) What are the two odd composite numbers less than 20?
(d) What is the next prime number after 30?
(e) What is the next composite number after 30?
(f) What is the next prime number after 40?
(g) How many prime numbers are there between 20 and 30?

8 Use one of the divisibility tests to show that these numbers are composites.

Hint

(a) 6785	**(b)** 34 450	**(c)** 7119
(d) 9909	**(e)** 977 824	**(f)** 4 516 803
(g) 2 987 625	**(h)** 87 912 404	**(i)** 2 871 027

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Extension

9 Write the following even numbers as the sum of two prime numbers.

(a) 4	**(b)** 6	**(c)** 10	**(d)** 12
(e) 18	**(f)** 20	**(g)** 22	**(h)** 100

Hint

10 Explain why 2 and 3 are the only two consecutive prime numbers.

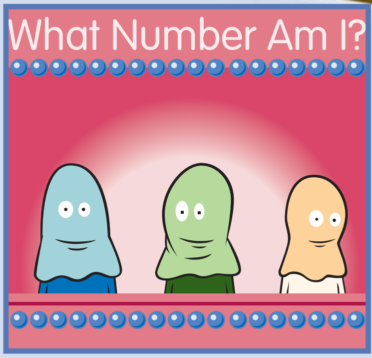
11 What is the greatest difference between any two consecutive composite numbers?

Worksheet A3.1

Working mathematically
problem solving

What number am I?

I am a two-digit prime number.
The sum of my digits is divisible by 4.
The product of my digits is less than 5.
I am greater than 20.
What am I?
What number am I if I am less than 20?



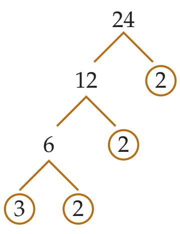
3.5 Prime factors and factor trees

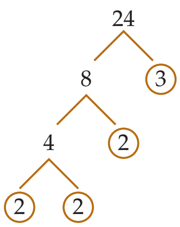
A **prime factor** of a number is a factor that is also prime. Every composite number can be expressed as a product of prime numbers.

A **factor tree** is a good way to find these prime factors.

The circled numbers are primes; we stop each branch when we get to a prime number. When every branch ends in a circled number we have found the prime factors of the number. So, $24 = 2 \times 2 \times 2 \times 3$. We usually write the factors in order from smallest to largest.

Note that there is often more than one way to construct the tree, as shown at right. However, the final product of the prime factors will always be the same.





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exercise 3.5 Prime factors and factor trees

Preparation: Prep Zone Q4, Exs 3.3 and 3.4

Worksheet C3.4

Core

1 Copy and complete these factor trees which have been started for you.

(a) 16

8

16 = ____ × ____ × ____ × ____

(b) 50

2

50 = ____ × ____ × ____

(c) 100

10

100 = ____ × ____ × ____ × ____

(d) 96

3

96 = ____ × ____ × ____ × ____ × ____ × ____

Hint

2 Write out the factor trees for these numbers, and then express the number as a product of its prime factors as in Question **1**.

(a) 8	**(b)** 12	**(c)** 18	**(d)** 26
(e) 20	**(f)** 48	**(g)** 68	**(h)** 44
(i) 64	**(j)** 72	**(k)** 108	**(l)** 144
(m) 140	**(n)** 1000	**(o)** 800	**(p)** 400

Hint

Extension

3 A number less than 550 is made up of four prime factors: 2, 3, 5 and a fourth factor between 15 and 20. What is the fourth factor, and what is the number?

Worksheet C3.5

speedingzone

Do these in your head as quickly as you can and write down the answers.

Time target: 2 minutes

1 8×21

2 $17 - 40$

3 $2000 \div 250$

4 $1.007 + 0.5$

5 $\frac{1}{4}$ of 280

6 $2.80 + $11.50

7 How many minutes are there in 6 hours?

8 If $30 is split between 4 people, how much does each person get?

9 Write the product of 99 and 7.

10 If we know that $72 \times 156 = 11\,232$, what does $11\,232 \div 7.2$ equal?

maths in action

Prime numbers versus terrorism

Terrorism has cost many innocent lives so far this century, and mathematics has a role to play in stopping terrorist acts before they happen. Terrorists are able to commit these acts because they can plan and communicate in secret. Government intelligence agencies all over the world try to intercept terrorist computer emails and decode them.

At the time of the terrorist attacks in 2001, encryption or coding techniques existed that couldn't be cracked. These encryption techniques are based on prime numbers. Encryption is based on a key, which is a word or a number. These keys give the information needed to decode or decrypt the message. The keys currently most commonly used to encrypt emails are numbers that are the products of two prime numbers. Multiplying two primes is an effective key for encryption because it is easy to do in one direction (multiplication), but extremely difficult to do in the other direction (finding factors). To crack the code, you have to work out what the original two prime numbers are. When the numbers involved are very large, this is almost impossible to do because there are so many possibilities.

The largest prime ever found has over two million digits in it, and there are always new primes being found. Even the most powerful computers in the world would take centuries to find the two primes involved in encryption.

