

Number and Algebra: Number and Place Value: Rounding Reasoning

Australian Curriculum

This lesson plan could be used to support the teaching and learning of the following Content Descriptions from the Australian Curriculum.

Y5 – Number and Algebra

Use estimation and rounding to check the reasonableness of answers to calculations (ACMNA099)

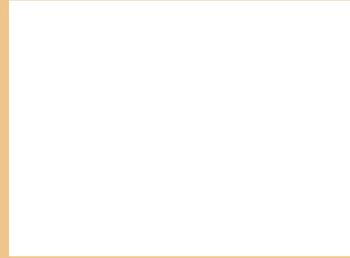
Compare, order and represent decimals (ACMNA105)

Child-Friendly Aim: I can solve reasoning problems by rounding numbers to a required degree of accuracy.	Success Criteria: I can break down complex problems into smaller steps. I can use mathematical language to explain solutions to problems.	Resources: Lesson Pack Calculators – as required
	Key/New Words: Round, digit, place value, ten, hundred, thousand, ten thousand, hundred thousand, million, accuracy.	Preparation: Rounding Reasoning Activity Sheet – per pair Explain Yourself Activity Sheet – per child

Prior Learning: It will be helpful if children have covered place value of numbers up to 10 000 000 and to three decimal places, as well as rounding to a required degree of accuracy.

Learning Sequence

	Rounding Reasoning: Share the steps that children will follow to solve the rounding reasoning problems throughout the lesson, referring to the Lesson Presentation .	
	Rounding Reasoning 1a: Use the step-by-step slides in the Lesson Presentation to model how to solve the rounding reasoning problem. Encourage children to share what they know about rounding that will help them to solve the problem.	
	Rounding Reasoning 1b: Recording their answers on the Rounding Reasoning Activity Sheet , the children work with a partner to apply the strategy to a similar question, explaining their reasoning. Share answers and discuss.	
	Rounding Reasoning 2a: Use the step-by-step slides in the Lesson Presentation to model how to solve the rounding reasoning problem. Encourage children to share what they know about rounding that will help them to solve the problem.	
	Rounding Reasoning 2b: Recording their answers on the Rounding Reasoning Activity Sheet , the children work with a partner to apply the strategy to a similar question, explaining their reasoning. Share answers and discuss.	
	Rounding Reasoning 3a: Use the step-by-step slides in the Lesson Presentation to model how to solve the rounding reasoning problem. Encourage children to share what they know about rounding that will help them to solve the problem.	
	Rounding Reasoning 3b: Recording their answers on the Rounding Reasoning Activity Sheet , the children work with a partner to apply the strategy to a similar question, explaining their reasoning. Share answers and discuss.	
	Explain Yourself! Children read the questions and answers on the differentiated Explain Yourself Activity Sheet , and decide whether they agree or disagree with the answers given. <i>Can children work step-by-step and use mathematical language to explain how to round numbers to solve the problems?</i>	
	Children solve and explain problems involving rounding with whole numbers and decimal numbers to two decimal places. Children solve and explain more complex problems involving rounding with whole numbers and decimal numbers to three decimal places. Children solve and explain more complex problems involving rounding with whole numbers and decimal numbers to four decimal places. Calculators may be needed for one problem.	
	Planetary Problem: Share the rounding problem shown on the Lesson Presentation . Children discuss whether they agree with the answer given, and explain why or why not. Reveal and discuss the explanation of the problem.	



Mathematics

Number and Algebra

Rounding Reasoning



Aim

- I can solve reasoning problems by rounding numbers to a required degree of accuracy.

Success Criteria

- I can break down complex problems into smaller steps.
- I can use mathematical language to explain solutions to problems.

Rounding Reasoning

Can you use your rounding skills to solve these reasoning problems?

We will solve each problem by following the same steps:

- read the question;
- highlight the information to help us understand it;
- use what we already know to solve the problem;
- check we have solved the problem fully.



Rounding Reasoning 1a



First, we read the question.

Esme thinks of two 2-digit numbers. They both round to three to the nearest whole number and their sum is 5.9.

Which numbers could Esme be thinking of?



Rounding Reasoning 1a



Next, we highlight the key information to help us understand the question.

Esme thinks of **two 2-digit numbers**. They **both round to three to the nearest whole number** and their **sum is 5.9**.

Which numbers could Esme be thinking of?



Rounding Reasoning 1a



Next, we need to think about what we already know in order to help us answer the question correctly.

Esme thinks of **two 2-digit numbers**. They **both round to three to the nearest whole number** and their **sum is 5.9**.

Which numbers could Esme be thinking of?

We know that the digits 1, 2, 3 and 4 tell us to round down.

We know that the digits 5, 6, 7, 8 and 9 tell us to round up.

We know that the tenths digit tells us which whole number to round to.

Rounding Reasoning 1a



We know that the digits 5, 6, 7, 8 and 9 tell us to round up.

We know that the digits 1, 2, 3 and 4 tell us to round down.

**2-digit numbers
that round up to 3:**

2.5
2.6
2.7
2.8
2.9

**2-digit numbers
that round down to 3:**

3.1
3.2
3.3
3.4

Rounding Reasoning 1a



Now we are ready to apply our knowledge to solve the problem.

Esme thinks of **two 2-digit numbers**. They **both round to three to the nearest whole number** and their **sum is 5.9**.

Which numbers could Esme be thinking of?

