



### Number and algebra

# Integers

Antarctica is the coldest continent on Earth, where the daily temperature over the year ranges from  $-70^{\circ}$ C to  $-15^{\circ}$ C. It also stays dark for six months of the year when the Sun does not rise between March and September. Because Antarctica is permanently covered with snow and ice, it reflects the Sun's rays rather than absorbs them, and its dry air and high altitudes contribute to its sub-zero temperatures.

## NEW CENTURY MATHS 7



### Chapter outline

Profi	ciency	y strar	lds
U	F	PS	
U	F		
U	F		
U	F		R
U	F		R
U	F		R
U	F		R
U	F		
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#### Wordbank

ascending Moving upward, increasing from smallest to largest

**descending** Moving downward, decreasing from largest to smallest

evaluate To find the value of an expression

integer A positive or negative whole number or zero

minus To subtract or 'take-away' a number

**negative number** A number that is less than zero; the opposite of a positive number

**number line** A line that shows the position and order of numbers

#### In this chapter you will:

- investigate everyday situations that use positive and negative whole numbers and zero, and locate and represent these numbers on a number line
- compare, order, add and subtract integers
- carry out the four operations with integers, using efficient mental and written strategies and appropriate digital technologies

### SkillCheck

M/orlich cot	1	Simplify each express	sion						
StartUp assignment 1 MAT07NAWK10001	-	<b>a</b> 7 + 9 <b>e</b> 13 + 8 <b>i</b> 6 + 7	b f i	12 - 4 30 - 5 14 - 6		c g k	$7 \times 4$ 2 × 11 3 × 5		
	2	Simplify each express <b>a</b> $12 + 37$ <b>e</b> $79 \times 3$ <b>i</b> $30 - 12 \div 6$ <b>m</b> $3^2$	sion b f j	652 - 48 $384 \div 3$ $20 \times (3 - 5^{2})$	- 17)	c g k	$14 \times 5$ $3 + 5 \times 4$ $12 - 3 \times 2 +$ $8^{2}$	6	<b>d</b> $66 \div 2$ <b>h</b> $18 \div 2 - 7$ <b>l</b> $43 - [5 \times 2 + 1]$ <b>p</b> $1^2$
	3	State whether each st a $15 > 12$ d $4 + 3 < 10$ g $15 \div 3 > 12 \div 4$	tate	ment is tru b e h	the (T) or fals 8 < 11 12 - 3 > 1 8 + 3 + 2	se ( 11 > (	(F). $6 \times 1$	c f i	6 < 3 $7 < 3 \times 2$ $18 \div 3 < 2 + 2 + 2$
Skillsheet	4	Write each set of nur	mbe	ers in ascer	nding order	(sr	nallest to larges	t).	
Ordering numbers		<b>a</b> 3, 8, 2, 1, 4		b	2, 18, 5, 7,	3,	16	c	38, 51, 49, 27, 66, 54
MAT07NASS10001	5	Write each set of nur	mbe	ers in desce	ending orde	er (]	largest to smalle	est)	).
		<b>a</b> 6, 11, 18, 17, 5, 3		b	8, 7, 14, 23	3,3	1, 5, 2	c	89, 91, 37, 69, 41, 3, 46

### 1-01 Numbers above and below zero

- 'The temperature in Canberra was  $3^{\circ}$ C yesterday but overnight it dropped 5 degrees to  $-2^{\circ}$ C'
- 'When Lisa withdrew \$400 from her bank account, her bank balance of \$340 went down to -\$60'

Both of the above situations involve numbers above and below zero.

Numbers greater than zero, such as 3, 400,  $8\frac{1}{2}$  and 14.37, are called **positive** numbers.

Numbers less than zero, such as -2, -60,  $-10\frac{3}{4}$  and -21.6, are called **negative** numbers.

The number -2 is the number that is 2 below 0. It is called 'negative 2', not 'minus 2'. The number 3 is the number that is 3 above 0. It can also be called 'positive 3' and be written as '+3'. The negative numbers are the opposites of the positive numbers. The opposite of 5 is -5. The opposite of -9 is 9.

#### **Exercise 1-01** Numbers above and below zero

- 1 The scale on the right shows temperatures in degrees Celsius (°C) above and below 0°C.
  - a At what temperature does water boil?
  - **b** What is measured at 37°C?
  - **c** Estimate the temperature at which dry ice evaporates.
  - **d** What is measured at 0°C?
  - e Last week, it was 48°C in Algeria, Africa and -69° at the South Pole in Antarctica. What was the difference between the two temperatures?



2 For each number below, write its opposite number.

a	6	b	1	с	-10
d	11	e	0	f	-2

**3** Write a word that is the opposite of:

a	up	b	more	с	down
d	left	e	before	f	south
ø	withdraw	h	decrease	i	west

- 4 Icebergs can be dangerous to ships because about  $\frac{5}{6}$  of their mass lies under water. The following diagram shows the position of an iceberg above and below sea level.
  - **a** What is the height of the iceberg above sea level?
  - **b** What is the depth of the iceberg below sea level?
  - **c** What is the total height of the iceberg?
  - **d** Why are '+' and '-' signs useful in these measurements?



**5** Dilshan's bank account has money coming in and going out over one day. Withdrawals have a negative sign.

Balance at the start:	\$720
	-\$50
	\$60
	-\$40
	-\$100
	\$80
	-\$260
Balance at the end of the day:	\$
Calculate the balance at the end of the day.	

- 6 Write the opposite of:
  - a withdrawing \$25 from the bank
    b winning \$12
    c walking 2 steps backwards
    e driving 5 km west
    b winning \$12
    d lowering the temperature by 3°
    f increasing the price by \$8
  - g going up 3 floors h 5 seconds before take-off
- 7 What number's opposite is itself?
- **8 a** BCE and CE are now widely used in place of the abbreviations BC and AD. Find out what BCE and CE stand for.
  - **b** Why do some historians use BC and AD when numbering years? Find out what BC and AD stand for.
- 9 This time line starts at 500 BCE and ends at 500 CE.



Copy the time line and place each event below in the correct place.

A	100 ce	The first Chinese dictionary was compiled.
B	400 bce	The first temple dedicated to the Greek god Zeus was built.
С	490 bce	Greek runner Phidippides inspired the first marathon with a
		26-mile run.
D	55 BCE	Roman forces under Julius Caesar invaded Britain.
Е	190 ce	The abacus was invented.
F	370 ce	Hypatia, a female mathematician, was born in Alexandria,
		Egypt.
G	410 ce	Roman forces left Britain.
Η	330 BCE	Euclid showed that an infinite number of prime numbers exist.
Ι	260 ce	The two-year war between Rome and Persia ended.
J	240 bce	Eratosthenes estimated the circumference of the Earth using
		two sticks.

**10** In the Jewish calendar, the year of Creation, 3760 BCE, is Year Zero, while in the Indian calendar, 78 CE is Year Zero.

- a In what year were you born, according to the:
  - i Jewish calendar?
- $\boldsymbol{b}$  What is this year, according to the:
  - i Jewish calendar?

#### Just for the record

- ii Indian calendar?
- ii Indian calendar?

