NAPLAN Numeracy Year 3: Number and Algebra

This document contains Year 3 Number and Algebra resources including items for:

- Number and place value
- Fractions and decimals
- Money and financial mathematics
- Patterns and algebra.

These items aim to develop and test Year 3 students' proficiency with the content of these sub-strands.

Please note that these resources do not encompass all that should be taught and learned for Number and Algebra in Year 3. Not all of the content of the curriculum can be effectively assessed in a written test format.

Revised September 2016

Partitioning whole numbers up to 1000 and beyond

Background information/teaching focus

Students should learn to think of a collection in component parts, building an understanding that:

- it is easier to see how many there are when collections are in special arrangements
- a collection can be separated into parts and each part can be represented by a number. The 'part-part-whole' model can help us to see how many there are. eg A student might say, 'I see 3 + 5, which is 8'. Another student might see the same collection as 3 + 4 +1 or 3 + 3 + 2
- the same number can be partitioned in different ways. eg 7 can be thought of as 6 + 1, 5 + 2 or 3 + 4.
- a number can also be thought of in more than two parts. For example, 9 can be represented as 3 + 3 + 3 or 2 + 4 + 3.

For further related information see *First Steps in Mathematics: Number (book one):*

- Chapter 3: Understand whole and decimal numbers
  - Key understanding 2: We can often see how many are in a collection just by looking and also by thinking of it in parts pp. 24-25.

Students need to be able to think about numbers flexibly and as being composed of other numbers. Students need opportunities to organise or group collections in various ways that make it easier to see how many there are. Grouping collections into bundles of ten provides a physical model of the way we write numbers. Partitioning a large collection into bundles of hundreds, tens and ones makes counting the collection efficient.

Any number can be split into standard place value partitions (eg 582 = 500 + 80 + 2) or non-standard partitions. (eg 582 = 382 + 200) It is important that students are exposed to both types of partitioning to provide a basis for efficient and flexible mental calculation strategies. For example, thinking of 582 as 382 + 200 helps us subtract 198.

Only when students can think of numbers as having their own meaning and can use part-whole relationships to partition and manipulate them, can they develop flexible and fluent mental calculation skills.

For further related information see *First Steps in Mathematics: Number (book one):*

- Chapter 3: Understand whole and decimal numbers
  - Key understanding 6: Place value helps us to think of a number in different ways and this can be useful p. 60.

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Western Australian Curriculum

- Year 2 – Recognise, model, represent and order numbers to at least 1000 (ACMNA027).

- Year 2 – Group, partition and rearrange collections up to 1000 in hundreds, tens and ones to facilitate more efficient counting (ACMNA028).
- Year 3 – Apply place value to partition, rearrange and regroup numbers to at least 10 000 to assist calculations and solve problems (ACMNA053).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

- Students need many opportunities to use manipulative objects such as straws and pop-sticks and symbols to represent numbers in physical models and representations. It is important to link the oral count by tens and by hundreds to the way numerals are written, as well as to the quantities that they represent. Students do not always realise that, for example, two hundred straws arranged in twenty bundles of ten are still two hundred straws.
- Some students do not see a MAB 'long' as being made up of ten ones. If students are to count bundles of ten they must first understand that one bundle of ten 'longs' is the same quantity as ten single 'longs' just as they need to understand that a single 'long' is the same as ten single 'ones'. Some students will need many opportunities to develop this understanding which students must have in order to make sense of trading games.
- Partition large quantities up to 1000 into groups of ten and one hundred. Ask students to skip count by 10s and 100s to show that this is the same quantity as counting by ones. Record the numbers corresponding to the count. Draw attention to what each digit represents in the bundles of materials (for example, nine-hundred and nine is 909 or 9 hundreds, 0 tens and 9 ones or 909 ones).

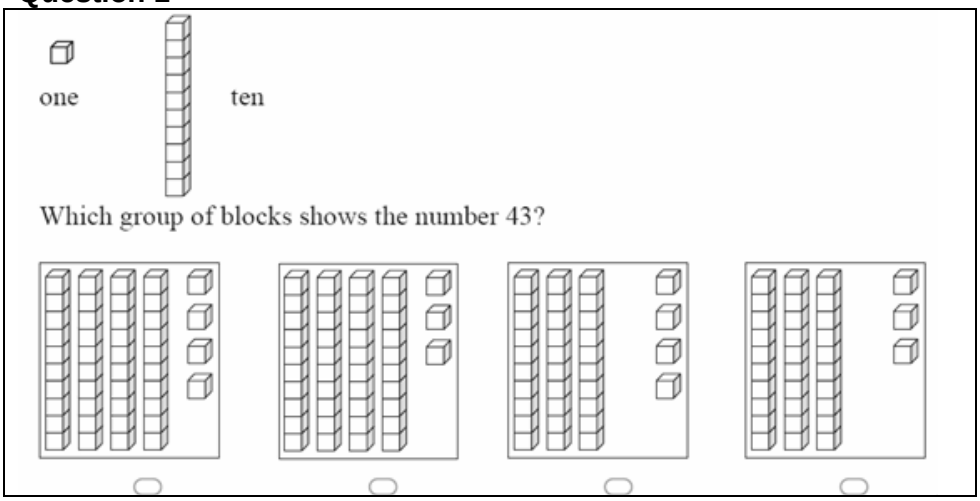
For further ideas for activities see *First Steps in Mathematics: Number* (book one):

- Combining groups p. 28
- Jigsaw cards p. 62
- Place-value beans p. 55
- Place-value kits p. 63
- Number sentences p. 63

Numeracy online resources

- Year 2–3 Number: Understand whole and decimal numbers Learning Sequence 1

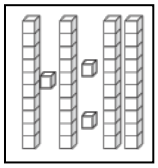
Question 1



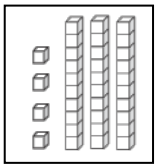
Skill: Students recognise partitioning of a two-digit number.
Answer key: B

Additional questions

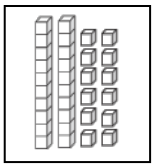
1. How many small blocks make one long block?
2. How many small blocks make four long blocks? If you cut up the four long blocks into small blocks, how many small blocks would you have?
3. Is there another way you could show 43? Draw or model 43 another way.
4. What number is modelled in the third group? How is this different/the same as 43?



5. What number is shown in this box? How is it different from 43?



6. Is 43 the number shown in this box? How do you know?



7. What number is shown in this box? How can you show this another way?

Question 2

785 =

- ❍ 70 + 50 + 80
- ❍ 700 + 80 + 50
- ❍ 7 + 8 + 5
- ❍ 700 + 5 + 80

Skill: Students recognise standard partitioning of a whole number.
Answer key: D

Additional questions

1. Does 80 + 700 + 5 also make 785? Why?
2. When would partitioning the number 785 into 80 + 700 + 5 be useful?
3. Fill in the missing number:

   274 = 4 + ☐ + 200

   70 + 8 + 300 = ☐

4. How else could you split up those numbers?

Question 3

Which one of these makes 97?

- ○ 97 tens
- ○ 9 ones and 7 tens
- ○ 9 ones and 7 ones
- ○ 9 tens and 7 ones

Skill: Students interpret partitioning of two-digit numbers.
Answer key: D

Additional questions

1. Would 7 ‘ones’ and 9 tens still make 97? How do you know?
2. What does 9 ‘tens’ mean?
3. If you were counting 9 ‘tens’ by ‘ones’, what number would you get to?
4. What are some other ways of partitioning 97 into two parts? List three others. Talk to someone else about how they partitioned 97. Did they have some different ways?
5. Ben wants to add 50 to 97. What would be a useful way to partition 97? (50 + 47)
6. How many ‘ones’ does the number 97 have altogether? (97, there are 90 ones and 7 more ones. Nine tens is the same amount as 90 ones)
7. Write the numeral that has 5 ones and 11 tens.

Question 4

19 + 22 has the same value as **20 +** ☐

Skill: Students apply partitioning knowledge to make calculating easier.
Answer key: 21

Additional questions:

1. How did you work this out? Can you show this, using bundles of straws?
2. If I had to work out 19 + 32, could you do the same thing to make this an easier calculation? How? Try 18 + 35.
3. Why does thinking about it this way make it easier to calculate?
4. What are two other numbers that would add together to give the same value?
5. Does this strategy work for subtraction?

Curriculum references

Department of Education and Training Western Australia 2004, *First Steps in Mathematics: Number* (book one):

- Chapter 3: Understand whole and decimal numbers
  - Key understanding 2: We can often see how many are in a collection just by looking and also by thinking of it in parts. p.24
  - Key understanding 5: There are patterns in the way we write numbers that help us to remember their order. p.52
  - Key understanding 6: Place value helps us to think of the same whole number in different ways and this can be useful. p.60

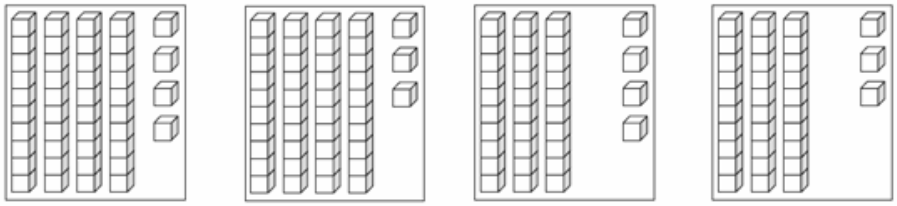
Student worksheet

Focus

Partitioning whole numbers up to 1000 and beyond

Question 1

Which group of blocks shows the number 43?



Question 2

785 =

- ❍ 70 + 50 + 80
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- ❍ 7 + 8 + 5
- ❍ 700 + 5 + 80

Question 3

Which one of these makes 97?

- ◯ 97 tens
- ◯ 9 ones and 7 tens
- ◯ 9 ones and 7 ones
- ◯ 9 tens and 7 ones

Question 4

19 + 22 has the same value as **20 +** ☐

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Equivalent number sentences for addition and subtraction

Background information/teaching notes

A good understanding of equality is essential for algebraic thinking. Many students interpret the = sign as 'makes' or as a signal to 'find the answer'. When asked to complete □ + 7 = 12, they may write 5 in the box but nevertheless say that 12 is the answer. Some students will find a sentence like □ + 5 = 12 + 3 a nonsense and others will write 7 on the line. It is important to emphasise that the = sign means 'is equal to' and that it indicates that both sides of the equation represent the same number.

- Using *properties of operations* and *relationships between them* means that students can construct and rearrange number sentences into simplified forms that help them solve equations and simplify computations.

For further related information see *First Steps in Mathematics: Number* (book two):

- Chapter 3: Understand operations
  - Key understanding 7: Properties of operations and relationships between them can help us to decide whether number sentences are true. p.66

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Western Australian Curriculum

- Year 2 – Explore the connection between addition and subtraction (ACMNA029).
- Year 3 – Recognise and explain the connection between addition and subtraction (ACMNA054).
- Year 4 – Find unknown quantities in number sentences involving addition and subtraction and identify equivalent number sentences involving addition and subtraction (ACMNA083).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

Students should use their understanding of properties and relationships to:

- Complete mathematical statements (without finding the 'answer' to the calculations), for example: 43 + 21 = ___ + 16 (write the missing number) or 24 – 12 ▭ 20 (put in < or = or >).
- Students should also generate numbers, or pairs of numbers, that fulfil some kind of rule, such as, ▭ + ◇ = 15. Students should consider whether they have all the possible numbers or pairs, how many there might be and how they can be sure they have them all?
- Construct mathematical statements, for example: 20 – 6 = 7 + 7.
- Check the truth of mathematical statements.

For further ideas for activities see, *First Steps in Mathematics: Number* (book two):

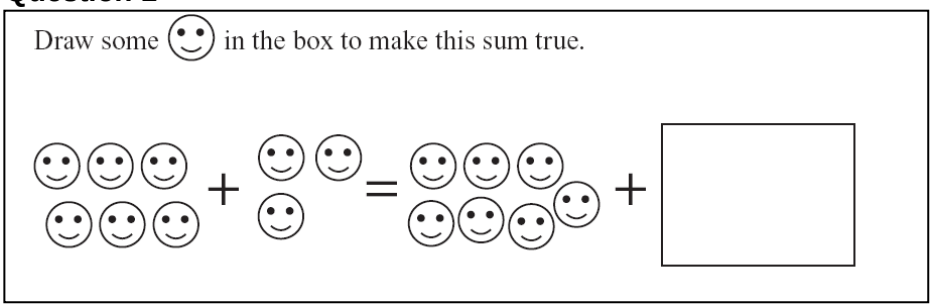
- Missing number p. 68
- Inequality statements p. 69
- Equals p. 69
- Today's number is… p. 69
- Bigger or smaller p. 70

Numeracy online resources

- Year 2–3 Number: Understand operations
  Learning sequence 3

- Year 2–3 Number: Calculate
  Learning sequence 3
  Learning sequence 4

Question 1

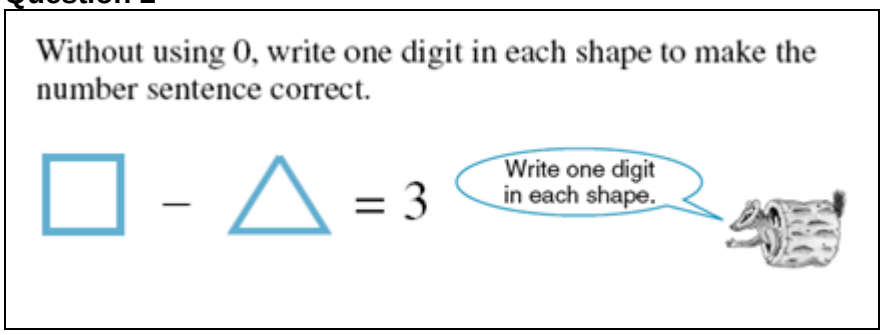


Skill: Students complete an informal number sentence.
Answer key: Two faces

Additional questions

1. In total, how many happy faces are on the left of the equal sign?
2. How many happy faces are on the right of the equal sign?
3. How many more faces are needed on the right to have equal numbers of happy faces on both sides of the equals sign?
4. How did you work this out? Is there another way you could have done this?
5. Write a number sentence to match this situation.
6. Is there another way you could make two groups of happy faces that would equal this quantity?

Question 2



Skill: Students complete a number sentence involving subtraction.
Answer key: Any correct difference

Additional questions

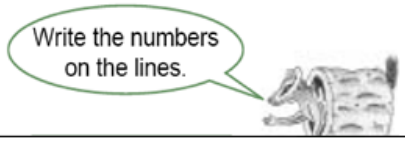
1. Which of the two numbers needs to be larger – the number in the square or the number in the triangle? Why?
2. Tell a story to match this number sentence.
3. If 16 is the first number, what is the number in the triangle? How did you work it out?
4. If the number in the triangle is 10, what is the number in the square? Why?
5. Write two other possible ways to complete the number sentence.
6. How many different ways could this be done? Explain your answer.

Question 3

Complete this number sentence correctly in two different ways.

7 + _____ + _____ = 20

7 + _____ + _____ = 20



Skill: Students complete a number sentence drawing on known number facts.
Answer key: Any two numbers that add to 13

Additional questions

1. How did you work it out?
2. How will taking seven away from 20 help you work this out?
3. Write all of the possible answers to this. How do you know you have all the possible answers?
4. If the number after the equal sign was 10 write two numbers that would complete this number sentence.
5. Think about your answer to the previous question, are there any other combinations of numbers that, when added to seven, would make 10?

Question 4

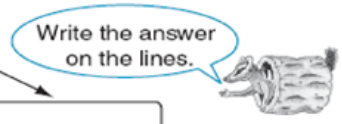
Here is a number family.

Fill in the missing numbers.

30 + 10 = ____

40 – 30 = ____

40 – 10 = ____

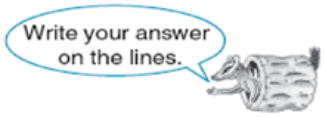


Make up a **different** number family. Choose your own numbers.

_____ + _____ = _____

_____ – _____ = _____

_____ – _____ = _____



Skill: Students solve and write number sentences showing inverse relationships.
Answer key: Any other correct *number family,* for example 20 + 10 = **30**; 30 — 20 = **10**; 30 — 10 = **20**.

Additional questions

1. How does the 30 + 10 help you answer the two subtraction number sentences in the question above?
2. What do you need to think about to plan your own *number family*?
3. Jane wrote an addition number sentence. How does she decide what is the starting number for the two subtraction number sentences?
4. Using whole numbers only, write two addition number sentences that add to 20. How many different sentences can you find? How many different sentences can you find if you use halves and quarters?

Curriculum references

Department of Education and Training Western Australia*, 2004, First Steps in Mathematics: Number* (book two):

- Chapter 3: Understand operations
  - Key understanding 2: Partitioning numbers into part-part-whole helps us relate addition and subtraction and understand their properties. p.20
  - Key understanding 7: Properties of operations and relationships between them can help us to decide whether number sentences are true. p.66

- Chapter 4: Calculate
  - Key understanding 2: We can think of a number as a sum or difference in different ways. We can rearrange the parts of an addition without changing the quantity. p.106

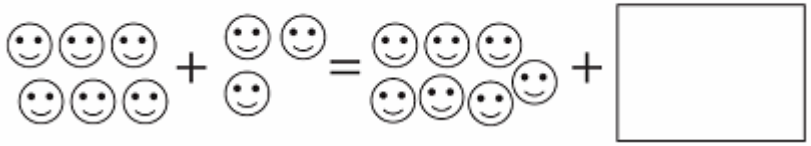
Student worksheet

Focus

Equivalent number sentences for addition and subtraction

Question 1

Draw some ☺ in the box to make this sum true.



Question 2

Without using 0, write one digit in each shape to make the number sentence correct.

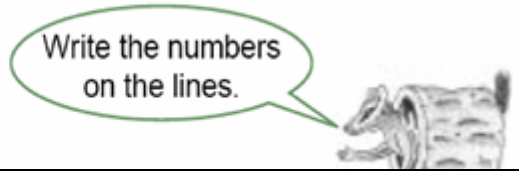
□ − △ = 3

Question 3

Complete this number sentence correctly in two different ways.

7 + _____ + _____ = 20

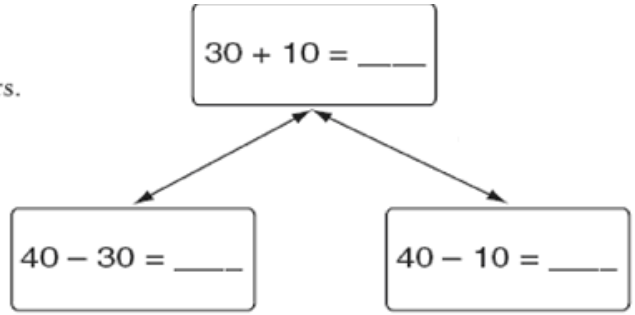
7 + _____ + _____ = 20



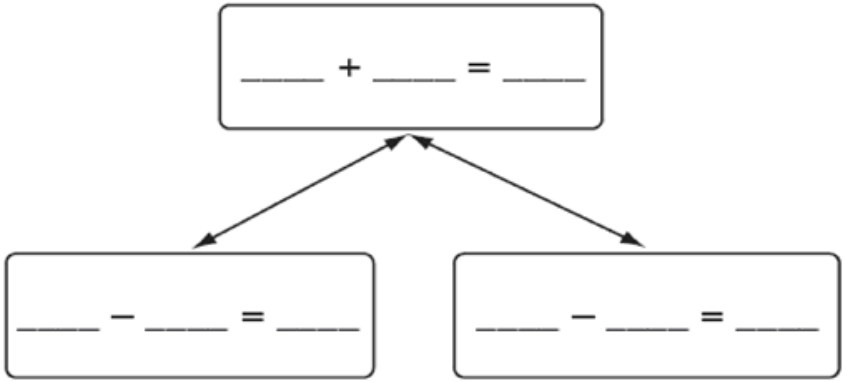
Question 4

Here is a number family.

