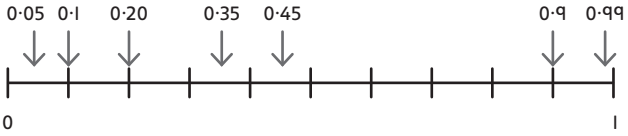
Unit 11: Decimals and percentages

Lesson 1: Writing decimals (1)

➜ pages 130–132

1. 0·7 0·75
0·4 0·43
0·6 0·62

2.



3. 0·23 – two 0·1 counters, three 0·01 counters
0·03 – three 0·01 counters
0·30 – three 0·1 counters

4. a) The value of the digit 4 in 0·34 is 4 hundredths.
b) 9 has the value of 9 tenths in the number 0·90
c) The value of the digit 5 in 0·5* is 5 tenths (* can be any digit)
d. You could put any digit, except 5, in the hundredths column and the statement will still be true, so there is more than one correct answer.

5. a) 0·28 b) 0·01

6. a) There are 18 possible answers: 0·10, 0·01, 0·21, 0·12, 0·32, 0·23, 0·43, 0·34, 0·54, 0·45, 0·65, 0·56, 0·76, 0·67, 0·87, 0·78, 0·98, 0·89
b) Two possible answers: 0·09, 0·90
c) There are only 10 digits, the largest digit being 9. So, there is only one pair of digits that have a difference of 9 (0 and 9). However, there are 9 pairs of digits with a difference of 1.

Reflect

Answers will vary. Same – 0·7 and 0·07 both contain one digit (7) but all other digits are 0; both numbers are smaller than 1. Different – the 7 digit has a different value (7 tenths in 0.7 and 7 hundredths in 0·07); 0·7 is greater than 0·1 whereas 0·07 is smaller than 0·1.

Lesson 2: Writing decimals (2)

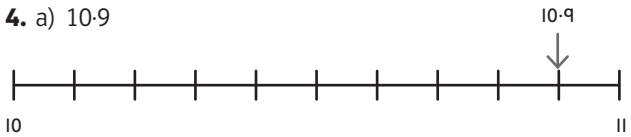
➜ pages 133–135

1. Numbers added to number line:
1·3, 1·4, 1·5, 1·6, 1·7, 1·8, 1·9, 2
1·11 … 1·13 … 1·15, 1·16, 1·17, 1·18, 1·19, 1·2
9·8, 9·9, 10, 10·1, 10·2, 10·3, 10·4, 10·5
5·66, 5·67, 5·68, 5·69, 5·7, 5·71, 5·72, 5·73, 5·74

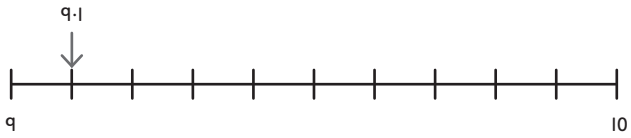
2. a) 1·4 c) 4·01
b) 5·59 d) 5·05

3. a) 1·3, 1·2, 1·1, 1, 0·9, 0·8, 0·7
b) 1·3, 1·31, 1·32, 1·33, 1·34, 1·35
c) 3·02, 3·01, 3, 2·99, 2·98, 2·97, 2·96
d) 5·9, 5·91, 5·92, 5·93, 5·94, 5.·95, 5·96

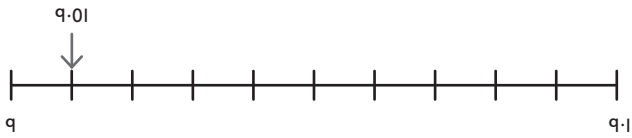
4. a) 10·9



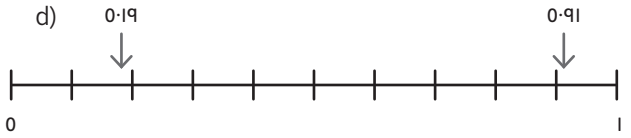
b) 9·1 (or 9·10)



c) 9·01



d)



5. a) 9·95 10·05
b) 99·5 100·5
c) 99·95 100·05
d) 999·5 1,000·5

Reflect

True – the digit 5 is in a different column in each number, which means its value is different. In 5·17 its value is 5 ones; in 7·15 its value is 5 hundredths; in 1·57 its value is 5 tenths.

