1:01 Numbers Above One Million

Content strand: Number and Algebra

Sub-strand: Number and place value

Content description:

- Apply place value to partition, rearrange and regroup numbers to at least tens of thousands to assist calculations and solve problems. *[Progression]*

Teaching Suggestions

- Demonstrate numbers above one hundred million.
- Provide students with frequent opportunities to read and write any number presented verbally.
- Revise place value, e.g. the value of the 6 in 216 439 251 is 6 millions (6 000 000).
- Revise rounding, i.e. digits 5 and above are rounded up while digits below 5 are rounded down.
- Revise powers of ten, e.g. 1 643 786 is $(1 \times 10^6) + (6 \times 10^5) + (4 \times 10^4) + (3 \times 10^3) + (7 \times 10^2) + (8 \times 10^1) + 6$.

Investigation

- The best strategy to use for this exercise is Guess and Check.
- Have students work in pencil and erase any guesses that do not satisfy the requirements of the exercise.
- Encourage students to check a final time when all of the digits have been used.

Extension Work

- Use powers of ten to write each numeral in Question 3.

Language

numeral, expanded notation, powers of ten, place value, hundred millions, ten millions, millions, hundred thousands, ten thousands, thousands, hundreds, tens, units, numeral expander

Resources

- pencil, eraser
- spare paper

Cross-reference

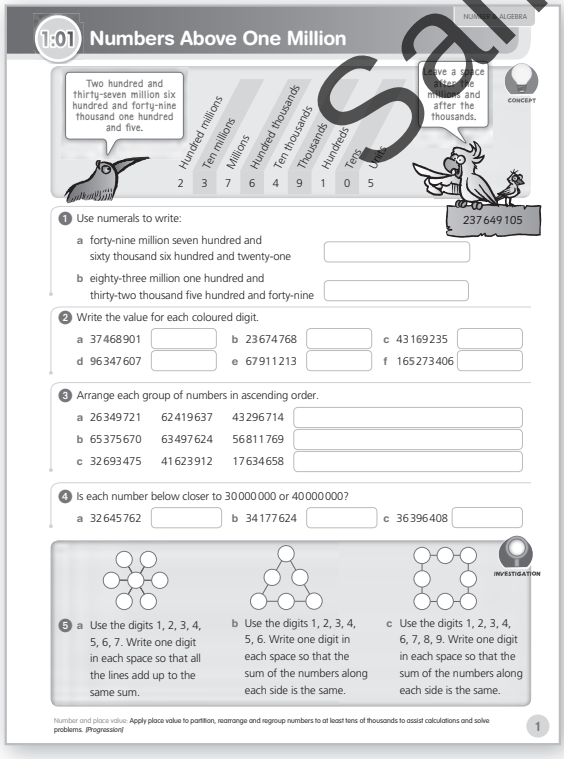
See also: p. 7

Year 5 p. 2

Evaluation

Is the student able to do the following?

- apply place value to partition, rearrange and regroup numbers to at least tens of thousands to assist calculations and solve problems


1:01 Numbers Above One Million

NUMBER & ALGEBRA

Two hundred and thirty-seven million six hundred and forty-nine thousand one hundred and five.

Leave a space after the millions and after the thousands.

CONCEPT

Hundred millions, Ten millions, Millions, Hundred thousands, Ten thousands, Thousands, Hundreds, Tens, Units

2 3 7 6 4 9 1 0 5

237 649 105

1 Use numerals to write:

a forty-nine million seven hundred and sixty thousand six hundred and twenty-one

b eighty-three million one hundred and thirty-two thousand five hundred and forty-nine

2 Write the value for each coloured digit.

a 37 468 901 b 23 674 768 c 43 169 235

d 96 347 607 e 67 911 213 f 165 273 406

3 Arrange each group of numbers in ascending order.

a 26 349 721 62 419 637 43 296 714

b 65 375 670 63 497 624 56 811 769

c 32 693 475 41 623 912 17 634 658

4 Is each number below closer to 30 000 000 or 40 000 000?

a 32 645 762 b 34 177 624 c 36 396 408

INVESTIGATION

5 a Use the digits 1, 2, 3, 4, 5, 6, 7. Write one digit in each space so that all the lines add up to the same sum.

b Use the digits 1, 2, 3, 4, 5, 6. Write one digit in each space so that the sum of the numbers along each side is the same.

c Use the digits 1, 2, 3, 4, 6, 7, 8, 9. Write one digit in each space so that the sum of the numbers along each side is the same.

Number and place value: Apply place value to partition, rearrange and regroup numbers to at least tens of thousands to assist calculations and solve problems. *[Progression]*

1

Answers

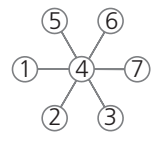
1 a 49 760 621
b 83 132 549

2 a 4 hundreds of thousands
b 3 millions
c 6 tens of thousands
d 9 tens of millions
e 7 millions
f 5 millions

3 a 26 349 721; 43 296 714; 62 419 637
b 56 811 769; 63 497 624; 65 375 670
c 17 634 658; 32 693 475; 41 623 912

4 a 30 000 000
b 30 000 000
c 40 000 000

5 a



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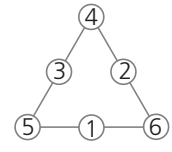

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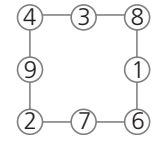


1:02 Square Numbers

Content strand: Number and Algebra

Sub-strand: Number and place value

Content description:

- Identify and describe properties of prime, composite, square and triangular numbers.

Teaching Suggestions

- 1:02 (p. 2) and 1:03 (p. 3) could be treated in the same lesson, as they both deal with the same concept.
- Discuss the features of a square.
- In Question 1, demonstrate on the board how to draw a square. How long is the line? Draw perpendicular lines of the same length above and at each end of the line. Draw in the fourth side.
- Multiplication facts should be used to determine answers as the little squares form an array.
- Cut squares of varying size from 1 cm grid paper (**BLM 12**, p. 206). Count the number of small squares to find the square numbers.

Extension Work

- Continue the pattern:

$1 \times 1 = 1$ $\quad$ $5 \times 5 =$
$2 \times 2 =$ $\quad$ $6 \times 6 =$
$3 \times 3 =$ $\quad$ $7 \times 7 =$
$4 \times 4 =$

- Have students cut out and stick together several pages of 1 cm grid paper (**BLM 12**, p. 206), then cut from this the largest possible square. What is the square number that this represents?

Language

square numbers, squared, multiple

Resources

- place-value ones
- counters
- scissors
- 1 cm grid paper (**BLM 12**, p. 206)

Cross-reference

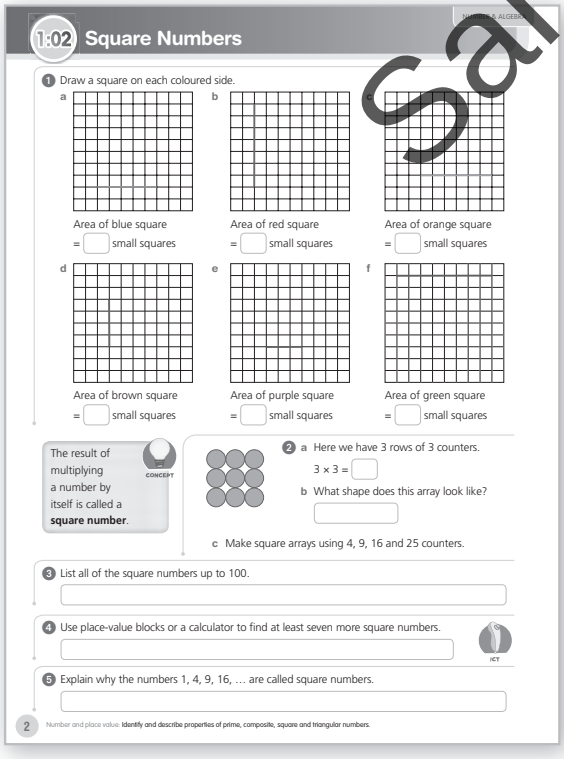
See also: p. 3

Year 5 p. 91

Evaluation

Is the student able to do the following?

