ACE

GO MATHS

TEACHER GUIDE

SAMPLE PAGES

YEAR 3

ORIGO EDUCATION

Exploring Number Patterns

CONTENT DESCRIPTIONS

NA051 Investigate the conditions required for a number to be odd or even and identify odd and even numbers

NA060 Describe continue and create number patterns resulting from performing addition or subtraction

MATHEMATICAL BACKGROUND

In previous years, the focus of patterning has been on copying, creating, continuing and translating repeating and growing patterns. Concrete and pictorial materials have been used to explore the majority of patterns. In this unit, students move away from concrete and pictorial materials to explore number patterns that result from addition or subtraction. The patterns relate closely to place value as students are asked to add or subtract 1 or 10 from each expression and describe how the pattern changes. For example, in an addition number pattern the answer increases by 10 if an addend increases by 10. Subtraction number patterns are slightly more complex because the difference will increase if 10 is added to the minuend (total) but decrease if added to the subtrahend (part).

LESSON OVERVIEW

12.1 Investigating Odd and Even Number Patterns

12.2 Exploring Patterns of Three

12.3 Investigating Addition Number Patterns

12.4 Extending Addition Number Patterns

12.5 Investigating Subtraction Number Patterns

LANGUAGE

Students will use and develop the following language:
odd, even, multiple, pattern, number pattern, addition, subtraction.

MATERIALS

Lesson 12.1

- *GM ACE* student journal, page 51
- *GM ACE* mentals workbook, page 23
- Odd and even arrangement cards (Use Blackline Master 20)

Lesson 12.2

- *GM ACE* student journal, page 52

Lesson 12.3

- *GM ACE* student journal, page 53
- Blackline Master 8 copied onto an overhead transparency
- Overhead projector
- Non-permanent marker

Lesson 12.4

- *GM ACE* student journal, page 54
- *GM ACE* mentals workbook, page 24
- 2 cubes R for each group of students:
  - cube 1: 10, 20, 30, 40, 50, 60
  - cube 2: 1, 2, 3, 4, 5, 6

Lesson 12.5

- *GM ACE* student journal, page 55
- Cubes from the previous lesson

Optional Digital Resources and Program Blackline Masters
The lessons in this program are further supported by optional online resources.
Go to **www.origoeducation.com/go-maths-ace-support** for further information about the program blackline masters and these resources.

Assessment

CONTENT INDICATORS

On completion of this unit, the students should be able to

NA051	A	investigate the conditions required for a number to be odd or even
	B	identify odd and even numbers
NA060	C	continue addition number patterns
	D	continue subtraction number patterns

TECHNIQUES

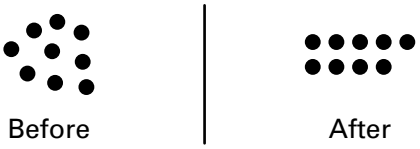
The following tools can be used to assess the content indicators.

1. Written Test B C D

Allow time for the students to complete the written test for Unit 12. Consider administering the test one or two weeks after completion of the unit.

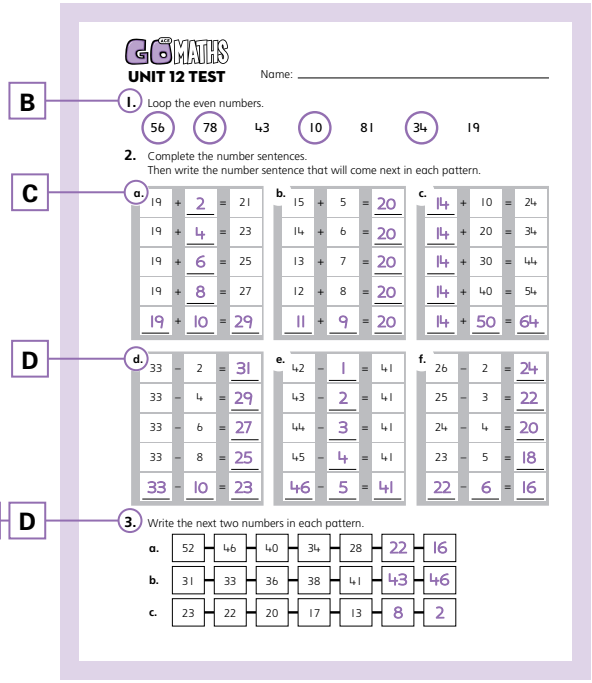
2. Diagnostic Probe A B

Ask the student to arrange a handful of counters to determine if the total number is odd or even (i.e. without counting). Students should identify that all counters in an even order arrangement have a partner (or that one counter in an odd order arrangement does not).