Fill in the missing numbers.



Make up a **different** number family. Choose your own numbers.



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Number patterns based on constant addition and subtraction

Background information/teaching focus

Students should look for what is the same and what is different between various patterns, leading to simple classifications of patterns. Students should put together sequences that involve constant addition or subtraction and compare them with those that involve addition or subtraction by an increasing or decreasing amount.
Students should draw conclusions such as:

- to get the next term you add or subtract a constant amount to the term before
- the difference between two terms next to each other is always the same
- the numbers go up (or down) at a steady rate.

For further related information see, *First Steps in Mathematics: Number* (book two):

- Chapter 5: Reason about number patterns
  - Key understanding 3: To describe a number pattern means to provide a precise rule that produces the pattern. p.224

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Western Australian Curriculum

- Year 2 – Describe patterns with numbers and identify missing elements (ACMNA035).
- Year 3 – Describe, continue, and create number patterns resulting from performing addition or subtraction (ACMNA060).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

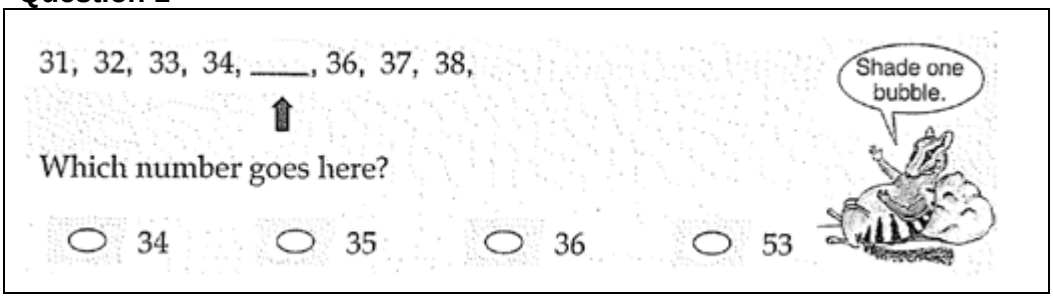
- Provide experiences in recognising, producing and describing patterns that include opportunities to explain the pattern.
- Copy and continue number patterns created by adding or subtracting a set number.
- Using the constant function on the calculator can also help students predict and test what number will be next in a pattern.
  What's my rule? – one student thinks of a rule about numbers and the others take turns to guess what the rule is. The numbers can be recorded so the students may see the developing number pattern. For example for the rule 'add three' if one student says 'four', the student who made the rule will reply seven; if another student says 'one' the student who made the rule will reply 'four' and so on. The numbers and responses can be recorded in a chart until the students are able to guess the rule.

1	4
3	6
4	7
5	8

For further ideas for activities see *First Steps in Mathematics: Number* (book two):

- Calculator patterns 1 p. 228
- Calculator patterns 2 p. 228
- What's my rule? p. 229
- What comes next? p. 229
- Find the rule p. 235
- Constant function p. 237

Question 1

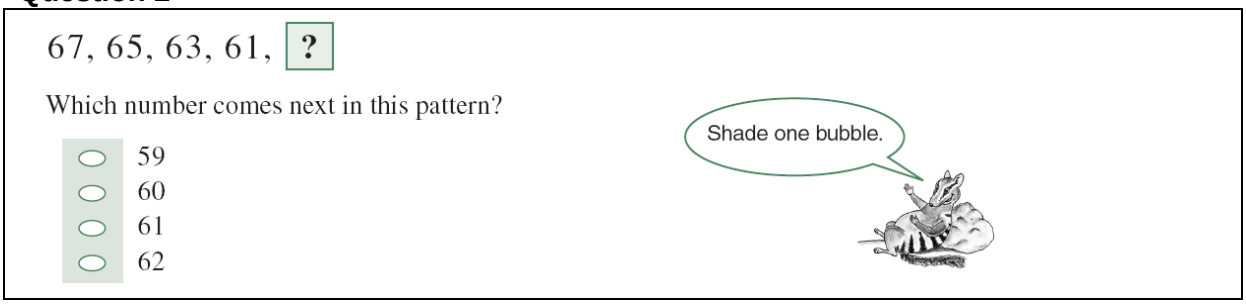


Skill: Students recognise patterns involving the constant addition of whole numbers.
Answer key: B

Additional questions

1. What will be the next number in this sequence? What will the 10th number be?
2. What would be the number before 31 in this sequence? Continue this backwards.
3. In the pattern above, what is the difference between any two numbers that are next to each other?
4. Other than writing all of the numbers down, is there another way you could work out the 12th number?
5. If this pattern started at 108, what would the next six numbers be? How did you work it out?

Question 2



Skill: Students recognise and continue a pattern involving a constant subtraction.
Answer key: A

Additional questions

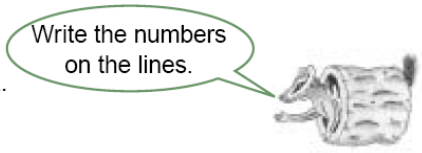
1. How did you work out your answer?
2. What would the next three numbers be?
3. What would the number before 67 be?
4. If this pattern started at 98 and followed the same rule, what would the first four numbers be?
5. What mathematical operation did you use to find the missing number?
6. Create your own number sequence and ask a partner to continue it.

Question 3

Pat made a number pattern that ended with 21.

Write the two numbers that are missing in her pattern.

3, 6, 9, _____, 15, _____, 21



Skill: Students recognise and find missing terms in patterns involving a constant addition.
Answer key: 12 and 18

Additional questions

1. Write the next five numbers in this pattern?
2. What would be the number before three in this pattern?
3. How did you work out your answer?
4. What mathematical operation did you use to find the missing number?
5. Nancy is counting by 2's. Her starting number is five.
   Which one of these numbers won't she say as she counts? How do you know?
   - 7
   - 9
   - 10
   - 11
6. Create your own number sequence and ask a partner to continue it.

Question 4

Add 17 to find out the next number in the sequence.

31, 48, 65, [ ]

Skill: Students recognise patterns involving the constant addition of a whole number.
Answer key: 82

Additional questions

1. What is the difference between the numbers in this pattern?
2. Write the next four numbers in this pattern. How did you work these out?
3. What is the number before 31 in this pattern?
4. If Jan started writing a number sequence at 69 and applied the same rule, write the first five numbers in her pattern.

Curriculum references

Department of Education and Training Western Australia, *2004, First Steps in Mathematics: Number* (book two):

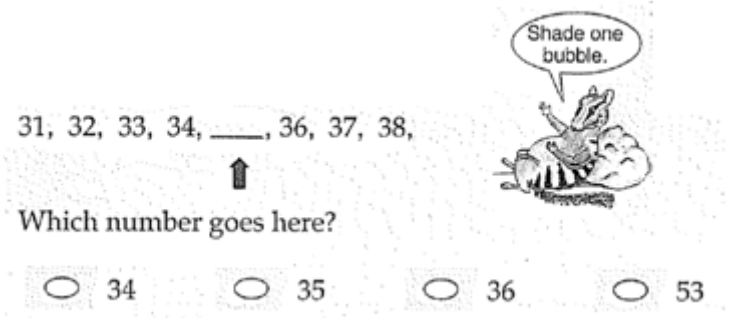
- Chapter 5: Reason about number patterns
  - Key Understanding 1: Representing aspects of a situation with numbers can make it easier to see patterns in the situation. p.224
  - Key understanding 4: There are strategies that help us become better at recognising common types of patterns. p.234

Student worksheet

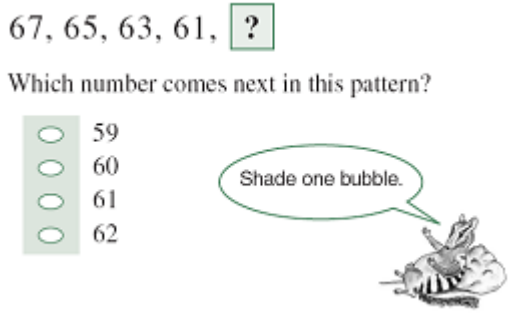
Focus

Number patterns based on constant addition or subtraction

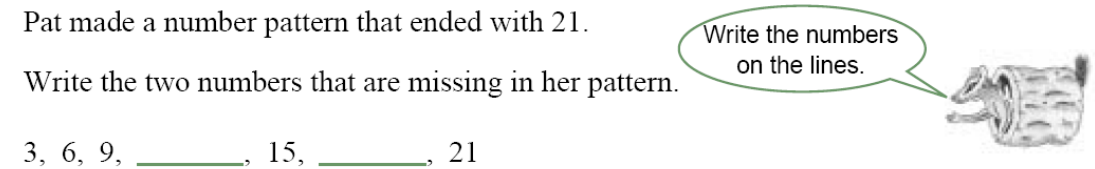
Question 1



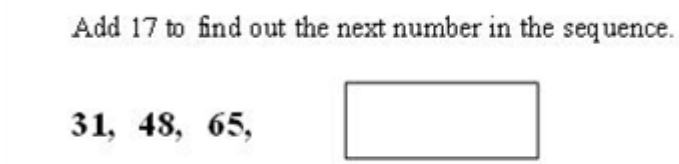
Question 2



Question 3



Question 4



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Describe and continue patterns with numbers and identify missing elements

Background information/teaching focus

The word 'pattern' refers to the underlying regularity or ongoing repetition in a situation. To copy a pattern means to reproduce the regularity. The main reasons we focus upon pattern is that patterns enable us to predict, expect and plan.

It is important to check that students actually do recognise and respond to or readily observe regularities in mathematical situations. Sometimes we think they are copying a pattern, when they haven't even noticed it. When students recognise the pattern, they can reproduce the sequence without looking back constantly and they notice errors and can self correct the copy.

Students should learn that representing aspects of a situation with numbers and then looking for patterns in the numbers can help us understand the situation better, often making patterns more obvious and predictions easier. For example a student observing a necklace that shows repetitions of *bead, leaf, leaf, shell, shell, shell, shell* might chant the numbers *1, 2, 4, 1, 2, 4, 1, 2, 4* and then say *it goes 1, 2, 4 over and over*, or *it goes one bead, two leaves, four shells over and over.* From the number pattern students could ask and answer questions such as: *If I keep making the necklace bigger will I need more beads, more leaves or more shells? If I use 16 shells, how many leaves will I need?*

Students should also learn that the same number pattern can be present in many different situations. For example, the repeating pattern 1, 2, 4…in the necklace as above is the same as in one squat, two jumps and four claps repeated over and over. This is useful because it means that the questions we have answered about the necklace have also been answered about the matching body actions.

Within a mathematical context, to describe a number pattern means to provide an ambiguous rule or relationship that produces it. Students should be able to follow rules provided by others, create rules for themselves and produce rules that fit the information provided. There is more advice on this in the *First Steps* Background Notes, Understand Number Patterns (page 258).

For further related information see *First Steps in Mathematics: Number* (book two):

- Chapter 5: Reason about number patterns
  - Key understanding 1: We use regularity or pattern to infer one thing from another thing and to make predictions. p.200
  - Key Understanding 2: Representing aspects of a situation with numbers can make it easier to see patterns in a situation. p.212
  - Key Understanding 3: To describe a number pattern means to provide a precise rule that produces the pattern. p.224

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Western Australian Curriculum

- Year 1 - Investigate and describe number patterns formed by skip counting and patterns with objects (ACMNA018).
- Year 2 – Describe patterns with numbers and identify missing elements (ACMNA035).
- Year 3 – Describe, continue and create number patterns resulting from performing addition or subtraction (ACMNA060).

For more information visit the Western Australian Curriculum.

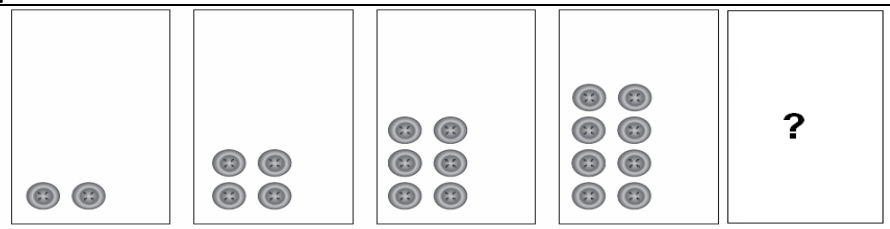
Learning experiences and activities

- Students should use obvious patterns to make copying arrangements and sequences easier; that is they no longer reproduce simply by matching each component one at a time.
- They are able to talk about regularity in situations using simple language such as 'pattern', 'over and over', 'repeat', 'again'.
- Students will get better at identifying patterns if they have sufficient and appropriate experiences in recognising, producing and describing patterns.

For further ideas for activities see *First Steps in Mathematics: Number* (book two):

- Necklaces p. 203
- Varied objects p. 203
- Pasta patterns p. 216
- Number scrolls p. 226
- What's my rule? p. 229
- Calculator patterns 1 & 2 p. 228

Question 1



Polly is making a pattern.

How many buttons will be in the next box?

10 12 14 16

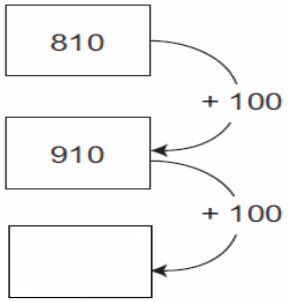
Skill: Students recognise and continue a pattern.
Answer key: A

Additional questions

1. Can you describe the rule for the pattern?
2. If you continued the pattern, how many buttons would be in the next box?
3. Make another pattern using buttons for a partner. If your partner continued the pattern, how many buttons would be next? Ask your partner to describe the rule for your pattern.
4. Can you create and continue the pattern using numbers instead of buttons?

Question 2

What is the next number in this pattern?



Write your answer in the box.

Skill: Students use the rule to write the next number in the pattern.
Answer key: 1 010

Additional questions

1. What number would come next if the pattern was continued?
2. What would the number pattern be if the rule was to add 1 000 each time?
3. What would the number pattern be if the rule was to subtract 100 each time?
4. Starting at number 10, can you think of a rule and write the number pattern for your rule. Ask a partner to guess your rule? Can you guess your partner's rule?

Question 3

Find the missing number in this pattern.

3, 6, _____, 12, 15

Skill: Students recognise the pattern and find the missing element.
Answer key: 9

Additional questions

1. Describe the rule for this pattern.
2. What number would come after 15 in the pattern?
3. What number would come before the 3 in the pattern?
4. What would the number pattern be if the rule was to add 4 each time?

Question 4

Dana started at 10 and made this number pattern.

10, 11, 13, 16, 20, 25, ?

What is the next number in the pattern?

26	30	31	35
⬭	⬭	⬭	⬭

Skill: Students recognise and complete a pattern.
Answer key: C

Additional questions

1. What is happening with numbers in this pattern?
2. What would the next number be after 31? Why?
3. What would the number pattern be if Dana had started at number 12?
4. What would the number pattern be if Dana had started at number 8?

Curriculum references

Department of Education and Training Western Australia *2004, First Steps in Mathematics: Number* (book two):

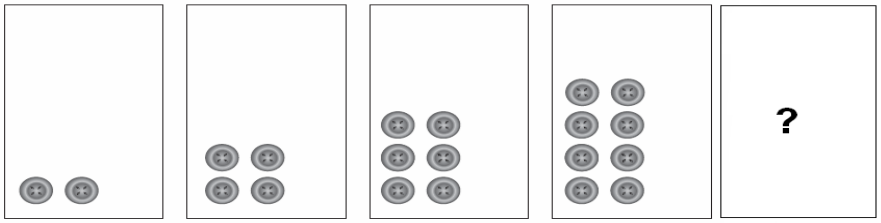
- Chapter 5: Reason about number patterns
  - Key understanding 1: We use regularity or pattern to infer one thing from another thing and to make predictions. p. 200
  - Key understanding 2: Representing aspects of a situation with numbers can make it easier to see patterns in the situation. p. 212
  - Key understanding 3: To describe a number pattern means to provide a precise rule that produces the pattern. p. 224

Student worksheet

Focus

Patterns based on repetition, size or orientation

Question 1



Polly is making a pattern.

How many buttons will be in the next box?

10 12 14 16

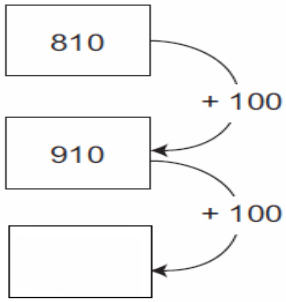
Question 3

Find the missing number in this pattern.

3, 6, _____, 12, 15

Question 2

What is the next number in this pattern?



Write your answer in the box.

Question 4

Dana started at 10 and made this number pattern.

10, 11, 13, 16, 20, 25, ?

What is the next number in the pattern?

26 30 31 35

Revised September 2016

Number sentences involving multiplication

Background information/teaching focus

Students should learn to recognise a wide range of problem types to which multiplication applies. They need to understand how these apparently different types of problems are related and to represent multiplication using materials, drawings, a story and number sentences.

The notion that 5 x 2 refers to five groups of two requires careful development. Students should be helped, from the earliest years, to think multiplicatively about these situations since repeated addition does not address all situations in which multiplying is helpful.

Initially, students learn to model problems involving 'repeating equal quantities' with materials and diagrams. Students are likely to think of these as the addition: 5 + 5 + 5 and should be helped to think of them multiplicatively as three lots of five. Once students can solve repeated addition problems, they can learn to solve simple familiar rate and combination problems, which do not explicitly involve repeating equal units. However, students' explanations of why multiplication works for rate and combination problems are likely to draw on ideas about repeated addition.

For further related information see *First Steps in Mathematics: Number* (book two)

- Chapter 3: Understand operations
  - Key Understanding 3: Multiplying numbers is useful when we:
    - repeat equal quantities
    - use rates
    - make ratio comparisons or changes, e.g. scales
    - make arrays and combinations
    - need products of measures. p.28

- Chapter 5: Reason about number patterns
  - Background Notes p.87

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- Year 3 – Represent and solve problems involving multiplication using efficient mental and written strategies and appropriate digital technologies (ACMNA057).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

- Make sets of repeated addition and multiplication equations and multiplication word problems for students to sort through and match up. Ask 'Is 3 x 6 the same as 6 x 3? Is it the same as 3 + 3 + 3 + 3 + 3 + 3? Why? Does 3 x 6 match the story that Billy needs three wheels to put on six tricycles? Why?'

- During daily activities ask students to collect and share materials and create groups of things. Ask them to describe and write the equations that are represented in each situation. Support students (especially those using repeated addition) to see the number of equal groups with focus questions such as ‘How many people are in your group? You needed two pieces of card each. You wrote 2 + 2 + 2 = 6. How many groups of two?’