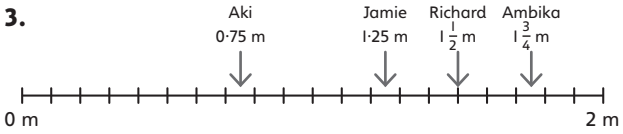
Lesson 3: Decimals as fractions (1)

➜ pages 136–138

1. a) A = $\frac{1}{10}$
B = $\frac{3}{10}$
C = $\frac{5}{10}$ or $\frac{1}{2}$
D = $\frac{9}{10}$
b) $\frac{5}{10}$ can be simplified to $\frac{1}{2}$ as they are equivalent.

2. Place value counters drawn on grid:
$\frac{4}{10}$: 4 counters in Tths column
$2\frac{3}{4}$: 2 counters in O column, 7 counters in Tth column, 5 counters in Hth column
$1\frac{4}{10}$: 1 counter in O column, 4 counters in Tth column
$1\frac{1}{4}$: 1 counter in O column, 2 counters in Tth column, 5 counters in Hth column

3.



Methods may vary. Children may say they converted the fractions to decimals first. Then they counted that there were 20 intervals between 0 m and 2 m so this meant that each interval was 0·1 m, and each half interval was 0·05 m.

4. a) 0·25
b) 0·5
c) 0·75
d) 1·0
e) 1·5
f) 2·0
g) $\frac{3}{10}$
h) 1·5
i) $3\frac{1}{5}$ (or $3\frac{2}{10}$)
j) $3\frac{2}{5}$ (or $3\frac{4}{10}$)
k) 1
l) $\frac{6}{3}$

5. Encourage children to use pictorial representations to see that $\frac{1}{5}$ is not the same as $\frac{1}{2}$ and therefore not 0·5.

Reflect

Diagrams may vary, for example children might draw a fraction wall to include tenths or a 0-1 number line divided into tenths. Ensure the correct representation of each fraction is shaded.

$\frac{1}{4} = 0{\cdot}25$ $\frac{1}{2} = 0{\cdot}5$ $\frac{3}{4} = 0{\cdot}75$ $\frac{1}{10} = 0{\cdot}1$

Lesson 4: Decimals as fractions (2)

➜ pages 139–141

1. a) $0{\cdot}09 = \frac{9}{100}$
b) $0{\cdot}23 = \frac{23}{100}$
c) $0{\cdot}35 = \frac{35}{100}$ (or $\frac{7}{10}$)
d) $0{\cdot}03 = \frac{3}{100}$
e) $0{\cdot}7 = \frac{7}{10}$
f) $0{\cdot}9 = \frac{9}{10}$

2. Place value counters drawn on grid:
a) $\frac{21}{100}$: no counters in O column, 2 counters in Tth column, 1 counter in Hth column
b) $\frac{21}{10}$: 2 counters in O column, 1 counter in Tth column, no counters in Hth column
c) $\frac{201}{100}$: 2 counters in O column, no counters in Tth column, 1 counter in Hth column

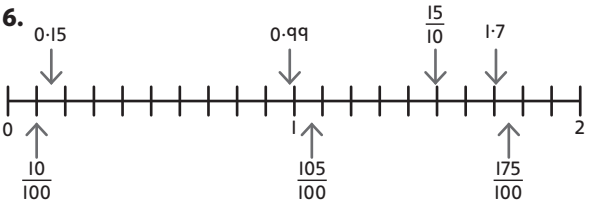
3. a) Numbers ticked: $\frac{11}{100}$ and 0·15
b) Numbers ticked: 2·80, 2·71 and $2\frac{87}{100}$

4. Answers will vary – any fraction, decimal or mixed number between 5·5 and 5·75.
Decimal = 5·6 Fraction = $\frac{45}{8}$ Mixed number = $5\frac{5}{8}$

5.