- identify and describe properties of square numbers



1:02 Square Numbers

1 Draw a square on each coloured side.

a Area of blue square = ☐ small squares

b Area of red square = ☐ small squares

c Area of orange square = ☐ small squares

d Area of brown square = ☐ small squares

e Area of purple square = ☐ small squares

f Area of green square = ☐ small squares

CONCEPT: The result of multiplying a number by itself is called a **square number**.

2 a Here we have 3 rows of 3 counters. 3 × 3 = ☐

b What shape does this array look like? ☐

c Make square arrays using 4, 9, 16 and 25 counters.

3 List all of the square numbers up to 100.

4 Use place-value blocks or a calculator to find at least seven more square numbers.

ICT

5 Explain why the numbers 1, 4, 9, 16, … are called square numbers.

2 Number and place value: Identify and describe properties of prime, composite, square and triangular numbers.

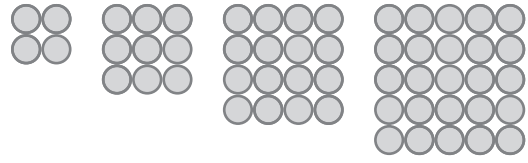
Answers

1 **a** 25 **b** 49 **c** 36
d 16 **e** 9 **f** 64

2 **a** 9

b a square

c



3 1, 4, 9, 16, 25, 36, 49, 64, 81, 100

4 Answers can vary. (Some are 121, 144, 169, 196, 225, 256 and 289.)

5 Counters representing square numbers can be arranged in the shape of a square.

1:03 Square Numbers

Content strand: Number and Algebra

Sub-strand: Number and place value

Content description:

- Identify and describe properties of prime, composite, square and triangular numbers.

Teaching Suggestions

- Provide each student with a hundred square. Have students cut off a square of their choice, e.g. 6 cm × 6 cm. Ask them to place a place-value one on each part of this square and count the ones. List the numbers discovered by the students. Call these *square numbers*.
- Find all factors of each square number by rearranging the place-value ones of each square into other rectangles. Students could colour squares of different sizes (e.g. 1 cm × 1 cm, 2 cm × 2 cm, 3 cm × 3 cm) on 1 cm grid paper (**BLM 12**, p. 206).
- Explain that a square number has other factors of which it is a multiple.
- Ask students to write square numbers as numbers squared, e.g. 25 can be written as 5 × 5 or five squared.

Extension Work

- Investigate larger square numbers with grid paper and calculators.
- Have students colour the square numbers on a multiplication grid and comment on the pattern.
- **BLW 5** Square Numbers, p. 215, could be given.

Language

square number, five squared, factor, multiple, product, odd numbers, even numbers

Resources

- hundred squares
- place-value ones
- multiplication grids
- calculators
- 1 cm grid paper (**BLM 12**, p. 206)
- **BLW 5** Square Numbers, p. 215

Cross-reference

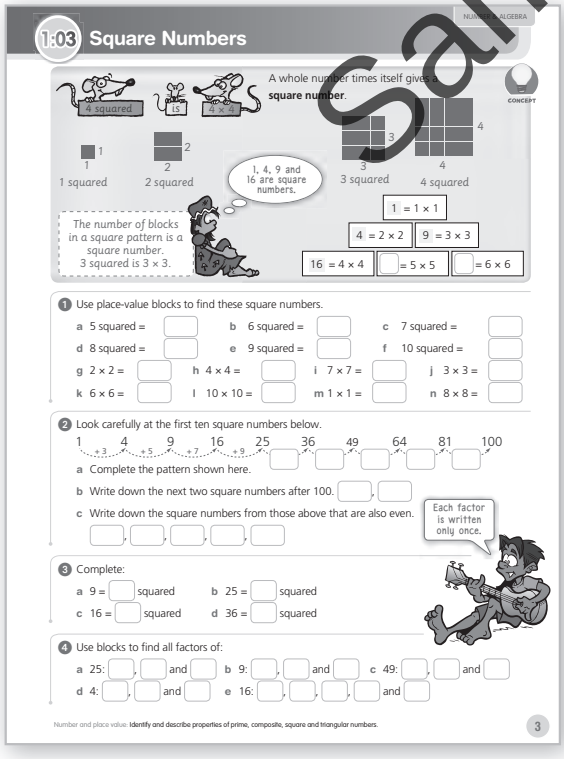
See also: p. 2

Year 5 p. 91

Evaluation

Is the student able to do the following?

- find multiples and squares of numbers


1:03 Square Numbers

A whole number times itself gives a square number.

4 squared is 4 × 4

1 squared, 2 squared, 3 squared, 4 squared

1, 4, 9 and 16 are square numbers.

The number of blocks in a square pattern is a square number. 3 squared is 3 × 3.

1 = 1 × 1; 4 = 2 × 2; 9 = 3 × 3; 16 = 4 × 4; ☐ = 5 × 5; ☐ = 6 × 6

1 Use place-value blocks to find these square numbers.

a 5 squared = ☐ b 6 squared = ☐ c 7 squared = ☐

d 8 squared = ☐ e 9 squared = ☐ f 10 squared = ☐

g 2 × 2 = ☐ h 4 × 4 = ☐ i 7 × 7 = ☐ j 3 × 3 = ☐

k 6 × 6 = ☐ l 10 × 10 = ☐ m 1 × 1 = ☐ n 8 × 8 = ☐

2 Look carefully at the first ten square numbers below.

1 (+3) 4 (+5) 9 (+7) 16 (+9) 25 36 49 64 81 100

a Complete the pattern shown here.

b Write down the next two square numbers after 100. ☐, ☐

c Write down the square numbers from those above that are also even. ☐, ☐, ☐, ☐, ☐

Each factor is written only once.

3 Complete:

a 9 = ☐ squared b 25 = ☐ squared

c 16 = ☐ squared d 36 = ☐ squared

4 Use blocks to find all factors of:

a 25: ☐, ☐ and ☐ b 9: ☐, ☐ and ☐ c 49: ☐, ☐ and ☐

d 4: ☐, ☐ and ☐ e 16: ☐, ☐, ☐, ☐ and ☐

Number and place value: Identify and describe properties of prime, composite, square and triangular numbers.

3

Answers

Concept

25 = 5 × 5, 36 = 6 × 6

1 a 25 b 36 c 49
d 64 e 81 f 100
g 4 h 16 i 49 j 9
k 36 l 100 m 1 n 64

2 a + 11, + 13, + 15, + 17, + 19
b 121, 144
c 4, 16, 36, 64, 100

3 a 3 squared b 5 squared
c 4 squared d 6 squared

4 a 1, 25, 5 b 1, 9, 3 c 1, 49, 7
d 1, 4, 2 e 1, 16, 2, 8, 4

1:04 Percentages

Content strand: Number and Algebra

Sub-strand: Fractions and decimals

Content description:

- Make connections between equivalent fractions, decimals and percentages.

Language

fraction, decimal, percentage, hundredth, tenth, decimal point, per cent sign, whole, denominator, numerator, 50 out of 100, sixty-five per cent, eighty per cent etc.

Resources

- hundred squares
- place-value blocks
- numeral cards
- dice

Cross-reference

See also: pp. 5, 6

Year 5 p. 26

Evaluation

Is the student able to do the following?