Before | After

Unit 12 Written Test



GO MATHS
UNIT 12 TEST
Name: _____

B
1. Loop the even numbers.
56 78 43 10 81 34 19

2. Complete the number sentences.
Then write the number sentence that will come next in each pattern.

C
a.
19 + 2 = 21
19 + 4 = 23
19 + 6 = 25
19 + 8 = 27
19 + 10 = 29

b.
15 + 5 = 20
14 + 6 = 20
13 + 7 = 20
12 + 8 = 20
11 + 9 = 20

c.
14 + 10 = 24
14 + 20 = 34
14 + 30 = 44
14 + 40 = 54
14 + 50 = 64

D
d.
33 − 2 = 31
33 − 4 = 29
33 − 6 = 27
33 − 8 = 25
33 − 10 = 23

e.
42 − 1 = 41
43 − 2 = 41
44 − 3 = 41
45 − 4 = 41
46 − 5 = 41

f.
26 − 2 = 24
25 − 3 = 22
24 − 4 = 20
23 − 5 = 18
22 − 6 = 16

C D
3. Write the next two numbers in each pattern.
a. 52 46 40 34 28 22 16
b. 31 33 36 38 41 43 46
c. 23 22 20 17 13 8 2

RECORDING

Content Strands

Record each student's achievement of the content indicators in the box(es) for this unit alongside the relevant content description(s) on a copy of the Progress Record (page xii).

	Year 3
NA051	12
NA060	12

Proficiency Strands

Record significant observations in the Progress Record (page xiv).

GO MATHS ACE
UNIT 12 TEST

Name: _____

1. Loop the even numbers.

56 78 43 10 81 34 19

2. Complete the number sentences.
Then write the number sentence that will come next in each pattern.

a.

19	+	____	=	21
19	+	____	=	23
19	+	____	=	25
19	+	____	=	27
____	+	____	=	____

b.

15	+	5	=	____
14	+	6	=	____
13	+	7	=	____
12	+	8	=	____
____	+	____	=	____

c.

____	+	10	=	24
____	+	20	=	34
____	+	30	=	44
____	+	40	=	54
____	+	____	=	____

d.

33	–	2	=	____
33	–	4	=	____
33	–	6	=	____
33	–	8	=	____
____	–	____	=	____

e.

42	–	____	=	41
43	–	____	=	41
44	–	____	=	41
45	–	____	=	41
____	–	____	=	____

f.

26	–	2	=	____
25	–	3	=	____
24	–	4	=	____
23	–	5	=	____
____	–	____	=	____

3. Write the next two numbers in each pattern.

a. 52 — 46 — 40 — 34 — 28 — ____ — ____

b. 31 — 33 — 36 — 38 — 41 — ____ — ____

c. 23 — 22 — 20 — 17 — 13 — ____ — ____

Investigating Odd and Even Number Patterns

In this lesson, students investigate the conditions required for a number to be odd or even. They then use these conditions to identify odd or even numbers.

DAILY NUMBER SENSE

Ask: *If we start at 100 and count by fives, what numbers between 150 and 170 will we say? How do you know?* Invite individuals to write the numbers ***155***, ***160*** and ***165*** on the board and to explain their thinking. Use the following questions to focus on the digits in the ones place: *What place do you use to help you decide? What digits are in that place?* Discussing the digits in the ones place is more helpful than using language such as 'ends in 5 (or 0).' Repeat the whole discussion starting at 100 and counting by twos.