Decimal number	Mixed number	Improper fraction
1·61	$1\frac{61}{100}$	$\frac{161}{100}$
1·6	$1\frac{6}{10}$	$\frac{16}{10}$
2·26	$2\frac{26}{100}$	$\frac{226}{100}$
2·06	$2\frac{6}{100}$	$\frac{206}{100}$
4·6	$4\frac{60}{100}$	$\frac{460}{100} = \frac{46}{10}$

6.



Reflect

Reena is incorrect as $\frac{35}{10} = 3{\cdot}5$. Instead, $3{\cdot}05 = \frac{305}{100}$.
Encourage children to explain with the use of pictorial representations such as place value counters.

Lesson 5: Understanding thousandths

➜ pages 142–144

1. a) $0{\cdot}004 = \frac{4}{1{,}000}$
b) $0{\cdot}024 = \frac{24}{1{,}000}$

2. a) 5 squares shaded
$\frac{50}{1{,}000} = \frac{5}{100} = 0{\cdot}05$
b) 90 squares shaded
$\frac{900}{1{,}000} = \frac{90}{100} = \frac{9}{10} = 0{\cdot}9$

3.

Decimal	0·002	0·02	0·251	0·25	0·2
Fraction	$\frac{2}{1{,}000}$	$\frac{20}{1{,}000}$	$\frac{251}{1{,}000}$	$\frac{250}{1{,}000}$	$\frac{200}{1{,}000}$

Decimal	1	1·001	1·251	1·25	0·000
Fraction	$\frac{1{,}000}{1{,}000}$	$\frac{1{,}001}{1{,}000}$	$\frac{1{,}251}{1{,}000}$	$1\frac{250}{1{,}000}$	$\frac{0}{1{,}000}$

4. a) $0{\cdot}2 = 0{\cdot}20 = 0{\cdot}200$ $\frac{2}{10} = \frac{20}{100} = \frac{200}{1{,}000}$ $(= \frac{1}{5})$
b) $0{\cdot}07 = 0{\cdot}070$ $\frac{7}{100} = \frac{70}{1{,}000}$
c) $0{\cdot}35 = 0{\cdot}350$ $\frac{35}{100} = \frac{350}{1{,}000}$ $(= \frac{7}{20})$

5. a) Answers will vary. Parts should total 0·01 $(= \frac{10}{1{,}000})$.
For example, $\frac{1}{1{,}000}$ and $\frac{2}{1{,}000}$ and $\frac{7}{1{,}000}$ or $\frac{5}{1{,}000}$ and $\frac{3}{1{,}000}$ and $\frac{2}{1{,}000}$.
b) Answers will vary. Parts should total $\frac{1{,}600}{1{,}000}$ $(= 1{\cdot}6)$.
For example 1 and $\frac{600}{1{,}000}$ or 1 and $\frac{6}{10}$ or $\frac{800}{1{,}000}$ and $\frac{800}{1{,}000}$ or $\frac{95}{100}$and $\frac{65}{100}$.

Reflect

$\frac{3}{100}$ and $\frac{30}{1{,}000}$ are both equivalent to 0·03.
Explanations may vary. Children may say they can check by using division as $3 \div 100 = 0{\cdot}03$ and $30 \div 1000 = 0{\cdot}03$.

Lesson 6: Writing thousandths as decimals

➜ pages 145–147

1. a) 0·225 b) 2·205 c) 1·166

2. a) No counters in O column, 4 counters in Tth column, 2 counters in Hth column, 5 counters in Thths column
b) No counters in O column, 4 counters in Tth column, no counters in Hth column, 5 counters in Thths column

3. 1·12

4. a) 3·91 3·95 3·98
b) 3·989 3·997 4·002

5. The mistake is that they think each interval represents 1 thousandth when in fact they represent 1 hundredth. The numbers should be labelled 0·11 and 0·19.

