

Student Name

Mathematics Stage 4

FRACTIONS DECIMALS PERCENTAGES

Book 2 Round decimals to a specified
degree of accuracy using approximations

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OVERVIEW

SYLLABUS CONTENT

MA4-FRC-C-01 represents and operates with fractions, decimals and percentages to solve problems

Round decimals to a specified degree of accuracy using approximations

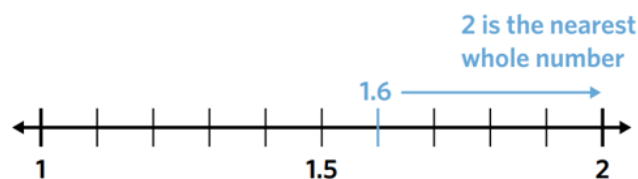
- Round decimals to a given number of decimal places
- Apply the notation $\approx$ as a symbol of numerical approximation
- Reason why an approximation may be more appropriate than an exact answer and vice versa

SUMMARY

Round Decimals

Rounding

Making a number simpler while keeping its value close to what it was.



Critical Digit Method

1. Draw a "cut" after the required place value/decimal place.
2. Circle the critical digit immediately to the right of the place value.
3. Decide whether to round up or round down.
 - i. Critical digit less than 5, round down
 - ii. Critical digit 5 or more, round up.
4. Round
 - i. Rounding down: remove digits after cut.
 - ii. Rounding up: Add 1 to digit before the cut, remove digits after cut.

Round to a Place Value

Round 22.53486 to the nearest hundredth.

1. Draw cut 22.53|486
 2. Critical digit 22.53(4)86
 3. Decide Round down
 4. Round 22.53
- $22.53486 \approx 22.53$

Round to a Decimal Place

Round 246.78 to one decimal place.

1. Draw cut 246.7|8
 2. Critical digit 246.7(8)
 3. Decide Round up
 4. Round 246.8
- $246.78 \approx 246.8$

REVIEW OF PRIOR KNOWLEDGE

1 Round these numbers to the nearest 10.

a 738

b 9115

c 135.8

d 995

2 Round these numbers to the nearest 100.

a 723

b 48 799

c 68.39

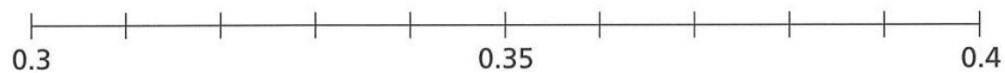
d 1999

3 $72\boxed{}65$ rounds to 72 000 to the nearest thousand.

What could the missing digit be?

.....

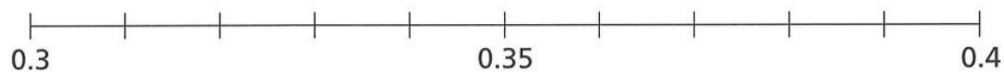
4 Show 0.37 on the number line.



5 Is 0.37 closer to 0.3 or 0.4?

.....

6 Show the approximate location of 0.349 on the number line.

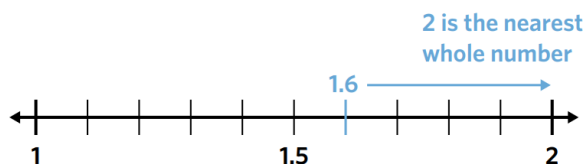


7 Is 0.349 closer to 0.3 or 0.4?

.....

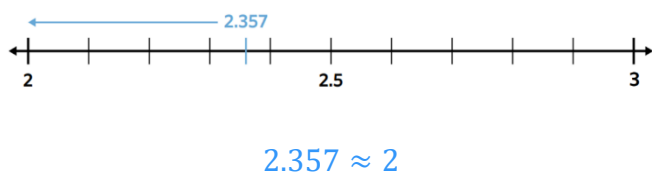
ROUNDING DECIMALS USING A NUMBER LINE

- **Rounding** means to make a number simpler while keeping its value close to what it was.
- When rounding, we go to the nearest place value.
- E.g., when rounding 1.6 to the nearest unit, round to 2 as it is closer to 2.
- 🌟 Rounding Decimals: <https://www.geogebra.org/m/awjqgrhy>



Example Round decimals using a number line.

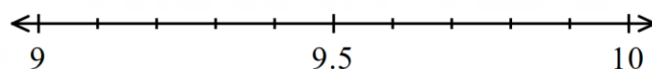
Round 2.357 to the nearest whole.



Why did we round down in this example?

2.357 is closer to than, so we rounded down to 2.