Governments are hoping that in the future quantum computers, which can process calculations simultaneously, will be able to find the two prime numbers quickly and enable them to crack the terrorists' codes.

Questions

1 Which two prime numbers were multiplied together to give each of these encryption keys?

(a) 77 **(b)** 38 **(c)** 65 **(d)** 202 **(e)** 143

2 Multiply the following prime numbers together to get encryption keys.

(a) 3 and 17 **(b)** 7 and 31 **(c)** 47 and 73
(d) 131 and 727 **(e)** 313 and 93 139

3 **(a)** Write out the first five prime numbers.

(b) Write out the six smallest keys that you can create by multiplying two primes together.

(c) How many factors does each key in part **(b)** have?

(d) Do you think every key created by multiplying two primes together will have this number of factors? Why?

(e) Why couldn't we use any number (e.g. 120) as a key?

4 Here's a simplified version of how decryption using prime numbers works. Suppose your encrypted message is W L R G Y S B E M R C R E B J C V and your key is 713.

You have to find the two prime numbers that multiply together to give you 713. The answer is 23 and 31. These digits tell you how much the letters in the original message have been shifted along the alphabet to give you the coded message.

You match these digits to the code as follows:

W	L	R	G	Y	S	B	E	M	R	K	C	R	E	B	J	C	V
2	3	3	1	2	3	3	1	2	3	3	1	2	3	3	1	2	3

The way this code works is that the number tells you how many letters to shift each letter along the alphabet. The 2 under the W means shift two letters forward through the alphabet from W, so the uncoded message, usually called the plaintext, has Y as its first letter. To get the second letter you find the letter 3 places on from L in the alphabet, which gives you O as the second letter of your plaintext.

(a) Continue decrypting the code to get the full original plaintext message.

(b) Describe what you did with coded letter Y.

5 Decode this message given the key 943.

K X P G Q F O N D M N H K B E L N L N S Y K Y D

Note: You need to work out which order to put the two primes in. Only one will give you the message.

6 Encrypt your own message using this prime number system. Use only prime numbers under 100 and keep the message under 25 letters. Give your coded message and key to someone to decrypt.

Research

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Find out about the GIMPS (Great Internet Mersenne Prime Search) project and present a report on how prime numbers are used in email encryption. Discuss whether governments should ban encryption and make it possible for intelligence agencies to read everyone's emails. Should people have a right to privacy?

3.6 Other special numbers

There are many other special groups of numbers, far too many to cover in this book. We will discuss some of them here.

Palindromes

What do the following words have in common?

KAYAK MADAM GLENELG DID MUM

These words are called **palindromes**.

Sentences can be palindromes:

Step on no pets

Numbers can also be palindromes. Like the palindromic words, they are the same backwards as they are forwards. Here are some number palindromes:

22 676 8 12 321 6 004 006

> Palindromes read the same backwards as forwards.

Fibonacci numbers

Leonardo Fibonacci was an Italian mathematician who lived from 1170 to 1240. He is most famous for describing the following number pattern:

1, 1, 2, 3, 5, 8, 13, 21, …

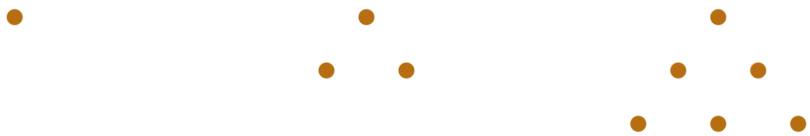
What's the next number?

How is the pattern formed?

The number of petals on many flowers are **Fibonacci numbers**.

Triangular numbers

Look at the following patterns.



Each pattern of dots forms a triangular shape. We call the number of dots that make up these patterns **triangular numbers**. In the following exercise you will be asked to find some more triangular numbers and explore the patterns in them.

exercise 3.6 Other special numbers

Preparation: Prep Zone Q1 and 2

Core

Animation

1 (a) How many two-digit palindromes are there? Write them down.
(b) How many one-digit palindromes are there?

2 (a) The year 1441 is a palindrome. During the 1990s, only one year was a palindrome. What was it?
(b) Which year is the first palindrome in the 21st century?
(c) In what year will the palindrome after that occur?

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3 The number 12 isn't a palindrome, but if we reverse it and then add the two numbers together, we get a palindrome:

$$\begin{array}{r} 12 \\ +\ 21 \\ \hline 33 \\ \hline \end{array}$$

For each of these numbers, state whether they become palindromes if you reverse them and add the two numbers together.

(a) 13	**(b)** 42	**(c)** 57
(d) 10	**(e)** 72	**(f)** 89

Hint

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4 Look at the following photos and count the number of petals on each plant. State in each case whether the number of petals is a Fibonacci number.

Hint

(a)

Agathea

(b)

Isotoma

(c)

White African Daisy

(d)

Marguerite

(e)

Dietes

(f)

Euryops

(g)

Luculia

(h)

Purple African Daisy

5 Write out the first 15 Fibonacci numbers.

Hint

6 (a) Look at every third Fibonacci number. What sort of number is it?
(b) Look at every fourth number. What is it divisible by?
(c) Look at every fifth number. What is it divisible by?