#### Tutankhamen, King of Egypt

In 1922, English archaeologist Howard Carter discovered the tomb of a pharaoh (king) in the Valley of the Kings in Egypt. It turned out to be that of Tutankhamen (meaning 'living image of Amun', an ancient Egyptian god). Tutankhamen became pharaoh at the age of 9 after the death of his parents, and he died aged 18 in 1323 BCE. The cause of his death remains a mystery – many possibilities have been suggested, including murder, but none can be proved. His tomb contained over 3000 treasures, many of them covered in gold, including his coffin. Carter's discovery was significant because Tutankhamen's tomb was so well-preserved. It still exists in the Valley of the Kings today. In what year did Tutankhamen become king? How many years after his death was King Tutankhamen's tomb discovered?



## 1-02 Integers on a number line

A **number line** shows the position and order of numbers. The number line below shows the positions of 2, 4 and 7 marked in pink.



As we move further to the right on the number line, the numbers become bigger. The arrow on the right end of the number line shows that numbers can increase infinitely ('forever'). We can extend our number line to the left to include the negative numbers below zero.

LEFT -4 -3 -2 -1 0 1 2 3 4

Worksheet A page of number lines MAT07NAWK10002

Puzzle sheet Integer snap MAT07NAPS10001

As we move further to the left on the number line, the numbers become smaller. The arrow on the left end of the number line shows that numbers can decrease infinitely.

Positive and negative numbers have size and direction. For example, 5 (or +5) means 5 units in the positive direction, while -2 means 2 units in the negative direction.

Positive and negative whole numbers are called **integers**, for example, -3, 4 and -20. Zero is also an integer.

Words printed in red also appear in the Glossary

#### Summary

Integers are the positive and negative whole numbers and zero.

*Note:* Integers are **whole** numbers, not fractions or decimals, so  $8\frac{1}{2}$ , 14.37,  $-10\frac{3}{4}$  and -21.6 are not integers. The general name for **all** positive or negative numbers is the **directed numbers**.

### **Exercise 1-02** Integers on a number line

1 Write the positive integer indicated by each arrow on this number line.



2 Estimate the value of the positive integer indicated by each arrow on the number lines below.



3 Copy and complete each number line, using a ruler to mark the positions evenly.



- 4 a Draw a number line and show all the integers between -5 and 3.
  - ${\bf b}~$  Draw a number line marked from -6 to 6 and show all the integers less than 1.
- 5 On this number line, where will *S* be if it moves:



## Technology Introducing spreadsheets

A spreadsheet is a **calculator** in the form of a grid made up of many cells where we can enter labels and numbers and display answers to calculations. The **columns** of a spreadsheet are ordered A, B, C, D, ... while the **rows** are ordered 1, 2, 3, 4, ...

Skillsheet Spreadsheets

MAT07NASS10002

	А	В	С	D	E	F	G	Н
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								

a c e g i

To make a calculation, we need to write a **formula** (rule) in a cell. A spreadsheet formula uses special symbols and always starts with an equals sign '='. Here are some examples of formulas:

Formula	Meaning		
=A1+A2+A3 or $=$ sum(A1:A3)	add the values in cells A1, A2 and A3		
=A5 $-$ A4	subtract the value in cell A4 from the value in		
	cell A5		
=A1*10	multiply the value in cell A1 by 10 (* is used		
	instead of $\times$ )		
=A1/A2	divide the value in cell A1 by the value in cell A2		
	(/ is used instead of $\div$ )		
=average(A1:A5)	find the <b>average</b> of all values from cells A1 to A5		

1 Open a new spreadsheet and enter the 5 numbers shown in column A at cells A1, A2, A3, A4 and A5.



- 2 In cell B1, enter the formula =A4-7 to calculate the value in A4, minus 7. You should get the answer 37, because 44 7 = 37.
- **3** For the rest of the cells in column B, enter the appropriate formula for each expression shown below and check that the spreadsheet calculates the correct answer. Remember to start each formula with an '=' sign.

at B2, $A2 + A1$	<b>b</b> at B3, $10 \times A5 - 6$
at B4, A4 $-$ A1 $\times$ 2	<b>d</b> at B5, A1 $\times$ A2 + A3
at B6, A1 $\times$ (A2 + A3)	<b>f</b> at B7, $3 \times A2 \div 2$
at B8 $A5 - A2$	<b>h</b> at B9, sum of A1, A2, A3, A4, A5
at D0, 3	i at B11 A4 A5
at B10, average of A1, A2, A3, A4, A5	$\int at B11, \frac{1}{A1} = \frac{1}{A2}$

4 Now enter **new** values in cells A1 to A5. Using the formulas entered from question **3**, check the new answers calculated in column B.

## 1-03 Ordering integers

#### Summary

- > means 'is greater than'
- < means 'is less than'

Think of the > and < signs as being like the mouths of crocodiles. They always open towards the **bigger** number.

'3 is greater than 1' is written as '3 > 1'.



'-2 is less than 3 is written as '-2 < 3.



Some more examples are shown in the table below. Remember that on a number line, the numbers on the right are larger than the numbers on the left.

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

Expression	Meaning	On a number line
3 > -4	3 is greater than $-4$	3 is to the <b>right</b> of $-4$
-5 < -3	-5 is <b>less than</b> $-3$	-5 is to the <b>left</b> of $-3$
-6 > -7	-6 is greater than $-7$	-6 is to the <b>right</b> of $-7$
-5 < 2	-5 is less than 2	-5 is to the <b>left</b> of 2

#### Example

Write these integers in ascending order: -5, 7, 0, 6, 3, -2, 4, -1.

#### Solution

Ascending order means from smallest to largest.

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

1

#### Summary

- Ascending means moving UP, from smallest to largest: think of 'A' as a ladder and going up a ladder
- Descending means moving DOWN, from largest to smallest: think of 'D' for 'down'