The following activities are from *First steps in Mathematics: Number* (book two):

- Describing p. 30
- Think board p. 32
- Multiplication p. 33

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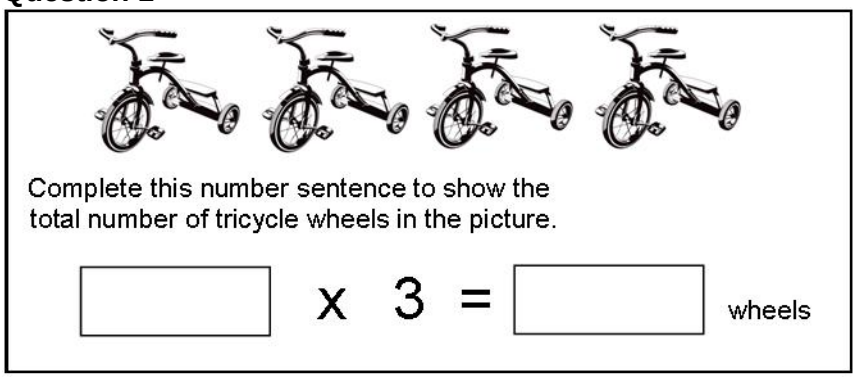
Numeracy online resources

- Year 2–3 Number: Understand operations
  Learning sequence 6
  Learning sequence 7

Question 1



Skill: Students use the links between repeated addition and multiplication.
Answer key: 4 × 3 = 12

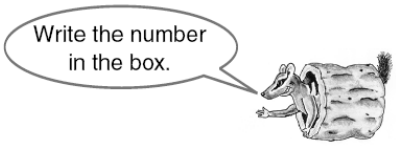
Additional questions

1. What is the three referring to?
2. When the students have worked out the answer ask: ‘What does the four refer to in the picture?’ ‘What does the 12 refer to?’
3. Write another number sentence to match this picture.
4. Maddie wrote: 3 + 3 + 3 + 3 = 12. Is there a shorter way of writing this?
5. Ann wrote 5 × 3 = 12. She is wrong. Why?

Question 2

Make this number sentence true.

$5 \times \square = 30$



Skill: Students interpret and complete a number sentence involving multiplication.
Answer key: 6

Additional questions

1. What did you have to think about to find the missing number?
2. What other ways could you use to work out the missing number?
3. Draw a diagram to show this. Draw it in an array (as a number of equal rows). Use the array to show the connection between multiplication and division.
4. How many groups of five make 15? How could you check your answer?
5. What is the missing number in these examples?
   i. $6 \times ? = 30$
   ii. $10 \times ? = 30$
   iii. $? \times 4 = 20$
   iv. $15 = ? \times 5$

Question 3

Six girls shared a bag of lollies.
Each girl got 8 lollies.

Which of these could be used to find how many lollies were in the bag at the start?

- ⬭ $6 \div 8$
- ⬭ $8 - 6$
- ⬭ $8 \div 6$
- ⬭ $6 + 8$
- ⬭ 6×8

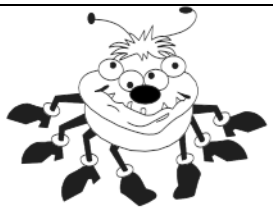
Skill: Students choose a number sentence to match a division situation.
Answer key: E

Additional questions

1. Helen said the answer is $8 \div 6$. Is she right? Why or why not?
2. Draw a diagram to represent the problem. Explain your diagram to a partner.
3. Write another number sentence to match the diagram or problem. (___$\div 6 = 8$)

Question 4

Carl collects squigs.
A squig has 7 legs and 4 eyes.
Altogether, Carl's squigs have 35 legs.



How many squigs does he have?

- ○ 5
- ○ 7
- ○ 35
- ○ 46

Skill: Students solve a problem involving equal sets using links between repeated addition and multiplication.
Answer key: A

Additional questions

1. How did you work it out? Draw a diagram to show your thinking.
2. Write a number sentence to match the problem.
3. Is there another way to work it out?
4. If there were 42 squigs' legs, how many squigs would there be?
5. If there were 700 squigs' legs how many squigs would there be?

Curriculum references

Department of Education and Training Western Australia 2004, *First Steps in Mathematics: Number* (book two):

- Chapter 3: Understand operations
  - Key understanding 3: Multiplying is numbers useful when we:
    - repeat equal quantities
    - use rates
    - make ratio comparisons or changes, for example, scales
    - make arrays and combinations
    - need products of measures. p.28
  - Key understanding 4: Dividing numbers is useful when we:
    - share or group a quantity into a given number of portions
    - share or group a quantity into portions of a given size
    - need the inverse of multiplication. p.40

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Student worksheet

Focus

Number sentences involving multiplication

Question 1

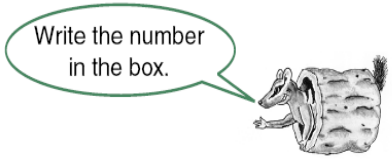
Complete this number sentence to show the total number of tricycle wheels in the picture.

☐ x 3 = ☐ wheels

Question 2

Make this number sentence true.

$5 \times \square = 30$



Question 3

Six girls shared a bag of lollies.
Each girl got 8 lollies.

Which of these could be used to find how many lollies were in the bag at the start?

- ○ 6 ÷ 8
- ○ 8 – 6
- ○ 8 ÷ 6
- ○ 6 + 8
- ○ 6 × 8

Question 4

Carl collects squigs.
A squig has 7 legs and 4 eyes.
Altogether, Carl's squigs have 35 legs.

How many squigs does he have?

- ○ 5
- ○ 7
- ○ 35
- ○ 46

Revised September 2016

Number sentences involving division

Background information/teaching focus

Students should learn to recognise a wide range of problem types, using materials and diagrams, to which division applies. They need to be helped to see how these apparently different types of problems are similar and so can all be solved using division and how to represent different styles of division equations using materials, drawings or a story.

Students should learn that the division operation is appropriate for problems where you know the quantity and the number of portions to be formed from it, and you want to find how many or how much will be in each portion. These are called partition problems because you know how many parts. They are also informally called sharing problems.

Students should also learn to use division for problems where you know the quantity and how many or how much is to be in each portion, and you want to find out how many portions there will be. These are called quotation problems because you know the quota. They are also informally called grouping, measuring or repeated subtraction problems.

For further related information see *First Steps in Mathematics: Number (Book two)*:

- Chapter 3: Understand operations
  - Key understanding 4: Dividing numbers is useful when we:
    - share or group a quantity into a •given number of portions
    - share or group a quantity into portions of a given size
    - need the inverse of multiplication. p.40
- Chapter 4: Calculate
  - Key understanding 3: We can think of a number as a multiplication or division in different ways. We can rearrange the factors of a multiplication without changing the quantity p.114
- Chapter 5: Reason about number patterns
  - Background Notes p. 258

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Western Australian Curriculum

- Year 2 – Recognise and represent division as grouping into equal sets and solve simple problems using these representations (ACMNA032).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

- Use daily activities to model and record grouping and sharing situations. For example, ask students to form groups of four, or to make four equal size groups. Discuss and record the matching equations for these problems.
- Provide students with a selection of pairs of story problems that involve the same numbers and context for them to match to diagrams and the two styles of equations. Ask students to describe their reasoning. For example, Sally had 12 lollies to share between three people. How many lollies did each person get? Sally had 12 lollies and wants to give three lollies to each person. How many people will receive lollies?

The following activities are from *First steps in Mathematics: Number (Book two)*:

- Recording p. 43
- Modelling p. 43
- Sharing and grouping p. 44
- Background notes on p. 87 (for further information)

Numeracy online resources

- Year 2–3 Number: Understand operations
  Learning sequence 6
  Learning sequence 7

Question 1

Look at this number sentence.

Which of these stories does it match?

- ○ I had $20 and spent $2.
- ○ Eighteen lollies were shared equally by two children.
- ○ After being given another $2, I had $16 altogether.
- ○ Two of our eighteen players were hurt and left the ground.

Skill: Children identify the story that matches a number sentence involving division.
Answer key: 2

Additional questions

1. I had eighteen lollies and I put two into each bag. How many bags did I need? How is it the same and how is it different from the first story?
2. Six children shared 60 lollies equally. How many lollies did each child get? Write a number sentence to match.
3. How many bags would you need if you started with 60 lollies and put six in each bag? Why is the number in the answer the same in questions 3 and in 4?
4. Can you write a different story problem using the same numbers?

Question 2

Three friends shared 27 lollies equally.
How many lollies did they each get?

Which number sentence matches this story?

- ○ $27 - 3 = ?$
- ○ $27 \times 3 = ?$
- ○ $27 \div 3 = ?$
- ○ $27 + 3 = ?$

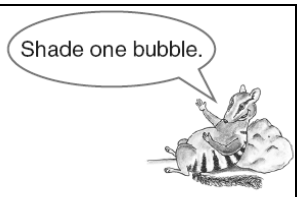
Skill: Students identify division as the operation to solve a sharing problem.
Answer key: C

Additional questions

1. Show how you would work out the answer to the number sentence.
2. Write a story to match each of the other number sentences.
3. What is 9 + 9 + 9 = ? Write a story to match this number sentence? Can you write the number sentence in a different way?

Question 3

Joanne started with a number.
She halved it.
Then she took away 4.
The answer was 3.



Which number sentence matches this story?

- ○ $4 - ? \div 2 = 3$
- ○ $? \div 2 + 3 = 4$
- ○ $? \div 2 + 4 = 3$
- ○ $? \div 2 - 4 = 3$

Skill: Students match a story to a number sentence.
Answer key: D

Additional questions

1. Which part of the number sentence shows that you halved the number?
2. How could you show that dividing by two is the same as halving?
3. What number did Joanne start with? How did you work it out?
4. Is there a different number sentence that you can write to show how you worked it out?
5. Carl doubled a number then he added six. His result was 10. What number did Carl start with? Write a number sentence to match this story.

Question 4

Eight people get an equal share of $2000.

How could you work out each person's share?

◯ 2000 + 8 ◯ 2000 - 8 ◯ 2000 x 8 ◯ 2000 ÷ 8

Skill: Students recognise division in familiar contexts.
Answer key: D

Additional questions

1. What is the question asking you to do? Explain it in your own words.
2. What does the 8 represent in the number sentence? What does the 2 000 mean?
3. Could repeatedly halving help you work it out? How?
4. Could you write a multiplication number sentence to represent the situation? (8 x ? = 2000)
5. How many people would get $8 each from $2000? What number sentence matches that situation?
6. Write another story problem that could be worked out using 2000 ÷ 8.

Curriculum references

*First steps in Mathematics: Number (*book two*)*:

- Chapter 3: Understand operations
  - Key understanding 3: Multiplying numbers is useful when we:
    - repeat equal quantities
    - use rates
    - make ratio comparisons or changes, for example, scales
    - make arrays and combinations
    - need products of measures. p.28
  - Key understanding 4: Dividing numbers is useful when we:
    - share or group a quantity into a given number of portions
    - share or group a quantity into portions of a given size
    - need the inverse of multiplication. p.40

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Student worksheet

Focus

Number sentences involving division

Question 1

Look at this number sentence.

1 8 ÷ 2 = ?

Which of these stories does it match?

- ◯ I had $20 and spent $2.
- ◯ Eighteen lollies were shared equally by two children.
- ◯ After being given another $2, I had $16 altogether.
- ◯ Two of our eighteen players were hurt and left the ground.

Question 2

Three friends shared 27 lollies equally.
How many lollies did they each get?

Which number sentence matches this story?

- ◯ 27 – 3 = ?
- ◯ 27 x 3 = ?
- ◯ 27 ÷ 3 = ?
- ◯ 27 + 3 = ?

Question 3

Joanne started with a number.
She halved it.
Then she took away 4.
The answer was 3.

Which number sentence matches this story?

- ◯ 4 – ? ÷ 2 = 3
- ◯ ? ÷ 2 + 3 = 4
- ◯ ? ÷ 2 + 4 = 3
- ◯ ? ÷ 2 – 4 = 3

Question 4

Eight people get an equal share of $2000.

How could you work out each person's share?

◯ 2000 + 8 ◯ 2000 - 8 ◯ 2000 x 8 ◯ 2000 ÷ 8

Revised September 2016

Number sentences involving addition and subtraction

Background information/teaching focus

Students should learn to recognise a wide range of problem types to which addition and subtraction apply. These should include change situations (add some or take some away), combine situations, and compare and equalise situations. Students should be helped to see how these types of problems can all be thought of in terms of part-part-whole, and can be solved using the same operations.

Students need to link the various addition situations to the part-part-whole notion, so they understand *why* the addition symbol works in each case. Similarly, they need to link various subtraction situations to part-part-whole and to the subtraction symbol. They should be given opportunities to write suitable number sentences.

The part-part-whole relationship shows how addition and subtraction are related, with subtraction being the inverse of addition. If the whole quantity is unknown, addition is required. If one of the other quantities is unknown, subtraction is required. This enables students to see *why* a problem that they think of as about adding, but with one of the addends unknown, could be solved by subtracting or vice-versa.

Part + Part = Whole Whole – Part = Part

Associating the joining and separating of the parts that make the whole to a variety of situations also helps students to see *why* subtraction can be used to solve a take-away problem and also a comparison problem.

The part-part-whole relationship is also the key to students seeing *why* addition is commutative and *why* subtraction is not. Knowing why addition is commutative and subtraction is not helps students represent word problems with appropriate addition and subtraction sentences.

For further related information see *First Steps in Mathematics: Number* (book two):

- Chapter 3: Understand operations
  - Key understanding 1:

    Adding and subtracting numbers is useful when we:
    - change a quantity by adding more or taking some away
    - think of a quantity as combined of parts
    - equalise or compare two quantities. p.12
  - Key understanding 2:

    Partitioning numbers into part-part-whole helps us relate addition and subtraction and understand their properties p. 20
- Chapter 4: Calculate
- Chapter 5: Reason about number patterns

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Western Australian Curriculum

- Year 2 – Explore the connection between addition and subtraction (ACMNA029).
- Year 2 – Solve simple addition and subtraction problems using a range of efficient mental and written strategies (ACMNA030).
- Year 2 – Solve problems by using number sentences for addition or subtraction (ACMNA036).
- Year 3 – Recognise and explain the connection between addition and subtraction (ACMNA054).
- Year 3 – Recall addition facts for single-digit numbers and related subtraction facts to develop increasingly efficient mental strategies for computation (ACMNA055).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

- Initially, students should solve problems by acting them out, modelling them with materials and diagrams, and imagining them in their 'mind's eye'. The goal is for students to build connections between dramatic, physical, diagrammatic and verbal forms of problems and their symbolic representations.
- A wide range of addition and subtraction problems should be posed so students can link various problem situations to the addition and subtraction operations and the symbols.

  See the background notes in *First Steps in Mathematics: Number* (book two) p. 87.

- Think board p. 23
- Separating objects p. 15
- Matching collections p. 15
- Word problems p. 15
- Part-part-whole p. 22
- Number sentences p. 23

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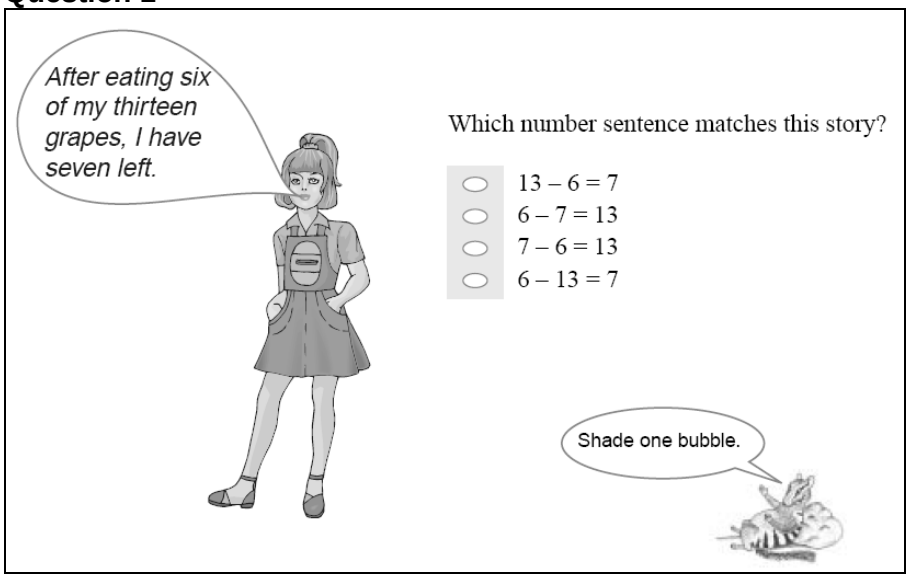
Numeracy online resources

- Year 2–3 Number: Understand operations
  Learning sequence 1
  Learning Sequence 3

Question 1



Skill: Students identify the number sentence that matches a story.
Answer key: A

Additional questions:

1. After buying four new toy cars, Michael has 12 toy cars altogether. Which number sentence matches this story?
   a) 4 + 12 = 16
   b) 12 – 4 = 8
   c) ? + 4 = 12
   d) 12 - ? = 4
2. If you needed to solve the number story in question 1 with your calculator, what number sentence would you put into the calculator?
3. Here is a number sentence: 10 – 4 = 6. Write a story to match this number sentence.

Question 2

Which one of these does **not** mean the same thing as $30 - 6$?

- ❍ Thirty take-away six
- ❍ Thirty subtract six
- ❍ Thirty plus six
- ❍ Six from thirty

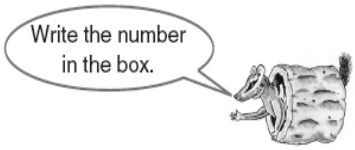
Skill: Recognising the language used for subtraction.
Answer key: C

Additional questions:

1. Write the number sentence for the answer you have chosen. (The one that does not mean 30 – 6.) What are some other ways of saying this number sentence?
2. Write a story to match this number sentence.
3. Write a story to match the number sentence 30 – 6.

Question 3

Make this number sentence true.



$\square - 34 = 22$

Skill: Students use the connection between addition and subtraction and their understanding of equality to solve a number sentence.
Answer key: 56

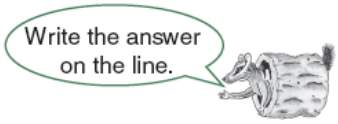
Additional questions:

1. How did you work out the answer?
2. What would you need to enter in your calculator to solve the number sentence?
3. Write a story to match the number sentence.
4. How would you solve this number sentence? $82 - \square = 39$
   Write a story to match. Explain how this number sentence and story is different from the first one.

Question 4

Joel had some strawberries. He ate 3. Now he has 7 left.
How many strawberries did Joel start with?

Write a number sentence to match this story.



Skill: Students use part-part-whole to write a number sentence to match a story.
Answer key: ? – 3 = 7 or ? = 3 + 7

Additional questions

1. How many strawberries did Joel start with? How did you work it out?
2. If you wanted to solve this number story with a calculator what buttons would you need to press? Is it the same as the number sentence that tells the order of events in the story?
3. Have children represent the parts of the story on grid paper similar to the diagram below. Ask: 'How can this diagram help solve the problem?' Draw out the parts of the problem represented by the numbers in the boxes.

?	
3	7

4. Place the parts for this story on the diagram: Joel had 30 strawberries and he ate some. Then he had 18 left. How many did he eat?
5. How can the diagram help you write a number sentence? How can this help to solve the problem? How? What is the answer?
6. Work in pairs to write some more problems like this (start unknown) for another pair to represent and solve. Encourage children to use the diagram to represent the situation.

Curriculum references

Department of Education and Training Western Australia 2004, *First Steps in Mathematics: Number (book two)*:

- Chapter 3: Understand operations
  - Key understanding 1: Adding and subtracting numbers is useful when we:
    - change a quantity by adding more or taking some away
    - think of a quantity as combined of parts
    - equalise or compare two quantities.
  - Key understanding 2: Partitioning numbers into part-part-whole helps us relate addition and subtraction and understand their properties.