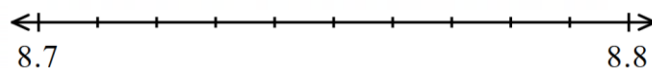
a Round 9.9 to the nearest whole



$9.9 \approx \dots\dots\dots$

10

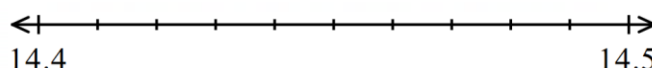
b Round 8.74 to the nearest tenth.



$8.74 \approx \dots\dots\dots$

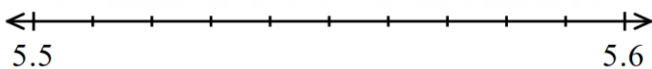
8.7

c Round 14.48 to the nearest tenth.



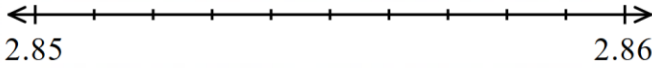
14.5

d Round 5.53 to the nearest tenth.



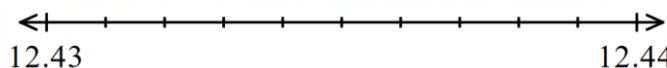
5.5

e Round 2.851 to the nearest hundredth.



2.85

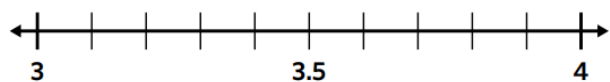
f Round 12.436 to the nearest hundredth.



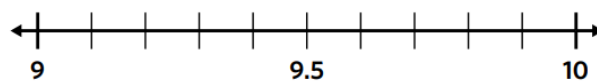
12.44

1 Round these decimals using a number line.

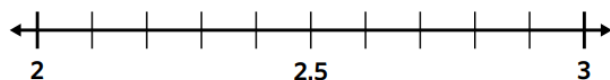
a $3.2 \approx \boxed{}$



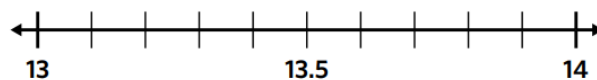
b $9.9 \approx \boxed{}$



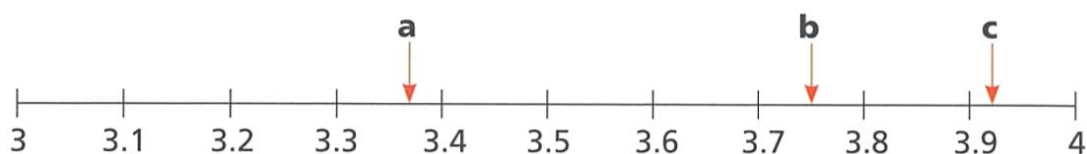
c $2.72 \approx \boxed{}$



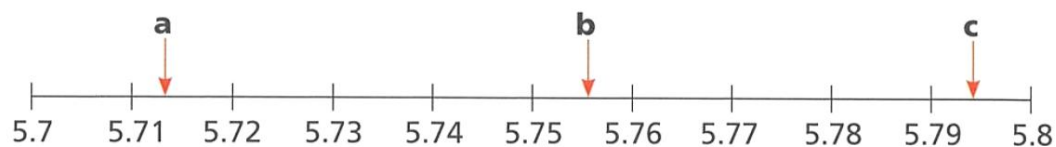
d $13.46 \approx \boxed{}$



2 Use the number line to round each number to 1 decimal place



3 Use the number line to round each number to 2 decimal places.



ROUNDING USING THE CRITICAL DIGIT METHOD

1. Draw a “cut” after the required place value.
2. Circle the **critical digit** right after the cut.
3. Decide to round up or down.
 - i. If critical digit is less than 5, round down.
 - ii. If critical digit is 5 or more, round up.
4. Round.
 - i. rounding down: Remove digits after the cut.
 - ii. rounding up: Add 1 to digit before the cut, then remove digits after the cut.

Example Round decimals to a place value.

Round 22.53486 to the nearest hundredth. 1. Draw cut 22.53 486 2. Critical digit 22.53 486 3. Decide Round down 4. Round 22.53 22.53486 $\approx$ 22.53	Where should you draw the “cut”? <i>We draw the cut after the required</i> How do you know which is the critical digit? <i>The critical digit is immediately to the of the</i> Explain why we rounded down in this example. <i>The critical digit is, so we round down as it is than 5.</i>
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a Round 0.954 to the nearest whole.

2|.954

b Round 3.276 to the nearest hundredth.