### **Exercise 1-03** Ordering integers

	1	Copy and complete each statement using $a > or < symbol$ .
		<b>a</b> 4 <u>1</u> <b>b</b> 0 <u>9</u> <b>c</b> 7 <u>-7</u> <b>d</b> 0 <u>-3</u>
		<b>e</b> 511
		$i -6 _{5} _{5} _{7} -6 _{-2} _{7} k _{17} _{23} _{124} -4$
		$m -15 \35$ $n -27 \29$ $o -8 \_ 47$ $p -12 \_ 0$
See Example 1	2	Here is a list of integers: 1, -2, 3, -4, 5, -6, 7, -8.
		<b>a</b> Which is the biggest integer?
		<b>b</b> Which is the smallest integer?
		c Rewrite the integers in order from smallest to biggest.
	3	Rewrite each set of integers in ascending order.
		<b>a</b> -3, 2, -1, 3 <b>b</b> 5, -5, 2, -8, -3 <b>c</b> -4, -6, -3, -10, 0
		$ \mathbf{d} \ \ 6, \ -3, \ 4, \ -2, \ -5 \qquad \mathbf{e} \ \ -48, \ 36, \ -24, \ 8, \ 0, \ -11 \qquad \mathbf{f} \ \ 15, \ 12, \ -10, \ -26, \ 3, \ -2 \ \mathbf{e} \ \ -48, \ 36, \ -24, \ 8, \ 0, \ -11 \qquad \mathbf{f} \ \ 15, \ 12, \ -10, \ -26, \ 3, \ -2 \ \mathbf{e} \ \ -48, \ -24, $
	4	Rewrite each set of integers in descending order.
		<b>a</b> 4, 3, -1, 5, -2 <b>b</b> -4, 8, -7, -2, 0 <b>c</b> 1, -1, 4, -5, -11, -3
		<b>d</b> 8, -4, -18, 3, -2 <b>e</b> -6, -15, -48, -3, 1 <b>f</b> 33, 1, -100, -58, -36
	5	The distance between $-3$ and 1 on a number line is 4.
		$\sim$
		-4 $-3$ $-2$ $-1$ 0 1 2 3 4
		Find the distance between each pair of integers
		2 = 14
		<b>a</b> 2 and 4 <b>b</b> $-2$ and $-4$ <b>c</b> 0 and 4 <b>d</b> 0 and $-5$ <b>e</b> $-3$ and 3 <b>f</b> $-10$ and $10$ <b>g</b> $-6$ and 1 <b>b</b> $-1$ and 6
	,	
	6	Which of the following statements is true? Select A, B, C or D.
		<b>A</b> $-6 > 2$ <b>B</b> $4 < -5$ <b>C</b> $0 < -3$ <b>D</b> $12 > -2$
	7	In this question, POS means positive and NEG means negative.
		Negative Positive
		-8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8
		<b>a</b> Start at $-3$ . Move 4 steps in the NEG direction. Move 9 steps in the POS direction. Move
		6 steps in the NEG direction. Where are you now?
		<b>b</b> Start at 8. Move 12 steps in the NEG direction. Move 5 steps in the POS direction. Move 7
		steps in the NEG direction. Where are you now?

- **c** Start at -5. Move 6 steps in the POS direction. Move 4 steps in the NEG direction. Move 7 steps in the POS direction. Where are you now?
- **d** Start at 3. Move 5 steps in the POS direction. Move 8 steps in the NEG direction. Move 2 steps in the NEG direction. Where are you now?
- e Start at −1. Move 10 steps in the NEG direction. Move 4 steps in the POS direction. Move 5 steps in the NEG direction. Where are you now?



#### Summary

When adding integers on a number line:

- adding a positive integer means moving to the right
- adding a **negative** integer is the same as **subtracting its opposite**, so it means moving to the left: 2 + (-5) = 2 5

#### **Exercise 1-04** Adding integers

See Example 2

- **1** Simplify each sum. **a** -6 + 10**b** 8 + (-3)**c** 4 + (-5)**d** 3 + (-1)f -1 + 5**e** -2+2g -7 + 4**h** -2 + (-2)i -8 + (-12)i 8 + (-12)**k** -11 + 3 $1 \quad 10 + (-10)$ m 7 + (-9)n -13 + 11**o** -16 + 5**p** -7 + 132 What is the correct answer for -2 + 7? Select A, B, C or D. A 9 **B** −9 **C** 5 **D** -5
- 3 a Is the answer to -5 + 9 the same as the answer to 9 + (-5)?

**b** Can integers be added in any order? Give an example to support your answer.

4 Evaluate each expression.

Evaluate means 'Find the value of'.
Here it means 'to work out the answer'.

- 5 What happens when you add an integer and its opposite?
- **6** For each of the following sums, state whether it is always positive (+), always negative (-), or could be either positive or negative (E).
  - **a** The sum of two positive integers
  - **b** The sum of two negative integers
  - **c** The sum of a positive integer and a negative integer
- 7 Copy and fill in the blank for each equation.

a	$7 + \ = 3$	<b>b</b> $-3 + \_\_= 4$	<b>c</b> $-3 + \= -6$
d	+(-8) = -1	<b>e</b> + 5 = 2	<b>f</b> + (-5) = 2

8 Copy and fill in the blanks for each equation, where at least one of the numbers must be negative.

**a** \_\_\_\_ + \_\_\_ = 7 **b** \_\_\_\_ + \_\_\_ = -6 **c** \_\_\_\_ + \_\_\_ = 0 **d** \_\_\_\_ + \_\_\_ = 1 **e** \_\_\_\_ + \_\_\_ = -4 **f** \_\_\_\_ + \_\_\_ = -9

9 Copy and fill in the blanks for each equation.

### Mental skills 1A Maths without calculators

### Adding 8 or 9

A quick way to mentally add 9 or 8 to a number is to add 10 and count back 1 or 2 respectively.

1 Study each example.

2

<b>a</b> $17 + 9 = 17 + 9$	+10 - 1	<b>b</b> 44 + 8 =	= 44 + 10 - 2	
= 27 -	- 1	=	= 54 - 2	
= 26		=	= 52	
Count: '17, 27	7, 26'	Count: '4	44, 54, 52'	
<b>c</b> $128 + 19 = 1$	28 + 20 - 1	<b>d</b> $256 + 38 = 256 + 40 - 2$		
= 1	48 - 1		= 296 - 2	
= 1	47		= 294	
Count: '128, 1	148, 147'	Count: '256, 296, 294'		
Now simplify eac	ch sum by counting.			
<b>a</b> 146 + 9	<b>b</b> 212 + 9	<b>c</b> 308 + 9	<b>d</b> 1755 + 9	
<b>e</b> 29 + 19	<b>f</b> 687 + 39	<b>g</b> 254 + 29	<b>h</b> 933 + 19	
<b>i</b> 714 + 8	<b>j</b> 623 + 8	<b>k</b> 207 + 8	<b>1</b> 155 + 8	
<b>m</b> 386 + 8	<b>n</b> 418 + 48	<b>o</b> 909 + 28	<b>p</b> 277 + 18	



### 1-05 Subtracting integers

Integers can also be subtracted using a number line.

#### Example



MAT07NAAE00003



Adding and subtracting integers
MAT07NAWK10003





MAT07NASS10004





MAT07NAHS10006







*Note:* (-3 - (-1)) is read as 'negative 3 minus negative 1', not 'minus 3 minus minus 1'.

#### Summary

When subtracting integers on a number line:

- subtracting a **positive** integer means moving to the left
- subtracting a **negative** integer is the same as **adding its opposite**, so it means moving to the right: 4 (-3) = 4 + 3

### Exercise 1-05 Subtracting integers

1	1 Simplify each difference.					
	<b>a</b> $4-2$	<b>b</b> $2-4$	<b>c</b> $3 - 13$	d $5 - (-1)$	Extra questions	
	e 7 - (-6) i -6 - 3	f = -3 - (-2) j = -4 - (-5)	g = -3 - (-3) k 2 - 9	n -3 - 3 1 - 3 - 3 1 - 3 - 3 1 - 4 - (-2)	Integers on the number line	
2	m -6 - (-1) What is the correct	n 12 – 18 t answer for 7 – 12? Sele	<b>o</b> $9 - (-3)$ ect <b>A</b> , <b>B</b> , <b>C</b> or <b>D</b> .	p -2 - /	MAT07NAEQ00012	
	<b>A</b> 19	<b>B</b> -5	<b>C</b> –19	<b>D</b> 5		

- 3 a Is the answer to 10 4 the same as the answer to 4 10?
  - **b** Is -5 9 the same as 9 (-5)?
  - c Can integers be subtracted in any order?