ACTIVITY

1. By this stage students will more than likely bring an understanding of odd and even numbers to the classroom. Ask confident volunteers to share their understandings with their classmates.
2. Display the odd and even arrangement cards and have the students identify the cards that show an odd or even number. Ask: *What makes a number odd? What makes a number even?* Elicit observations such as: an even number always has a partner, an even number can be shared equally between two groups, an even number is always a twos fact, and so on.
3. Have the students complete Questions 1 and 2 on page 51 of the *GO Maths ACE* student journal.
4. Discuss Question 3 on page 51 of the student journal. Have the students shade the numbers between 1 and 10 that are even. Ask: *Who can see a pattern? Who can shade the remaining numbers that are even on the hundred chart?* Invite students to describe the pattern that they see, then shade the remaining even numbers. Discuss the numbers that were shaded. Ask: *How can we prove that each of these numbers is even?* Invite students to share their suggestions. Suggestions might include drawing two rows of dots to confirm that each dot has a partner or cutting out an array to match the number in question then splitting it into two equal groups.
5. Have the students complete Question 4 on page 51 of the student journal.

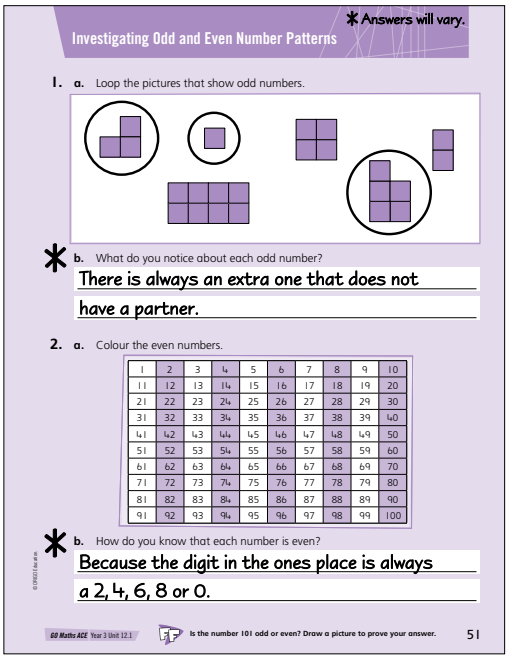
REFLECTION

Ask the students to consider why a twos fact is always an even number. Encourage them to share their reasoning.

MATERIALS

- *GM ACE* student journal, page 51
- *GM ACE* mentals workbook, page 23
- Odd and even arrangement cards (use Blackline Master 20)

Student Journal



Investigating Odd and Even Number Patterns

✱ Answers will vary.

1. a. Loop the pictures that show odd numbers.

b. What do you notice about each odd number?

There is always an extra one that does not have a partner.

2. a. Colour the even numbers.

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

b. How do you know that each number is even?

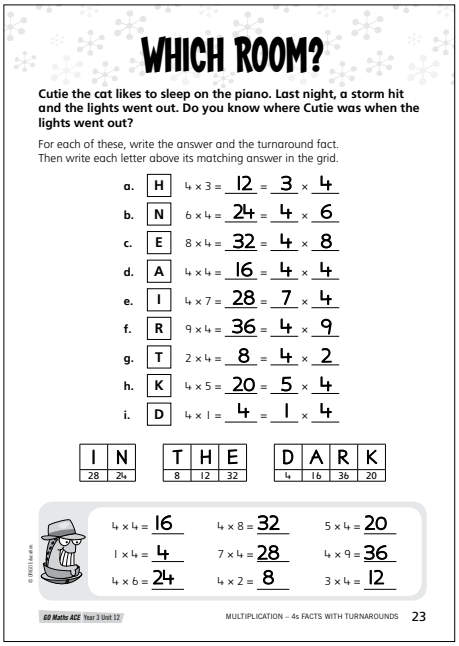
Because the digit in the ones place is always a 2, 4, 6, 8 or 0.

GO Maths ACE Year 3 Unit 12.1 — Is the number 101 odd or even? Draw a picture to prove your answer. 51

DAILY COMPUTATION PRACTICE

Use page 23 of the *GM ACE* mentals workbook.