6. a) There are three possible solutions: 0·231, 0·462 and 0·693
b) There are four possible solutions: 8·003, 8·513, 9·004 and 9·514

Reflect

Answers may vary. Encourage children to show a pictorial representation as well as a fractional representation. The number has 1 one, 2 tenths, 0 hundredths and 5 thousandths.

Lesson 7: Ordering and comparing decimals (I)

➜ pages 148–150

1. a) 0·7 is greater than 0·5
b) 1·7 is less than 2·5
c) 0·85 is greater than 0·75
d) 0·42 is greater than 0·05

2. Answers may vary – between 15 and 25 squares in middle grid.
0·25 is greater than (shaded number between 0·15 and 0·25) which is greater than 0·15.

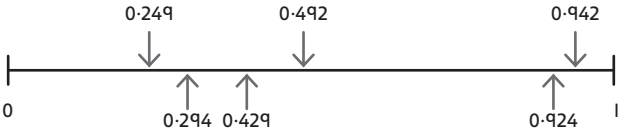
3.

Order (Ist is least fierce, 5th is most fierce)	Dinosaur
Ist	Brachiosaurus
2nd	Stegosaurus
3rd	Triceratops
4th	Spinosaurus
5th	T-Rex

4. 0·255 > $\frac{251}{1{,}000}$
0·089 < 1·001
$\frac{980}{1{,}000} > \frac{97}{100}$

5. a) 6·701, 1·760, 1·607, 0·176
b) $\frac{15}{100}$, $\frac{126}{1{,}000}$, $\frac{1}{10}$
Explanations may vary. Encourage children to convert fractions to decimals and then to compare the decimal numbers.

6. 0·249, 0·294, 0·429, 0·492, 0·924, 0·942



Reflect

Methods may vary. First, compare digits in the column of largest value. In this case they are all zero, so then compare the next highest value column. If the digits in this column are the same, then compare digits in the next column and so on.

So in ascending order: 0·453, 0·456, 0·998.

Lesson 8: Ordering and comparing decimals (2)

➜ pages 151–153

1. a) Least 2·21 < 2·25 < 2·3 < 3·1 Greatest
b) Greatest 1·42 > 0·43 > 0·4 > 0·33 > 0·322 Least

2. Lee has not compared digits in corresponding columns accurately. The digit 1 in 1·627 represents 1 one, whereas the digit 1 in 15·6 is 1 ten. This means that 15·6 is greater than 1·627 even though 1·627 has more digits.

3. a) 0·5 < 0·51
b) 0·51 < 0·6
c) 1·6 > 0·511
d) 1·056 > 1·05
e) $\frac{11}{1{,}000}$ < 0·11
f) $\frac{101}{100}$ > 0·101
g) 0·11 = $\frac{110}{1{,}000}$
h) $\frac{1{,}001}{1{,}000}$ < 1·01

4. Place value counters drawn:
Three 0·1 counters and some 0.·01 and/or 0·001 counters (with total value less than 0·1)
One 0·1 counter, one 0·01 counter and from two to nine 0·001 counters

5. a) Numbers circled: 2 $\frac{51}{100}$ 2 $\frac{52}{100}$ 2·501
b) Answers will vary, numbers must be between 2·5 and 2·52, for example 2·51 and $\frac{2{,}507}{1{,}000}$.

6. There are many possible answers, for example
Less than 2·12: 0·005, 0·014, 1·111, 2·102, 2·003
Greater than 2·12: 2·201, 2·21, 3·002, 3·101, 4·01
To find all possibilities, encourage children to list answers in a methodical way such as in a particular order.

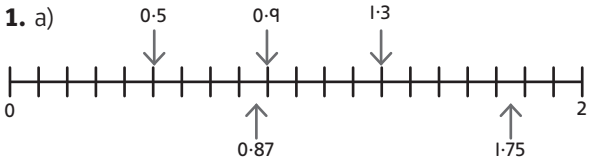
Reflect

Children should disagree. Explanations may vary, for example both numbers have 3 ones and 3 tenths, however, 3·309 has no hundredths, whereas 3·31 has 1 hundredth. So, this means that 3·31 is greater than 3·309.