4 Evaluate each expression.

a	20 - 9	b	9 - 20	c	20 - (-9)	d	-9 - 20
e	-4 - 27	f	-4 - (-27)	g	13 - (-3)	h	-13 - (-3)
i	0 - 50	j	0 - (-50)	k	17 – (–25)	1	-17 - 25
m	16 - 8 - 20	n	-4 - (-10) - 1				

Worked solutions

Exercise 1-05

5

6

- MAT07NAWS10001
- What happens when you subtract an integer from its opposite?

For each of the following differences, state whether it is always positive (+), always negative (-), or could be either positive or negative (E).

- **a** A larger integer minus a smaller integer
- **b** A smaller integer minus a larger integer
- c A positive integer minus a positive integer
- d A positive integer minus a negative integer
- e A negative integer minus a negative integer
- 7 The difference between 1 and -3 is also how much 1 is more than -3 on the number line.



- **a** Find the difference between 1 and -3.
- **b** Evaluate 1 (-3).
- **c** Find the difference between 4 and 1.
- **d** Evaluate 4 1.
- **e** Find the difference between -1 and -2.
- **f** Evaluate -1 (-2).
- **g** Find the difference between -1 and 3.
- **h** Evaluate -1 3.
- i Find the difference between -4 and -2.
- j Evaluate -4 (-2).
- 8 Copy and complete the blank for each equation.
  - **a**  $4 \_ = -3$  **b**  $-1 \_ = -4$  **c**  $-2 \_ = -10$ **d**  $\_ -(-1) = 9$  **e**  $\_ -6 = -5$  **f**  $\_ -(-4) = -2$
- 9 Copy and complete the blanks for each equation, where at least one of the numbers must be negative.
  - **a** \_\_\_\_ = 3 **b** \_\_\_\_ = -2 **c** \_\_\_\_ = 0 **d** \_\_\_\_ = -5 **e** \_\_\_\_ = 6 **f** \_\_\_\_ = -11

#### **Investigation: Multiplying integers**

- 1 Copy and complete each pattern.
  - **a** 9, 6, 3, 0, -3, \_\_\_, \_\_\_, \_\_\_,
  - **b** 4, 2, 0, <u>\_\_\_</u>, <u>\_\_\_</u>, <u>\_\_\_</u>
- 2 Copy and complete each multiplication.
  - **a**  $3 \times (-7) = (-7) + (-7) + (-7) = \_$
  - **b**  $2 \times (-5) = (-5) + (-5) =$ \_\_\_\_
  - **c**  $3 \times (-4) = (-4) + (-4) + (-4) = \_$
  - **d**  $4 \times (-2) = (-2) + (-2) + (-2) + (-2) = \_$
  - **e**  $2 \times (-6) =$  \_\_\_\_\_
  - $\mathbf{f} \quad \mathbf{3} \times (-\mathbf{3}) = \underline{\qquad}$
- **3** a In pairs or as a group activity, copy the multiplication grid below onto a large piece of paper and complete the shaded section.

$\bigotimes$	5	4	3	2	1	0	-1	-2	-3	-4	-5
5											
4											
3											
2											
1											
0											
-1											
-2											
-3											
-4											
-5											

- **b** Continue the pattern for the first row: 25, 20, 15, 10, 5, 0, -5, ...
- **c** Continue the pattern for the second row: 20, 16, 12, 8, 4, 0, -4, ...
- **d** Complete the next four rows.
- e Continue the pattern for each column.
- 4 Use your completed table to simplify each product.

<b>a</b> $4 \times (-3)$	<b>b</b> $-3 \times 5$	<b>c</b> $-4 \times (-2)$	<b>d</b> $5 \times (-1)$
<b>e</b> $0 \times (-4)$	f $-3 \times 3$	<b>g</b> $2 \times (-4)$	<b>h</b> $-5 \times (-5)$

**5** How do the signs (positive or negative) of the integers in the question affect the sign of the product (answer)? Try to put the rules for multiplying integers into words and write them down.

#### YEAR 8

### 1-06 Multiplying integers

#### Summary

#### When **multiplying integers**:

- positive × positive = positive
- positive × negative = negative
- negative × positive = negative
- negative × negative = positive

or

- If both numbers have the same sign, the answer is positive.
- If both numbers have **different** signs, the answer is **negative**.



### Exercise 1-06 Multiplying integers

See Example 4

#### **e 4 1** Simplify each product.

$a -3 \times 6$	<b>b</b> $6 \times (-4)$	<b>c</b> $-3 \times (-7)$	<b>d</b> $4 \times (-8)$
<b>e</b> $-7 \times (-9)$	$f -9 \times 5$	$\mathbf{g}$ 7 × 6	<b>h</b> $-7 \times (-6)$
$3 \times (-8)$	$j - 6 \times 1$	$\mathbf{k}$ $-1 \times (-1)$	$1 - 9 \times 6$
m 5 × $(-2)$	$n -7 \times 6$	<b>o</b> $-11 \times (-4)$	$\mathbf{p} - 9 \times 9$
q $-12 \times (-5)$	<b>r</b> $20 \times (-3)$	<b>s</b> $-10 \times (-10)$	t $-7 \times (-8)$

NEW CENTURY MATHS for the Australian Curriculum

Worked solutions

Exercise 1-06

MAT07NAWS10002

- For each expression, select the correct answer A, B, C or D.
   a 8 × (-5)
- **3** Copy and complete each multiplication grid.



- **4 a** Is the answer to  $6 \times (-4)$  the same as the answer to  $(-4) \times 6$ ?
  - **b** Can integers be multiplied in any order?
- 5 What happens when you multiply an integer by its opposite? 6 Evaluate: a  $3^2$  b  $(-3)^2$  c  $7^2$  d  $(-7)^2$ e  $5^2$  f  $(-5)^2$  g  $1^2$  h  $(-1)^2$ Worked solutions Exercise 1-06 MATO7NAWS10002
- 7 For each of the following products, state whether it is always positive (+), always negative (-), or could be either positive or negative (E).
  - **a** The product of two positive integers
  - **b** The product of two negative integers
  - c The product of a positive integer and a negative integer
  - **d** A positive integer squared
  - e A negative integer squared
- 8 Copy and complete the blank for each equation.

a	$2 \times \_\_ = -10$	<b>b</b> $-4 \times \_\_ = 16$	<b>c</b> $9 \times \_\_ = -27$
d	(-5) = 35	<b>e</b> × 8 = $-40$	<b>f</b> × (-11) = 22

**9** Copy and complete the blanks for each equation, where at least one of the numbers must be negative.

### Technology Daily temperatures in Thredbo

This spreadsheet shows the minimum and maximum daily temperatures for Thredbo for the last two weeks in July 2010.