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Student worksheet

Focus

Number sentences involving addition and subtraction.

Question 1

Which number sentence matches this story?

- ○ 13 – 6 = 7
- ○ 6 – 7 = 13
- ○ 7 – 6 = 13
- ○ 6 – 13 = 7

Question 2

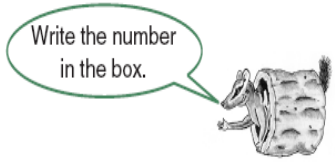
Which one of these does **not** mean the same thing as $30 - 6$?

- ❍ Thirty take-away six
- ❍ Thirty subtract six
- ❍ Thirty plus six
- ❍ Six from thirty

Question 3

Make this number sentence true.

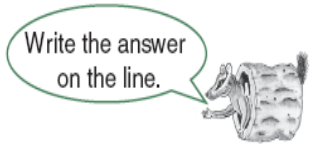
$\square - 34 = 22$



Question 4

Joel had some strawberries. He ate 3. Now he has 7 left.
How many strawberries did Joel start with?

Write a number sentence to match this story.



Finding missing numbers in a number sentence

Background information/teaching focus

To solve everyday problems involving numbers, we have to represent the problem as a number sentence. For example, when we buy two things that cost $35 and $17 we have to think of it as '35 add 17 is what?' Students need a lot of experience in representing problems in ways that enable them to be dealt with mathematically.
Most students readily learn to write addition and subtraction number sentences where the result is unknown. The difficulty is that the standard representations often do not match the modelling or counting processes they use. For example:
We had eight mice but some escaped and now we only have five left. How many mice escaped?

Students may think of this as eight mice and some ran away now we have five and represent it as 8 — ? = 5. It is much harder for students to think of such a problem as the standard subtraction: 8 — 5 = ? If a student cannot solve 8 — ? = 5, it is unlikely that they will have been able to arrange the problem in order to get 8 — 5 = ?
This process is the basis of algebraic thinking. This flexibility depends on students understanding of the following:

- Two number sentences are equivalent when they represent the same situation.
- It is not necessary to go back to the original situation to know that two number sentences are equivalent; instead we can use properties of operations and the relationships between them.

For further related information see, *First Steps in Mathematics: Number* (book two):

- Chapter 3: Understand operations
  - Key understanding 8: Thinking of a problem as a number sentence often helps us to solve it. Sometimes we need to rewrite the number sentence in a different but equivalent way.

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Western Australian Curriculum

- Year 2 – Solve problems by using number sentences for addition or subtraction (ACMNA036).
- Year 4 – Find unknown quantities in number sentences involving addition and subtraction and identify equivalent number sentences involving addition and subtraction (ACMNA083).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

- Students should learn to write and solve number sentences like 8 − ? = 5 and over time develop their part-part-whole understanding to link equivalent addition and subtraction number sentences, eg 3 + 5 = 8, 5 + 3 = 8, 8 — 3 = 5, 8 — 5 = 3. When

students understand these links they can move between the various ways of representing the situation.

- Students should be encouraged to think flexibly about problems and be helped to see that we can often think about the same situation in different ways and so represent it differently. Unless students are confident that such transformed number sentences are always 'asking the same question' they will not be able to use strategies flexibly to find unknown quantities and will be forced to rely on trial-and-error or rote procedures.

For further ideas for activities see *First Steps in Mathematics: Number* (book two):

- Inverse relationships p. 76
- Choose the operation p. 77
- Numbers and signs p. 77
- Related numbers p. 78
- Story problems p. 78

Numeracy online resources

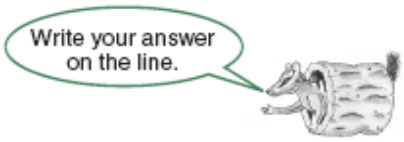
- Year 2–3 Number: Understand operations
  Learning sequence 3
  Learning sequence 4
  Learning sequence 8

Question 1

The **difference** between two numbers is 6.
The first number is 13.

What could the second number be?

_____



Skill: Students identify the missing number given the start and result.
Answer key: 7

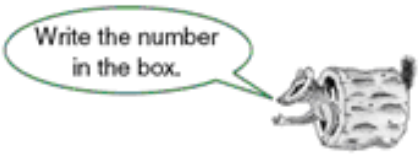
Additional questions

1. How did you work out your answer? Draw a picture to show your thinking.
2. Write the number sentence to match this story.
3. Can you write any other number sentences related to the number sentence you wrote for Question 2?
4. If we know that the second number is 9 and the difference is 18, with what number did we start? Write the matching number sentence.

Question 2

Make this number sentence true.

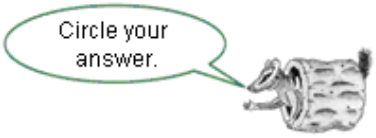
$9 - \square = 5$



Which expression should also be true?

A) $\square = 9 + 5$ B) $\square = 14 — 9$

C) $\square = 9 — 5$ D) $\square = 14 — 5$



Skill: Students recognise equivalent number sentences.
Answer key: 4; C

Additional questions

1. How did you work out your answer?
2. What would you say to a friend to prove that C is the correct number sentence.
3. Write a story to match the original number sentence.
4. Write another true statement to match each of the other options.

Question 3

$2 \times 5 \times \square = 40$

Skill: Students identify number needed to make a number sentence true.
Answer key: 4

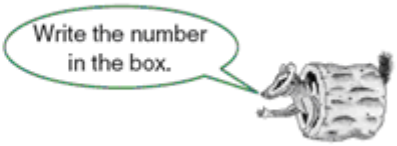
Additional questions

1. How did you work out your answer?
2. Could you put the same number in the box for this number sentence 2 x $\square$ x 5 = 40. Why or why not?
3. Can you change the order of numbers for other operations? If so, which ones?

Question 4

Make this number sentence true.

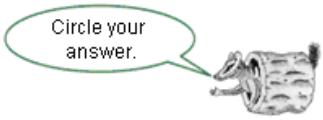
$\square - 34 = 22$



Which expression should also be true?

A) $\square$ = 34 — 22 B) $\square$ = 34 × 22

C) $\square$ = 34 + 22 D) $\square$ = 34 ÷ 22



Skill: Students recognise equivalent number sentences.
Answer key: 56; C

Additional questions

1. Explain how you know that C is the correct number sentence.
2. Write a story to match the original number sentence.
3. Draw a diagram to represent each of the other options to explain how they are

Curriculum references

Department of Education and Training Western Australia, 2004, *First Steps in Mathematics: Number* (book two):

- Chapter 3: Understand operations
  - Key understanding 2: Partitioning numbers into part-part-whole helps us relate addition and subtraction and understand their properties. p.20
  - Key understanding 5: Repeating equal properties and partitioning a quantity into equal parts helps us relate multiplication and division and understand their properties.p.52
  - Key understanding 8: Thinking of a problem as a number sentence often helps us solve it. Sometimes we need to rewrite the number sentence in a different but equivalent way. p.74

Student worksheet

Focus

Finding missing numbers in a number sentence

Question 1

The **difference** between two numbers is 6.

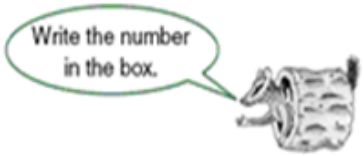
The first number is 13.

What could the second number be?

Question 2

Make this number sentence true.

9 − ☐ = 5



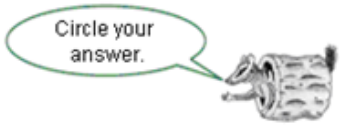
Which expression should also be true?

A) ☐ = 5 + 9

B) ☐ = 14 - 9

C) ☐ = 9 – 5

D) ☐ = 14 - 5



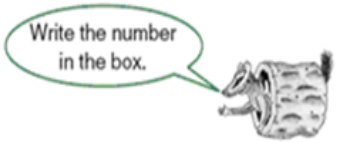
Question 3

2 × 5 × ☐ = 40

Question 4

Make this number sentence true.

☐ − 34 = 22



Which number sentence should also be true?

A) ☐ = 34 - 22

B) ☐ = 34 × 22

C) ☐ = 34 + 22

D) ☐ = 34 ÷ 22

Revised September 2016

Patterns based on halving and doubling

Background information/teaching notes

From the beginning years, students should be encouraged to use their everyday language to talk about the patterns they have observed, created or produced according to rules provided by others. During the middle years they should learn to clarify and refine their descriptions, using as the criteria that another person should be able to recreate the sequence or arrangement from the pattern description alone. Thus, describing 6, 12, 24 …as a 'doubling pattern' isn't enough, but saying 'start with six and then keep doubling' is. During the later primary years, students should also get better at writing rules for patterns. Trying to follow the rules of others will help them to identify what is needed in a rule.

For further related information see *First Steps in Mathematics: Number* (book two):

- Chapter 5: Reason about number patterns
  - Key understanding 3: To describe a number pattern means to provide a precise rule that produces the pattern.

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Western Australian Curriculum

- Year 2 – Describe patterns with numbers and identify missing elements (ACMNA035).
- Year 3 – Describe, continue, and create number patterns resulting from performing addition or subtraction (ACMNA060).
- Year 4 – Explore and describe number patterns resulting from performing multiplication (ACMNA081).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

- Students will get better at identifying patterns if they have sufficient and appropriate experiences in recognising, producing and describing patterns.
- It is important for students to experience a range of pattern types and develop some of the strategies that are helpful for finding patterns. As students explore various number patterns, their attention should be drawn to:
  - the strategies that they found helpful in identifying patterns
  - the similarities between certain patterns.

For further ideas for activities see *First Steps in Mathematics: Number* (book two):

- What's my rule? p. 229
- What comes next? p. 229
- Find the rule p. 235
- Practising strategies p. 235
- Halving p. 237
- Doubling p. 238

Question 1

Pat made a number pattern that ended with **48**.

3, 6, 12, __, 48

Write the missing number in her pattern. _____

Skill: Students recognise and continue a number pattern based on doubling.
Answer key: 24

Additional questions

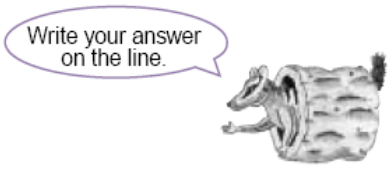
1. How did you work this out?
2. What are the next two numbers in Pat's pattern after 48?
3. Start with 5 and write the first four numbers in a pattern using doubling.
4. Make up a pattern of your own using doubling and give it to another student to continue.

Question 2

Jamie was making a pattern based on halving.

The first three numbers were:

64 32 16



What was the first number in the pattern that was less than 1? _____

Skill: Students continue a number pattern using halving.

Answer key: a half ($\frac{1}{2}$)

Additional questions

1. How did you work this out?
2. What are the next two numbers after 16 in Jamie's pattern?
3. List the next two numbers after 1 in Jamie's pattern.
4. Using halving, what number should you start with for the number 9 to be the third number in your pattern?
5. Make a pattern based on halving.

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Question 3

Karen started this pattern.

How many small squares should she draw next?_____

Karen now continues the pattern to the next group of squares.
In total, how many triangles has Karen drawn altogether?
_____

Skill: Students continue a spatial pattern requiring doubling.
Answer key: 8, 4

Additional questions

1. How many triangles will there be once Karen has drawn the pattern to the fifth group of squares?
2. Describe what changes in this pattern.
3. Use different shapes to make and draw a pattern using the same rule.

Question 4

Alison used shells to show a number pattern.
She wants to make **two more** rows of the pattern.

How many **more** shells will she need? _____

Skill: Students continue a number pattern based on doubling.
Answer key: 48

Additional questions

1. How many shells does Alison need:
   a. in the fifth row?
   b. in the sixth row?
2. How many shells does Alison need in the eighth row?
3. How did you work it out?
4. Describe what changes between each row?
5. Alison's friend Anna wants to start her shell pattern with two shells. She uses the same rule. How many shells will she need to make four rows?

Curriculum references

Department of Education and Training Western Australia*, 2004, First Steps in Mathematics: Number* (book two):

- Chapter 5: Reason about number patterns
  - Key understanding 1: We use regularity or pattern to infer one thing from another and to make predictions.
  - Key understanding 3: To describe a number pattern means to provide a precise rule that produces the pattern.
  - Key understanding 4: There are strategies that help us become better at recognising common types of patterns.
  - Key understanding 6: Some numbers have interesting or useful properties. Investigating the patterns in these special numbers can help us to understand them.

Student worksheet

Focus

Patterns based on halving and doubling

Question 1

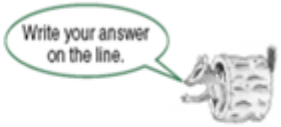
Pat made a number pattern that ended with **48**.

3, 6, 12, __, 48

Write the missing number in her pattern. _____

Question 2

Jamie was making a pattern based on halving.



The first three numbers were:

64 32 16

What was the first number in the pattern that was less than 1?

_____

Question 3

Karen started this pattern.

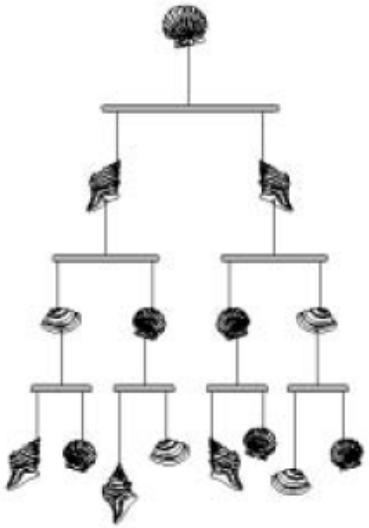
How many small squares should she draw next? _____

Karen now continues the pattern to the next group of squares.
In total, how many triangles has Karen drawn altogether?

_____

Question 4

Alison used shells to show a number pattern.
She wants to make **two more** rows of the pattern.



?

?

How many **more** shells will she need? _____

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Identifying and applying a rule in a pattern

Background information/teaching focus

Within a mathematical context, to describe a number pattern means to provide an unambiguous rule or relationship that produces it. Students should be able to follow rules provided by others, create rules for themselves and produce rules that fit the information provided.

There are some conventional mathematical types of rules that students should begin to use in the primary years. For example:

- Sequences of numbers can be described by giving a rule that says where to start and how to get from any number in the sequence to the next one. For example: Start with 7. Each number after that is five more than the one before (7, 12, 17, 22 …)
- Sequences of numbers can also be described by giving a general rule that says how to work out any number in the sequence by knowing what its position in the sequence is. For example: Each number in the sequence is two added to five times its position (7, 12, 17, 22 …)
- Other patterns can be described by rules that say what the general relationship is between two quantities. For example: The area of a square is the length of one side squared.

For further related information see *First Steps in Mathematics: Number* (book two):

- Chapter 5: Reason about number patterns
  - Key understanding 3: To describe a number pattern means to provide a precise rule that produces the pattern. p.224

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Western Australian Curriculum

- Year 2 – Describe patterns with numbers and identify missing elements (ACMNA035).
- Year 3 – Describe, continue, and create number patterns resulting from performing addition or subtraction (ACMNA060).
- Year 4 – Explore and describe number patterns resulting from performing multiplication (ACMNA081).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

- From the beginning years, students should be encouraged to use their everyday language to talk about the patterns they have observed, created or have produced according to rules provided by others.
- During the middle years they should learn to clarify and refine their descriptions, using as the criteria that another person should be able to recreate the sequence or arrangement from the description of the pattern alone.
- During the later primary years students should also get better at writing rules for patterns. Trying to follow the rules of others will help them to identify what is needed in a rule.

For further ideas for activities see *First Steps in Mathematics: Number* (book two):

- Function box p. 228
- What's my rule? p. 229
- What comes next? p. 229
- Find the rule p. 235

Question 1

Beth made a number pattern, starting with 34.

34, 31, 28, 25, 22, 19, 16

Which rule did she use?

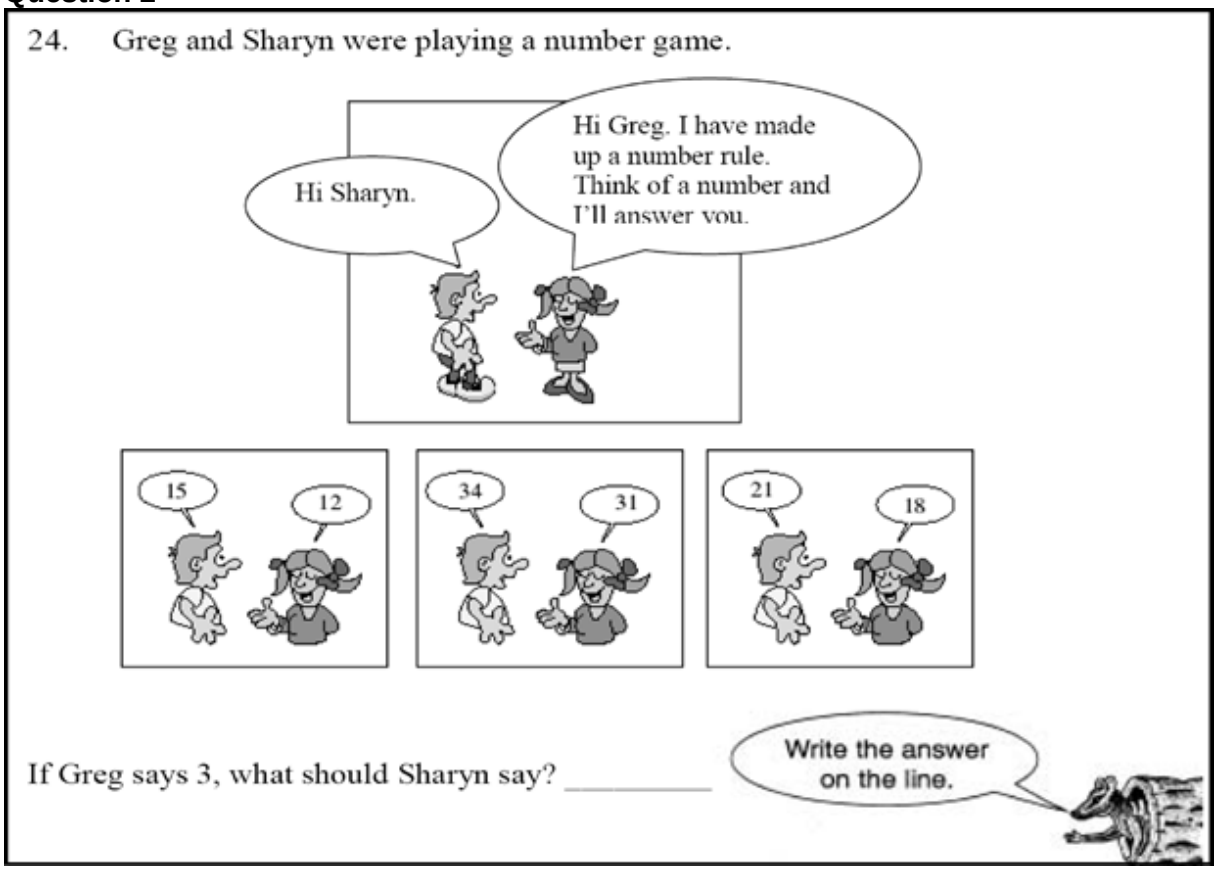
- add 3
- subtract 4
- add 4
- subtract 3

Skill: Students identify the rule used in a number pattern.
Answer key: D

Additional questions

1. Write the next two numbers in the pattern.
2. How many more numbers would Beth need to write to reach the number 4?
3. What would be the number before 34?
4. If Beth started at the number 68 and applied this same rule, what would be the 5th number in her pattern?