Mentals Workbook



WHICH ROOM?

Cutie the cat likes to sleep on the piano. Last night, a storm hit and the lights went out. Do you know where Cutie was when the lights went out?

For each of these, write the answer and the turnaround fact. Then write each letter above its matching answer in the grid.

a. H 4 × 3 = 12 = 3 × 4
b. N 6 × 4 = 24 = 4 × 6
c. E 8 × 4 = 32 = 4 × 8
d. A 4 × 4 = 16 = 4 × 4
e. I 4 × 7 = 28 = 7 × 4
f. R 9 × 4 = 36 = 4 × 9
g. T 2 × 4 = 8 = 4 × 2
h. K 4 × 5 = 20 = 5 × 4
i. D 4 × 1 = 4 = 1 × 4

I	N	T	H	E	D	A	R	K
28	24	8	12	32	4	16	36	20

4 × 4 = 16 | 4 × 8 = 32 | 5 × 4 = 20
1 × 4 = 4 | 7 × 4 = 28 | 4 × 9 = 36
4 × 6 = 24 | 4 × 2 = 8 | 3 × 4 = 12

GO Maths ACE Year 3 Unit 12 — MULTIPLICATION – 4s FACTS WITH TURNAROUNDS 23

Exploring Patterns of Three

In this lesson, students investigate patterns that are made when skip counting by three on a hundred chart.

DAILY NUMBER SENSE

Ask: *If we start at 101 and count by fives, what numbers between 180 and 200 will we say? How do you know?* Encourage the students to count a few numbers and then use the pattern to work out the remaining numbers (181, 186, 191, 196). Repeat the whole discussion starting at 103 and counting by fives.

ACTIVITY

1. Have the students form a large circle in a spacious area of the classroom. Say: *Today we are going to count in threes. I'll start the count then we'll work in a clockwise direction around the circle.* Repeat the activity several times starting at a different number or a different position in the circle.
2. Have the students complete Questions 1 and 2 page 52 of the *GO Maths ACE* student journal. Students can then describe the patterns that they have made.
3. Read Question 3 of the student journal. Model the question by selecting one of the shaded squares e.g. 45. Ask: *What is the sum of the digits? What is 4 + 5?* Write the answer (9) on the board. Ask: *Can nine be shared evenly among three?* Receive confirmation before asking students to add the digits of another multiple of three to see if the sum of the digits can also be shared evenly among three.
4. Have the students complete Question 4 on page 52 of the *GO Maths ACE* student journal.

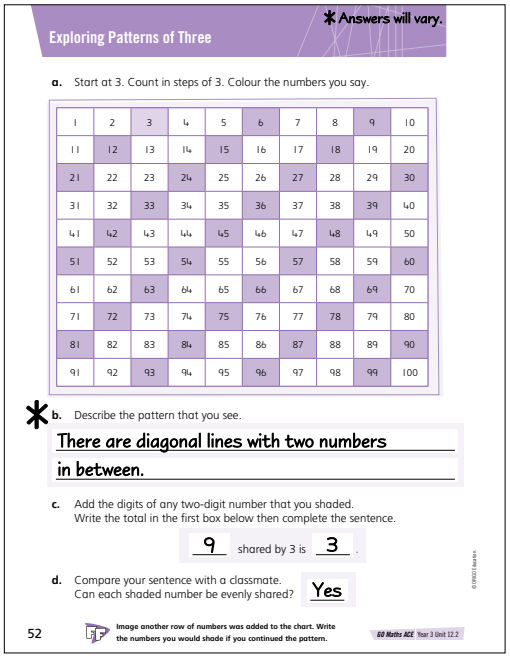
REFLECTION

Write a three-digit number on the board e.g. 144. Students then use their findings to determine if the number is divisible by three. Repeat with other examples.

MATERIALS

- *GM ACE* student journal, page 52

Student Journal



Exploring Patterns of Three

✱ Answers will vary.

a. Start at 3. Count in steps of 3. Colour the numbers you say.

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

✱ b. Describe the pattern that you see.