RETURN TO MAIN MENU

7 It's possible to make different Fibonacci sequences by using different starting numbers. Copy and complete these sequences.

(a) 2, 2, 4, 6, 10, ____, ____, ____ **(b)** 1, 2, 3, 5, 8, ____, ____, ____

(c) 0, 4, 4, 8, ____, ____, ____ **(d)** 10, 1, 11, 12, ____, ____, ____

(e) 0, 0, ____, ____, ____ **(f)** 10, 10, 20, 30, ____, ____, ____

(g) 6, ____, 8, ____, 18, ____ **(h)** 9, ____, 9, ____, ____, ____

(i) ____, 5, ____, 11, ____, ____ **(j)** ____, 4, ____, 20, ____, ____

e Hint

8 Write two of your own Fibonacci sequences. Take out some of the numbers as in Question **7**, and ask another person to work out the missing numbers in your sequences.

9 Draw diagrams for the fourth, fifth and sixth triangular numbers. Find the corresponding numbers.

e Hint

10 Write out the triangular numbers in a row. What do you notice about the amount each number increases by?

Extension

11 **(a)** Add the first two triangular numbers together. Add the second and third numbers together, then the third and fourth numbers together. What do you notice about these numbers?

(b) Look back at your triangles and explain how pairs could be placed together to form squares. Relate this to what you found in part **(a)**.

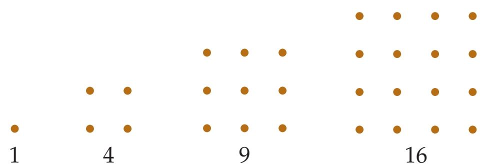
e Homework 3.2

e Worksheet A3.2

e Worksheet A3.3

3.7 Square and cube numbers

A number is called a **square number** if we can arrange that number of dots in a square pattern. The patterns for the first four square numbers are shown below.



The first square number, 1, makes a 1×1 square.
The second square number, 4, makes a 2×2 square.
The third square number, 9, makes a 3×3 square.
The fourth square number, 16, makes a 4×4 square.

We say, for instance, that four squared is equal to sixteen. In mathematical symbols we write $4^2 = 16$.

Calculators can be used to find squares.
For example $17^2 = 17 \times 17$ can be found by pressing

[1] [7] [×] [1] [7] [=].

You can also use the [x^2] key, if your calculator has one. To find 17^2, press [1] [7] [x^2] [=].

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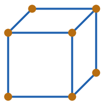

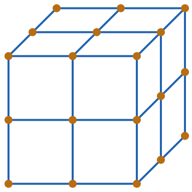

Similarly, a number is called a **cube number** if we can arrange that number of dots in a cube pattern (including dots in the middle of the cube).

Look back at the 2×2 square. If you imagine putting another of the same square behind the first one you will get a $2 \times 2 \times 2$ cube and 8 dots will have been used. We say that two cubed is equal to eight.

In mathematical symbols we write $2^3 = 8$.

Now look at the 3×3 square. If you imagine putting two more of the same square behind the first one you will get a $3 \times 3 \times 3$ cube and 27 dots will have been used. Similarly $3 \times 3 \times 3 = 3^3 = 27$.

On the calculator you can press

[2] [×] [2] [×] [2] [=].

Many calculators also have a [x^y] key. If yours has, you need to press [2] [x^y] [3] [=].

If your calculator has a [x^3] key then you only need to press [2] [x^3].

eTutorial

Square and cube roots

Finding the **square root** or **cube root** is the opposite to squaring or cubing a number. For example, to find the square root of 16, you have to think of a number that when squared gives you 16.

The number is 4 since $4 \times 4 = 16$. This means the square root of 16 is 4.

We write this as $\sqrt{16} = 4$.

To find the cube root of 27, you have to think of a number that when cubed gives 27.

$3 \times 3 \times 3 = 27$. So the cube root of 27 is 3.

We write this as $\sqrt[3]{27} = 3$.

You can use [$\sqrt{\ }$] and [$\sqrt[3]{\ }$] keys on your calculator to find square and cube roots.

eTutorial

exercise 3.7 Square and cube numbers

Preparation: Prep Zone Q1, Ex 3.2

Core

1 (a) Write the 5th, 6th and 7th square numbers. Hint

(b) What is

(i) the 12th **(ii)** the 20th **(iii)** the 100th **(iv)** the 300th

square number? eQuestions

2 (a) Write the 4th, 5th and 6th cube numbers.

(b) What is

(i) the 9th **(ii)** the 15th **(iii)** the 100th **(iv)** the 200th

cube number? eQuestions

3 (a) Write down two numbers between 5 and 40 that are both even and square.

(b) Write down two numbers between 30 and 90 that are both odd and square.

4 (a) Write in words how we would say these.

(i) 5^2 **(ii)** 2^2 **(iii)** 14^2 **(iv)** 31^2 Hint

(v) 3^3 **(vi)** 7^3 **(vii)** 19^3 **(viii)** 27^3

(b) Write out what numbers these are equal to.