Question 2



Skill: Students identify and use a simple rule based on subtraction.
Answer key: 'zero'

Additional questions

1. How did you decide what the answer would be?
2. If Greg says 100, what should Sharyn's answer be?
3. If Greg says **15, 34** and **21** and Sharyn's answers are **19, 38** and **25** respectively, what should Sharyn's rule be?
4. Make up your own rule and play the game with a partner.

Question 3

Jasmine wants Briana to write this number pattern.

4, 8, 16, 32, 64, …

Which **two** instructions should Jasmine give?

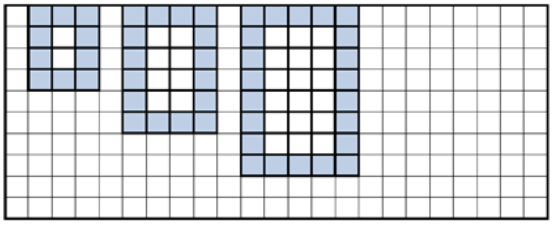
start with 4	and halve	and double	and add 4	and add 2
A	B	C	D	E

Skill: Students recognise the rule of a pattern based on doubling.
Answer key: A and C

Additional questions

1. Write the next two numbers in this pattern.
2. Briana continues the number pattern above and ends with 256. How many more times did she carry out the instruction?
3. Could Jasmine have started her number pattern at 0? Explain your thinking?
4. Briana wants Jasmine to write this number pattern: 192, 96, 48, 24 . . .
5. What two instructions should Briana give?
6. Jasmine continues the number pattern. Will she write the number 0 in her pattern? Why?

Question 4



How many squares will be shaded in the next shape if the pattern is continued?

- 26
- 28
- 30
- 32

Skill: Students continue a geometric pattern and identify numbers to match it.
Answer key: 28

Additional questions

1. How many squares would be in the 6th shape?
2. Andy put the information from the above pattern into a table. Complete the following table:

Shape number	1	2	3	4	5	6	7	8
Number of squares	10	16	22					

3. How did you know what to put in the table? Is there another way to work it out?

Curriculum references

Department of Education and Training Western Australia*, 2004, First Steps in Mathematics: Number* (book two):

- Chapter 5: Reason about number patterns
  - Key understanding 1: We use regularity or pattern to infer one thing from another and to make predictions.
  - Key understanding 2: Representing aspects of a situation with numbers can make it easier to see patterns in the situation.
  - Key understanding 3: To describe a number pattern means to provide a precise rule that produces the pattern.

Student worksheet

Focus

Identifying and applying a rule in a pattern

Question 1

Beth made a number pattern, starting with 34.

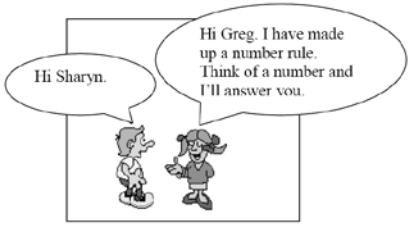
34, 31, 28, 25, 22, 19, 16

Which rule did she use?

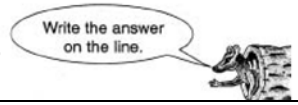
- ○ add 3
- ○ subtract 4
- ○ add 4
- ○ subtract 3

Question 2

24. Greg and Sharyn were playing a number game.



If Greg says 3, what should Sharyn say? _____



Question 3

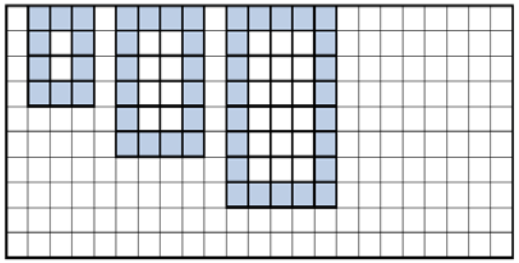
Jasmine wants Briana to write this number pattern.

4, 8, 16, 32, 64, …

Which **two** instructions should Jasmine give?

- start with 4 ○
- and halve ○
- and double ○
- and add 4 ○
- and add 2 ○

Question 4



How many squares will be shaded in the next shape if the pattern is continued?

- ○ 26
- ○ 28
- ○ 30
- ○ 32

Revised September 2016

Reading and writing whole numbers up to four digits and beyond

Background information/teaching focus

Place value is the key to understanding how we say, read, write and calculate with whole numbers. The pattern in the way we put the digits together enables us to write an infinite sequence of whole numbers and to put any two whole (or decimal) numbers in order easily.

Students have to understand the following important characteristics of our place-value system:

- the order of the digits makes a difference to the number, so 28 is different from 82
- the position (or place) of a digit tells us the quantity it represents; for example, in 3 526, the 2 indicates 2 tens or 20; but in 247, the 2 indicates 2 hundreds or 200
- zero is used as a place holder. It indicates there is none of a particular quantity and holds the other digits 'in place'; for example, 27 means 2 tens and 7 ones, but 207 means 2 hundreds, 0 tens and 7 ones.

Students need to understand that they do not have to remember every number name because the patterns in the numeration system enable us to predict a number even if we have never heard it before. In order to develop the capacity to generate any numbers in sequence students need to:

- memorise the 1 to 13 words in sequence, since there is no inherent pattern in the sounds.
- hear the 4 to 9 part of the sequence in 14 to 19 (although, 'fifteen' does not sound quite like 'fiveteen')
- predict and name the decades by following the 1 to 9 sequence
- repeat the 1 to 9 sequence within each decade
- predict and name the hundreds by following the 1 to 9 sequence
- repeat the decade sequence and 1 to 9 sequence within each of the hundreds
- predict and name the thousands by following the 1 to 9 sequence
- repeat the hundreds, decades and 1 to 9 sequences within each of the thousands
- except for the teens, say the places in the order in which the digits are written from left to right.

For further related information see *First Steps in Mathematics*: Number (Book one)

- Chapter 3: Understand whole and decimal number
  - Key understanding 4: The whole numbers are in a particular order and there are patterns in the way we say them which help us to remember the order p. 40
  - Key understanding 5: There are patterns in the way we write whole number that help us to remember the number p. 52

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Western Australian Curriculum

- Year 2 – Recognise, model, represent and order numbers to at least 1000 (ACMNA027).

- Year 2 – Group, partition and rearrange collections up to 1000 in hundreds, tens and ones to facilitate more efficient counting (ACMNA028).
- Year 3 – Recognise, model, represent and order numbers to at least 10 000 (ACMNA052).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

- Students will need considerable experience of the cyclical role of each set of three places. We have the first set of three places: ones, tens and hundreds; followed by the second set of three places: the ones of thousands, tens of thousands and hundreds of thousands; and so on. The way we *say* large numbers is based on powers of a thousand, with the 1-9 pattern in the initial ones, tens and hundreds being repeated.
- Use a variety of resources to monitor classroom activities that involve large numbers. For example, the 'errand runner' may use a pedometer for the week and keep a record of how many steps they take. Collect aluminium can pull-tops for charity and have students keep a running record of the daily totals. Keep a count on the interactive whiteboard and regularly refer to the current total by asking what number will be next.
- Include the writing of large numbers in digits and words, in a variety of contexts. Ask, ''Does the word 'and' mean the same in 127 as in 207?".

For further related information see *First Steps in Mathematics: Number* (book one):

- Hundred charts p. 43
- Expanded notation p. 55
- See sample lesson 3 - Number cards p. 48–50
- Peg up p. 77
- Correct order p. 78

Numeracy online resources

- Year 2–3 Number: Understand whole and decimal numbers
  Learning sequence 5
  Learning sequence 6

Question 1

What number comes next?

807 808 809 _____

Skill: Students recognise and write whole numbers.
Answer key: 810

Additional questions

1. What number comes after **9** when counting?
2. What is the value of the digit **8** in these numbers?
3. What number would come next again?
4. What number would come before **807**?

Question 2

Which one of these is the number **14** written in words?

○ four ○ forty-one ○ forty ○ fourteen

Skill: Students read small numbers in numerals and words.
Answer key: D

Additional questions

1. How do you say that number?
2. What is one more/one less than that number?
3. Can you get me that many counters?
4. Say and write the number 24 in words. How many more counters would you need to get to have 24 counters?
5. How is 14 different to 41? How do you know it is different?

Question 3

Vitek had to work out 30 + 200 + 5
He then had to add ten.
What should his answer be?

- 236
- 245
- 326
- 335

Skill: Students recognise standard partitioning of a whole number and can add on ten.
Answer key: B

Additional questions

1. What would Vitek get if he added 30 more to the original sum?
2. Would he get the same answer if he had 200 + 5 + 30 and then added 10? How do you know?
3. Write the largest three-digit number you can make using the digits 3, 5 and 2.
4. Write a number between 300 and 400 using the digits 5, 3 and 2. Is there more than one number you could write using these digits? Explain how you know your numbers are between 300 and 400.

Question 4

Two thousand, six hundred and five is

- 2000605
- 20006005
- 26005
- 2605

Skill: Students recognise numerals up to 4 digits.
Answer key: D

Additional questions

1. Write two thousand and sixty-five in numbers. Why is the zero in a different place than in two thousand six hundred and five?
2. Which number is bigger 2605 or 2065? How do you know?
3. Read this number 2 560. What would it be if you took away 200?
4. Alex wrote a two-digit number. Which one of these is his number?
   a) 1
   b) 99
   c) 909
   d) 1010

Curriculum references

Department of Education and Training Western Australia 2004, *First Steps in Mathematics: Number* (book one):

- Chapter 3: Understand whole and decimal numbers - Key understanding 4: The whole numbers are in a particular order and there are patterns in the way we say them which helps us to remember the order. p.40
- Chapter 3: Understand whole and decimal numbers - Key understanding 5: There are patterns in the way we write whole numbers that helps us to remember their order. p.52
- Chapter 3: Understand whole and decimal numbers - Key understanding 8: We can compare and order the numbers themselves. p.74

Student worksheet

Focus

Reading and writing whole numbers up to four digits and beyond

Question 1

What number comes next?

807 808 809 _____

Question 2

Which one of these is the number **14** written in words?

- four
- forty-one
- forty
- fourteen

Question 3

Vitek had to work out 30 + 200 + 5
He then had to add ten.
What should his answer be?

- 236
- 245
- 326
- 335

Question 4

Two thousand, six hundred and five is

- 2000605
- 20006005
- 26005
- 2605

Comparing and ordering whole numbers up to four digits and beyond

Background information/teaching focus

Students need to think of numbers independently of any particular context and learn to think of numbers as positioned on a number line. Initially, they should imagine moving backwards and forwards on a number line, often in conjunction with counting forwards and backwards on a counting track and later a calculator.

For further related information see *First Steps in Mathematics: Number* (book one):

- Chapter 3: Understand whole and decimal number
  - Key understanding 8: We can compare and order the numbers themselves p. 74

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Western Australian Curriculum

- Year 2 – Recognise, model, represent and order numbers to at least 1000 (ACMNA027).
- Year 3 – Recognise, model, represent and order numbers to at least 10 000 (ACMNA052).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

Students should have many opportunities to develop a sense of the order and relative magnitude of numbers.

- Construct counting tracks to count forwards and backwards in 1s, 2s. 5s and 10s using alternating sets of coloured interlocking blocks. Encourage students to locate numbers on their counting track using the colour differentiation to skip count to the appropriate number place.
- My magic number: Have students ask questions that encourage ordering of numbers using a number line. For example, the teacher could say ‘My number is between 75 and 81’. Have students identify the number by asking questions to eliminate numbers. For example, ‘Is it closer to 75 or 81?’ ‘Is it larger than 76?’ Students place a mark on the number line to show the decreasing range that the number is within and explain their reasoning.
- Students should learn to think of numbers as positioned on a number line and so use a range of calibrated scales. Initially, they should imagine moving backwards and forwards on a number line, often in conjunction with counting forwards and backwards on a calculator. *First Steps in Mathematics* (book one), 2004, Rigby Harcourt, Australia p. 74.

- Read the 'Did you Know?' part of sample learning activities section within Key understanding 8 of Chapter 3 of the *First Steps in Mathematics: Number (book one)* .

- Next number p. 44
- Forward and reverse p. 76
- Peg up pp. p. 77–78
- Correct order p. 78
- Number line p. 76

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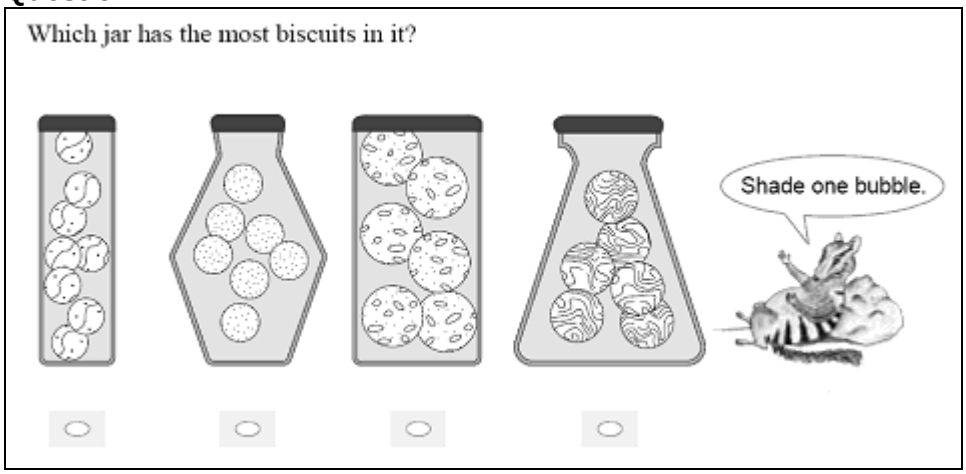
Numeracy online resources

- Years 2–3 Number: Understand whole and decimal numbers
  Learning sequence 1
  Learning Sequence 6

Question 1



Skill: Students quantify and compare small numbers of items.
Answer key: A

Additional questions

1. How many biscuits are there in each jar?
2. How did you work it out? (See if students count or subtilise/partition to work it out.)
3. Put the jars in order from the least to the most number of biscuits (two jars have the same quantity of biscuits.)
4. Which two jars have the same number of biscuits?
5. Which jar has more than six and less than eight biscuits?
6. How many biscuits are there all together? How did you count them?

Question 2

Select **all** the numbers less than 199.

- ◯ 199
- ◯ 198
- ◯ 189
- ◯ 200

Skill: Students compare three-digit whole numbers.
Answer key: B (198), C (189)

Additional questions

1. Write a number 10 less than 199. How did you know?
2. Write a number 10 more than 199. How did you know? (Try 20 or 30 more or less.)
3. Write a number which is 5 less than 199. How did you know? Try 15 less?
4. Write a number which is 15 less than 299. Try 15 less than 399, then 15 less than 499. What changes, what stays the same? Why?

Question 3

Helen is counting by ones.

Which number should she say next after 109?

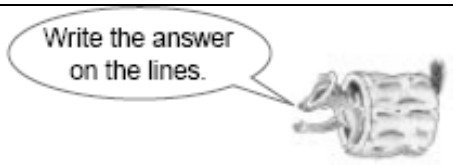
- ◯ 108
- ◯ 1010
- ◯ 110
- ◯ 200

Skill: Students count whole numbers beyond 109.
Answer key: C

Additional questions

1. What number would Helen say after 209?
2. What number would Helen say after 219?
3. How many numbers would Helen have to say to count from 101 to 200?
4. What number would come after 299?

Question 4



Which number is halfway between 19 and 27? _____

Show how you got your answer.

_____

_____

Skill: Students compare two-digit whole numbers.
Answer key: 23 (There are a variety of ways to work it out.)

Additional questions

1. Is there another way you could work this out? (Share strategies – use a number line or rows of blocks to model the strategies.)
2. How would knowing which number is half way between 19 and 27 help you to work out which number is halfway between 29 and 37, or 39 and 47?
3. Which number is halfway between 25 and 39? How did you work it out?

Curriculum references

Department of Education and Training Western Australia 2004, *First Steps in Mathematics: Number* (book one):

- Chapter 3: Understand whole and decimal numbers - Key understanding 4: The whole numbers are in a particular order and there are patterns in the way we say them which helps us to remember the order. p.40
- Chapter 3: Understand whole and decimal numbers - Key understanding 5: There are patterns in the way we write whole numbers that helps us to remember their order. p.52
- Chapter 3: Understand whole and decimal numbers - Key understanding 8: We can compare and order the numbers themselves. p.74

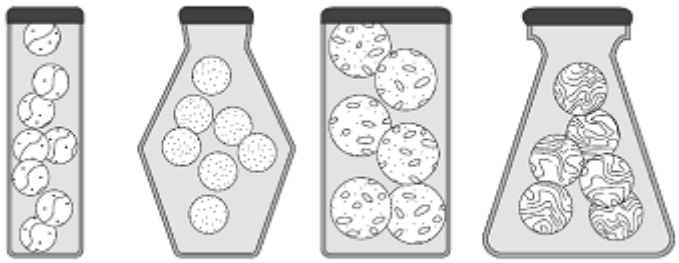
Student worksheet

Focus

Comparing and ordering whole numbers up to four digits and beyond.

Question 1

Which jar has the most biscuits in it?



Question 3

Helen is counting by ones.

Which number should she say next after 109?

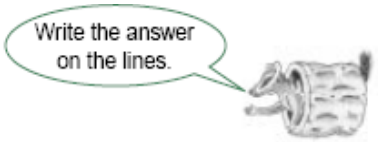
- 108
- 1010
- 110
- 200

Question 2

Select **all** the numbers less than 199.

- 199
- 198
- 189
- 200

Question 4



Which number is halfway between 19 and 27? _____

Show how you got your answer.

_____

_____

Revised September 2016

Problem solving based on addition and subtraction

Background information/teaching focus

Initially, students will solve addition and subtraction problems using counting strategies such as combining collections and counting the lot, counting on from the first number or counting on from the largest number. Once students have learnt these strategies it is important for them to know how to count forwards and backwards in tens from any starting point, to remember and use known basic addition facts to work out others and to use informal methods based on partitioning to solve two-digit addition and subtraction problems.

For an explanation of calculation strategies refer to *First Steps in Mathematics: Number* (book two) - Techniques for mental calculation pp. 194–195.

Students will need both explicit teaching of each of these calculation strategies and many opportunities to use materials, diagrams and jottings or notations as they learn to select the most appropriate strategy and use it to solve story problems and symbolically expressed addition and subtraction.

Western Australian Curriculum

- Year 2 – Solve simple addition and subtraction problems using a range of efficient mental and written strategies (ACMNA030).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

- Counting tracks: Have each student join ten each of the same colour interlocking blocks together into a set. Next join the sets together with some other students in their group to form a long counting track. Start on a number in the first set, for example three, and count on ten to thirteen. Then count on to 23 and ask 'Where will the ten more be? How else could we find out?' Repeat with counting backwards.
- Heads and tails: In pairs, have the students take a small collection of coins and take turns in tossing the coins. Ask students to write equations to record the number of heads and the number of tails which are facing upwards each time the collection is tossed. For example, nine coins tossed could result in them recording 6 + 3 = 9, 1 + 8 = 9, 4 + 5 = 9, 9 – 5 = 4, 9 – 4 = 5.
- Doubles and near doubles: Students first need to investigate doubles to 20 and then have opportunities to use known doubles facts to solve near double problems. For example, 8 + 8 = 16, so 8 + 9 is double eight plus one.
  Tens frames provide a visual model for doubles and near doubles.