There are diagonal lines with two numbers in between.

c. Add the digits of any two-digit number that you shaded.
Write the total in the first box below then complete the sentence.

9 shared by 3 is 3.

d. Compare your sentence with a classmate.
Can each shaded number be evenly shared? Yes

52

Image another row of numbers was added to the chart. Write the numbers you would shade if you continued the pattern.

GO Maths ACE Year 3 Unit 12.2

DAILY COMPUTATION PRACTICE

Orally practise a selection of mixed facts and their turnarounds from the × 2 and × 4 facts.

Investigating Addition Number Patterns

In this lesson, students use a hundred chart to study the effect of adding the same single-digit number to a sequence of two-digit numbers.

DAILY NUMBER SENSE

Ask: *If we start at 100 and count by fours, what numbers do we say? What do you notice? What patterns do you see?* Invite individuals to count and then write the numbers they say — from 100 to 140 — on the board. Then ask: *If you keep counting, what numbers between 180 and 200 will you not say?* Encourage them to identify the odd numbers. Some confident students might be able to identify other numbers that will not be in the count.

ACTIVITY

1. Project the hundred chart. Then write ***23 + 5*** on the board and ask: *How could we use the hundred chart to show this number sentence?* Encourage students to provide suggestions before inviting a confident volunteer to come to the front. Guide them to shade the first addend (23) and the number that is 5 more. Complete the number sentence to match (***23 + 5 = 28***). Repeat for each of the number sentences shown below, writing them one below the other so that the pattern is more visible.

   33 + 5 = ___

   43 + 5 = ___

   53 + 5 = ___

   63 + 5 = ___

2. Have the students look at the number sentences and describe what they notice. Ask: *Which numbers changed? How did the numbers change? Which numbers stayed the same?* Encourage students to provide a variety of observations.

3. Repeat the activity for the sequence of addition number sentences shown below.

   18 + 7 = ___

   28 + 7 = ___

   38 + 7 = ___

   48 + 7 = ___

4. Have the students work independently to complete page 53 of the *GO Maths ACE* student journal.

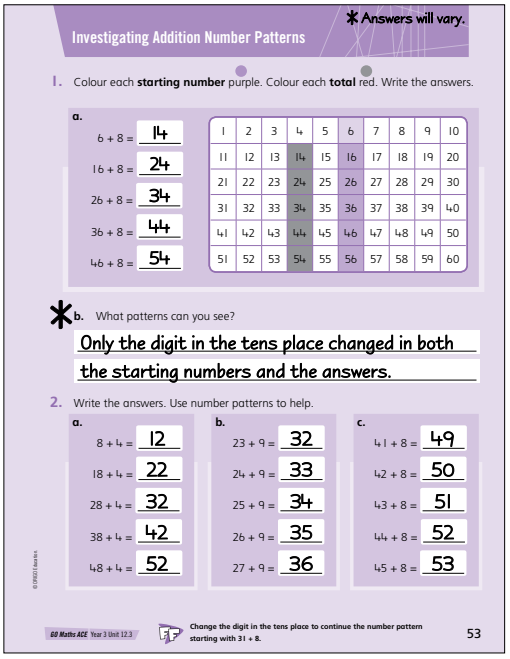
REFLECTION

Discuss the students' answers to page 53 of the *GO Maths ACE* student journal. Have the student describe the patterns and the relationships between changes in the addend and the related changes in the answer, for example, when an addend increases by ten the answer increases by ten.

MATERIALS

- *GM ACE* student journal, page 53
- Blackline Master 8 copied onto an overhead transparency
- Overhead projector
- Non-permanent marker

Student Journal



Investigating Addition Number Patterns

✱ Answers will vary.

1. Colour each **starting number** purple. Colour each **total** red. Write the answers.

a.

6 + 8 =	14
16 + 8 =	24
26 + 8 =	34
36 + 8 =	44
46 + 8 =	54

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

✱b. What patterns can you see?

Only the digit in the tens place changed in both the starting numbers and the answers.

2. Write the answers. Use number patterns to help.

a.