Lesson 9: Rounding decimals

➜ pages 154–156

1. a)



b. 0·9 rounds to 1 to the nearest whole number.
1·3 rounds to 1 to the nearest whole number.
0·87 rounds to 1 to the nearest whole number.
0·5 rounds to 1 to the nearest whole number.
1·75 rounds to 2 to the nearest whole number.

2. 3·9 cm rounds to 4 cm.
5·2 cm rounds to 5 cm.
3·5 cm rounds to 4 cm.
4·4 cm rounds to 4 cm.

3. a) 5·23 rounds to 5·2 to the nearest tenth.
b) Explanations will vary. First, identify the tenths the number is between. Then look at the hundredths digit, if it is less than 5 then the number rounds down to the smaller tenth. If it is 5 or more then it rounds up to the next tenth.

4.

Number	Rounded to nearest whole number	Rounded to the nearest tenth
1·19	1	1·2
10·19	10	10·2
0·75	1	0·8
100·75	101	100·8
100·03	100	100
100·037	100	100

5. When rounding to the nearest tenth, it means the nearest multiple of tenths – therefore there would not be a digit in the hundredths column after rounding, so the answer should be 2·8.

6. a) The number is in the range 8·45 to 8·5 (including 8·45 but not including 8·5).
b) 0·529 rounded to the 1 decimal place is 0·5
0·592 rounded to the 1 decimal place is 0·6
2·950 rounded to the 1 tenth place is 3·0

Reflect

2·91 to the nearest tenth is 2·9 and to the nearest whole number is 3.

Methods may vary – encourage children to show rounding on a number line as well as using what they know about the digits to help them decide whether to round up or down.

Lesson 10: Understanding percentages

➜ pages 157–159

1. a) 33 out of 100 are shaded. That is 33%.
b) 24 out of 100 are shaded. That is 24%.

2. a) 4 squares shaded
b) 96 squares shaded
c) 24 squares shaded

3. Diagrams circled: Bead string Circles divided into tenths

4. Children should not agree with Olivia as some children may wear wellies and a scarf. 112% is more than all the children! The only certain facts are that 61% of children wear wellies and 51% wear scarves.

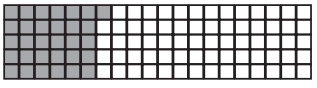
5. a) 3 squares shaded.
70% is not shaded.
b) $2\frac{1}{2}$ squares shaded in one colour and $2\frac{1}{2}$ squares shaded in another colour.
50% is not shaded. 50% is shaded.
c) Check 11 mm is one colour, 22 mm is a second colour and 33 mm is a third colour.
34% is not shaded
d) 5 × 20% = 100%

Reflect

Answers may vary. Encourage children to explain using a pictorial representation, for instance, shading 42 squares out of 100. Children should recognise that 42% is between $\frac{1}{4}$ and $\frac{1}{2}$ and is closer to $\frac{1}{2}$.

Lesson 11: Percentages as fractions and decimals

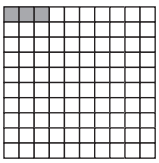
➜ pages 160–162

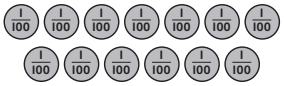
1. 0·31 ➜  ➜ 31%

$\frac{33}{100}$ ➜

O	•	Tth	Hth
0	•	3	3

➜33%

3% ➜  ➜ 0·03

13% ➜  ➜ 0·13

2. $\frac{32}{100}$ as a decimal is 0·32
$\frac{32}{100}$ as a percentage is 32%
$\frac{32}{100}$ as a decimal is **32%**

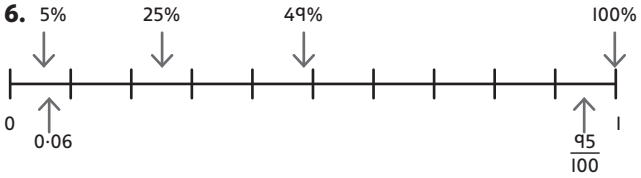
3.