For further related information see *First Steps in Mathematics: Number* (book two):

- Chapter 3: Understand operations
- Chapter 4: Calculate
  - Number line p.34
  - Compatible numbers p. 135
  - Favourite number p.109
  - The answer is… p. 110
- Chapter 5: Reason about number patterns

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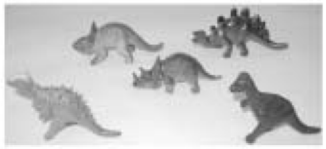
Numeracy online resources

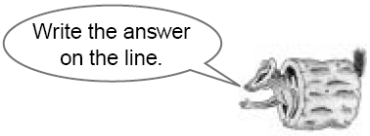
- Year 2–3 Number: Calculate
  Learning Sequence 3
  Learning Sequence 4

Question 1

Pablo has these dinosaurs.



Tina has these dinosaurs.



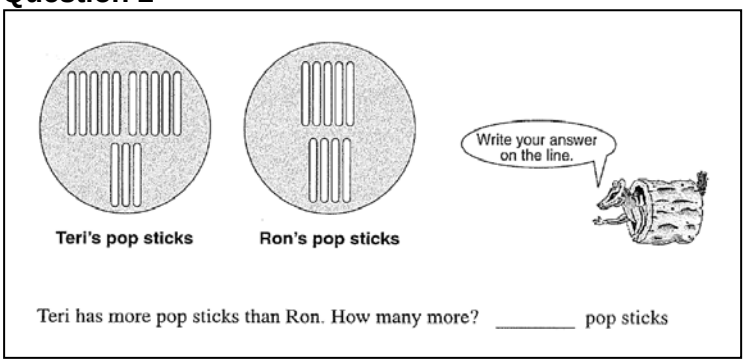
How many dinosaurs do they have altogether? _____

Skill: Students solve simple addition and subtraction number problems.
Answer key: 9

Additional questions

1. How many dinosaurs does Pablo have?
2. How many dinosaurs does Tina have?
3. What do you have to do to find out how many dinosaurs they have altogether? How could knowing 4 + 4 = 8 make it easier to get the answer?
4. Have students use grid paper and a number sentence to solve the problem.
5. Tina's brother has two dinosaurs less than Tina. How many dinosaurs do Tina and her brother have altogether?

Question 2

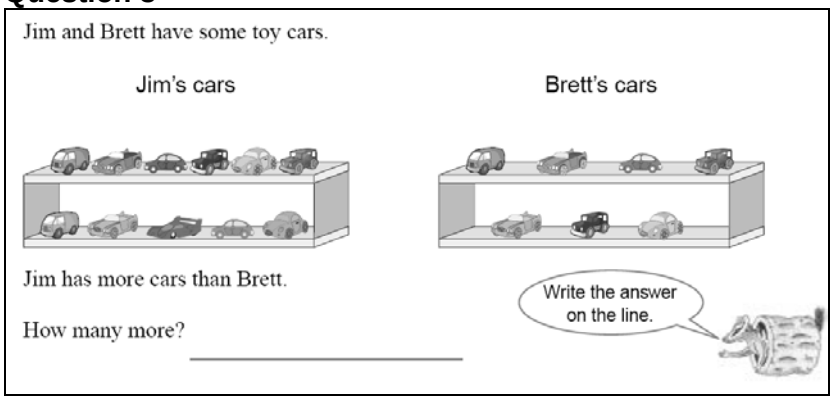


Skill: Students compare collections and calculate how many more.
Answer key: 4

Additional questions

1. How many pop sticks would Teri have if she had the same number as Ron? How do you know?
2. How many less pop sticks does Ron have than Teri? Can you write a number sentence to show how you can compare the pop sticks? (9 + ? = 13 or 13 – 9 = ?)
3. If Ron had two more pop sticks, what would be the difference between the number of pop sticks the children had?
4. Use grid paper to model and compare the quantities.

Question 3



Skill: Students compare two quantities to find the difference.
Answer key: 4

Additional questions

1. How many cars does Jim have? How many does Brett have?
2. Brett wants to have as many cars as Jim has. How many more cars does he need to collect?
3. Emma wrote: 11 – 7 = 4. John wrote 7 + 4 = 11. Who was right? Could they both be right? Why?

Question 4

Steven had 23 pencils.
He lost 7, then he threw away 4.

How many did he have left?

○ 34 ○ 16 ○ 13 ○ 12

Skill: Students use subtraction in a familiar context.
Answer key: D

Additional questions

1. Draw a picture or diagram to illustrate this problem and use it to explain what this problem is about to a partner.
2. Steven had 23 pencils. He lost seven. What would you do to find out how many pencils he has left (before he threw away four)?
3. Bev started her answer by adding seven and four first. What should she do next to find the number of pencils left? Can you write a number sentence about this.
4. Andrew said he took three away from seven first. What could he have done next? Can you write a number sentence to show what you did to work it out?

Curriculum references

Department of Education and Training Western Australia 2004, *First Steps in Mathematics: Number* (book two):

- Chapter 4: Calculate - Key understanding 1: The same number fact will be true no matter how you count the objects or what the objects are. p.98
- Chapter 4: Calculate - Key understanding 2: We can think of a number as a sum or difference in different ways. We can rearrange the parts of an addition without changing the quantity. p.122
- Chapter 4: Calculate - Key understanding 5: There are strategies we can practise to help us do calculations in our head. p.132

Student worksheet

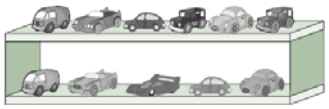
Focus

Problem solving based on addition and subtraction.

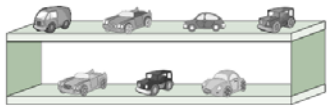
Question 1

Jim and Brett have some toy cars.

Jim's cars



Brett's cars

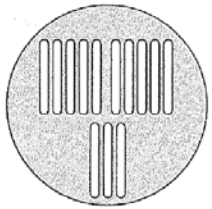


Jim has more cars than Brett.

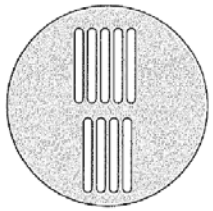
How many more? _____

Write the answer on the line.

Question 2



Teri's pop sticks



Ron's pop sticks

Write your answer on the line.

Teri has more pop sticks than Ron. How many more? _____ pop sticks

Question 3

Pablo has these dinosaurs.

Tina has these dinosaurs.

Write the answer on the line.

How many dinosaurs do they have altogether? _____

Question 4

Steven had 23 pencils.
He lost 7, then he threw away 4.

How many did he have left?

- ○ 34
- ○ 16
- ○ 13
- ○ 12

Revised September 2016

Multiplication as repeated addition

Background information/teaching focus

Students are usually introduced to multiplication as 'repeated addition'. This requires a big shift in thinking. To interpret 5 + 2 or 5 – 2, students can show five blocks and two blocks and then think about what the + or – means. The parts and the whole are visible and the 5 and 2 each refer to a number of blocks. However, for 5 x 2, the 5 and the 2 do not each refer to a number of blocks. One refers to a number of blocks, but the other refers to a number of sets of blocks. The notion that 5 x 2 refers to five groups of two requires careful development.

Students require many opportunities to model problems involving 'repeating equal quantities' with materials and diagrams and they need to learn that the equations 5 + 5 + 5 can also be written as 3 x 5. For example, to make flowers we need to make five petals for each flower. How many petals do we need for three flowers? Students are likely to think of it as the addition: 5 + 5 + 5 and in time they may think of the x sign as a shortcut to adding three lots of five.

For further related information see *First Steps in Mathematics: Number* (book two):

- Chapter 3: Understand operations
  - Key understanding 3: Multiplying numbers is useful when we… p. 28
- Chapter 4: Calculate
- Chapter 5: Reason about number patterns

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Western Australian Curriculum

- Year 2 – Recognise and represent multiplication as repeated addition, groups and arrays (ACMNA031).
- Year 3 – Recall multiplication facts of two, three, five and ten and related division facts (ACMNA056).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

- Read *100 Hungry Ants* by Elinor J. Pinczes (Houghton Mifflin, 1993). In pairs, ask the students to count out 100 small items in different arrays. Ask the students to write the repeated addition number sentences and the corresponding multiplication number sentences to represent the arrays.
- Printing: In pairs have one student make multiple prints of two fingertips. Their partner writes the corresponding repeated addition and multiplication equations, eg 2 + 2 + 2 = 6 and 3 x 2 = 6. Swap roles and repeat, changing the number of fingertips to be printed.
- Discover arrays: Have students investigate a range of items organised in arrays, such as muffin trays, chocolate blocks, slab paving and bathroom tiles and help them to see that, for example, 4 x 3 = 3 x 4. Ask students to draw their arrays and write all the corresponding repeated addition and multiplication equations eg, 4 + 4 + 4 = 12, 3 + 3 + 3 + 3=12, 4 x 3 +12 and 3 x 4 = 12.

For further related activity ideas see *First Steps in Mathematics: Number* (book two):

- Describing p. 30
- Arrays p. 30
- Array problems p. 31

Numeracy online resources

- Year 2–3 Number: Understand operations
  Learning sequence 5
  Learning Sequence 6

Question 1

Jessica wrote

7 + 7 + 7 + 7 + 7 + 7 = 42

A shorter way of writing this is

_____ x _____ = _____

Skill: Students link repeated addition and multiplication.
Answer key: 6 × 7 = 42 (6 lots of 7 make 42)

Additional questions:

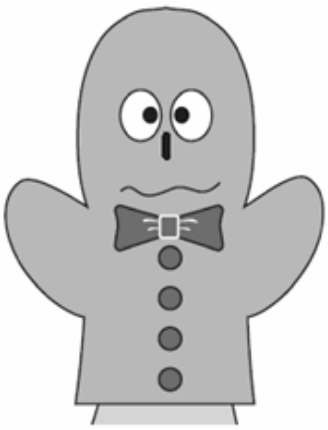
1. How many times did Jessica add seven to make 42?
2. What would Jessica write to show that she added 7 three times?
3. Jessica wrote: 8 × 4 = 32
   How many fours did Jessica add? Write the number sentence as addition.

Question 2

To make 1 puppet 4 buttons are needed.

Which shows how many buttons are needed to make 7 puppets?

- ○ 7 + 7 + 7 + 7
- ○ 7 + 4 + 4 + 4 + 4 + 4 + 4 + 4
- ○ 7 × 4
- ○ 7 + 4



Skill: Students recognise the links between repeated addition and multiplication.
Answer key: C

Additional questions:

1. What does the 7 mean? What does the 4 mean?
2. Draw an array diagram on grid paper to represent the story. Ask students to explain how the rows and columns link back to the story.
3. Why could 7 + 7 + 7 + 7 also show how many buttons are needed? (Each 7 represents one button each on all seven puppets.)
4. Ask children to write their own stories that could be represented by 7 × 4. Read them to other group members. Ask the group to say whether the story can (or cannot be) represented by 7 x 4. Collect and display.

Question 3

Each beetle has 4 spots.

Which of these shows one way to work out the total number of spots?

3+3+3	3+4	4-3	4+4+4
○	○	○	○

Skill: Students identify a number sentence to match a situation involving repetition of equal groups.
Answer key: D

Additional questions:

1. How many groups of four can you see?
2. How many spots on one ladybird? Did you need to count them or did you look and see without counting? What helped you work it out without counting?
3. Write a different number sentence to match the picture. Betty said 3 x 4 matches the picture. Is she right? Explain.

Question 4

6 groups of 5 pens is the same number of pens as 3 groups of

10	6	5	3
○	○	○	○

Skill: Students partition numbers into equal groups in different ways.
Answer key: A

Additional questions:

1. How did you work this out?
2. Draw a diagram on grid paper or use materials to demonstrate why both are the same quantity. Use arrays to show what both of these situations would look like.
3. Write a number sentence to match each situation.
4. Can you write four different number sentences to match each array?

(Note some students may use multiplication and division, others may use multiplication and repeated addition.)

Curriculum references

Department of Education and Training Western Australia 2004, *First Steps in Mathematics: Number* (book two):

- Chapter 3: Understand operations – Key understanding 3
  Multiplying is numbers useful when we:
  - Repeat equal quantities
  - Use rates
  - Make ratio comparisons or changes, eg scales
  - Make arrays and combinations
  - Need products of measures. p.28
- Chapter 3: Understand operations – Key understanding 4
  Dividing numbers is useful when we:
  - Share or group a quantity into a given number of portions
  - Share or group a quantity into portions of a given size
  - Need the inverse of multiplication. p.40

Student worksheet

Focus

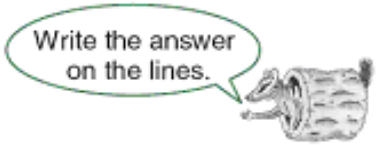
Multiplication as a repeated addition

Question 1

Jessica wrote

$7 + 7 + 7 + 7 + 7 + 7 = 42$

A shorter way of writing this is



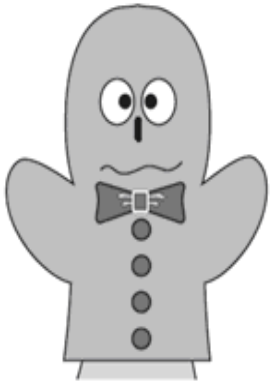
_____ × _____ = _____

Question 2

To make 1 puppet 4 buttons are needed.

Which shows how many buttons are needed to make 7 puppets?

- ○ 7 + 7 + 7 + 7
- ○ 7 + 4 + 4 + 4 + 4 + 4 + 4 + 4
- ○ 7 × 4
- ○ 7 + 4



Question 3

Each beetle has 4 spots.

Which of these shows one way to work out the total number of spots?

3+3+3	3+4	4-3	4+4+4
○	○	○	○

Question 4

6 groups of 5 pens is the same number of pens as 3 groups of

10	6	5	3
○	○	○	○

Revised September 2016

Division using equal grouping or sharing equally

Background information/teaching focus

Students should learn to recognise a wide range of problem types to which division applies. They need to be helped to see how these apparently different types of problems are similar and so can all be solved using division. Division problems include partitioning a quantity into a known number of groups and quotation problems when a quantity is portioned into known portion sizes. It is important to provide opportunities for students to use materials and drawings to demonstrate the similarities and differences between these problems and to explain their understandings before representing them with equations.
For further related information see *First Steps in Mathematics: Number* (book two):

- Chapter 3: Understand operations
  - Background notes p. 87

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Western Australian Curriculum

- Year 2: Recognise and represent division as grouping into equal sets and solve simple problems using these representations (ACMNA032).

For more information visit the Western Australian Curriculum.

Learning Experiences and Activities

- Classroom sharing and grouping: Use daily activities to demonstrate and work out real grouping and sharing problems. For example, 'There are 24 children and six tables. How many students will be at each table? There are 24 children and four activities. How many students will be at each activity? Students draw diagrams to show their working out for the problems and discuss the differences and similarities.
- Muffins for all: Have students construct a 3x4 array to explore how one problem can be solved by grouping or sharing. For example, 'There are 12 muffins with three in each row, how many rows are there? There are four rows, how many muffins are in each row?' Extend this by having students construct a variety of arrays and represent them with the variety of matching equations.

For further related activities see *First Steps in Mathematics:* Number (book two):

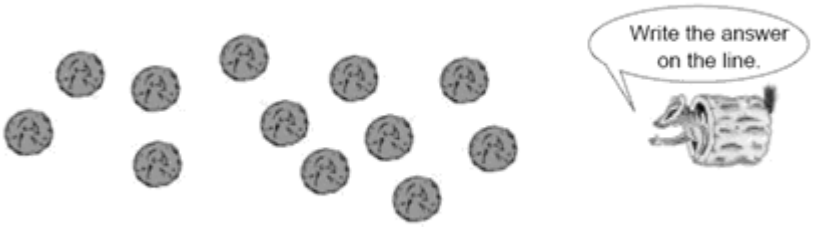
- Counting a collection p. 42
- Sharing problems p. 43
- Modelling p. 43
- Sharing and grouping p. 44

Numeracy online resources

- Year 2–3 Number: Calculate
  Learning Sequence 5

Question 1

These biscuits were shared equally between four boys.



How many did each boy get? _____

Skill: Students divide a set of objects into four equal groups.
Answer key: 3
Additional questions

1. If the biscuits are shared equally between two boys, will there be any biscuits left over? Use a drawing to help you find the answer.
2. If the biscuits were shared equally between three boys, how many biscuits will each boy get? Use a drawing to help you find the answer.
3. How could four boys share 14 biscuits equally? Use a drawing to help you find the answer.

Question 2

Three friends shared 27 lollies equally.

How many lollies did they each get? _____

Skill: Students use strategies to work out 27 divided by 3.
Answer key: 9

Additional questions

1. What does the word ‘equally’ mean? How many lollies did the three friends share? How could you work it out?
2. Draw a picture of 27 lollies or use grid paper and colour in 27 squares to help work out the answer.
3. Provide a calculator or a picture of a calculator to the students. Ask: ‘What buttons could you press on your calculator to check your answer?’ If the students use repeated subtraction, ask them what they thought about while they were using the calculator.

Question 3

Students in a year 3 class work in groups of 3.
How many students might there be in this class?

- ◯ 15
- ◯ 21
- ◯ 22
- ◯ 24
- ◯ 26

Skill: Students identify numbers that are multiples of 3.
Answer key: 15, 21 and 24

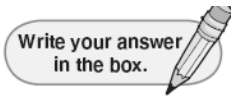
Additional questions

1. Explain how you worked out your answers.
2. Write a number sentence that matches how you worked out each of your answers.
3. Make a table to show the size of more classes that could work in groups of three. How far can you go? What patterns do you notice in the numbers?
4. If the students worked in groups of six, what class sizes could there be? How can the table you made for classes with groups of three help you to decide?

Question 4

Lin is packing 34 cakes into boxes.
Each full box holds 5 cakes.

What is the smallest number of boxes Lin needs to pack all the cakes?



Skill: Students solve problems involving equal groups.
Answer key: 7

Additional questions

1. Show how you worked out the number of boxes needed.
2. How could you show what you did as a number sentence?
3. Lin has to deliver cakes to three cafes. Lin had to deliver nine cakes to one café, 16 cakes to the second café and the remainder of the 34 cakes to a third café. How many boxes will each café get? Explain how you worked it out to some other people in your group. How did they work it out?

Curriculum references

Department of Education and Training Western Australia 2004, *First Steps in Mathematics: Number* (book one):

- Chapter 3: Understand whole and decimal numbers - Key Understanding 2: We can often see how many are in a collection just by looking and also by thinking of it in parts. p.24

Department of Education and Training Western Australia 2004, *First Steps in Mathematics: Number* (book two):

- Chapter 4: Calculate - Key Understanding 3: We think of a number as a multiplication or division in different ways. We can rearrange the factors of a multiplication without changing the quantity. p.114

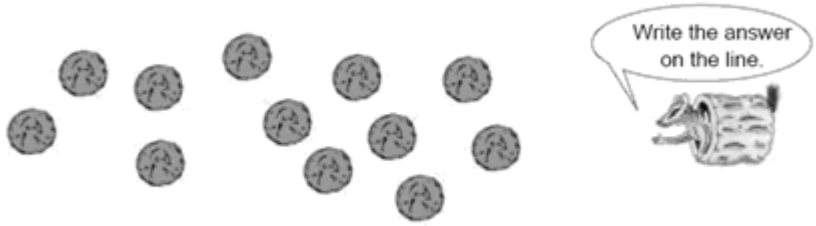
Student worksheet

Focus

Division using equal grouping or sharing equally

Question 1

These biscuits were shared equally between four boys.