8 + 4 =	12
18 + 4 =	22
28 + 4 =	32
38 + 4 =	42
48 + 4 =	52

b.

23 + 9 =	32
24 + 9 =	33
25 + 9 =	34
26 + 9 =	35
27 + 9 =	36

c.

41 + 8 =	49
42 + 8 =	50
43 + 8 =	51
44 + 8 =	52
45 + 8 =	53

GO Maths ACE Year 3 Unit 12.3

Change the digit in the tens place to continue the number pattern starting with 31 + 8.

53

DAILY COMPUTATION PRACTICE

Orally practise a selection of mixed facts and their turnarounds from the × 2 and × 4 facts.

Extending Addition Number Patterns

In this lesson, students use addition number patterns to find unknowns in number sentences involving equality.

DAILY NUMBER SENSE

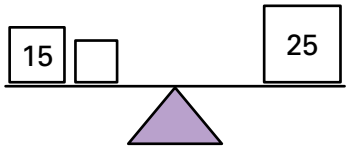
Ask: *If we start at 3 and count by threes, what numbers between 80 and 100 will we say?* Have the students count by threes and write the numbers on the board as shown below.

3	6	9	12	15	18	21	24	27	30
33	36	39	42	45	48	51	54	57	60

Ask: *What do you notice? What do you think the last number in the next row will be?* Invite individuals to make predictions and describe any patterns they notice.

ACTIVITY

1. On the board, draw the pan balance shown below. Ask: *What do we know about this pan balance?* (It's level so the total on each side must be 25.) *What number sentence can we write?* Encourage the students to explain that the number sentence must involve 'equals' and assist them to write ***25 = 15 +*** ___. Then ask: *What will we write in the box? How many different numbers could we write? How do you know?* Establish that there is only one number and ask a student to write 10 in the box. During the discussion, use language such as 'empty box' or 'unknown' to describe the missing addend.



2. Replace 25 with 26 and ask: *What will happen to the pan balance? How can we keep it level (even)?* Encourage students to explain that an addend will need to be changed. On the board, write the related sentence, ***26 = 15 +*** ___ and have a volunteer write the missing addend. Repeat the discussion to change one of the numbers; the total or either addend.
3. Organise the students into small groups and provide each group with two labelled cubes for them to complete Question 1 on page 54 of the *GO Maths ACE* student journal. Have the students take turns to roll the cubes. They can discuss where one of the numbers can be used to complete a sentence so all members of the group write the number in the same place.
4. Have the students work independently to complete page 54 of the student journal. Retain the cubes for use in the next lesson.

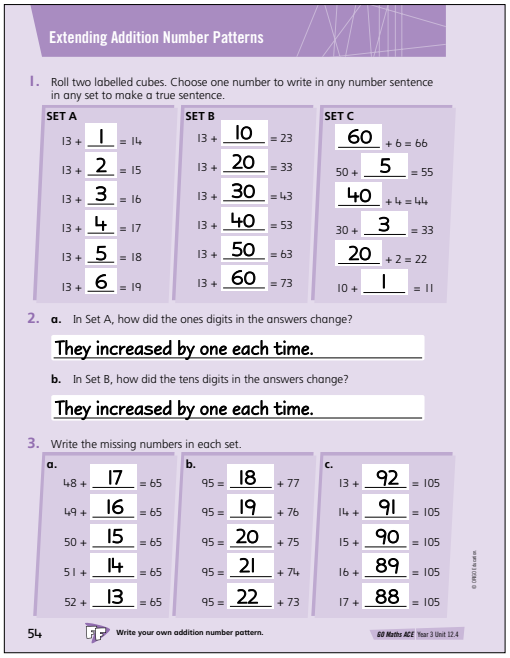
REFLECTION

Discuss the students' answers to page 54 of the *GO Maths ACE* student journal. Invite students to describe what they notice about each of the patterns in Question 1. Reinforce the idea that increasing or decreasing an addend increases or decreases the total by the same amount when the other addend is always the same.