3.27|6

c Round 9.871 to the nearest tenth.

9.871

d Round 14.2129 to the nearest hundredth.

14.21|29

e Round 8.991 to the nearest tenth.

9.9

f Round 1.34294 to the nearest thousandth.

14.21

9.0

1.343

ROUNDING TO A DECIMAL PLACE

- Each digit to the right of the decimal point is called a decimal place.
- 17.854 has three decimal places, with the digit 4 in the third decimal place.
- The critical digit is immediately to the right of the decimal place being rounded to.

Example Round decimals to a decimal place.

Round 246.78 to one decimal place. 1. Draw cut 2 4 6 . 7 8 2. Critical digit 2 4 6 . 7 8 3. Decide Round up 4. Round 2 4 6 . 8 246.78 $\approx$ 246.8	What is the place value of the first decimal place? <i>The first decimal place represents theths place value</i> Explain why we rounded up in this example. <i>The critical digit is, so we round up as it is than 5.</i>
--	--

a Round 5.5323 to one decimal place.

5 . 5 | 3 2 3

5.5

b Round 3.276 to two decimal places.

3 . 2 7 6

3.28

c Round 9.8742 to two decimal places.

9.87

d Round 12.895 to two decimal places.

12.90

e Round 81.6814 to two decimal places.

81.68

f Round 241.9026343 to one decimal place.

241.9

Key ideas

1. Rounding makes a number while keeping its value close to what it was.
2. For decimals, you can round to a place value or to a
3. We round when the number is halfway or more to the next place value.
4. We round down when the number is than halfway to the next place value.
5. When rounding, we always look at the digit immediately of the place value we are required to round to.

- 1 State the critical digit in each of the following numbers and decide whether to round up or down.

Question	Critical digit	Round up/down
25.8①74 rounded to 1 decimal place.	1	Down
25.81⑦4 rounded to 2 decimal places.	7	Up
25.817④ rounded to 3 decimal places	4	Down
25.⑧174 rounded to the nearest whole number.	8	Up

- 2 Round each of the following to the nearest whole number.
Draw a line where the number must be cut, circle the critical digit, then round.

a 27.⑥12	b 9.458	c 12.299	d 123.72
28	9	12	124
e 22.26	f 117.555	g 2.6132	h 10.7532
22	118	3	11

- 3 Round each of the following amounts to the nearest dollar.

a \$12.85	b \$30.50	c \$7.10	d \$1566.80
\$13	\$31	\$7	\$1567
e \$120.45	f \$9.55	g \$1.39	h \$36.19
\$120	\$10	\$1	\$36

- 4 The following decimals need to be rounded to 2 decimal places.

a 12.64⑤3	b 4.81932	c 157.281	d 465.3841
12.65	4.82	157.28	465.38
e 0.06031	f 203.5791	g 66.6666	h 7.995123
0.06	203.58	66.67	8.00

- 5 Round each of the following to 1 decimal place.

a 14.82	b 7.38	c 15.62	d 0.87
14.8	7.4	15.6	0.9
e 6.85	f 9.94	g 55.55	h 7.98
6.9	9.9	55.6	8.0

6 Explain the mistakes that these students have made, and give the correct answers.

a

6.2:34 34 is greater than 5, so $6.234 = 6.3$ to 1 decimal place

We only look at the digit immediately after the cut; 6.2

b

4.3:2 2 is less than 5, so $4.32 = 4.30$ to 1 decimal place

When we round down we don't change the digit before the cut; 4.3

c

8.9:7 7 is more than 5, so $8.97 = 8.10$ to 1 decimal place

When we round up from 9, it becomes 10, which we carry over to the next place value; 9.0

7 Complete the table.

Number	Rounded to 1 d.p.	Rounded to 2 d.p.	Rounded to 3 d.p.
5.6	5.6	5.60	5.600
7.5	7.5	7.50	7.500
1.23	1.2	1.23	1.230
0.152	0.2	0.15	0.152
1.49	1.5	1.49	1.490
0.152	0.2	0.15	0.152
1.5015	1.5	1.50	1.502
1.2753	1.3	1.28	1.275
0.1204	0.1	0.12	0.120
2.3428	2.3	2.34	2.343
12.5007	12.5	12.50	12.501
1.6043	1.6	1.60	1.604
9.9899	10.0	9.99	9.990

8 Round these decimals as specified.

a 0.27 to the nearest tenth	b 125.91247 to the nearest tenth	c 321.4891 to the nearest hundredth
0.3	125.9	321.49
d 987.7983 to the nearest hundredth	e 0.73 to 1 decimal place	f 0.67321 to 3 decimal places
987.80	0.7	0.637
g 3.982178 to 4 decimal places	h 2.987 to 1 decimal place	i 3.32913 to the nearest hundredth
3.9822	3.0	3.33
j 19.9267 to the nearest tenth	k 0.2985 to 1 decimal place	l 0.2714 to 2 decimal places
19.9	0.3	0.27

9 Jamie goes to buy a watermelon. The clerk gives Jamie a watermelon that weighs 10.26 kg. What is the weight of the watermelon rounded to the nearest 100 g?