- recognise percentages in everyday situations
- relate a common percentage to a fraction or decimal

Teaching Suggestions

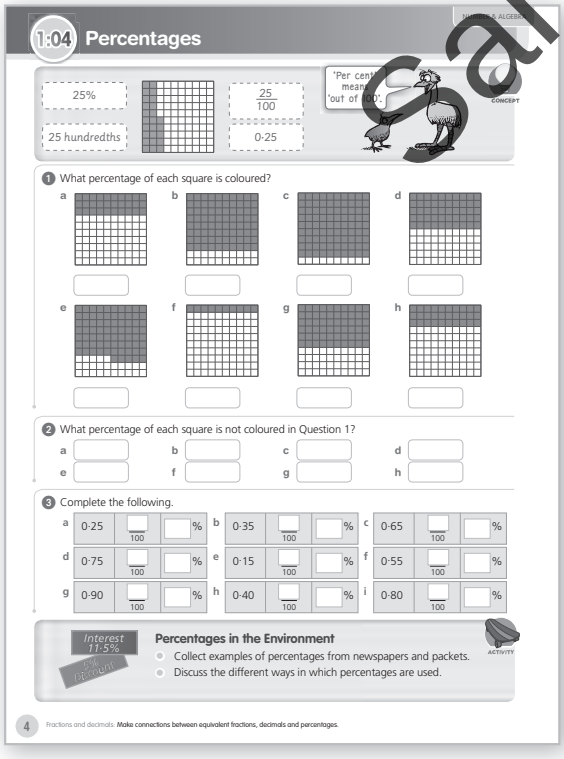
- 1:04 (p. 4) and 1:05 (p. 5) could be treated in the same lesson, as they both deal with the same concept.
- Read percentages as a number out of 100, e.g. '25% is 25 out of 100'.
- Emphasise the relationship between percentages, decimals and common fractions. Use hundred squares and place-value blocks to demonstrate this equivalence.
- Use numeral cards to label fractions, decimals and percentages in many different ways.

Activity

- Students could categorise examples of percentages collected from the environment, e.g. interest rates, discounts, nutrition information on food packaging etc.

Extension Work

- Have students take turns to roll two dice, multiply the numbers thrown and colour the appropriate percentage on a hundred square. The first player to completely colour the hundred square is the winner.



Answers

1 a 30% b 80% c 90% d 50%
e 75% f 10% g 60% h 30%

2 a 70% b 20% c 10% d 50%
e 25% f 90% g 40% h 70%

3

a	0·25	$\frac{25}{100}$	25%
b	0·35	$\frac{35}{100}$	35%
c	0·65	$\frac{65}{100}$	65%
d	0·75	$\frac{75}{100}$	75%
e	0·15	$\frac{15}{100}$	15%
f	0·55	$\frac{55}{100}$	55%
g	0·90	$\frac{90}{100}$	90%
h	0·40	$\frac{40}{100}$	40%
i	0·80	$\frac{80}{100}$	80%

Activity

Answers will vary.

1:05 Percentages

Content strand: Number and Algebra

Sub-strand: Fractions and decimals

Content description:

- Make connections between equivalent fractions, decimals and percentages.

Teaching Suggestions

- Read percentages as a number out of 100, e.g. '75% is 75 out of 100'.
- Emphasise the relationship between percentages, decimals and common fractions.
- Use calculators to convert fractions to decimals, e.g. $\frac{9}{10}$ is 9 divided by 10 to give 0·9.
- Use numeral cards to label fractions, decimals and percentages in many different ways.
- Reinforce the concept of significant and non-significant zeros.

Extension Work

- Have students work in groups with sets of cards representing hundredths, using different names, e.g. $\frac{25}{100}$, 25 out of 100, 0·25 and 25%. Have them use the cards to play familiar games such as *Fish* and *Old Maid*.

Language

whole, fraction, decimal, percentage, hundredth, tenth, decimal point, per cent sign, denominator, numerator, 75 out of 100, seventy-five per cent, sixty per cent etc.

Resources

- hundred squares
- place-value blocks
- calculators
- numeral cards
- cards with various matching expressions representing hundredths

Cross-reference

See also: pp. 4, 6

Year 5 p. 26

Evaluation

Is the student able to do the following?

- recognise percentages in everyday situations
- make connections between equivalent fractions, decimals and percentages

Answers

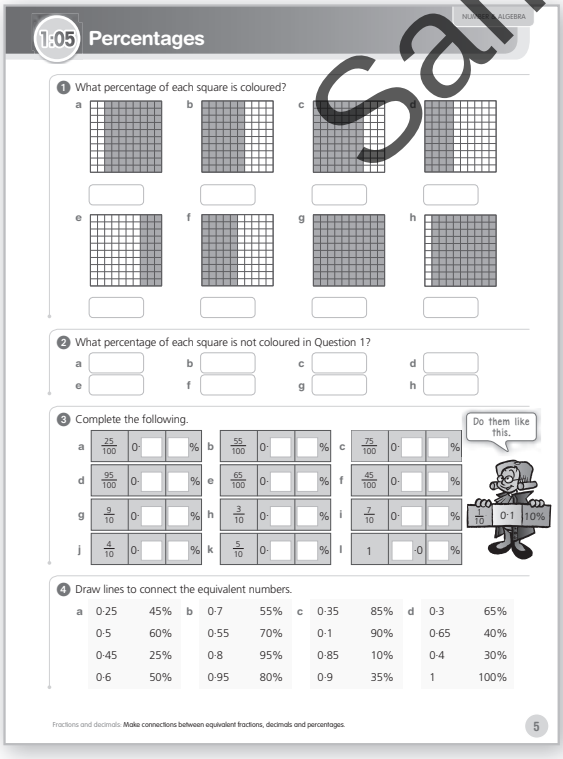
1 **a** 80% **b** 60% **c** 70% **d** 40%
e 30% **f** 50% **g** 100% **h** 90%

2 **a** 20% **b** 40% **c** 30% **d** 60%
e 70% **f** 50% **g** 0% **h** 10%

3

a	$\frac{25}{100}$	0·25	25%	**b**	$\frac{55}{100}$	0·55	55%
c	$\frac{75}{100}$	0·75	75%	**d**	$\frac{95}{100}$	0·95	95%
e	$\frac{65}{100}$	0·65	65%	**f**	$\frac{45}{100}$	0·45	45%
g	$\frac{9}{10}$	0·9	90%	**h**	$\frac{3}{10}$	0·3	30%
i	$\frac{7}{10}$	0·7	70%	**j**	$\frac{4}{10}$	0·4	40%
k	$\frac{5}{10}$	0·5	50%	**l**	1	1·0	100%

4 **a** 0·25 – 25%, 0·5 – 50%, 0·45 – 45%, 0·6 – 60%
b 0·7 – 70%, 0·55 – 55%, 0·8 – 80%, 0·95 – 95%
c 0·35 – 35%, 0·1 – 10%, 0·85 – 85%, 0·9 – 90%
d 0·3 – 30%, 0·65 – 65%, 0·4 – 40%, 1 – 100%



1:06 Percentages

Content strand: Number and Algebra

Sub-strand: Fractions and decimals

Content description:

- Make connections between equivalent fractions, decimals and percentages.

Teaching Suggestions

- Answer Questions 9 to 23 on **ID Card 1**, p. 188.
- Revise the concept of the percentage (%) as a fraction with a denominator of 100.
- Use place-value blocks and hundred squares to demonstrate tenths and hundredths in decimals and corresponding percentages.
- Discuss the equivalence between decimal fractions and common percentages, e.g. 10%, 20%, 25%, 50%, 75%, 100%.
- Use fraction labels (**BLM 2**, p. 196) to name fractions.
- Provide students with frequent opportunities to read and write percentages in everyday situations, e.g. '30% of the land is irrigated'.

Extension Work

- Use **BLW 20** Finding Percentage, p. 230, for further work.

Language

fraction, decimal, percentage, per cent (%), tenths, hundredths, zero point four, zero point three five

Resources

- place-value blocks and hundred squares
- **ID Card 1**, p. 188
- fraction labels (**BLM 2**, p. 196)
- **BLW 20** Finding Percentage, p. 230

Cross-reference

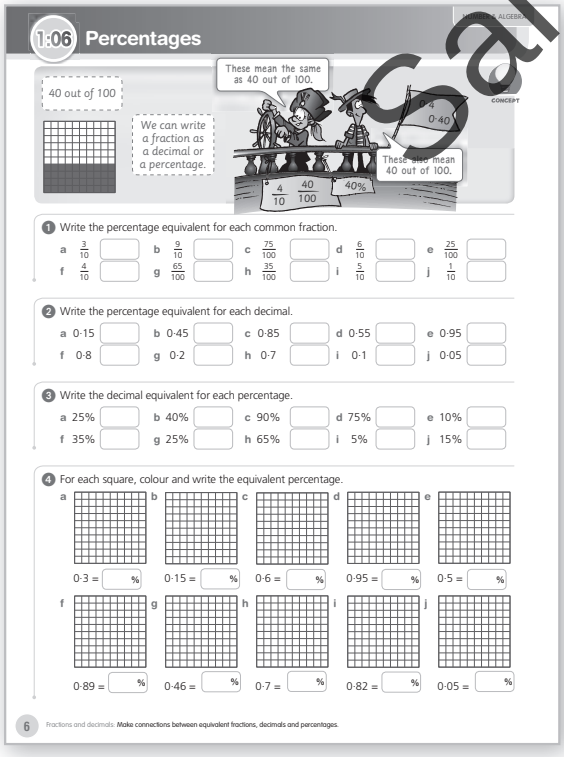
See also: pp. 4, 5

Year 5 p. 26

Evaluation

Is the student able to do the following?