MATERIALS

- *GM ACE* student journal, page 54
- *GM ACE* mentals workbook, page 24
- 2 cubes R for each group of students:
  - cube 1: 10, 20, 30, 40, 50, 60
  - cube 2: 1, 2, 3, 4, 5, 6

Student Journal


Extending Addition Number Patterns

1. Roll two labelled cubes. Choose one number to write in any number sentence in any set to make a true sentence.

SET A	SET B	SET C
13 + 1 = 14	13 + 10 = 23	60 + 6 = 66
13 + 2 = 15	13 + 20 = 33	50 + 5 = 55
13 + 3 = 16	13 + 30 = 43	40 + 4 = 44
13 + 4 = 17	13 + 40 = 53	30 + 3 = 33
13 + 5 = 18	13 + 50 = 63	20 + 2 = 22
13 + 6 = 19	13 + 60 = 73	10 + 1 = 11

2. a. In Set A, how did the ones digits in the answers change?

They increased by one each time.

b. In Set B, how did the tens digits in the answers change?

They increased by one each time.

3. Write the missing numbers in each set.

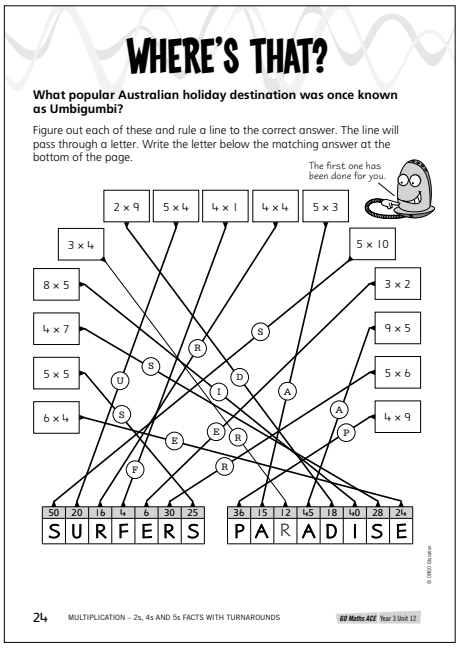
a.	b.	c.
48 + 17 = 65	95 = 18 + 77	13 + 92 = 105
49 + 16 = 65	95 = 19 + 76	14 + 91 = 105
50 + 15 = 65	95 = 20 + 75	15 + 90 = 105
51 + 14 = 65	95 = 21 + 74	16 + 89 = 105
52 + 13 = 65	95 = 22 + 73	17 + 88 = 105

54 Write your own addition number pattern. GO Maths ACE Year 3 Unit 12.4

DAILY COMPUTATION PRACTICE

Use page 24 of the *GM ACE* mentals workbook.

Mentals Workbook


WHERE'S THAT?

What popular Australian holiday destination was once known as Umbigumbi?

Figure out each of these and rule a line to the correct answer. The line will pass through a letter. Write the letter below the matching answer at the bottom of the page.

The first one has been done for you.

2 × 9 | 5 × 4 | 4 × 1 | 4 × 4 | 5 × 3

3 × 4 | 5 × 10 | 8 × 5 | 3 × 2 | 4 × 7 | 9 × 5 | 5 × 5 | 5 × 6 | 6 × 4 | 4 × 9

50	20	16	4	6	30	25
S	U	R	F	E	R	S

36	15	12	45	18	40	28	24
P	A	R	A	D	I	S	E

24 MULTIPLICATION – 2s, 4s AND 5s FACTS WITH TURNAROUNDS GO Maths ACE Year 3 Unit 12

Investigating Subtraction Number Patterns

Subtraction sentences involving balance are difficult to model with concrete or pictorial materials. In this lesson, students use their understanding of the subtraction concept to find unknowns in number sentences involving equality.

DAILY NUMBER SENSE

Review the previous Daily Number Sense discussion. Ask: *If we start at 3 and count by threes, what numbers between 100 and 120 will we say?* Have the students count by threes and write the numbers on the board. Ask: *What do you notice? What do you think the last number in the next row will be?* Invite individuals to make predictions and describe any patterns they notice.