1 Enter the data into a spreadsheet.

	А	В	С	
		Min Temp	Max Temp	
1	Date	(deg C)	(degC)	
2	Sun 18	-5	4.8	
3	Mon 19	0	4	
4	Tue 20	-8.5	5	
5	Wed 21	-9.5	5.3	
6	Thu 22	-5	4.9	
7	Fri 23	-1.2	7	
8	Sat 24	-4.5	8	
9	Sun 25	-4	6.8	
10	Mon 26	-6.4	7	
11	Tue 27	-8	8.5	
12	Wed 28	-6	7.5	
13	Thu 29	-3.5	7.4	
14	Fri 30	1.6	8.5	
15	Sat 31	3	6	



	А	В	С	D	
		Min Temp	Max Temp		
1	Date	(deg C)	( deg C)	Difference	
2	Sun 18	-5	4.8	9.8	
3	Mon 19	0	4		
4	Tue 20	-8.5	5		
5	Wed 21	-9.5	5.3		
6	Thu 22	-5	4.9		
7	Fri 23	-1.2	7		
8	Sat 24	-4.5	8		
9	Sun 25	-4	6.8		
10	Mon 26	-6.4	7		
11	Tue 27	-8	8.5		
12	Wed 28	-6	7.5		
13	Thu 29	-3.5	7.4		
14	Fri 30	1.6	8.5		
15	Sat 31	3	6		
16					

2 In cell D1, enter the label 'Difference'. To find the difference between the maximum and minimum temperatures for Sunday 18, enter the formula =C2-B2 in cell D2.

- 3 To copy D2's formula into cells D3 to D15, click on D2 and position the cursor over the bottom right-hand corner of this cell so that it becomes a '+' sign. Drag down to cell D15 to highlight cells D3 to D15, as shown on the right. This is called Fill Down and you should notice that the temperature differences for each day have been calculated. Fill Down can also be selected by highlighting cells D2 to D15 and either selecting Fill Down from the Editing toolbar in the Home menu or by pressing Ctrl-D.
- **4 a** On which day was the largest difference between the maximum and minimum temperatures recorded? Enter your answer in cell E1.
  - **b** On which day was the smallest difference recorded? Enter your answer in cell E2.
- **5** Enter the following labels: 'Lowest Minimum' in cell A17, 'Highest Minimum' in cell A18, 'Lowest Maximum' in D17, 'Highest Maximum' in D18, 'Difference' in A19.
- 6 a To find the lowest minimum, in cell B17 enter the formula =min(B2:B15), which finds the lowest number from cells B2 to B15.
  - **b** To find the highest minimum, in cell B18 enter =max(B2:B15).
  - **c** Now, enter appropriate formulas into cells C17 and C18 for the lowest and highest maximums.
  - d What do you notice about the value in cell B17, compared to the other three values?
- 7 In cell B19 enter =B18-B17 for the difference between the highest and lowest minimums. From cell B19, use Fill Right to copy this formula into cell C19. Alternatively, you can highlight cells B19 and C19 and either select Fill Right from the Editing toolbar in the Home menu or press Ctrl-R.
- **8** a Which column (B or C) had the greatest difference in temperature? Enter your answer in cell E3.
  - **b** In cell E4, enter a formula to find the difference between the lowest minimum temperature and the highest maximum temperature.

#### **Investigation: Dividing integers**

1 In pairs or as a group activity, copy and complete each question.

**a**  $5 \times \_\_ = -20$ 

**b**  $-6 \times = 12$ 

**c**  $-3 \times = 27$ **f** \_\_\_\_ × -5 = 15

2 Write down the rules for dividing integers in words.

#### YEAR 8

### 1-07 Dividing integers

MAT07NAWK10005

MAT07NAWK10006

MAT07NASS10003

Because division is the opposite of multiplication, the rules for dividing integers are the same as those for multiplying them.

#### Summary

#### When **dividing integers**:

- positive  $\div$  positive = positive
- positive  $\div$  negative = negative
- negative  $\div$  positive = negative •
- negative  $\div$  negative = positive
- If both numbers have the **same** sign, the answer is **positive**.
- If both numbers have **different** signs, the answer is **negative**. .

#### 5 Example

or

Simplify each quotient:

**a** −15 ÷ 3 **c**  $-24 \div (-4)$ 

### Solution

- **a**  $-15 \div 3 = -5$
- **b**  $18 \div (-2) = -9$
- **c**  $-24 \div (-4) = 6$
- **d**  $\frac{14}{-7} = 14 \div (-7) = -2$
- **b** 18 ÷ (−2) *◄* A quotient is the answer to a d  $\frac{14}{-7}$ division
  - negative  $\div$  positive = negative positive  $\div$  negative = negative negative  $\div$  negative = positive
  - positive  $\div$  negative = negative

#### **Exercise 1-07** Dividing integers

1 Simplify each quotient.

	<b>a</b> 20 ÷ (−5)	<b>b</b> $-8 \div 4$	<b>c</b> $-12 \div (-3)$	<b>d</b> $6 \div (-2)$
	<b>e</b> 27 ÷ (−3)	<b>f</b> $-18 \div (-6)$	<b>g</b> $24 \div (-8)$	<b>h</b> $40 \div (-4)$
	i $-20 \div 5$	<b>j</b> $-21 \div (-3)$	<b>k</b> $45 \div (-5)$	$1 - 36 \div 6$
	$m -45 \div (-5)$	$\mathbf{n}$ -16 ÷ 2	<b>o</b> 28 ÷ (−7)	<b>p</b> $48 \div (-8)$
2	For each expression, se	elect the correct answer A, I	<b>B</b> , <b>C</b> or <b>D</b> .	
	<b>a</b> −48 ÷ (−2)			
	<b>A</b> 24	<b>B</b> −24	<b>C</b> 46	<b>D</b> -46
	h <u>16</u>			
	-4 <b>A</b> 12	<b>B</b> -4	<b>C</b> 4	<b>D</b> –12
	11 12			
3	Simplify:			
	<b>a</b> $\frac{12}{-2}$	<b>b</b> $\frac{100}{-50}$	c $\frac{-18}{-3}$	d $\frac{-32}{-2}$
	e $\frac{-42}{4}$	f $\frac{45}{5}$	$g \frac{100}{5}$	h $\frac{-81}{2}$
	6	$-\overline{2}$	5	_9

4 Divide the top row by the left-hand column to complete each division grid.



- 5 What happens when you divide an integer by its opposite?
- **6** For the statements below, are the results always positive (+), always negative (-), or could they be either (E)?
  - **a** The quotient of two positive integers
  - **b** The quotient of two negative integers
  - c The quotient of a positive integer and a negative integer
- 7 Copy and fill in the blank for each equation.

a 
$$16 \div \_ = -2$$
 b  $-24 \div \_ = -8$ 
 c  $35 \div \_ = -5$ 

 d  $\_ \div (-11) = 4$ 
 e  $\_ \div 5 = -10$ 
 f  $\_ \div (-8) = 4$ 

8 Copy and fill in the blanks for each equation, where at least one of the numbers must be negative.

<b>a</b> ÷ = 10	<b>b</b> $\div$ = -4	$\mathbf{c} = 5$
d $\div$ = -8	$\mathbf{e}  \underline{\qquad} \div \underline{\qquad} = 6$	f $\div$ = -3

See Example 5

#### YEAR 8

### 1-08 Order of operations

Now that you can add, subtract, multiply and divide with integers, you can evaluate mixed expressions involving integers. Remember to follow the 'order of operations' rules.