10.3 kg

10 James is ranked first on his cricket team with a batting average of 99.9387. Cricket batting averages are usually only calculated to two decimal places. What is James' batting average rounded to two decimal places?

99.94

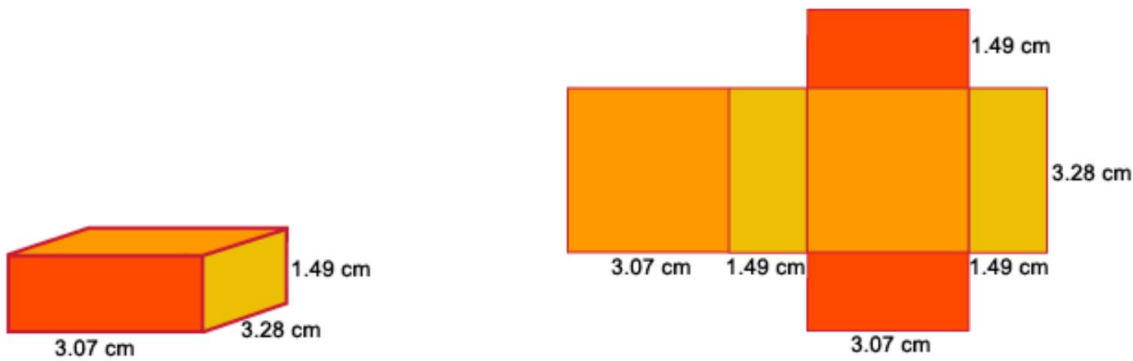
11 Samara believes 0.449999 should be rounded up to 0.5, but Cassandra believes it should be rounded down to 0.4. Who is correct, and why?

It should be rounded down to 0.4 as the critical digit in the hundredths place value is less than 5.

12 Josh is rounding 9.999 to two decimal places. He writes 9.90. Explain why he is incorrect.

When we round up from 9, it becomes 10, which we carry over to the next place value. This then causes the next place value to change.
The answer should be 10.00

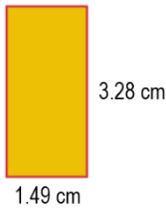
13 A common mistake students (even senior students!) make is rounding too early. We will find the area of the net of this box.



Rounding after 1 calculation:

Use a calculator to find the exact area of each rectangle, round each answer to 2 decimal places, then add them to find the total area of the net.

Left and right sides



Area of one side = 3.28×1.49
= 4.8872
 $\approx 4.89 \text{ cm}^2$

Area of both sides $\approx 9.78 \text{ cm}^2$

Top and bottom



Area of top =
=
 $\approx$

Area of top and bottom $\approx$

Front and back



Area of front =
=
 $\approx$

Area of bottom $\approx$

Total area of the net =

Rounding at the very end:

Use a calculator to find the exact area of each rectangle. Do not round at any stage.

Left and right sides



Area of one side =
=

Area of both sides =

Top and bottom



Area of top =

Area of top and bottom =

Front and back



Area of front =

Area of bottom =

Exact total area of the net =

Was there a difference between the two methods?

CHECK YOUR UNDERSTANDING

Rounding decimals

1	Round 8.7401 to 1 decimal place:						
a	9.8	b	9.0	c	8.7	d	8.74
2	Round 24.7386 to 2 decimal places:						
a	24.84	b	24.74	c	2473.86	d	24.83
3	Round 7.6503 to 1 decimal place:						
a	7.7	b	8.7	c	7.6	d	8.0
4	Round 0.059623 to 2 decimal places.						
a	0.060	b	0.05	c	0.051	d	0.06
5	Round 509.493 to 1 decimal place.						
a	509.5	b	510.5	c	509.4	d	510
6	Round 49.089 to the nearest whole.						
a	50	b	49.1	c	49	d	48
7	Two numbers are equal to 7.46 to two decimal places. The numbers could be:						
a	7.4651	b	7.4628	c	7.463	d	7.4608
	and		and		and		and
	7.4559		7.4528		6.461		7.4551