- model, compare and represent commonly used fractions, decimals and percentages


1:06 Percentages

40 out of 100

We can write a fraction as a decimal or a percentage.

These mean the same as 40 out of 100.

These also mean 40 out of 100.

0·40

$\frac{4}{10}$ $\frac{40}{100}$ 40%

1 Write the percentage equivalent for each common fraction.

a $\frac{3}{10}$ b $\frac{9}{10}$ c $\frac{75}{100}$ d $\frac{6}{10}$ e $\frac{25}{100}$

f $\frac{4}{10}$ g $\frac{65}{100}$ h $\frac{35}{100}$ i $\frac{5}{10}$ j $\frac{1}{10}$

2 Write the percentage equivalent for each decimal.

a 0·15 b 0·45 c 0·85 d 0·55 e 0·95

f 0·8 g 0·2 h 0·7 i 0·1 j 0·05

3 Write the decimal equivalent for each percentage.

a 25% b 40% c 90% d 75% e 10%

f 35% g 25% h 65% i 5% j 15%

4 For each square, colour and write the equivalent percentage.

a 0·3 = % b 0·15 = % c 0·6 = % d 0·95 = % e 0·5 = %

f 0·89 = % g 0·46 = % h 0·7 = % i 0·82 = % j 0·05 = %

6 Fractions and decimals: Make connections between equivalent fractions, decimals and percentages.

Answers

1 a 30% b 90% c 75% d 60% e 25%
f 40% g 65% h 35% i 50% j 10%

2 a 15% b 45% c 85% d 55% e 95%
f 80% g 20% h 70% i 10% j 5%

3 a 0·25 b 0·4 c 0·9 d 0·75 e 0·1
f 0·35 g 0·25 h 0·65 i 0·05 j 0·15

4 a 0·3 = 30% b 0·15 = 15% c 0·6 = 60%

d 0·95 = 95% e 0·5 = 50% f 0·89 = 89%

g 0·46 = 46% h 0·7 = 70% i 0·82 = 82%

j 0·05 = 5%

1:07 Powers of Ten

Content strand: Number and Algebra

Sub-strand: Number and place value

Content description:

- Recognise, represent and order numbers to at least tens of thousands. *[Progression]*

Teaching Suggestions

- Read 10^2 as 'ten to the power of two', 10^3 as 'ten to the power of three' and 10^4 as 'ten to the power of four'.
- Demonstrate that the index number shows the number of times that ten is multiplied by itself, i.e. 10^1 is 10, 10^2 is 10×10, 10^3 is $10 \times 10 \times 10$, and 10^4 is $10 \times 10 \times 10 \times 10$.
- Demonstrate that the index number also shows the number of zeros in the answer, i.e. 10^1 is 10, 10^2 is 100, 10^3 is 1000 and 10^4 is 10000.
- Link powers of ten with previous work on powers such as 3^2 is 3×3 (or 9) and 5^2 is 5×5 (or 25).
- Relate powers of ten to previous work on place value and expanded notation.

Extension Work

- Some students may use the term 'index notation' (note 'indices' plural) to refer to the power to which a number is written e.g. 'the index number in 10^2 is two'.
- Have students record 5-digit numbers in as many different ways as possible, e.g. 25368 is:
  - $20000 + 5000 + 300 + 60 + 8$,
  - $(2 \times 10^4) + (5 \times 10^3) + (3 \times 10^2) + (6 \times 10^1) + 8$,
  - $(2 \times 10000) + (5 \times 1000) + (3 \times 100) + (6 \times 10) + 8$
- On a place-value chart, arrange three-digit cards drawn at random. Have students use powers of ten notation to record each display.

Language

power, powers of ten, squared, place value, expanded notation, numeral, numeral expander, digits, hundreds, tens, units, abacus, index notation, indices

Resources

- abacus
- place-value chart
- numeral expander

Cross-reference

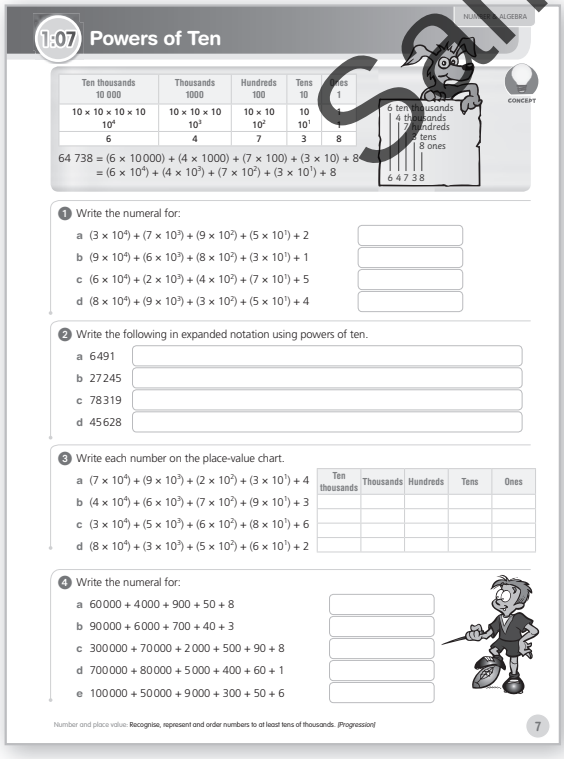
See also: pp. 61, 84

Year 5 p. 3

Evaluation

Is the student able to do the following?

- recognise and calculate simple powers of whole numbers
- explain the place value of any digit in a number



1:07 Powers of Ten

Ten thousands 10 000	Thousands 1000	Hundreds 100	Tens 10	Ones 1
$10 \times 10 \times 10 \times 10$ 10^4	$10 \times 10 \times 10$ 10^3	10×10 10^2	10 10^1	1
6	4	7	3	8

$64\,738 = (6 \times 10000) + (4 \times 1000) + (7 \times 100) + (3 \times 10) + 8$
$= (6 \times 10^4) + (4 \times 10^3) + (7 \times 10^2) + (3 \times 10^1) + 8$

6 ten thousands
4 thousands
7 hundreds
3 tens
8 ones
6 4 7 3 8

1 Write the numeral for:
a $(3 \times 10^4) + (7 \times 10^3) + (9 \times 10^2) + (5 \times 10^1) + 2$
b $(9 \times 10^4) + (6 \times 10^3) + (8 \times 10^2) + (3 \times 10^1) + 1$
c $(6 \times 10^4) + (2 \times 10^3) + (4 \times 10^2) + (7 \times 10^1) + 5$
d $(8 \times 10^4) + (9 \times 10^3) + (3 \times 10^2) + (5 \times 10^1) + 4$

2 Write the following in expanded notation using powers of ten.
a 6491
b 27245
c 78319
d 45628

3 Write each number on the place-value chart.
a $(7 \times 10^4) + (9 \times 10^3) + (2 \times 10^2) + (3 \times 10^1) + 4$
b $(4 \times 10^4) + (6 \times 10^3) + (7 \times 10^2) + (9 \times 10^1) + 3$
c $(3 \times 10^4) + (5 \times 10^3) + (6 \times 10^2) + (8 \times 10^1) + 6$
d $(8 \times 10^4) + (3 \times 10^3) + (5 \times 10^2) + (6 \times 10^1) + 2$