(i) 4^2 **(ii)** 6^2 **(iii)** 9^2 Hint

(iv) 13^2 **(v)** 30^2 **(vi)** 50^2

(vii) 7^3 **(viii)** 15^3 **(ix)** seventeen squared

(x) 40^3 **(xi)** fifty cubed **(xii)** one hundred squared

(xiii) 5×10^2 **(xiv)** 4×10^2 **(xv)** $3 + 10^2$

(xvi) $10^3 \times 2$ **(xvii)** $10^3 - 7$ **(xviii)** $11 + 10^3$

5 (a) Evaluate:

(i) $3^2 + 4^2$ **(ii)** $6^2 + 8^2$

(b) Rewrite both your answers from part **(a)** as a number squared.

(c) Look for a pattern in your two results and then copy and complete these.

(i) $9^2 + 12^2 = \_\_\_^2$ **(ii)** $12^2 + 16^2 = \_\_\_^2$ **(iii)** $30^2 + 40^2 = \_\_\_^2$

(d) If $5^2 + 12^2 = 13^2$, what does $10^2 + 24^2$ equal?

6 Copy and complete. Use your calculator if necessary.

(a) **(i)** $3^2 \times 4^2$
$= 9 \times 16$
$= \_\_\_$

(ii) $(3 \times 4)^2$
$= 12^2$
$= \_\_\_$

(b) **(i)** $5^2 \times 2^2$
$= \_\_\_ \times \_\_\_$
$= \_\_\_$

(ii) $(5 \times 2)^2$
$= \_\_\_^2$
$= \_\_\_$

(c) What can you say about $(a \times b)^2$ and $a^2 \times b^2$?

7 What number do you have to square to get each of these?

(a) 9 **(b)** 4 **(c)** 49 **(d)** 64
(e) 81 **(f)** 25 **(g)** 144 **(h)** 10 000

Hint
Worksheet C3.6

8 What number do you have to cube to get each of these?

(a) 1 **(b)** 27 **(c)** 8 **(d)** 64
(e) 8000 **(f)** 1000 **(g)** 125 **(h)** 1 000 000

Hint

9 Evaluate:

(a) $\sqrt{25}$ **(b)** $\sqrt{49}$ **(c)** $\sqrt{36}$ **(d)** $\sqrt{64}$
(e) $\sqrt{100}$ **(f)** $\sqrt{121}$ **(g)** $\sqrt{196}$ **(h)** $\sqrt{169}$
(i) $\sqrt{1}$ **(j)** $\sqrt{0}$ **(k)** $\sqrt{4900}$ **(l)** $\sqrt{400}$
(m) $\sqrt{1600}$ **(n)** $\sqrt{2500}$ **(o)** $\sqrt{360\,000}$ **(p)** $\sqrt{810\,000}$

Hint
eQuestions

10 Evaluate:

(a) $\sqrt[3]{8}$ **(b)** $\sqrt[3]{64}$ **(c)** $\sqrt[3]{1000}$ **(d)** $\sqrt[3]{1}$
(e) $\sqrt[3]{0}$ **(f)** $\sqrt[3]{125}$ **(g)** $\sqrt[3]{8000}$ **(h)** $\sqrt[3]{27\,000}$

Hint

11 Copy and complete.

(a) **(i)** $\sqrt{9 \times 4}$
$= \sqrt{36}$
$=$ ___

(ii) $\sqrt{9} \times \sqrt{4}$
$= 3 \times 2$
$=$ ___

(b) **(i)** $\sqrt{100 \times 16}$
$= \sqrt{\_\_\_}$
$=$ ___

(ii) $\sqrt{100} \times \sqrt{16}$
$=$ ___ $\times$ ___
$=$ ___

(c) What can you say about $\sqrt{a \times b}$ and $\sqrt{a} \times \sqrt{b}$?

Extension

12 **(a)** Can you find the square root of a negative number? Why or why not?
(b) Can you find the cube root of a negative number? Why or why not?

13 Without using your calculator, find between which two consecutive whole numbers the following lie.

(a) $\sqrt{10}$ **(b)** $\sqrt{5}$ **(c)** $\sqrt{20}$ **(d)** $\sqrt{62}$
(e) $\sqrt{99}$ **(f)** $\sqrt{2}$ **(g)** $\sqrt{70}$ **(h)** $\sqrt{108}$

Hint

14 Without using your calculator, find between which two consecutive whole numbers the following lie.

(a) $\sqrt[3]{10}$ **(b)** $\sqrt[3]{52}$ **(c)** $\sqrt[3]{1001}$ **(d)** $\sqrt[3]{30}$
(e) $\sqrt[3]{5}$ **(f)** $\sqrt[3]{71}$ **(g)** $\sqrt[3]{120}$ **(h)** $\sqrt[3]{2}$

Hint

15 Check your answers to Questions **13** and **14** by finding the actual values using your calculator.

Calculator

Worksheet A3.4

16 Is it more appropriate to use non-calculator strategies or a calculator to find the square root of each of the following numbers? Explain why.