#### Summary

Skillsheet

- Order of operations
- MAT07NASS10005
- To evaluate mixed expressions, the order of operations is:
- 1 Simplify any expression inside grouping symbols (brackets)
- 2~ Simplify any multiplication  $(\times)$  and division  $(\div),$  from left to right
- 3 Simplify any addition (+) and subtraction (-), from left to right

TLF learning object
Exploring order of
operations (1 6543)

#### Example 6

Evaluate each expression. **a**  $3 \times (-4 - 6)$ 

#### Solution

**a** 
$$3 \times (-4 - 6) = 3 \times (-10)$$
  
= -30  
**b**  $8 + (-7) \times 4 - (-2) = 8 + (-28) - (-2)$   
= -20 - (-2)  
= -18

**b**  $8 + (-7) \times 4 - (-2)$ 

brackets first: -4 - 6 = -10

multiplication first:  $(-7) \times 4 = -28$ left to right: 8 + (-28) = -20-20 - (-2) = -20 + 2

### **Exercise 1-08** Order of operations

Extra questions 1 Operating with integers MAT07NAEQ00013	Evaluate each expression. <b>a</b> $9 - 12 + 10$ <b>d</b> $1 - 6 + 7 - 9$ <b>g</b> $5 \times (-10) \div 2$ <b>j</b> $-3 \div (-1) \times 4$ <b>m</b> $-100 \div (-20) \times 3$	<b>b</b> $-13 - 10 - (-1)$ <b>e</b> $6 + (-3) - 9$ <b>h</b> $6 \times (-4) \div (-3)$ <b>k</b> $24 \div (-6) \times 50$ <b>n</b> $-5 \times (-9) \div 9$	c $4-6+2+(-1)$ f $7-5-(-4)+(-2)$ i $7 \times 6 \div (-2)$ l $-56 \div (-8) \times 4$ o $2 \times 12 \div (-4) \div (-2)$
See Example 6 2	What is the value of $6 + 4$ A 14 B	(-2)? Select <b>A</b> , <b>B</b> , <b>C</b> or <b>D</b> . (-20) <b>C</b> $-2$	<b>D</b> –14
Worked solutions Exercise 1-08 MAT07NAWS10003	Evaluate each expression. <b>a</b> $-5 \times 2 + 3$ <b>d</b> $12 - 8 \div 4$ <b>g</b> $21 \div (-7) + 8$ <b>j</b> $-3 \div 3 + 9$	<b>b</b> $-5 \times (2+3)$ <b>e</b> $12 - 8 \div (-4)$ <b>h</b> $[-6 - (-2)] \times (-4)$ <b>k</b> $12 \times (6-7) + 1$	c $3 \times 6 \times (-2)$ f $-3 \times (9 - 10)$ i $(-6 - 2) \div (-4)$ l $-4 \times 7 \div (-7 - 7)$

4 Copy and fill in the blank for each equation.

a	$-5 \times 6 - \_ = -38$	<b>b</b> × (6 - 8) = -10	<b>c</b> $[8 - \_] \times 4 = 44$
d	$5 + \_\_ \times (-7) = 19$	<b>e</b> $8 - (-3 \times \_) = 17$	<b>f</b> × $(-5+3) = -24$
g	$6 \times \_\_+ (-4) = -16$	<b>h</b> $15 \div (-3) \times \_\_ = 10$	i + 4 × 6 = 5
j	$[-6 - \_] \times (-2) = -6$	<b>k</b> $(-6-3) \div \_\_= -3$	1 $\div$ (-5) + 6 = 1

5 Nuraan completed these 10 questions. Mark her work and correct any mistakes.

<b>a</b> $6 - 9 + 5 - 11 = -9$	<b>b</b> $-32 \div (-4) \times (-2) = 4$
<b>c</b> $-6 \times (-2) - 8 = -4$	<b>d</b> $-11 + 11 \div (-1) = -22$
<b>e</b> $24 \div (-4) \div (-2) = 3$	<b>f</b> $(-2+6) \times 2 = -8$
<b>g</b> $-7 - 6 + 10 = 3$	<b>h</b> $(-12 - 3) \div (-3) = 3$
i $12 - 3 \times 5 = 45$	$j  2 - 9 \times (-3) - (-18) = 39$

#### 6 Copy each equation and insert grouping symbols to make it true.

- a  $-4 \times 7 2 + (-3) = -8$ b  $-4 \times 7 2 + (-3) = -27$ c  $-4 \times 7 2 + (-3) = -33$ d  $40 \div 10 \times (-2) + 15 = 13$ e  $40 \div 10 \times (-2) + 15 = 52$ f  $40 \div 10 \times (-2) + 15 = -8$
- 7 Use all the integers 4, -8 and 3 and grouping symbols to complete each equation.

**a** \_\_\_\_\_ = -20 **b** \_\_\_\_\_ = 15 **c** \_\_\_\_\_ = 8

#### Mental skills 1B Maths without calculators

#### Subtracting 8 or 9

A quick way to mentally subtract 9 or 8 from a number is to subtract 10 and count forward 1 or 2 respectively.

1 Study each example.

a	66 - 9 = 66 - 10 + 1	Ь	83 - 8 = 83 - 10 + 2
	= 56 + 1		= 73 + 2
	= 57		= 75
	Count: '66, 56, 57'		Count: '83, 73, 75'
c	72 - 49 = 72 - 50 + 1	d	141 - 28 = 141 - 30 + 2
	= 22 + 1		= 111 + 2
	= 23		= 113
	Count: '72, 22, 23'		Count: '141, 111, 113'

2 Now simplify each difference by counting.

<b>a</b> 26 - 9	<b>b</b> 44 - 9	<b>c</b> 123 – 9	<b>d</b> 270 – 9
<b>e</b> 161 − 29	<b>f</b> 187 - 59	<b>g</b> 75 - 19	<b>h</b> 457 – 39
i 82 – 8	<b>j</b> 131 – 8	<b>k</b> 96 – 8	<b>1</b> 120 - 8
<b>m</b> 44 - 8	<b>n</b> 577 – 28	<b>o</b> 203 - 18	<b>p</b> 365 - 48

#### **YEAR 8**

### -09 Integers and the calculator

Negative numbers can be entered into a calculator using the sign change key (-) or +/-. For example, to enter (-3), type (-) 3 or +/- 3.

#### Example

Use your calculator to evaluate:

a	$798 \div (-7) + 135$	<b>b</b> $23 \times [10 - (-6)]$	<b>c</b> $(-18)^2$
~	1.11		

#### Solution

a	$798 \div (-7) + 135 = 21$	On a calculator, enter 798 ÷ (–) 7 + 135 =
b	$23 \times [10 - (-6)] = 368$	On a calculator, enter 23 $\times$ () 10 $-$ (-)
с	$(-18)^2 = 324$	On a calculator, enter ( ( (–) $18$ ) $x^2$ =

There are more examples in Appendix 1: Calculator Skills on page 519.