Ten thousands	Thousands	Hundreds	Tens	Ones

4 Write the numeral for:
a 60000 + 4000 + 900 + 50 + 8
b 90000 + 6000 + 700 + 40 + 3
c 300000 + 70000 + 2000 + 500 + 90 + 8
d 700000 + 80000 + 5000 + 400 + 60 + 1
e 100000 + 50000 + 9000 + 300 + 50 + 6

Number and place value: Recognise, represent and order numbers to at least tens of thousands. *[Progression]*

7

Answers

1 a 37 952 b 96 831
c 62 475 d 89 354

2 a $(6 \times 10^3) + (4 \times 10^2) + (9 \times 10^1) + 1$
b $(2 \times 10^4) + (7 \times 10^3) + (2 \times 10^2) + (4 \times 10^1) + 5$
c $(7 \times 10^4) + (8 \times 10^3) + (3 \times 10^2) + (1 \times 10^1) + 9$
d $(4 \times 10^4) + (5 \times 10^3) + (6 \times 10^2) + (2 \times 10^1) + 8$

3

	Ten thousands	Thousands	Hundreds	Tens	Ones
a	7	9	2	3	4
b	4	6	7	9	3
c	3	5	6	8	6
d	8	3	5	6	2

4 a 64 958 b 96 743 c 372 598
d 785 461 e 159 356

1:08 Negative Numbers

Content strand: Number and Algebra

Sub-strand: Number and place value

Content description:

- Investigate everyday situations that use positive and negative whole numbers and zero. Locate and represent these numbers on a number line.

Teaching Suggestions

- Discuss the concept of a negative number, i.e. a number less than zero.
- Use a thermometer scale as a number line to order numbers including some negative numbers.
- Discuss the use of negative numbers in everyday contexts, e.g. bank balances, scientific experiments.
- Relate the use of negative numbers to the operation of subtraction.

ICT

- Ask students to use the internet to research the use of negative numbers in real-life situations.

Extension Work

- Have students roll two dice three times and record the totals.
- Repeat and record the totals as negative numbers.
- Order the six numbers along a number line drawn on 5 mm grid paper (**BLM 13**, p. 207).

Language

numeral, digits, zero, negative number, less than zero, positive number, more than zero

Resources

- internet access
- dice
- 5 mm grid paper (**BLM 13**, p. 207)

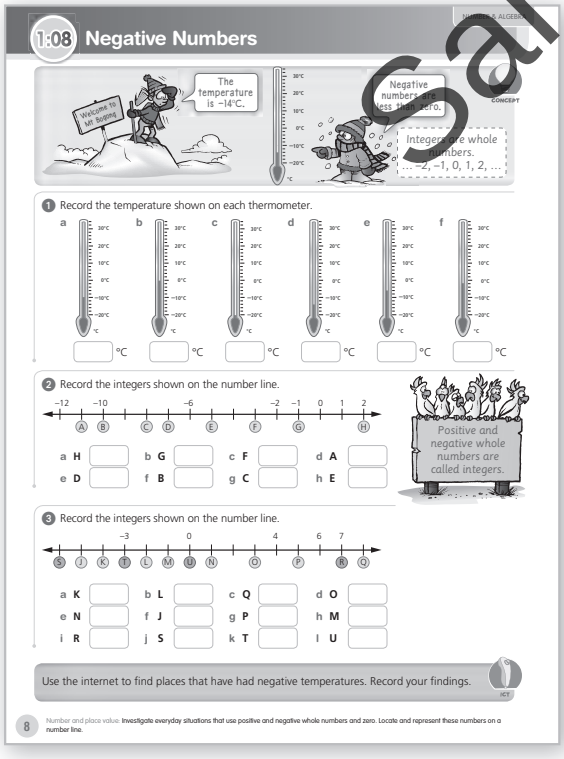
Cross-reference

See also: pp. 9, 12, 13, 14

Evaluation

Is the student able to do the following?

- read, write and order numbers using place value
- locate and represent negative numbers on a number line



Answers

❶ **a** −10°C **b** 0° C **c** −20° C
d −14° C **e** −6° C **f** −2° C

❷ **a** 2 **b** −1 **c** −3 **d** −11
e −7 **f** −10 **g** −8 **h** −5

❸ **a** −4 **b** −2 **c** 8 **d** 3
e 1 **f** −5 **g** 5 **h** −1
i 7 **j** −6 **k** −3 **l** 0

ICT

Answers will vary.

1:09 Positive and Negative Numbers

Content strand: Number and Algebra

Sub-strand: Number and place value

Content description:

- Investigate everyday situations that use positive and negative whole numbers and zero. Locate and represent these numbers on a number line.

Teaching Suggestions

- Revise the definition of the term *negative number*, i.e. a number less than zero.
- Discuss the fact that whole numbers, fractions, decimals and percentages can be extended to include negative numbers.
- Ask students to look carefully at the number lines and compare the use of fractions, decimals and percentages.
- Relate the use of negative numbers to the operation of subtraction.
- Discuss rocket countdowns: 3, 2, 1, 0, 1 after lift-off, 2 after lift-off etc. Discuss the use of negative numbers to say this: 3, 2, 1, 0, –1, –2 etc.

Fun Spot

- Students can work in groups of two or more. Ensure they understand the rules of the game by demonstrating how it works. Choose one dice to represent the direction of movement and the other dice to represent the size of the move.

Extension Work

- Ask students to use number lines (**BLM 11**, p. 205) to devise their own number patterns using fractions, decimals and percentages.

Language

numeral, digits, zero, negative and positive numbers, positive 2, negative 2, minus 2, whole numbers, fractions, decimals, percentages, number line

Resources

- dice
- number lines (**BLM 11**, p. 205)

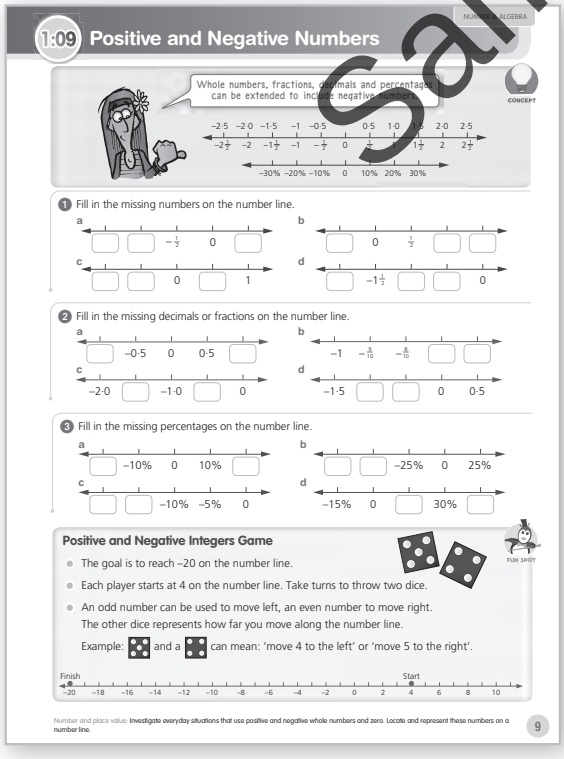
Cross-reference

See also: pp. 8, 12, 13, 14

Evaluation

Is the student able to do the following?

- use a number line to complete fraction, decimal and percentage patterns


1:09 Positive and Negative Numbers

NUMBER & ALGEBRA

Whole numbers, fractions, decimals and percentages can be extended to include negative numbers.

CONCEPT

1 Fill in the missing numbers on the number line.

2 Fill in the missing decimals or fractions on the number line.

3 Fill in the missing percentages on the number line.

Positive and Negative Integers Game

- The goal is to reach –20 on the number line.
- Each player starts at 4 on the number line. Take turns to throw two dice.
- An odd number can be used to move left, an even number to move right. The other dice represents how far you move along the number line.

Example: and a can mean: 'move 4 to the left' or 'move 5 to the right'.

FUN SPOT

Finish Start

Number and place value: Investigate everyday situations that use positive and negative whole numbers and zero. Locate and represent these numbers on a number line.