(a) 9 **(b)** 24 **(c)** 10 000 **(d)** 10

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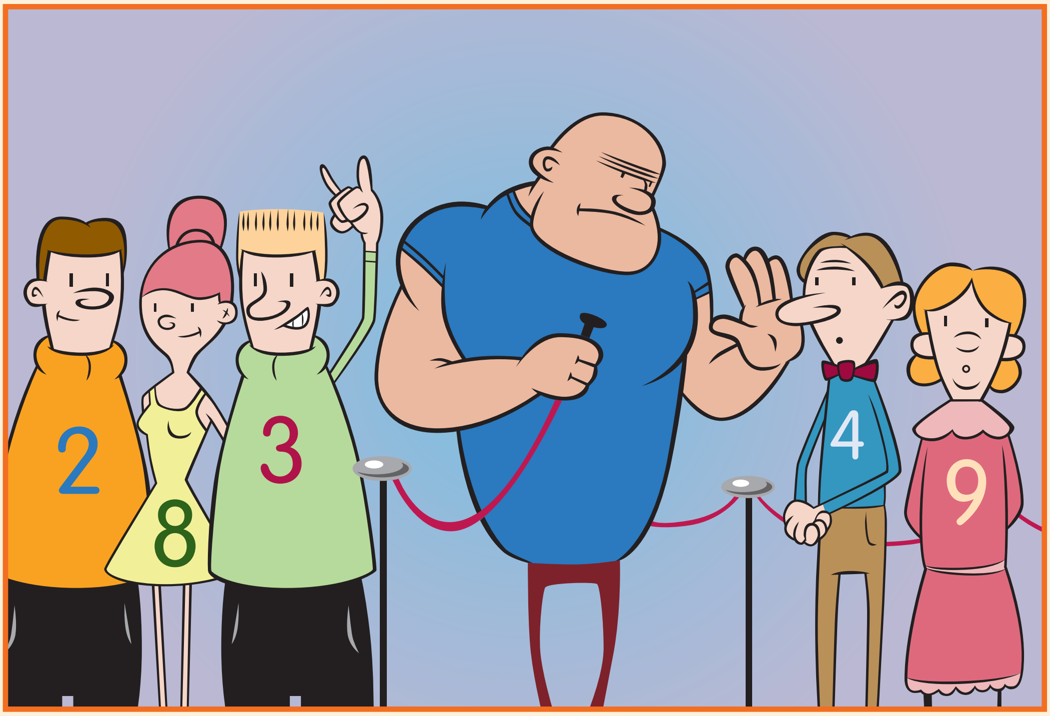


Answer the questions, showing your working, and then arrange the letters in the order shown by the corresponding answers to find the cartoon caption.

Which of the following is not a square number?

1, 12, 100	**U**	6, 9, 16	**Y**	4, 49, 122	**L**	25, 52, 64	**O**

Which of the following is a cube number?

2, 8, 10	**S**	1, 9, 15	**W**	27, 36, 49	**R**	400, 1000, 1600	**N**

Find the following.

$\sqrt{49}$	**Q**	$\sqrt{100}$	**A**	$\sqrt{121}$	**E**	$\sqrt{81}$	**D**
$\sqrt[3]{64}$	**O**	$\sqrt[3]{125}$	**S**	$\sqrt[3]{8000}$	**L**	$\sqrt[3]{27}$	**E**
$5^2 - 2^3$	**R**	$8^2 - 3^3$	**S**	$10^2 \div 2^2$	**R**	$2^3 \times 2^2$	**A**

How many square numbers are there between 50 and 60? **O**

‘

5	0	25	27	6

,

1000	4

8	7	12	32	17	11	37

10	122	20	52	1	3	9

’

3.8 Powers

Powers are a short way of writing large numbers. The small 2 in 5^2 is an example of a **power**. The other number is called the **base**.

power
↓
base → 5^2

The power tells you how many times the base will appear when you multiply the power out. For example:

$4^3 = 4 \times 4 \times 4$ $\quad$ $7^4 = 7 \times 7 \times 7 \times 7$

$5^3 = 5 \times 5 \times 5$ $\quad$ $9^5 = 9 \times 9 \times 9 \times 9 \times 9$

For 4^3 we say 'four cubed' or 'four raised to the power of three' or just 'four to the power of three'.

For 5^3 we say 'five cubed' or 'five raised to the power of three' or just 'five to the power of three'.

For 7^4 we say 'seven raised to the power of four' or just 'seven to the power of four'.

> Another word for a power is an **index** (plural **indices**). When numbers are written using an index we say they are in **index form**.
>
> 4^3 is in index form.
>
> $4 \times 4 \times 4$ is in **expanded form**.

worked example 3

Write out these numbers in expanded form and work out the answer.