How many did each boy get? _____

Question 2

Three friends shared 27 lollies equally.

How many lollies did they each get? _____

Question 3

Students in a year 3 class work in groups of 3.
How many students might there be in this class?

- ◯ 15
- ◯ 21
- ◯ 22
- ◯ 24
- ◯ 26

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Each full box holds 5 cakes.

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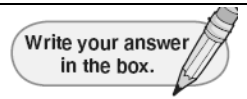

Identifying unit fractions

Background information/teaching focus

The idea that things can be partitioned or split into parts of equal size underpins the fraction concept.

Students need to see that the equality of two 'halves' refers to the relevant quantity, not appearance. That is, two halves of something need not look alike, but they must have the same 'amount'. Objects and collections can be split into halves in many different ways.

Students should develop the idea that equal parts need not look alike, but they must have the same size or amount of the relevant quantity. In reality, the parts may look different, but still be equal in size. When attempting to make equal parts or portions young students may neglect to use up the entire whole, discarding remaining portions rather than distributing them into the equal groups.

For further related information see *First Steps in Mathematics: Number* (book one):

- Chapter 4: Understand fractional numbers
  - Key understanding 2: We can partition objects and collections into two or more equal-sized parts and the partitioning can be done in different ways p.104.

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Western Australian Curriculum

- Year 2 – Recognise and interpret common uses of halves, quarters and eighths of shapes and collections (ACMNA033).
- Year 3 – Model and represent unit fractions including 1/2, 1/4, 1/3, 1/5 and their multiples to a complete whole (ACMNA058).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

- Initially, students should be encouraged to use a variety of strategies, such as folding, dealing out, or measuring to partition quantities into two equal shares, and learn to name each equal share as 'a half '. It is important to that students do the actual partitioning with manipulatives and drawings because this helps them link the action of partitioning into equal portions with the language of unit fractions. Pre drawn diagrams and models provide limited opportunities for students to make this connection because the partitioning into equal portions is already done for them. Students should be able to justify that their partitions produce equal portions.
- Progress from students recognising half, to half of one half as 'a quarter' and then to eighths using repeated partitioning.
- Use a variety of shapes when looking at regional models so that students do not think that a fraction is always a 'part of a pie.' Provide opportunities for students to find different ways the same shape may be partitioned into different unit fractions. Compare, display and talk about their findings.
- Link work on finding unit fractions of collections to the language of division (ie grouping and sharing).

For further activity ideas see *First Steps in Mathematics: Number* (book one):

- Halving p. 94
- Chocolate bars p. 95
- Collections p. 96
- Comparing fractions p. 97

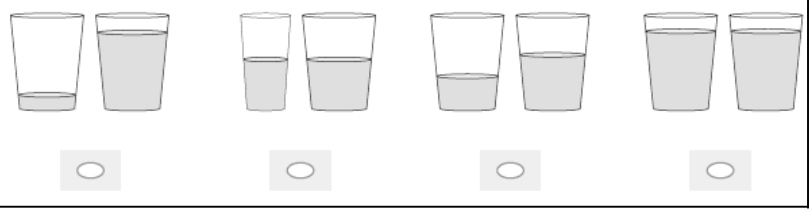
Numeracy Online Resources

- Years 2–3 Number: Understand fractional numbers

Question 1

Pat and Lee shared the drink from a bottle. They had half each.

Which picture shows their shares of the drink?

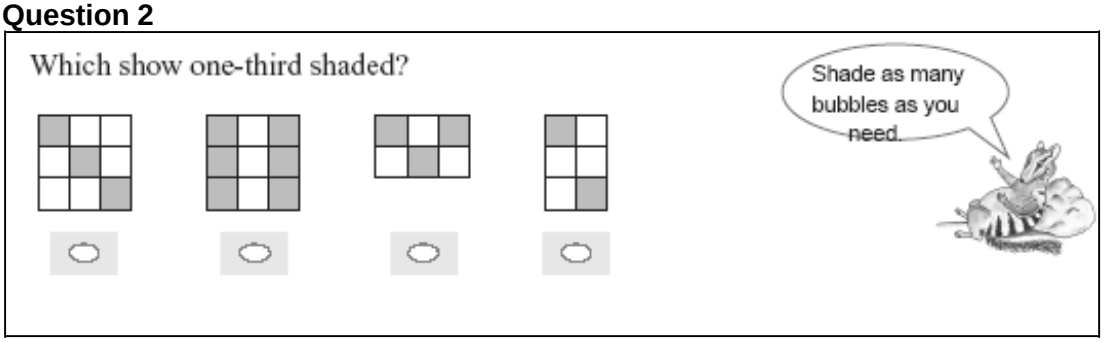


Skill: Students recognise halves as a whole amount divided into two equal quantities.
Answer key: D

Additional questions

1. Which two glasses have the same amount of drink? How do you know?
2. Helen said that the second option is wrong. Is she correct? Why?
3. Explain why option three can't be the answer. How do you know?

Question 2

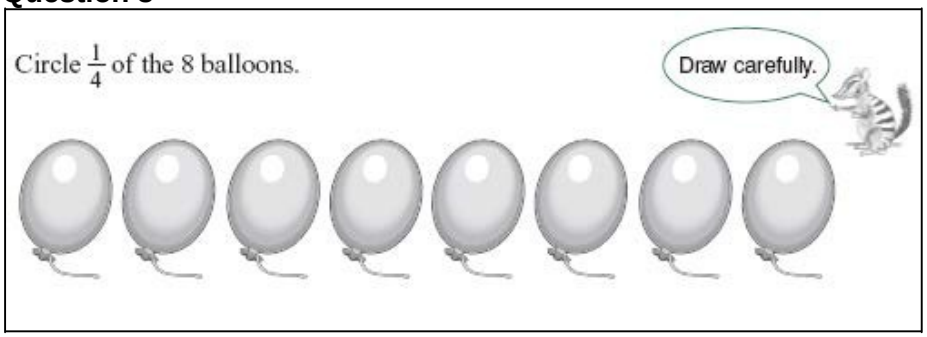


Skill: Recognise one third of a number of squares.
Answer key: A and D

Additional questions

1. Can you show another way to make a third of the first rectangle shaded?
2. Are three sections always coloured to show a third? Talk about this question in your group. Be ready to explain what you think to the rest of the class.
3. What is the same and what is different about options 1 and 4? How do you know they both have the same fraction of squares shaded?
4. What fraction is not shaded in option 2? What fraction is shaded? How do you know?

Question 3



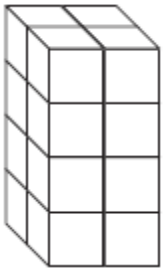
Skill: Recognise one quarter of a collection
Answer key: two balloons coloured

Additional questions

1. How many balloons are in each quarter of the eight balloons?
2. How many quarters are in the whole collection?
3. I have four balloons and give away one quarter of my balloons. You have eight balloons and give away a quarter of your balloons. Who gave away more balloons? Explain?
4. How many equal parts in halves? Quarters? Eighths?

Question 4

Peter made this prism from 1-centimetre cubes.



- Peter took away half the cubes.
- He then took away half of the cubes left.
- How many cubes was Peter left with?

_____cubes

Skill: Students apply repeated halving in a familiar context.
Answer key: four cubes

Additional questions

1. If Peter continued the process, could he be left with just one cube? Explain why.
2. Peter starts with one cube. He builds a prism with cubes by reversing the process above (doubling). He continues until he has a prism with 128 cubes. How many times did he double the number of cubes?

Curriculum references

Department of Education and Training Western Australia 2004, *First Steps in Mathematics: Number* (book one):

- Chapter 4: Understand fractional numbers - Key understanding 1: When we split something into two equal-sized parts, we say we have halved it and that each part is half the original thing. p.88
- Chapter 4: Understand fractional numbers - Key understanding 2: We can partition objects and collections into two or more equal-sized parts and the partitioning can be done in different ways. p.100
- Chapter 4: Understand fractional numbers - Key understanding 3: We use fraction words and symbols to describe parts of a whole. The whole can be an object, a collection or a quantity. p.112

Student worksheet

Focus

Identifying unit fractions

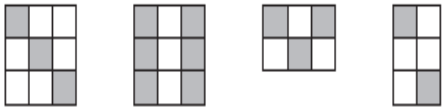
Question 1

Pat and Lee shared the drink from a bottle. They had half each.

Which picture shows their shares of the drink?

Question 2

Which show one-third shaded?

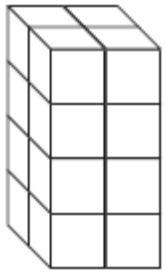


Question 3

Circle $\frac{1}{4}$ of the 8 balloons.

Question 4

Peter made this prism from 1-centimetre cubes.



Peter took away half the cubes.
He then took away another half of the cubes.
How many cubes was Peter left with?

Revised October 2016

Linking fractions to the whole

Background information/teaching focus

Students should become flexible in partitioning and develop the following ideas:

- Equal parts need not look alike, but they must have the same size or amount of the relevant quantity.
- When splitting a whole into equal parts, the whole should be completely used up.
- Regardless of how we partition, the whole remains the same amount.

Students will often think that 'equal parts' means that the parts have to look alike. In reality, the parts may look different, but still be equal in size.

- The more shares something is split into, the smaller size each share is.
- Students should understand that to find three quarters of 'a whole', one must separate the whole into equal parts and take three out of **each** four parts. The equal parts need not look alike, but they must have the same measure of, for example: mass, length, angle or number. The whole could be an object (a banana), a collection (a bag of shells) or a quantity (the length of a trip or weight of flour). It may be a single thing, many things or a part of a thing.

For further related information see *First Steps in Mathematics: Number* (book one):

- Chapter 4: Understand fractional numbers
  - Key understanding 2: We can partition objects and collections into two or more equal-sized parts and the partitioning can be done in different ways p.104.

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Western Australian Curriculum

- Year 2 - Recognise and interpret common uses of halves, quarters and eighths of shapes and collections (ACMNA033).
- Year 3 – Model and represent unit fractions including 1/2, 1/4, 1/3, 1/5 and their multiples to a complete whole (ACMNA058).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

- Students need extensive experience in splitting a diverse range of discrete and continuous wholes into equal-sized parts. Collections (discrete quantities) can be shared into equal parts by dealing out or distributing, while objects can be shared into equal parts by cutting, folding, drawing, pouring and weighing. See the link to Key understanding 2 above for more information.
- Students construct their own partitions, using a wide range of materials, to model the different unit fractions.

For further activity ideas see *First steps in Mathematics: Number* (book one):

- Making a sandwich p. 106
- Thirds p. 107
- Three colours p. 108
- Equal shares p. 118
- One third p. 118
- Finding fractions p. 120
- Equal groups p. 120
- Fractions and shapes p. 121

Numeracy online resources

- Years 2–3 Number: Understand fractional numbers

Question 1

Sarah is going to cut each sandwich in half.

How many halves will she have?

- ○ 2
- ○ 3
- ○ 4
- ○ 6
- ○ 12

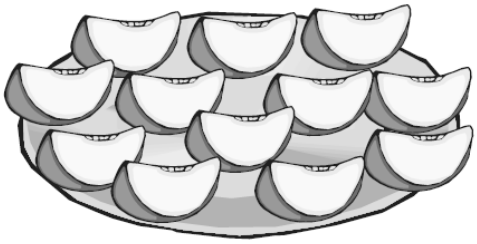
Skill: Students apply halving in familiar contexts.
Answer key: E

Additional questions:

1. Which ‘halves’ does the question ask about? Is it ‘How many half sandwiches?’ or could it be ‘How many halves of the whole six sandwiches together?’ (Clarify that ‘halves’ in this question is about ‘half sandwiches’.)
2. Joe cut three oranges in half. How many half oranges did he get? How do you know?
3. Sarah wants to cut the six sandwiches into quarters.
   How many quarter sandwiches will she have? How do you know?
4. Leah wants a half of an apple for herself and for each of her friends.
   How many apples would she need if she has six friends? How did you work it out?
5. Can you count in halves? (half, one, one and a half, two, two and a half, and so on).
   Can you show this count on a number line?

Question 2

Kate cut some apples into quarters.



How many apples did she start with?

2 ⬭ 3 ⬭ 4 ⬭ 6 ⬭ 12 ⬭

Skill: Students recognise four quarters combine to make each whole.
Answer key: B

Additional questions

1. I cut an apple into quarters. How many quarters did I get? How do you know? What about cutting two apples into quarters?
2. Cut an apple into quarters. Then cut each of the quarter apples in half. How many pieces will you have? How do you know? If I eat one piece what fraction of the apple have I eaten? Why? What fraction of the whole apple is left?
3. I have two and a half apples. If I cut each of the whole apples and the half apple in half, how many quarter apples will there be? How do you know?
   (Students may have difficulty seeing that each half can be counted as two quarters, even if they are not cut up).

Question 3

Kate picked 24 strawberries and ate one-quarter of them.

How many of the strawberries did she eat?

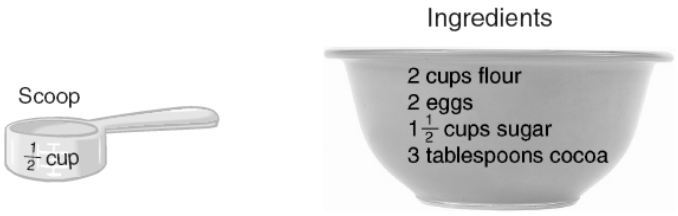
- ○ 4
- ○ 6
- ○ 18
- ○ 24

Skill: Students calculate a quarter of a number of items.
Answer key: B

Additional questions:

1. Kate halved 24 strawberries between two bowls and then halved each amount again. How many groups did she get? What fraction would each group be of the whole amount of strawberries? How many strawberries are there in each group?
2. How many strawberries is a quarter of 4 strawberries, 8 strawberries, 12 strawberries, 16 strawberries? Can you continue the pattern further?
3. How much would a quarter of 25 strawberries be? Why couldn't you just throw away the extra strawberry? (It would not be a quarter of the 25 strawberries.) What could you do to the extra strawberry so that you had a quarter of the 25 strawberries?

Question 4



Jamie put the ingredients for a cake into a bowl.

How many times did Jamie fill the scoop with flour?

$\frac{1}{2}$	1	$1\frac{1}{2}$	2	3	4
○	○	○	○	○	○

Skill: Students interpret and use symbols for familiar fractions.
Answer key: F

Additional questions:

1. How many scoops will fill up one cup? How do you know?
2. How many scoops are needed to fill up three cups? How would you work this out?
3. Carol used one and a half cups of sugar. How many scoops of sugar would she need? How did you work this out?

Curriculum references

Department of Education and Training Western Australia 2004, *First Steps in Mathematics: Number* (book one):

- Chapter 4: Understand fractional numbers - Key understanding 1: When we split something into two equal-sized parts, we say we have halved it and that each part is half the original thing. p.88
- Chapter 4: Understand fractional numbers - Key understanding 2: We can partition objects and collections into two or more equal-sized parts and the partitioning can be done in different ways. p.100
- Chapter 4: Understand fractional numbers - Key understanding 3: We use fraction words and symbols to describe parts of a whole. The whole can be an object, a collection or a quantity. p.112

Student worksheet

Focus

Linking fractions to the whole

Question 1

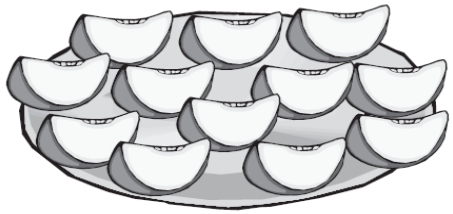
Sarah is going to cut each sandwich in half.

How many halves will she have?

- 2
- 3
- 4
- 6
- 12

Question 2

Kate cut some apples into quarters.



How many apples did she start with?

2 3 4 6 12

Question 3

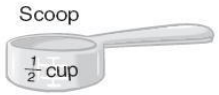
Kate picked 24 strawberries and ate one-quarter of them.

How many of the strawberries did she eat?

- 4
- 6
- 18
- 24

Question 4

Ingredients



Jamie put the ingredients for a cake into a bowl.

How many times did Jamie fill the scoop with flour?

$\frac{1}{2}$ 1 $1\frac{1}{2}$ 2 3 4

Revised September 2016

Counting money in dollars and cents

Background information/teaching focus

Some considerations when teaching the topic of money:

- The sizes of coins are not indicative of their value and are not physically proportional, for example, the $2 coin is not twice as big as the $1 dollar coin.
- Having a greater number of coins or notes in different collections does not necessarily mean that that collection has the greater value.
- Amounts less than one dollar can be written as whole cents or parts of a dollar using the dollar sign and the decimal point.
- Amounts which comprise both dollars and cents can be confusing for children particularly if they do not understand that 50c is half of one dollar, eg they may think that 50 cents is worth more than two dollars because 50 is greater than two.
- Some children may not have the opportunity to spend money themselves so may not have experienced the need to count out coins to make a particular amount.
- After a calculation is entered into a calculator the zero is cut off, for example, the result of $3.75 add $0.25 will show as 4. Students need to know that the calculator does this and be taught to interpret this as $4.00.
- Skip counting in 2's, 5's, 10's, 20's and 50's can help students find the value of collections of notes and coins and provides purposeful practise of this skill.

For further related information see *First Steps in Mathematics: Number:* (book one):

- Chapter 3: Understand whole and decimal numbers
  - Key understanding 1: We can count a collection to find out how many are in it p. 12.
- Chapter 3: Understand whole and decimal numbers
  - Key understanding 7: We can extend the patterns in the way we write whole numbers to write decimals p. 68.

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- Year 2 - Count and order small collections of Australian coins and notes according to their value (ACMNA034).
- Year 3 - Represent money values in multiple ways and count the change required for simple transactions to the nearest five cents (ACMNA059).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

- Initially have students skip count using coins of the same denominations then progress to counting a mixed set of coins. Have the students use coins to show different representations of various amounts of money up to $5.00.
- Money games: Play games such as rolling a money dice and collecting the matching coins, make memory cards of different combinations of amounts of money and at the

end of a round have students make informal comparisons about who has the most money. Ask, ‘Does the person with the most money have the greatest number of coins?’

- Shopping games: Provide opportunities for students to ‘purchase’ priced items of given amounts. Encourage students to count out money to see if they have the correct amount and to work out how much change they will receive after making a purchase. Show students how to count back change.
- Use opportunities when students bring money for events, such as an incursion, to count larger amounts of money. Think aloud with students to estimate the total and suggest ways of organising the notes and coins to make counting easier.

For additional ideas for activities see *First Steps in Mathematics* (book one):

- Skip counting money p. 17
- Dollars and cents p. 70

Numeracy online resources

- Year 2–3 Number: Understand whole and decimal numbers
  Learning sequence 7

Question 1

Oliver has these coins.

How much money does he have in total?