9

Answers

1 a –1½, –1, –½, 0, ½

b –½, 0, ½, 1, 1½

c –1, –½, 0, ½, 1

d –2, –1½, –1, –½, 0

2 a –1·0, –0·5, 0, 0·5, 1·0

b –1, –9/10, –8/10, –7/10, –6/10

c –2·0, –1·5, –1·0, –0·5, 0

d –1·5, –1·0, –0·5, 0, 0·5

3 a –20%, –10%, 0, 10%, 20%

b –75%, –50%, –25%, 0, 25%

c –20%, –15%, –10%, –5%, 0

d –15%, 0, 15%, 30%, 45%

1:10 Improper Fractions and Mixed Numbers

Content strand: Number and Algebra

Sub-strand: Fractions and decimals

Content description:

- Count by quarters, halves and thirds, including with mixed numerals. Locate and represent these fractions on a number line. *[Progression]*

Sub-strand: Patterns and algebra

Content description:

- Continue and create sequences involving whole numbers, fractions and decimals. Describe the rule used to create the sequence.

Teaching Suggestions

- Answer Questions 9 to 24 on **ID Card 1**, p. 188.
- Revise these terms:
  - *mixed number* – a whole number and a fraction part;
  - *improper fraction* – the numerator is bigger than the denominator.
- Use concrete materials and number lines to demonstrate mixed numbers and improper fractions.
- Provide frequent opportunities for students to rename mixed numbers as improper fractions.
- Discuss the use of division to find the mixed number for an improper fraction.

Extension Work

- Complete **BLW 8** Mixed Numbers, p. 218.
- On 5 mm grid paper (**BLM 13**, p. 207) draw a number line to show quarters from zero to four. Record the fractions as both mixed numbers and improper fractions.

Language

fraction, numerator, denominator, improper fraction, mixed number

Resources

- place-value blocks
- fraction charts
- **ID Card 1**, p. 188
- 5 mm grid paper (**BLM 13**, p. 207)
- **BLW 8** Mixed Numbers, p. 218

Cross-reference

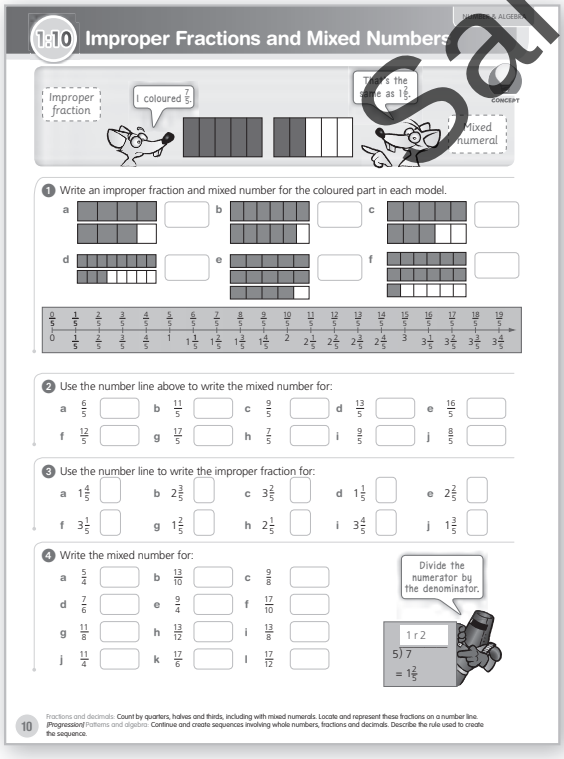
See also: pp. 11, 20

Year 5 p. 18

Evaluation

Is the student able to do the following?

- model, compare and represent commonly used fractions
- express a mixed number as an improper fraction and vice versa


1:10 Improper Fractions and Mixed Numbers

Improper fraction

I coloured $\frac{7}{5}$.

There's the same as $1\frac{2}{5}$.

Mixed numeral

1 Write an improper fraction and mixed number for the coloured part in each model.

2 Use the number line above to write the mixed number for:

3 Use the number line to write the improper fraction for:

4 Write the mixed number for:

Divide the numerator by the denominator.

1 r 2
5) 7
= $1\frac{2}{5}$

10 Fractions and decimals: Count by quarters, halves and thirds, including with mixed numerals. Locate and represent these fractions on a number line. *[Progression]* Patterns and algebra: Continue and create sequences involving whole numbers, fractions and decimals. Describe the rule used to create the sequence.

Answers

1 a $\frac{7}{4}, 1\frac{3}{4}$ b $\frac{11}{6}, 1\frac{5}{6}$ c $\frac{8}{5}, 1\frac{3}{5}$
d $\frac{11}{8}, 1\frac{3}{8}$ e $\frac{14}{5}, 2\frac{4}{5}$ f $\frac{13}{6}, 2\frac{1}{6}$

2 a $1\frac{1}{5}$ b $2\frac{1}{5}$ c $1\frac{4}{5}$ d $2\frac{3}{5}$ e $3\frac{1}{5}$
f $2\frac{2}{5}$ g $3\frac{2}{5}$ h $1\frac{2}{5}$ i $1\frac{4}{5}$ j $1\frac{3}{5}$

3 a $\frac{9}{5}$ b $\frac{13}{5}$ c $\frac{17}{5}$ d $\frac{6}{5}$ e $\frac{12}{5}$
f $\frac{16}{5}$ g $\frac{7}{5}$ h $\frac{11}{5}$ i $\frac{19}{5}$ j $\frac{8}{5}$

4 a $1\frac{1}{4}$ b $1\frac{3}{10}$ c $1\frac{1}{8}$
d $1\frac{1}{6}$ e $2\frac{1}{4}$ f $1\frac{7}{10}$
g $1\frac{3}{8}$ h $1\frac{1}{12}$ i $1\frac{5}{8}$
j $2\frac{3}{4}$ k $2\frac{5}{6}$ l $1\frac{5}{12}$

5:15 Using Samples

Content strand: Statistics and Probability

Sub-strand: Data representation and interpretation

Content description:

- Interpret secondary data presented in digital media and elsewhere.

Sub-strand: Chance

Content description:

- Describe probabilities using fractions, decimals and percentages.

Teaching Suggestions

- Discuss the use of survey data to make predictions about bigger samples.
- Provide students with frequent opportunities to use survey data to make predictions about bigger samples.
- Survey students in one class to gather data and make predictions for 100 students. Survey 100 students and compare the results with those predicted. Discuss the results.

Activity

- Ask students to predict the outcome of this survey before they begin. Have them list the colours in expected order of choice and write the number out of 50 that might choose each colour. Have students write each estimate as a percentage.
- Results could be combined and then discussed. Discover whose estimate was closest.

Extension Work

- Have students design a spinner (**BLM 10**, p. 204) or dice so that a particular outcome is more likely to occur than another.

Language

survey, probability, likelihood, predict, outcome

Resources

- dice
- spinners (**BLM 10**, p. 204)

Cross-reference

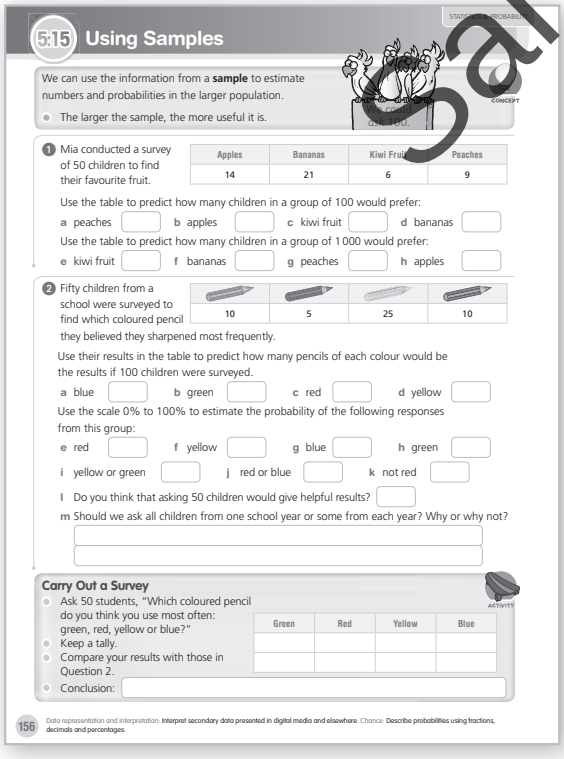
See also: pp. 155, 158, 159

Year 5 p. 163

Evaluation

Is the student able to do the following?