(a) 4^3 $\quad$ **(b)** 7^4

Steps	Solutions
(a) 1. Write 4^3 in expanded form.	**(a)** $4^3 = 4 \times 4 \times 4$
2. Calculate the first part of the product.	$4 \times 4 = 16$
3. Multiply this by the next part of the product.	$16 \times 4 = 64$
4. Write down the answer.	$4^3 = 64$
(b) 1. Write 7^4 in expanded form.	**(b)** $7^4 = 7 \times 7 \times 7 \times 7$
2. Calculate the first part of the product.	$7 \times 7 = 49$
3. Calculate the second part of the product.	$7 \times 7 = 49$
4. Multiply these two together.	$49 \times 49 = 2401$
5. Write down the answer.	$7^4 = 2401$

RETURN TO MAIN MENU

Powers on calculators

Many calculators have a key to help you work quickly with powers. It's usually y^x or x^y or a^b or something similar.

For example, if you want to work out 12^3, you press

1 2 x^y 3 =

Some other calculators, including graphics calculators, use a process similar to that used in computer spreadsheet programs. A key like this ^ is used. If we entered 6 ^ 3 this would mean 6^3 or six to the power of three.

eTutorial

exercise 3.8 Powers

Preparation: Ex 3.6

Core

1 Write each of these in index form. (Don't work out the answer.)

Hint

(a) $8 \times 8 \times 8$ **(b)** $4 \times 4 \times 4 \times 4 \times 4 \times 4$
(c) $9 \times 9 \times 9 \times 9$ **(d)** $7 \times 7 \times 7$
(e) $5 \times 5 \times 5 \times 5 \times 5 \times 5$ **(f)** $9 \times 9 \times 9 \times 9 \times 9$
(g) $12 \times 12 \times 12 \times 12 \times 12$ **(h)** $16 \times 16 \times 16 \times 16 \times 16 \times 16 \times 16 \times 16 \times 16$
(i) $6 \times 6 \times 6 \times 6 \times 6 \times 6 \times 6 \times 6 \times 6$ **(j)** $11 \times 11 \times 11 \times 11 \times 11 \times 11 \times 11 \times 11$
(k) seventeen cubed **(l)** thirteen to the power of seven
(m) eight to the fourth power **(n)** nine to the six
(o) eleven to the seven **(p)** nine to the three

2 Write these out in expanded form. (Don't work out the answer.)

Hint

(a) 4^5 **(b)** 6^5 **(c)** 5^4 **(d)** 5^6
(e) 2^7 **(f)** 3^8 **(g)** 7^2 **(h)** 8^3
(i) 9^6 **(j)** 9^7 **(k)** 10^4 **(l)** 13^2
(m) 54^8 **(n)** 71^6 **(o)** 111^3 **(p)** 517^4

3 Write these out in expanded form and then work out the answer.

Hint

(a) 2^3 **(b)** 2^4 **(c)** 2^6 **(d)** 2^5
(e) 1^8 **(f)** 0^7 **(g)** 0^6 **(h)** 1^7
(i) 10^3 **(j)** 10^5 **(k)** 6^4 **(l)** 8^4
(m) 11^3 **(n)** 12^4 **(o)** 5^3 **(p)** 10^6

4 Simplify:

Hint

Worksheet C3.7

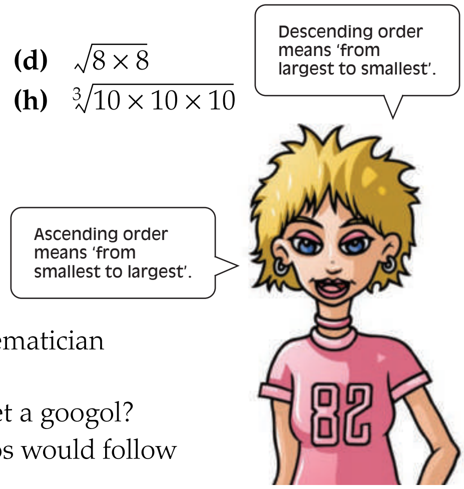
(a) $1^4 + 2^2$ **(b)** $2^3 - 1^6$ **(c)** $3^4 - 2^4$
(d) $2^5 + 5^2 - 6^2$ **(e)** $10^2 + 3^2 - 4^3$ **(f)** $5^2 - 1^6 + 3^3$
(g) $2^3 \times 2^2$ **(h)** $2^2 \times 2^4$ **(i)** $3^6 \times 3^2$
(j) $(8 + 5^3) \times 2^4$ **(k)** $(6^4 - 7) \times 10^2$ **(l)** $(4^7 - 3) \times 3^2$
(m) 4×10^3 **(n)** 7×10^4 **(o)** 9×10^5
(p) $9^2 \times 10^4$ **(q)** $6^2 \times 10^6$ **(r)** $2^2 \times 10^7$
(s) $2 \times 10^4 + 7 \times 10^3 + 8 \times 10^2 + 6 \times 10^1 + 9$
(t) $5 \times 10^6 + 3 \times 10^4 + 2 \times 10^3 + 9 \times 10^2 + 7 \times 10^1 + 4$

5 **(a)** Arrange these numbers in ascending order.
$4^5, 5^4, 1^{200}, 10^3, 4^6, 5^5$

(b) Arrange these numbers in descending order.
$100^2, 10^5, 1^{1000}, 0^{100}, 3^2, 2^3$