- 83c
- $3.80
- $3.08
- $3.85

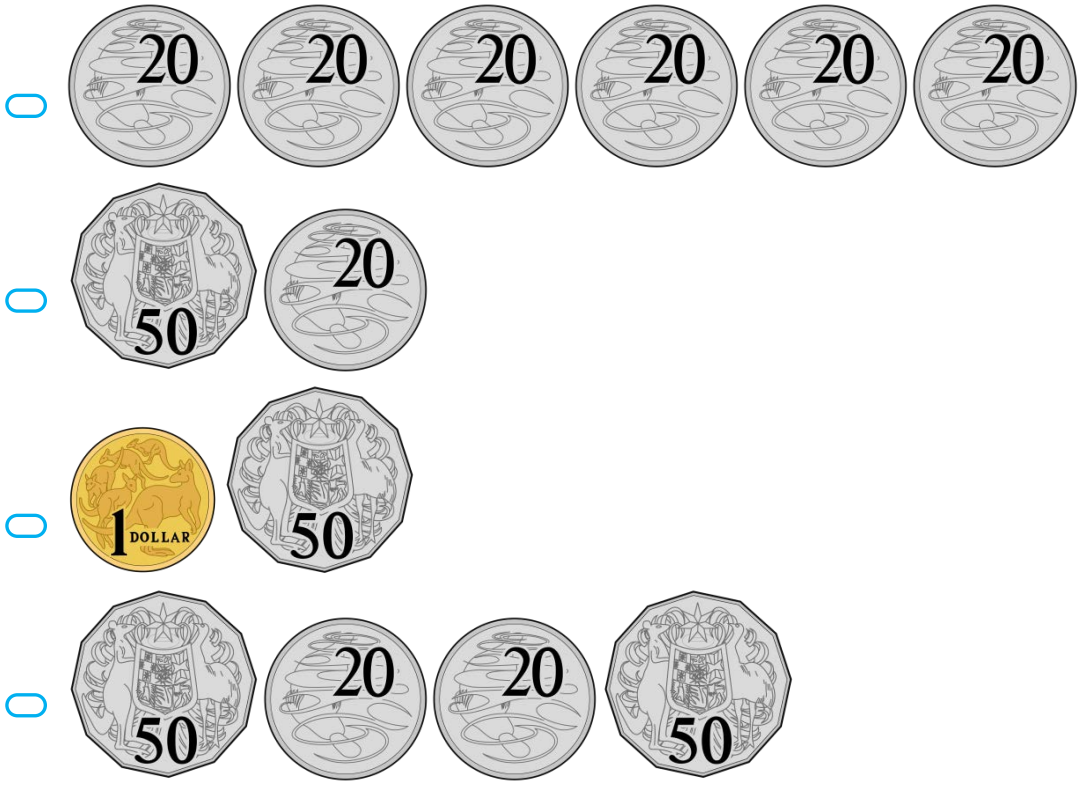
Skill: Students count coins and record the total amount.
Answer key: B

Additional questions

1. In the diagram above, which coin has the highest value? How do you know?
2. How many 5c coins equal $1.00? What information helped you work this out?
3. In the diagram above, which coins make a total of $1.30?
4. A card costs $4.30. Which extra coins would give Oliver enough to buy the card?
5. What coins would you use to make $4.70? Can you make it another way? What is the least number of coins you would need?

Question 2

Which set of coins makes $1.40?



Skill: Students read money notation and select the set of coins that matches that amount.
Answer key: D

Additional questions

1. Find the total for each row. Which row has the smallest total?
2. What is the difference in totals between the second and the third rows?
3. Using different coins make the same amount as in the fourth row. Is there another way?
4. If I added $1.90 to the first row, how much would I have?
5. What is the total of all the coins in the picture? Make this same amount using different coins.

Question 3

Jack has 6 coins, how much money does he have altogether?

$0.90 $2.50 $3.85 $4.05

Skill: Students calculate amounts of money in coins.
Answer key: C

Additional questions

1. Which are the ‘cents’ coins? What is the total of these coins?
2. Which coins make a total of 65 cents? How did you add them up?
3. Find the total of all the coins except the $2 coin.
4. Is this total less than $2? How much less is it?

Question 4

Dan paid $2.
He used 10c and 20c coins.

How many of each coin might Dan have used?

Write the answer in the boxes.

Skill: Students represent an amount of money with coins.
Answer key: Any correct response

Additional questions

1. Dan had two 20c coins. How many 10c coins would equal two 20c coins?
2. Find all the different ways you could make $2. What coins did you use?

Curriculum references

Department of Education and Training Western Australia 2004 *First Steps in Mathematics: Number* (book one):

- Chapter 3: Understand whole and decimal numbers
  - Key Understanding 1: We can count a collection to find out how many are in it. p.12
  - Key Understanding 7: We can extend the patterns in the way we write whole numbers to write decimals. p.68

Student worksheet

Focus

Money in dollars and cents

Question 1

Oliver has these coins.
How much money does he have in total?

- 83c
- $3.80
- $3.08
- $3.85

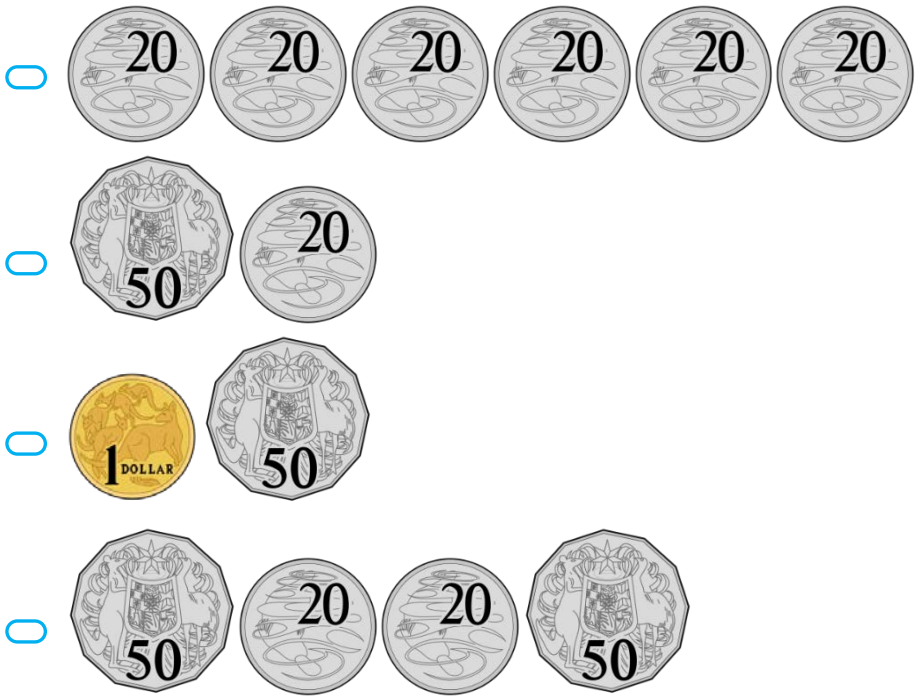
Question 3

Jack has 6 coins, how much money does he have altogether?

- $0.90
- $2.50
- $3.85
- $4.05

Question 2

Which set of coins makes $1.40?

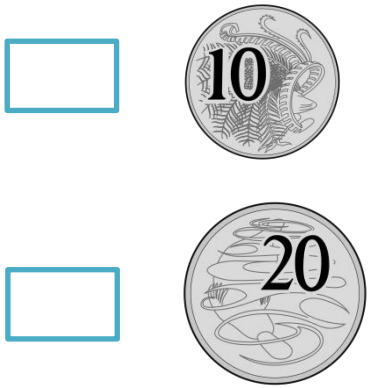


Question 4

Dan paid $2.
He used 10c and 20c coins.

How many of each coin might Dan have used?

Write the answer in the boxes.



Revised September 2016

Finding change in dollars and cents

Background information/teaching focus

Students need to know that there are one hundred cents in one dollar and that when writing money amounts the decimal point separates the dollars and the parts of a dollar. Students also need to know how to count coins in multiples of 5c, 10c, 20c, 50c up to and over one dollar and be able to skip count $1 and $2 dollar coins.
They need to be able to make up a given amount with coins in different ways, to know whether they have enough money to purchase a priced item. Calculating change provides opportunities to use basic number facts; counting forwards and backwards in multiples; partitioning and calculation strategies such as compatible numbers.

Western Australian Curriculum

- Year 3 – Represent money values in multiple ways and count the change required for simple transactions to the nearest five cents (ACMNA059).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

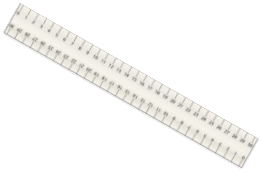
- Coin count: Have the students skip count a collection of coins of a particular denomination up to and over one dollar. Extend this to skip counting mixed denominations.
- Quick money: Ask the students to select two or more coins to make up one dollar and explain how they can use calculation strategies to quickly identify how much they have. For example, 'I know 50c + 50c is $1' or 'I know 4 x 20c is 80c and 4 x 5c is 20c and 80c + 20c is $1'. Then pose questions that require students to quickly calculate how much more or less they need to make a given amount, eg 'You have 25c, how much more do you need to make $1?' or 'The book is $1.50 and you have $2. How much change will you get?'
- Give the students a mixed selection of coins. Have them make up given amounts. Then ask them to write the amounts and explain which part represents the dollars and which part represents the cents.
- Toy sale: Use catalogues for students to purchase with a given amount of mixed coins. Ask, 'Do you have enough to buy that? How much change should you get? How much more would you need?

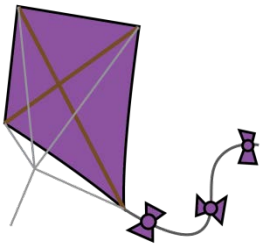
Numeracy Online Resources

- Year 2–3 Number: Calculate
  Learning Sequence 2
  Learning Sequence 3

Question 1

Lily has these coins. What can Lilly buy?





$1.05	75c	95c	$1.85

Skill: Students add and compare amounts of money.
Answer key: B

Additional questions

1. How much money does Lilly have? How much change will Lilly get?
2. If the 5c coin was a $1 coin:
   a) What two things could Lilly buy?
   b) Lilly buys two rulers. What change should she get?
3. How does knowing how to count by fives help when you are counting money?

Question 2

Greta has these coins.

She buys a chocolate for 50 cents.
How much money does she have left?

45c 55c 65c 75c

Skill: Students add amount of money in coins and calculate change.
Answer key: C

Additional questions

1. How much change would Greta get if she buys three chocolates? How did you work it out?
2. How much more money would she need if she wanted to buy three chocolates? How did you work it out?
3. Pretend the 20c coins are 50c coins. If Greta buys five chocolates, how much change would she get? Explain how you worked it out. Draw a diagram to show what you did.

Question 3

	icy pole	90c		soup	$1.80
	milk	$1.60		pizza Slice	80c
	apple	20c		sandwich	$2.00

Carla spent $1.00

She bought an apple.

What else did she buy?

- ◯ soup
- ◯ pizza slice
- ◯ icy pole
- ◯ sandwich
- ◯ milk

Skill: Students solve problems involving money in an everyday context.
Answer key: B

Additional questions

1. Louise has $3.
   a) How much change would she get if she bought a pie and chips?
   b) How much more money would Louise need to buy a pie and an orange juice?
2. Jack has $2. He needs to have a 20c coin for his bus fare.
   c) What two items could he buy so he would get a 20c coin in his change?
   d) What else could he buy for $1.80?
3. Draw diagrams to show how you worked out the problems.

Question 4

Tom bought 1 loaf of bread and 1 carton of milk.
This picture shows how much each item cost.

$2.80

$2.05

What is the correct change from $10.00?

Skill: Students interpret and use decimals in a money context.
Answer key: $5.15

Additional questions

1. How did you work out how much change?
2. How much change would Tom get if he buys two loaves of bread and one carton of milk? How did you work it out?
3. If Tom bought three bottles of milk, would he have enough left over to buy a loaf of bread? Explain how you know.

Curriculum references

Department of Education and Training Western Australia 2004, *First Steps in Mathematics: Number* (book one):

- Chapter 3: Understand whole and decimal numbers - Key understanding 7: We can extend the patterns in the way we write whole numbers to write decimals.

Department of Education and Training Western Australia 2004, *First Steps in Mathematics: Number* (book two):

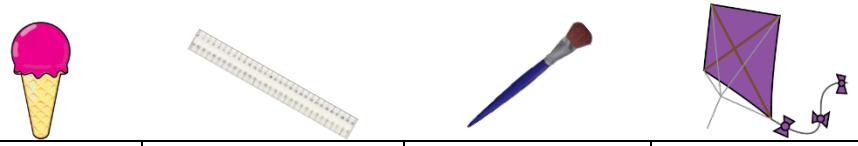
- Chapter 4: Calculate
  - Key Understanding 4: Place value and basic number facts together allow us to calculate with any whole or decimal numbers. p.122
  - Key Understanding 5: There are strategies we can practise to help us do calculations in our head. p.132

Student worksheet

Focus - Finding change in dollars and cents

Question 1

Lily has these coins. What can Lilly buy?



$1.05	75c	95c	$1.85
◯	◯	◯	◯

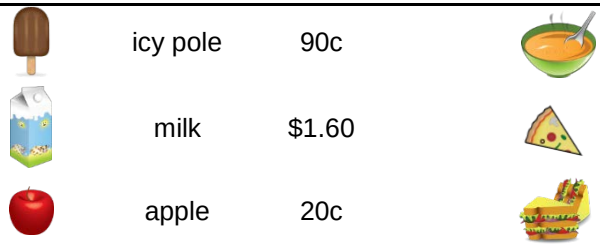
Question 2

Greta has these coins.

She buys a chocolate for 50 cents.
How much money does she have left?

◯ 45c ◯ 55c ◯ 65c ◯ 75c

Question 3



	icy pole	90c		soup	$1.80
	milk	$1.60		pizza Slice	80c
	apple	20c		sandwich	$2.00

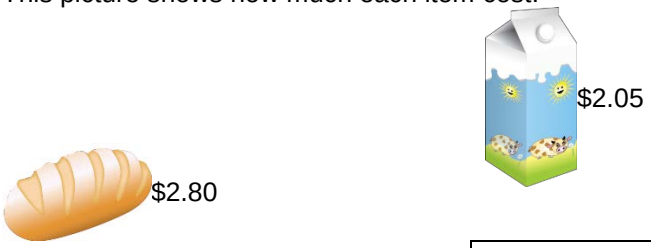
Carla spent $1.00. She bought an apple. What else did she buy?

- ◯ soup
- ◯ pizza slice
- ◯ icy pole
- ◯ sandwich
- ◯ milk

Question 4

Tom bought 1 loaf of bread and 1 carton of milk.

This picture shows how much each item cost.



What is the correct change from $10.00?

Solving problems involving money

Background information/teaching focus

Students need to know that there are one hundred cents in one dollar. They also need to know how to count coins in multiples of 5c, 10c, 20c, 50c up to and over one dollar and also to skip count $1 and $2 dollar coins.
Students need to be able to make up a given amount with coins in different ways, to know whether they have enough money to purchase a priced item, and how to calculate change using basic number facts such as compatible numbers, and calculation strategies including counting forwards and backwards in multiples and partitioning.

There are a variety of ways that we read and write money in our environment. Students need to know that:

- the decimal point separates the dollars and the parts of a dollar.
- on a calculator, four dollars will show as 4, rather than $4.00 and four dollars and thirty cents will show as 4.3, not $4.30.
- some restaurants may write four dollars as 4.0 and four dollars eighty cents as 4.8; and some price tags are written in this way.

It is therefore important that students develop an understanding of the structure and relationships involved when place value is extended to represent decimal numbers.

For further related information see *First Steps in Mathematics: Number* (book one):

- Chapter 3: Understand whole and decimal number
- Chapter 4: Understand fractional numbers

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Western Australian Curriculum

- Year 3 – Represent money values in multiple ways and count the change required for simple transactions to the nearest five cents (ACMNA059).

For more information visit the Western Australian Curriculum.

Learning experiences and activities

- Provide opportunities for students to use money to skip count forwards and backwards, make up given amounts in a variety of ways to match to price tags and to work out change.
- Focus on the cents as being part of a dollar and the decimal point as the separator between dollars and parts of a dollar.
- Provide opportunities for students to read amounts of money written using the dollar sign and decimal point. We say the cents as a whole number, for example, four dollars thirty-five, contrary to the 'decimal rule' which would be four point three five.
- Ask students to match amounts (using coins) to word problems involving money diagrams or equations.
- Provide opportunities which require students to read and write amounts of money in words as well as in symbols in a variety of styles, for example, six dollars, $6, $6.00. Include the use of calculators to check money problems.

For further activity ideas see *First Steps in Mathematics: Number* (book one):

- Dollars and cents p. 70
- Price tags p. 70
- Skip counting money p. 70

Numeracy online resources

- Year 2–3 Number: Calculate
  Learning sequence 2
  Learning sequence 3

Question 1

Gemma has $2.35. She needs 45 cents more to buy this drink.

How much does the drink cost?	$

Skill: Students add amounts of money in dollars and cents.
Answer key: $2.80

Additional questions:

1. What did you need to do to find the answer? How did you do it?
2. What coins could Gemma have had to make the $2.80?
3. What extra coins could she have got to have enough to buy the drink? If Gemma bought three drinks, how much would they cost? How much more money would she need? How did you work it out?

Question 2

Josie bought a 'Burger Fun Meal' for $4.65.
How much change should she receive from $5.00?

_____

Skill: Students add and subtract change for a purchase.
Answer key: 35 cents

Additional questions:

1. Josie wanted to buy a fruit salad for dessert. It costs $2.00. How much more money does she need to buy the fruit salad? How did you work it out?
2. Josie's family wanted burgers for dinner. She needed to buy four 'burger fun meals'. How much would it cost for four meals? How did you work it out?

Question 3

5 boys get $4.00 to share equally amongst themselves.

How much money do they each get?

Skill: Students divide money into equal shares
Answer key: 80 cents

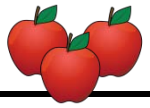
Additional questions:

1. How did you work out how much each boy would get?
2. How much would each boy get if they shared $8 equally? How did you work it out?
3. How much would each get if $10 was shared between four people? How did you work it out? Could halving help you work it out? Why?
4. Why is halving not helpful if something is shared between five people?

Question 4

A bag of apples costs $2.00

Apples
3 for $2.00



What is the largest amount of apples that can be bought for $10.00

5 6 15 20

Skill: Students calculate with money in a familiar context.
Answer key: C

Additional questions:

1. Ask the children to explain the question in their own words. What did you work out first? What did you work out next? Is there another way to do it?
2. How much would six apples cost? How do you know?
3. Len bought some apples that cost $20 altogether. How many apples did he buy? How did you work it out?
4. If you used your calculator, what keys would you need to press?
5. With a partner make up a question like this one about different bags of fruit. Ask another pair to solve it.

Curriculum references

Department of Education and Training Western Australia 2004, *First Steps in Mathematics: Number* (book one):

- Chapter 3: Understand whole and decimal number
  - Key Understanding 7: We can extend the patterns in the way we write whole numbers to write decimals. p.68

Department of Education and Training Western Australia 2004, *First Steps in Mathematics: Number* (book two):

- Chapter 4: Calculate
  - Key Understanding 3: We think of a number as a multiplication or division in different ways. We can rearrange the factors of a multiplication without changing the quantity. p.114
  - Key understanding 4: Place value and basic number facts together allow us to calculate with any whole or decimal number. p.122

Student worksheet

Focus

Solving problems involving money

Question 1

Gemma has $2.35. She needs 45 cents more to buy this drink.

How much does the drink cost?

$

Question 2

Josie bought a ‘Burger Fun Meal’ for $4.65.

How much change should she receive from $5.00?

_____

Question 3

5 boys get $4.00 to share equally amongst themselves.

How much money do they each get?

Question 4

A bag of apples costs $2.00

Apples

3 for $2.00

What is the largest amount of apples that can be bought for $10.00

5	6	15	20
○	○	○	○