- assign numerical values to the likelihood of simple events occurring
- order the likelihood of simple events on a number line from zero to one



5:15 Using Samples

We can use the information from a **sample** to estimate numbers and probabilities in the larger population.

- The larger the sample, the more useful it is.

CONCEPT

1 Mia conducted a survey of 50 children to find their favourite fruit.

Apples	Bananas	Kiwi Fruit	Peaches
14	21	6	9

Use the table to predict how many children in a group of 100 would prefer:

a peaches ☐ b apples ☐ c kiwi fruit ☐ d bananas ☐

Use the table to predict how many children in a group of 1 000 would prefer:

e kiwi fruit ☐ f bananas ☐ g peaches ☐ h apples ☐

2 Fifty children from a school were surveyed to find which coloured pencil they believed they sharpened most frequently.

10	5	25	10

Use their results in the table to predict how many pencils of each colour would be the results if 100 children were surveyed.

a blue ☐ b green ☐ c red ☐ d yellow ☐

Use the scale 0% to 100% to estimate the probability of the following responses from this group:

e red ☐ f yellow ☐ g blue ☐ h green ☐

i yellow or green ☐ j red or blue ☐ k not red ☐

l Do you think that asking 50 children would give helpful results? ☐

m Should we ask all children from one school year or some from each year? Why or why not?

Carry Out a Survey

ACTIVITY

- Ask 50 students, "Which coloured pencil do you think you use most often: green, red, yellow or blue?"
- Keep a tally.
- Compare your results with those in Question 2.
- Conclusion:

Green	Red	Yellow	Blue

156 Data representation and interpretation: **Interpret secondary data presented in digital media and elsewhere.** Chance: **Describe probabilities using fractions, decimals and percentages.**

Answers

1 a 18 b 28 c 12 d 42
e 120 f 420 g 180 h 280

2 a 20 b 20 c 10 d 50
e 10% f 50% g 20% h 20%
i 70% j 30% k 90%

l yes (Answers will vary.)

m Answers will vary. If the purpose was to sample the school, some from each year would be a better sample.

5:16 Collecting Information

Content strand: Statistics and Probability

Sub-strand: Data representation and interpretation

Content description:

- Interpret secondary data presented in digital media and elsewhere.

Teaching Suggestions

- Discuss the Concept box and explain the difference between the terms *census* (everybody in the chosen population is asked the question) and *sample* (only part of the chosen population is asked the question).
- Determine the goal of the survey in Question 1. Is it to find the fruit liked by one class or by the school? If it is for one class, choosing 10 people as a sample would be reasonable. If it is for the school, it would be hopelessly inadequate as the number would be too small and the choices from one class would not be a good indication of the preferences of the whole school. Ask if the order in which the fruits are listed might affect a person's choice. Ask how this might be overcome. (Many survey sheets could be used, each using a different order of the fruits. If this method is used, it would be explained in Question 4.)
- Revise changing the score out of 10 into a percentage, and quickly discuss the column graph that is to be drawn.
- Remind students that these graphs could be called either 'bar graphs' or 'column graphs'.
- Review the use of tally marks.

Extension Work

- Have students decide how a sample of the whole school population might be taken, giving consideration to numbers in the sample and the choice of students who are to be surveyed.

Language

census, sample, population, graphs, display, results, table, survey, tally, method

Resources

- survey sheets showing lists of different orders of fruit

Cross-reference

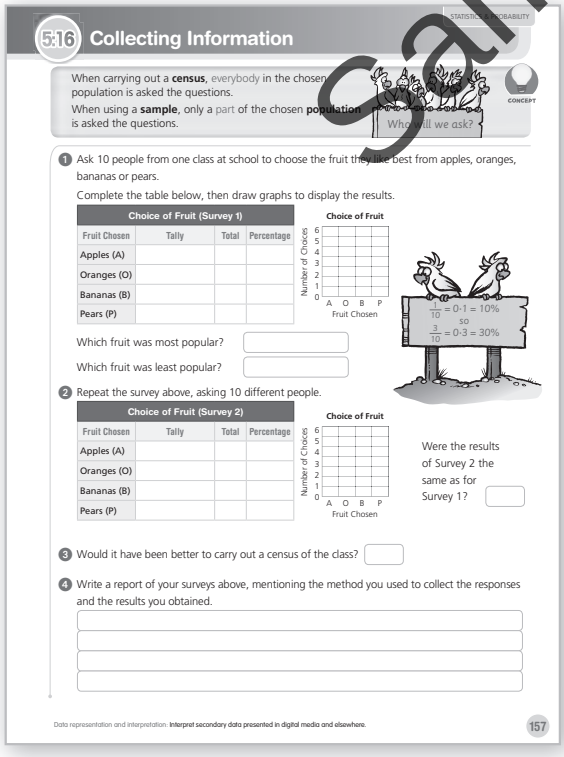
See also: pp. 150, 156, 158, 159, 162

Year 5 p. 163

Evaluation

Is the student able to do the following?

- understand how samples are used



5:16 Collecting Information

When carrying out a **census**, everybody in the chosen population is asked the questions.
When using a **sample**, only a part of the chosen **population** is asked the questions.

CONCEPT

Who will we ask?

1 Ask 10 people from one class at school to choose the fruit they like best from apples, oranges, bananas or pears.
Complete the table below, then draw graphs to display the results.

Choice of Fruit (Survey 1)			
Fruit Chosen	Tally	Total	Percentage
Apples (A)			
Oranges (O)			
Bananas (B)			
Pears (P)			

Choice of Fruit
Number of Choices
Fruit Chosen
A O B P

$\frac{1}{10} = 0{\cdot}1 = 10\%$ so $\frac{3}{10} = 0{\cdot}3 = 30\%$

Which fruit was most popular?

Which fruit was least popular?

2 Repeat the survey above, asking 10 different people.

Choice of Fruit (Survey 2)			
Fruit Chosen	Tally	Total	Percentage
Apples (A)			
Oranges (O)			
Bananas (B)			
Pears (P)			

Choice of Fruit
Number of Choices
Fruit Chosen
A O B P

Were the results of Survey 2 the same as for Survey 1?

3 Would it have been better to carry out a census of the class?

4 Write a report of your surveys above, mentioning the method you used to collect the responses and the results you obtained.

Data representation and interpretation: Interpret secondary data presented in digital media and elsewhere.

157

Answers

Answers will vary.

5:17 Repeating an Experiment

Content strand: Statistics and Probability

Sub-strand: Chance

Content description:

- Conduct chance experiments with both small and large numbers of trials using appropriate digital technologies.
- Describe probabilities using fractions, decimals and percentages.

Teaching Suggestions

- The purpose of this lesson is to demonstrate that when an experiment is repeated we are unlikely to gain identical results, but there should be some similarity. We also wish to demonstrate that the results are more reliable if the number of cases we use is large. By combining the results of the two trials we would obtain more reliable experimental probabilities.
- These experiments should be carried out in small groups. Discussion of the investigation as it occurs will increase understanding.

Investigation

- Discuss the possibility that the bottle top could land on its side. This is highly unlikely, but if it occurs during the experiment a third category would have to be added, 'On its side'.
- Discuss the tables on the page and how they should be used. Review the method of changing a fraction out of 50 into a fraction out of 100 and so into a percentage.
- Have students discuss the results of their experiment and have each group read this aloud to the class. Compare the results.

Extension Work

- Ask students to carry out the experiment a third time using two bottle tops and the categories, '2 open ends up', '1 open end up' and 'No open end up'.
- Remind students that it may be necessary to include a fourth category, 'On its side'.
- Have students provide tables similar to those on the Student Book page and write a report on their experiment.