#### **Exercise 1-09** Integers and the calculator

Evaluate each expression **without** using a calculator. 1

a	6 - 13	<b>b</b> 4 – (–2)	<b>c</b> −7 + 3	<b>d</b> -5 - (-6)
e	3 + (-8)	<b>f</b> $11 - (-3)$	<b>g</b> 11 - (-15)	<b>h</b> $-13 + (-15)$
i	12 - (-18)	$j - 8 \times 6$	$\mathbf{k}$ -11 × (-4)	$1 -5 \times (-6)$
m	$13 \times (-5)$	<b>n</b> 88 $\div$ (-11)	<b>o</b> $-30 \div (-2)$	<b>p</b> −36 ÷ 9
q	$(-5)^2$	<b>r</b> $(-8)^2$	<b>s</b> $-3 \times (-4)^2$	t $18 \div (-3)^2$

#### See Example 7

Check your answers to question 1 using a calculator. 2

- When using your calculator, why are there different answers for  $(-5)^2$  and  $-5^2$ ? Explain the 3 difference in meaning between  $(-5)^2$  and  $-5^2$ .
- 4 Use a calculator to evaluate each expression.

a	13 + (-22) - 9	<b>b</b> 64 +	+23 + (-16)	c	$-200 \div (-100) \div 2$
d	$-40 \times (-3) \div (-20)$	<b>e</b> −44	$\times$ (-15) $\times$ (-6)	f	$48 \div 3 \times (-12)$
g	$125 \div (-5) \div (-5)$	<b>h</b> [12	$-(-10)] \times (-3) + 6$	i	$-3 \times (-8) \div (-4) + (-11)$
j	$9 - 19 - 8 \times (-6)$	<b>k</b> −12	$(-30 \div (-2) + 58)$	1	$6 + 4 \times (-5) \div (-2)$

#### Copy and fill in the blank for each equation. 5

<b>a</b> $6 \times (\27) = -84$	<b>b</b> 8 - (-14) = -4	<b>c</b> $45 \div (-9) \times \= -10$
<b>d</b> $-2 \times \_\_ + 11 = -19$	<b>e</b> × (-4) ÷ 2 = 112	<b>f</b> $-14 - 6 \times \= 34$

6 Use all the integers 75, -18 and -15 and grouping symbols to complete each equation.

**a** \_\_\_\_\_ = -1395 **b** \_\_\_\_\_ = -13c = -855

## Technology Sorting numbers

In this activity, we will sort this set of numbers {60, 107, 85, 6, 28, 45, 265} by using a spreadsheet. **1** a Enter the set of numbers {60, 107, 85, 6, 28, 45, 265}, in the given order, into column A of a spreadsheet.



**b** Highlight cells A1 to A7 and select **Sort & Filter** from the Editing menu on the top righthand side. Choose the option shown for ascending order: **Smallest to Largest**.



- **c** The data should now be sorted from the smallest number, 6 (in cell A1), to the largest number, 265 (in cell A7).
- d A set of numbers can also be sorted in descending order: choose Largest to Smallest.
- **2** Now enter each of the following sets of numbers in the columns given, and sort in ascending order.
  - **a** {55, 89, 36, 21, 19, 4, 95} in column B
  - **b** {-17, 14, -90, 58, 0, 392, -6} in column C
  - c  $\{4987, -4200, 8740, -5176, 2601, 713, -4810\}$  in column D
  - $\boldsymbol{d}~$  {16 101, 12 167, 10 010, 11 412, 10 107, 10 761, 11 214} in column E
- 3 Sort each column of data from question 2 in descending order.

Puzzle sheet

MAT07NAPS10004

### 10 Integer problems

#### Example

The average temperature on the planet Mars is -63 °C while the average temperature on Jupiter is -150 °C. What is the difference between these temperatures?

#### Solution

Write a number sentence to calculate the answer.

$$-63 - (-150) = -63 + 150$$
$$= 87$$

8

The difference in temperature is 87°C.

#### **Exercise 1-10** Integer problems

See Example 8

**Ie 8** For each question, write a number sentence to calculate the answer.

- 1 In Bathurst, the temperature reached a maximum of 11°C. Overnight, it dropped to a minimum of -2°C. How many degrees did it drop?
- **2** Craig walked 16 kilometres east and then 20 kilometres west. How far is he from his starting point?
- 3 The heights above and below sea level of some places around the world are given below.

The Dead Sea (Jordan)	-397 metres
Death Valley (USA)	-86 metres
Mt Kosciuszko (Australia)	2230 metres
Mt Everest (Nepal)	8840 metres

- a How much higher is Mt Everest than Mt Kosciuszko?
- **b** How much higher is Mt Kosciuszko than Death Valley?
- c How much lower is the Dead Sea than Death Valley?
- **d** The highest point on Earth is Mt Everest and the lowest point is the Dead Sea. What is the difference in height between these two points?

4 The graph below shows the profit made by the company Moneta over 6 years.

- a In which years did Moneta make a profit?
- **b** In which years did Moneta make a loss?
- **c** What was the decrease in profit between 2010 and 2011?
- **d** Did the company make an overall profit or loss over the six years shown? How much profit or loss did they make?



- **5** Anya left home and walked 3 kilometres south to Brock's home. Together, they then walked north for 4 kilometres. What distance and direction are they from Anya's home now?
- **6** Karina had \$74 in her bank account yesterday but was allowed to withdraw \$121. Today, she deposited \$40 into the account. What is her account balance now?
- 7 In Hicksville, the temperature overnight dropped to −6°C. During the day it rose by 13°C but then dropped 5°C after sunset. Which of the following expressions describes the temperature after sunset? Select A, B, C or D.

 $A - 6 + 13 - 5 \qquad B - 6 - 13 - 5 \qquad C - 6 + 13 + 5 \qquad D - 5 - 13 - 6$ 

- 8 In indoor cricket, each time a batting player gets out, the team's score is reduced by 5 (that is, -5 is added to the total). Liam's cricket team is midway through a match. The first 5 batters have each scored 23, 16, 19, 0 and 16 before getting out. Liam is still batting and has scored 10 so far. What is the current score for Liam's team?
- **9** Mt Etna is an active volcano in Italy, 3200 m high. The lava starts 652 m below the Earth's surface and shoots to a height of 750 m above the top of Mt Etna. How far does the lava travel?



- **10** A bird dives into a river from a height of 680 cm above the water, travelling at a speed of 120 cm per second. How far below the water will it be after 8 seconds?
- **11** The submarine Nemesis descends from the surface to a depth of 955 metres to inspect a shipwreck. It then ascends 800 metres to send a message. How far below the surface is it when it sends the message?
- 12 Find the closing balance of this bank account after all deposits and withdrawals.

Starting balance	\$ 37.85
Deposit	\$ 18.20
Deposit	\$120.00
Withdraw	\$ 45.00
Deposit	\$ 8.15
Withdraw	\$248.20
Closing balance	

13 A scuba diver was swimming at a depth of 18 metres. Her diving friend was at a depth of 7 metres. What was the vertical distance between them? Worked solutions Exercise 1-10 MAT07NAWS10004

#### Worked solutions Exercise 1-10

- 14 Jayden's bank balance is -\$120 but he deposits \$9 each day for the next 20 days.
  - a On which day will his bank balance become positive?
- MAT07NAWS10004
- **b** What will be his bank balance after 20 days?

#### Investigation: Above and below sea level

- 1 What is sea level?
- 2 Where is the highest point in Australia? What is its height above sea level?
- 3 Where is the lowest point in Australia? What is its height below sea level?
- 4 What is the difference in height between the highest and lowest points in Australia? Is it more than a kilometre?
- 5 What is the height of your town or city above sea level?
- 6 Find five places in the world that are above sea level and five that are below sea level. Write four questions about this information for other students to answer. Swap your work with other students and answer their questions. Note: you must know the answers to your questions so you can mark other students' work!