ACTIVITY

1. Write ***25 – 15 =*** ___ on the board and ask: *What happens if we add 1 to either number? How is the answer changed? What happens if we take 1 away from either number? How is the answer changed?* Invite students to change either the known part (subtrahend) or the total (minuend) by adding or subtracting one and describe the effect on the answer. Write new sentences each time, e.g. ***26 – 15 =*** ___, ***24 – 15 =*** ___, ***25 – 16 =*** ___ ***and 25 – 14 =*** ___.
2. Repeat the discussion for ***25 –*** ___ ***= 15.***
3. Organise the students into small groups and provide each group with the labelled cubes from the previous lesson to complete Question 1 on page 55 of the *GO Maths ACE* student journal. Have the students take turns to roll the cubes. They can discuss where one of the numbers can be used to complete a sentence so all members of the group write the number in the same place.
4. Have the students work independently to complete page 55 of the *GO Maths ACE* student journal.

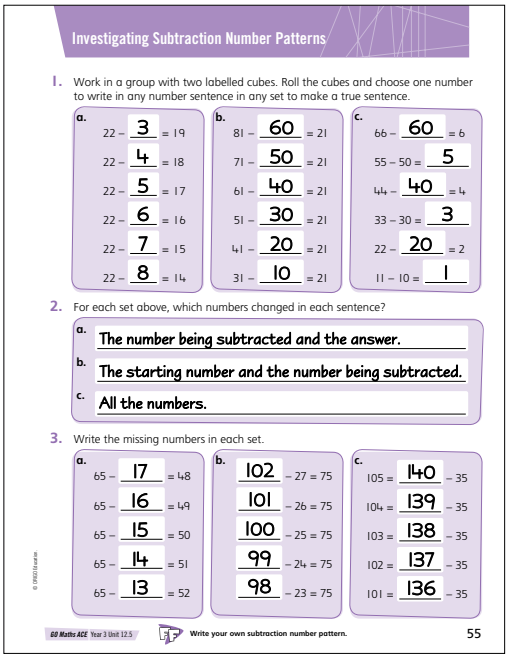
REFLECTION

Discuss the students' answers to page 55 of the *GO Maths ACE* student journal. Invite students to describe what they notice about each of the patterns in Question 1. Reinforce the idea that increasing the minuend (the total) increases the difference (part/answer), and increasing the subtrahend (first part) decreases the difference (second part/answer).

MATERIALS

- *GM ACE* student journal, page 55
- Cubes from the previous lesson

Student Journal



Investigating Subtraction Number Patterns

1. Work in a group with two labelled cubes. Roll the cubes and choose one number to write in any number sentence in any set to make a true sentence.

a. 22 – 3 = 19; 22 – 4 = 18; 22 – 5 = 17; 22 – 6 = 16; 22 – 7 = 15; 22 – 8 = 14

b. 81 – 60 = 21; 71 – 50 = 21; 61 – 40 = 21; 51 – 30 = 21; 41 – 20 = 21; 31 – 10 = 21

c. 66 – 60 = 6; 55 – 50 = 5; 44 – 40 = 4; 33 – 30 = 3; 22 – 20 = 2; 11 – 10 = 1

2. For each set above, which numbers changed in each sentence?

a. The number being subtracted and the answer.

b. The starting number and the number being subtracted.

c. All the numbers.

3. Write the missing numbers in each set.

a. 65 – 17 = 48; 65 – 16 = 49; 65 – 15 = 50; 65 – 14 = 51; 65 – 13 = 52

b. 102 – 27 = 75; 101 – 26 = 75; 100 – 25 = 75; 99 – 24 = 75; 98 – 23 = 75

c. 105 = 140 – 35; 104 = 139 – 35; 103 = 138 – 35; 102 = 137 – 35; 101 = 136 – 35

GO Maths ACE Year 3 Unit 12.5 — Write your own subtraction number pattern. — 55

DAILY COMPUTATION PRACTICE

Write ***2 ×*** ___ ***=*** ___ and ***4 ×*** ___***=*** ___ on the board. Write the same multiple of 10 in both sentences and ask the students to give the answers.