Fraction	Decimal	Percentage
$\frac{48}{100}$	0·48	48%
$\frac{99}{100}$	0·99	99%
$\frac{1}{100}$	0·01	1%

4. a) $\frac{53}{100}$ = 0·53 = 53%
b) 0·35 = $\frac{35}{100}$ = 35%
c) 92% = $\frac{92}{100}$ = 0·92
d) 0·78 = $\frac{78}{100}$ = 78%

5. 8%, 0·18, 0·8, $\frac{81}{100}$, 88%, 1

6.



7. The first number line is the longest.
The last number line is the shortest.
Explanations will vary. For example, each interval on the first number line is worth 1% so it will take 100 intervals to make 1. Each interval on the second and third number lines represent 10% so it will take 10 intervals to make 1. The interval length on the third number line is slightly shorter than that of the second number line so the third number line will be shorter.

Reflect

Explanations will vary – 'Per cent' means 'out of 100' so 4% = $\frac{4}{100}$ and 14% = $\frac{14}{100}$. To then work out the decimal equivalents, 4 ÷ 100 = 0·04 and 14 ÷ 100 = 0·14.

Lesson 12: Equivalent fractions, decimals and percentages

➜ pages 163–165

1. a) 40 squares shaded
40% = $\frac{40}{100}$
b) 25 squares shaded
$\frac{25}{100}$ = 25% = 0·25
c) 7 squares shaded
0·07 = 7%
d) 5 strips shaded
$\frac{5}{10}$ = 50%
e) 90 squares shaded
0·9 = 90% = $\frac{9}{10}$ = $\frac{90}{100}$

2. Pairs matched:

 ➜ 25%

50% ➜ 

1 ➜ $\frac{10}{10}$

0% ➜ $\frac{0}{100}$

60% ➜ 

$\frac{2}{10}$ ➜ 0·2

3.

Fraction	Decimal	Percentage
$\frac{4}{5}$ (or $\frac{8}{10}$)	0·8	80%
$\frac{1}{10}$ (or $\frac{10}{100}$)	0·1	10%
$\frac{1}{2}$ (or $\frac{5}{10}$)	0·5	50%
$\frac{3}{4}$	0·75	75%
$\frac{90}{100}$	0·9	90%

4. Yes – Luis achieved his target as 7 out of 14 would be 50%, he scored 7 out of 13 which means it is more than 50%.

5. a) 50% b) 80% c) 10%

6. a)

×	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

b) 25% are odd. 75% are even.
c) Explanations will vary. For example
Even × even = even Even × odd = even
Odd × even = even Odd × odd = odd
So, only 1 multiplication in every 4 will have an odd product, which means $\frac{1}{4}$ or 25% of the products will be odd. The rest, which is $\frac{3}{4}$ or 75% are even.

Reflect

Andy is incorrect. Explanations will vary, for example 0·8 = $\frac{8}{10}$ = $\frac{80}{100}$, so is the same as 80%.

End of unit check

➜ pages 166–168

My journal

1. Children should not agree with Aki as $\frac{1}{20} = \frac{5}{100} = 5\%$. Aki does not realise that the bigger the denominator, the smaller the part size and therefore the smaller the number (when the numerators are the same). 20% is actually $\frac{20}{100} = \frac{1}{5}$.

2. a) Richard scored 40 points on his test.
b) Children can write Richard's score as a fraction: $\frac{40}{50} = \frac{4}{5}$.
c) Ebo has given the decimal of 0·08, which is 8%. 80% is $\frac{80}{100}$, which is 0·8.

Power play

Look for children who look to the grid below to plan their next move. Listen to the explanations of their strategies, and note down any children who may need further support. Children should be encouraged to go deeper with this Power play by creating their own similar puzzle