#### **Power plus**

- 1 Copy and complete each pattern.
  - **a**  $(-1)^2 = (-1) \times (-1) = \_$
  - **b**  $(-1)^3 = (-1) \times (-1) \times (-1) =$
  - **c**  $(-1)^4 = (-1) \times (-1) \times (-1) \times (-1) = \_$
  - **d**  $(-1)^5 = \_\_\_\_$
  - **e**  $(-1)^6 =$  \_\_\_\_\_
  - **f**  $(-1)^7 =$  \_\_\_\_\_ = \_\_\_\_
- 2 Explain how  $(-1)^n$ , where *n* is a whole number, is equal to only one of two possible numbers and which one it is depends on the type of number *n* is.
- 3 Find the number (or numbers) which make each of these expressions true.
  - **a**  $\_\_^2 = 16$  **b**  $\_\_^2 = 100$  **c**  $\_\_^3 = -8$
- 4 Dylan says there is no answer to  $2^2 = -25$ . Is he correct?
- 5 a Find three integers that have a sum of -7.
  - **b** Find two negative integers that have a sum of -1.
  - c Find three integers that have a product of 36.
  - **d** Find three integers that have a product of -24.
- 6 Find the average of:
  - **a** -8 and 12 **b** -1 and -17 **c** 21 and -19

- 7 If *a* and *b* are integers, determine whether the following equations are true or false.
  - **a** a+b=b+a**b** a - b = b - a**d**  $a \div b = b \div a$ **e** a + (-a) = 0**h**  $a \div (-a) = -1$
- **c**  $a \times b = b \times a$ **f**  $(-a) \times (-a) = a \times a$ i  $(-a) + (-a) = -2 \times a$

Find two integers that: 8

**g** a - (-a) = 0

- **a** have a sum of -3 and a product of -10
- **b** have a sum of -8 and a product of 15
- **c** have a sum of -2 and a product of -8
- **d** have a sum of -1 and a product of -6
- **e** have a sum of 7 and a product of -30

### Chapter 1 review

I	Language of maths			
Puzzle sheet	ascending	evaluate	number line	quotient
Integers find-a-word	Celsius	greater than (>)	opposite	sign
MAT07NAPS10005	degrees (°)	integer	order	sum
	deposit	less than (<)	order of operations	whole number
	descending	minus	positive	withdraw
	difference	negative	product	zero

- 1 What is the opposite of 'deposit'?
- 2 What number is neither positive nor negative?

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- 3 Write sentences using the words 'ascending' and 'descending' to show their meanings.
- 4 Write '-5 < -1' in words.
- 5 What is the order of operations?
- 6 What is the difference between -4 ('negative 4') and -4 ('minus 4')?

#### Topic overview

#### Worksheet Mind map: Integers MAT07NAWK10007

- Write in your own words what integers are.
- Write any rules you have learnt about integers.
- What parts of this topic did you find difficult?
- What parts didn't you understand? Discuss them with a friend or your teacher.
- Give some examples of where negative numbers are used.

Print (or copy) and complete this mind map of the topic, adding detail to its branches and using pictures, symbols and colour where needed. Ask your teacher to check your work.



### Chapter 1 revision

1	Write the opposite of each interaction $\mathbf{a} - 2$ $\mathbf{b} - 23$	eger. <b>c</b> 56 <b>d</b> −10 <b>e</b>	8 <b>f</b> 0	See Exercise 1-01
2	Use a separate number line to <b>a</b> 6, -3, 5, 1, -1, 4, 7 <b>b</b> integers between -2 and 5 <b>c</b> integers less than 1 and great	mark each of the following sets ater than -6	of numbers.	See Exercise 1-02
3	Write true (T) or false (F) for $a = -4 > 2$ $b = -2 < -4$ $a = -4 > 2$ $b = -2 < -4$ $a = -11 < -10$ $f = -3 > -4$ $i = 5 < -4$ $j = -16 < 6$	each statement. -3 c -1 > 1 -4 g -8 < 11 0 k 1 > -5	d $2 > -1$ h $-4 > -3$ l $-9 > -2$	See Exercise 1-03
4	Write this set of integers in des -9, 14, 3, 0, -5, -10, -1.	scending order:		See Exercise 1-03
5	Evaluate each expression. <b>a</b> $3 + (-4)$ <b>d</b> $-4 + 8$ <b>g</b> $-5 + (-4) + (-2)$	<b>b</b> $-8 + (-2)$ <b>e</b> $-5 + (-5)$ <b>h</b> $-8 + 5 + 4$	<b>c</b> $10 + (-13)$ <b>f</b> $-3 + 6$ <b>i</b> $-7 + 6 + (-7)$	See Exercise 1-04
6	Evaluate each expression. <b>a</b> $3 - (-4)$ <b>d</b> $-4 - 8$ <b>g</b> $-8 + 5 - 4$	<b>b</b> $-5 - (-9)$ <b>e</b> $-5 - (-5)$ <b>h</b> $8 - 6 - (-4)$	c $7 - 11$ f $-3 - 4 - 5$ i $3 - 8 + (-6)$	See Exercise 1-05
7	Evaluate each product. <b>a</b> $6 \times (-3)$ <b>d</b> $-11 \times 4$ <b>g</b> $-6 \times (-4) \times (-1)$	<b>b</b> $-8 \times (-6)$ <b>e</b> $7 \times (-9)$ <b>h</b> $-2 \times 3 \times 7$	c $-2 \times 5$ f $6 \times 8$ i $-4 \times 2 \times (-5)$	See Exercise 1-06
8	Evaluate each quotient. <b>a</b> $-12 \div (-4)$ <b>d</b> $16 \div (-4)$ <b>g</b> $24 \div (-6) \div (-2)$	<b>b</b> $15 \div (-5)$ <b>e</b> $-24 \div 12$ <b>h</b> $-36 \div 3 \div 4$	c $-6 \div (-6)$ f $-1000 \div 10$ i $-64 \div (-4) \div 2$	See Exercise 1-07
9	Evaluate each expression. <b>a</b> $-6 + (-3) \times 2$ <b>d</b> $-3 \times 5 + 6 \div (-2)$ <b>g</b> $-12 + (-3) \times (-7) - 2$	<b>b</b> $4 - 3 \times 6$ <b>e</b> $30 \div (-6) + 5$ <b>h</b> $14 + 7 \times (-3) + 5$	c $-12 \div 4 - 10$ f $-2 \times 7 + 15 \div (-3)$ i $-6 + -6 \div (-2) \times 2$	See Exercise 1-08
10	Use your calculator to evaluate a $28 - 37$ d $100 - 120 \div 4 + 17$	e each expression. <b>b</b> $-17 + 11$ <b>e</b> $-16 \times 3 + (-4)$	c $18 - 15 \times 2$ f $[5 + (-20)] \div (-3)$	See Exercise 1-09
11	The minimum overnight temp By how much did the tempera	erature in Goulburn was −5°C. ture rise?	During the day, it rose to 11°C.	See Exercise 1-10

12 Harrison starts a new job and opens a new bank account. Each week he saves \$80 to put into the account. Each month, however, \$210 is withdrawn from the account to pay off a car loan. Calculate how much will be in Harrison's account after 6 months if there are 26 weeks in 6 months.