Language

experiment, more likely, open end up, open end down, fraction, percentage, hundredths, numerator, denominator, tally, trial, data, results, probability

Resources

- bottle tops

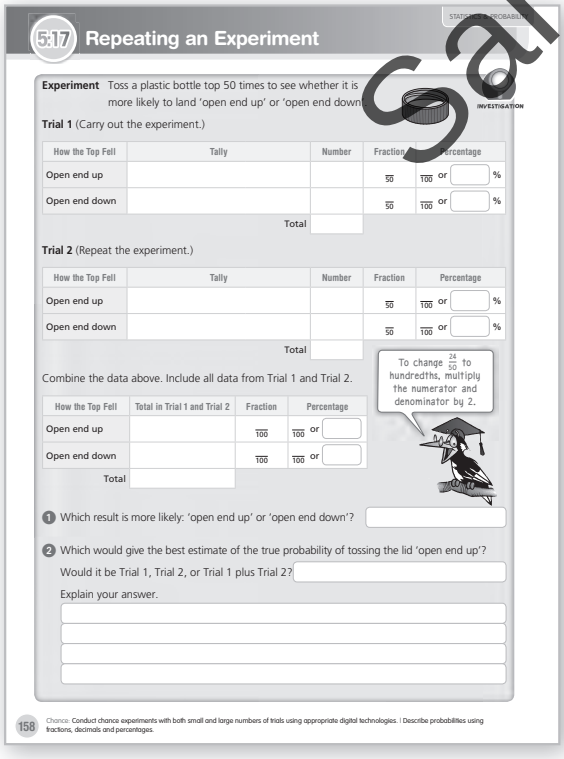
Cross-reference

See also: pp. 150, 154, 155, 159
Year 5 p. 163

Evaluation

Is the student able to do the following?

- conduct chance experiments involving a large number of trials



5:17 Repeating an Experiment

Experiment Toss a plastic bottle top 50 times to see whether it is more likely to land 'open end up' or 'open end down'.

INVESTIGATION

Trial 1 (Carry out the experiment.)

How the Top Fell	Tally	Number	Fraction	Percentage
Open end up			$\frac{}{50}$	$\frac{}{100}$ or %
Open end down			$\frac{}{50}$	$\frac{}{100}$ or %
		Total		

Trial 2 (Repeat the experiment.)

How the Top Fell	Tally	Number	Fraction	Percentage
Open end up			$\frac{}{50}$	$\frac{}{100}$ or %
Open end down			$\frac{}{50}$	$\frac{}{100}$ or %
		Total		

Combine the data above. Include all data from Trial 1 and Trial 2.

To change $\frac{24}{50}$ to hundredths, multiply the numerator and denominator by 2.

How the Top Fell	Total in Trial 1 and Trial 2	Fraction	Percentage
Open end up		$\frac{}{100}$	$\frac{}{100}$ or
Open end down		$\frac{}{100}$	$\frac{}{100}$ or
Total			

1. Which result is more likely: 'open end up' or 'open end down'?
2. Which would give the best estimate of the true probability of tossing the lid 'open end up'? Would it be Trial 1, Trial 2, or Trial 1 plus Trial 2? Explain your answer.

158 Chance: Conduct chance experiments with both small and large numbers of trials using appropriate digital technologies. | Describe probabilities using fractions, decimals and percentages.

Answers

1. Answers will vary.
2. Trial 1 plus Trial 2. The more times it is trialled, the greater is the likelihood that the answer will reflect the real probability.

5:18 Chance: Expected Results

Content strand: Statistics and Probability

Sub-strand: Chance

Content description:

- Compare observed frequencies across experiments with expected frequencies.

Teaching Suggestions

- Discuss the term *random*. One definition is 'to choose without looking'. Ask: 'Will the result be random if I tossed a coin? Do I need to be blindfolded? Why or why not?' This is a random action because we cannot affect the result of tossing a coin. Ask: 'How would we randomly select a counter from the container in Question 1?'
- Ask: 'If I tossed a coin 1000 times, how many tails would you expect to be tossed? What percentage is this?' Most people would say 500, as heads and tails have the same chance of occurring and so should occur the same number of times. In practice, this rarely works out exactly, but we use the term *expected result* to describe the result that is most likely to happen.
- Ask: 'If I roll a dice 600 times, how many sixes would you expect me to roll?'
- Ask: 'If I choose a counter from the container in Experiment 1, replacing the counter after each choice, how many red counters would you expect me to choose in 400 choices? What percentage would this be?'
- Ask: 'Could I toss 100 heads in a row?' Even though this is possible, the chance of it occurring is extremely small, and if it happened, you would doubt that the coin is a fair coin.

Extension Work

- Have students collect information from other groups and combine them with their own to see if a large number of cases will give you a result that is closer to the expected result, when expressed as a percentage.

Language

chance, expected (calculated) result, experimental result, random, tally, probability

Resources

- 3 red counters, 1 blue counter
- container
- coins

Cross-reference

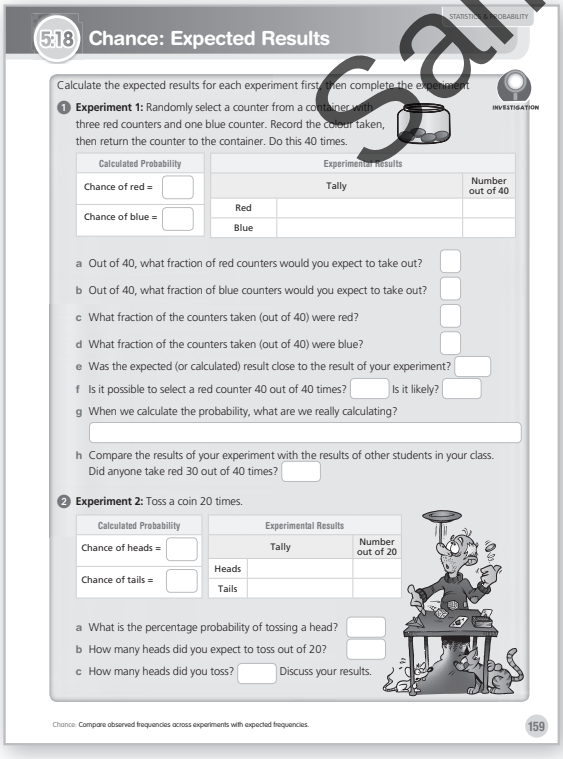
See also: pp. 150, 154, 155, 158

Year 5 p. 163

Evaluation

Is the student able to do the following?

- predict expected results in chance experiments



5:18 Chance: Expected Results

Calculate the expected results for each experiment first, then complete the experiment.

INVESTIGATION

1 **Experiment 1:** Randomly select a counter from a container with three red counters and one blue counter. Record the colour taken, then return the counter to the container. Do this 40 times.

Calculated Probability		Experimental Results		
Chance of red =		Tally		Number out of 40
Chance of blue =		Red		
		Blue		

a Out of 40, what fraction of red counters would you expect to take out?

b Out of 40, what fraction of blue counters would you expect to take out?

c What fraction of the counters taken (out of 40) were red?

d What fraction of the counters taken (out of 40) were blue?

e Was the expected (or calculated) result close to the result of your experiment?

f Is it possible to select a red counter 40 out of 40 times? Is it likely?

g When we calculate the probability, what are we really calculating?

h Compare the results of your experiment with the results of other students in your class. Did anyone take red 30 out of 40 times?

2 **Experiment 2:** Toss a coin 20 times.

Calculated Probability		Experimental Results		
Chance of heads =		Tally		Number out of 20
Chance of tails =		Heads		
		Tails		

a What is the percentage probability of tossing a head?

b How many heads did you expect to toss out of 20?

c How many heads did you toss? Discuss your results.

Chance: Compare observed frequencies across experiments with expected frequencies.

159

Answers

1 Calculated probability: chance of red = $\frac{3}{4}$, chance of blue = $\frac{1}{4}$. Tally will vary.

- **a** $\frac{30}{40}$
- **b** $\frac{10}{40}$
- **c–e** Answers will vary.
- **f** yes, no
- **g** We are calculating the expected outcome.
- **h** Answers will vary.

2 Calculated probability: chance of heads = $\frac{1}{2}$, chance of tails = $\frac{1}{2}$. Tally will vary.

- **a** 50%
- **b** 10
- **c** Answers will vary.