6 Evaluate:

(a) $\sqrt{2 \times 2}$ **(b)** $\sqrt{10 \times 10}$ **(c)** $\sqrt{5 \times 5}$ **(d)** $\sqrt{8 \times 8}$
(e) $\sqrt[3]{5 \times 5 \times 5}$ **(f)** $\sqrt[3]{3 \times 3 \times 3}$ **(g)** $\sqrt[3]{1 \times 1 \times 1}$ **(h)** $\sqrt[3]{10 \times 10 \times 10}$



Extension

7 **(a)** Copy and complete:

$10^1 = 10 = 10$ $10^4 =$
$10^2 = 10 \times 10 = 100$ $10^5 =$
$10^3 = 10 \times 10 \times 10 = 1000$ $10^6 =$

(b) The number 10^{100} was called a googol by the mathematician Edward Kasner.

(i) How many times is 10 multiplied by itself to get a googol?
(ii) Look at the pattern in part **(a)**. How many zeros would follow the 1 in a googool?

(c) If you raise the number ten to the power of a googol, you get a number called a googolplex.

(i) How many times is 10 multiplied by itself to get a googolplex?
(ii) How many zeros would follow the 1 in a googoolplex? How much time do you think you save by writing a googolplex in index form?

8 Simplify these with your calculator, using the shortest method.

(a) 6^5 **(b)** 8^5 **(c)** 7^3 **(d)** 9^3
(e) 13^6 **(f)** 15^3 **(g)** 28^3 **(h)** 25^3
(i) 32^3 **(j)** 2^7 **(k)** 3^6 **(l)** 4^5
(m) $16^3 - 4096$ **(n)** $21^4 - 4481$ **(o)** $15^4 - 5625$
(p) $36^3 \times 53$ **(q)** $14^4 \times 14$ **(r)** $19^5 \times 21$
(s) $2^{12} + 2^{18}$ **(t)** $3^{10} + 12^4$ **(u)** $4^9 + 3^{11}$

Hint
Worksheet C3.8

9 **(a)** Use your calculator to answer TRUE or FALSE to each of the following statements.

(i) 4^6 is bigger than 6^4. **(ii)** 2^{10} is bigger than 10^2.
(iii) 3^9 is bigger than 9^3. **(iv)** 19^2 is bigger than 2^{19}.

(b) Look at your answers for part **(a)** and *without* using your calculator answer TRUE or FALSE to these statements.

(i) 9^8 is bigger than 8^9. **(ii)** 2^{100} is bigger than 100^2.

10 Use your calculator to find the following through trial and error.

(a) A number which when raised to the power of three gives:
(i) 343 **(ii)** 1728 **(iii)** 2744 **(iv)** 39 304

(b) A number which when raised to the power of four gives 4096.

(c) A number which when raised to the power of five gives 161 051.

Worksheet C3.9

11 Find a number that when raised to the power of four gives a number between 150 000 and 300 000.

eQuestions
Homework 3.3

RETURN TO MAIN MENU

languagezone

Summary

Copy and complete the following summary of this chapter using the words and phrases from the list. A word or phrase may be used more than once.

1 A ______ of 6 is 18.

2 A number that is not ______ by any numbers other than 1 and itself is called a ______ ______.

3 A number with more then two factors is called a ______ ______.

4 1, 9 and 25 are all examples of ______ ______. 1, 8 and 27 are all examples of ______ ______.

5 The ______ ______ of 8 is 2.

6 The long way of writing a number in index form is in ______ ______.

7 A ______ is a number that looks the same when the order of the numbers is reversed.

Key words

base
composite number
cube numbers
cube root
divisibility tests
divisible
expanded form
factor
factor tree
Fibonacci
index
index form
indices
multiple
palindrome
power
prime factor
prime number
square numbers
square root
triangular numbers

Questions

1 Write a non-mathematical meaning for the word 'factor'.

2 Write in words how we would say $\sqrt[3]{64} = 4$.

3 Label the parts. ______ → 5^3 ← ______.

4 Write $6 \times 6 \times 6 \times 6$ in a shorter form. What do we call this form?

5 Write each of the following using symbols.

- **(a)** five cubed
- **(b)** seven to the power of four
- **(c)** nine squared

6 Try to make at least 10 words, of three letters or more, from the letters of 'composite'.

7 The following words from this chapter are missing their vowels (a, e, i, o, u). Copy and complete the words.

- **(a)** m _ l t _ p l _
- **(b)** c _ l c _ l _ t _ r
- **(c)** d _ v _ s _ b _ l _ t y

Worksheet L3.1
Worksheet L3.2

RETURN TO MAIN MENU

chapter 3 REVIEW

FAQs

I keep getting the wrong answers for power questions. What could I be doing wrong?
A common mistake is thinking that something like 3^2 means 3×2. The best way to avoid this is to read it correctly. Don't say to yourself 3^2 is 'three twos'. Say it is 'three to the power of two'.

I get factors and multiples confused. Is there an easy way to remember the difference?
A factor is always that number and numbers smaller than it. Multiples are always that number and numbers larger than it. Tell yourself that because they are called 'multiples' we need to *multiply* that number to get its multiples.

How do I know when I have found all the factors of a particular number?
Follow a pattern. Start with 1 and its pair, then 2 and its pair, and so on. When you get to a factor that you have already found, then you have found all the factors. For example, to find the factors of 15, first you will find 1 and its pair 15, then 3 and its pair 5. The next factor is 5 but you have already found this so all factors are found. The factors of 15 are 1, 3, 5 and 15.

Core

1 Find the first three multiples of: 3.1

(a) 7 **(b)** 10 **(c)** 12 **(d)** 52

2 Copy the following table and do the divisibility tests. Circle the number if the original number is divisible by it. 3.2

5301	2	3	4	5	6	9	10
10 000	2	3	4	5	6	9	10
333 333	2	3	4	5	6	9	10
31 700	2	3	4	5	6	9	10
43 521 820	2	3	4	5	6	9	10

3 Find all the factors of: 3.3

(a) 35 **(b)** 31 **(c)** 44
(d) 48 **(e)** 51 **(f)** 100

4 State whether each of the following numbers is a prime number or a composite, and explain why. 3.4

(a) 5 **(b)** 16 **(c)** 1
(d) 77 **(e)** 17 **(f)** 276 350

RETURN TO MAIN MENU

5 Write out the factor trees for these numbers, and then express each number as a product of its prime factors. 3.5

(a) 24 **(b)** 30 **(c)** 88 **(d)** 200

6 Copy and complete these Fibonacci sequences. 3.6

(a) 6, 3, 9, ____, 21, ____, ____, ____

(b) 5, ____, 11, ____, 28, ____

7 Evaluate: 3.7

(a) 12^2 **(b)** 7^2 **(c)** 20^2

(d) $\sqrt{64}$ **(e)** $\sqrt{900}$ **(f)** $\sqrt{225}$

8 Evaluate: 3.7

(a) 2^3 **(b)** 10^3 **(c)** 5^3

(d) $\sqrt[3]{0}$ **(e)** $\sqrt[3]{27}$ **(f)** $\sqrt[3]{64}$

9 Write each of these numbers in index form. 3.8

(a) $7 \times 7 \times 7 \times 7 \times 7$ **(b)** ten cubed

(c) five squared **(d)** twelve to the power eight

10 Write these numbers in expanded form and then work out the answer. 3.8

(a) 5^3 **(b)** 8^4 **(c)** $(3^2 - 2^3) \times 16^2$

Extension

11 **(a)** Copy and complete the following. 3.7

(i) $2^2 = 1^2 + 3$ **(ii)** $3^2 = 2^2 +$ ____

(iii) $4^2 = 3^2 +$ ____ **(iv)** $5^2 = 4^2 +$ ____

(b) Describe the relationship between a square number and the square number before it.

(c) Using the relationship you established in part **(b)**, copy and complete the following.

(i) $12^2 = 11^2 +$ ____ **(ii)** $20^2 = 19^2 +$ ____

12 Is 2^{10} larger or smaller than 1000? Write the difference. 3.8

13 Put these numbers in ascending order. 3.8

2^4, $\sqrt{121}$, 10^2, 3^3, $4 \times \sqrt{81}$

RETURN TO MAIN MENU

REPLAY

1 Calculate: (Worksheet R3.6)
(a) 1200 – 567 **(b)** 2971 – 730 **(c)** 8903 – 6784

2 Calculate: (Worksheet R3.7)
(a) 675 ÷ 9 **(b)** 3164 ÷ 7 **(c)** 5052 ÷ 6

3 **(a)** How many seconds are there in three minutes? (Worksheet R3.8)
(b) How many minutes are there in 10 hours?

4 Frank takes $50 to purchase his mum's birthday present. He buys her a book for $22 and a shirt for $19.50. How much change does he have left over? (Worksheet R3.9)

5 **(a)** How many faces (flat sides) does a cube have? (Worksheet R3.10)
(b) How many faces does a pyramid with a square base have?
(c) How many faces does a pyramid with a triangular base have?

6 Copy and complete the following magic squares. (1.3)

(a)

6		
8	18	4

(b)

		10
	9	11
8		

(c)

	3	
	11	
	19	5

7 Round these numbers off to the first digit. (1.5)
(a) 28 **(b)** 136 **(c)** 968 **(d)** 12

8 Simplify: (1.6)
(a) 6 × 4 ÷ 2 × 6 **(b)** 5 + 6 × 7 **(c)** 18 + 12 – 7 + 6

9 Write the following numbers in order from smallest to largest. (2.2)
(a) –4, 10, 0, –6, 3 **(b)** –89, 78, –100, 29, –1 **(c)** 0, –5, 6, 7, –4

10 Simplify: (2.5)
(a) 90 – 110 **(b)** –17 – 52 **(c)** 15 – 20 + 12

11 Calculate: (2.6)
(a) –7 × 6 **(b)** –5 × (–12) **(c)** 3 × (–3) × 7

12 Calculate: (2.7)
(a) $\frac{72}{-8}$ **(b)** –100 ÷ (–10) **(c)** –120 ÷ 60

Assignment 3