**2-digit numbers
that round up to 3:**

2.5
2.6
2.7
2.8
2.9

+

**2-digit numbers
that round down to 3:**

3.1
3.2
3.3
3.4

→

**Pairs of 2-digit
numbers that round
to 3 with a sum of 5.9:**

2.5 + 3.4
2.6 + 3.3
2.7 + 3.2
2.8 + 3.1

Rounding Reasoning 1a



Let's check our answer by looking back at the question.

Esme thinks of **two 2-digit numbers**. They **both round to three to the nearest whole number** and their **sum is 5.9**.

Which numbers could Esme be thinking of?

There are several possibilities for the numbers Esme may have been thinking of!
The numbers in each pair both round to 3 to the nearest whole number and their sum is 5.9.

2.5 and 3.4

2.7 and 3.2

2.6 and 3.3

2.8 and 3.1



Rounding Reasoning 1b



Work with your partner to solve the first question on your **Rounding Reasoning Talk Partners Activity Sheet**.

Rounding Reasoning

I can solve reasoning problems by rounding numbers to a required degree of accuracy.

Rounding Reasoning 1	Rounding Reasoning 2
<p>Ava thinks of two 3-digit numbers. They both round to 400 to the nearest hundred, and their sum is 780. Which numbers could Ava be thinking of?</p> <p>Show your working out:</p>  <p>Ava</p>	<p>These children each have one of these number cards.</p> <p>Can you work out which child has which number card?</p> <p>45 673 45 642 45 589</p>  <p>Oliver</p>  <p>Chelsea</p>  <p>Martin</p> <p>My number rounds to 46 000 to the nearest 1000.</p> <p>My number rounds to 45 600 to the nearest 100.</p> <p>My number rounds to 45 590 to the nearest 10.</p>
<p>Answer</p> <p>Ava's numbers:</p>	<p>Answer</p> <p>Oliver: Chelsea: Martin:</p>
Rounding Reasoning 3	
<p>Can you give a number that rounds to 9.83 to the nearest hundredth and has a digit sum of 24? Show your working out:</p>	
<p>Answer</p> <p>Number:</p>	

Rounding Reasoning 1b



Work with your partner to solve the first question on your **Rounding Reasoning Talk Partners Activity Sheet**.



Ava thinks of two 3-digit numbers. They both round to 400 to the nearest hundred, and their sum is 780. Which numbers could Ava be thinking of?

We need numbers between 350 and 449. The numbers need to add up to 780. We could choose 350 and 430, 365 and 415, or several other possibilities.

Rounding Reasoning 2a



Let's try another one. First, we read the question.

These children each have one of these number cards.
Can you work out which child has which number card?

78 932

78 841

78 945

78 886

My number is 79 000 to the nearest 1000.

Maisie



My number is 78 950 to the nearest 10.

Kieran



My number is 78 900 to the nearest 100.

Harry



My number is 78 890 to the nearest 10.

Renée



Rounding Reasoning 2a



Next, we highlight the key information.

These children each have one of these number cards.
Can you work out which child has which number card?

78 932

78 841

78 945

78 886

My number
is 79 000 to
the nearest
1000.



Maisie

My number is
78 950 to the
nearest 10.



Kieran

My number
is 78 900 to
the nearest
100.



Harry

My number
is 78 890 to
the nearest
10.



Renée

Rounding Reasoning 2a



Now we think about what we already know.

These children each have one of these number cards.

Can you work out which child has which number card?

78 932

78 841

78 945

78 886

We know that the digits 5, 6, 7, 8 and 9 tell us to round up.

We know that we need to consider the digit in the place before the value we are rounding to.

My number is 79 000 to the nearest 1000.

My number is 78 950 to the nearest 10.

My number is 78 900 to the nearest 100.

My number is 78 890 to the nearest 10.

Rounding Reasoning 2a



We are ready to apply this knowledge to solve the problem.
Let's look at Maisie's statement first.

78 932

78 841

78 945

78 886

We know that her number must have 78 at the start, because all the numbers in the number cards do. We also know that it must round up to 79 000, so the digit in the hundreds place must be higher than 5. However, all the number cards have digits higher than 5 in the hundreds place, so we can't narrow down Maisie's number yet.

My number is
79 000 to the
nearest 1000.



Rounding Reasoning 2a



Let's look at Kieran's statement next.

78 932

78 841

78 945

78 886

In order to round to 78 950 to the nearest 10, Kieran's number must be between 78 945 and 78 954.

There is only one number card that is between these numbers, so Kieran's number must be 78 945.

My number is
78 950 to the
nearest 10.



Rounding Reasoning 2a



Now we can look at Harry's statement.

78 932

78 841

78 945

78 886

Harry's number must be between 78 850 and 78 949 in order to round to 78 900 to the nearest 100. We know that 78 945 is Kieran's number, so it can't be that one. There are two possibilities for Harry's number - both 78 932 and 78 886 round to 78 900. We can't be sure which one is Harry's number just yet.

My number is
78 900 to the
nearest 100.



Rounding Reasoning 2a



Let's see if Renée's statement helps us.

78 932

78 841

78 945

78 886

Renée's number must be between 78 885 and 78 894 in order to round to 78 890 to the nearest 10. We can see that 78 886 fits this description, so this must be Renée's number.

My number is
78 890 to the
nearest 10.



Rounding Reasoning 2a



Now we need to go back and match up the last two number cards.

78 932

78 841

78 945

78 886

We worked out that Harry's number could have been 78 886 or 78 932.
We can now see that it must be 78 932.

My number is
**78 900 to the
nearest 100.**



Rounding Reasoning 2a



Now we need to go back and match up the last two number cards.

78 932

78 841

78 945

78 886

Maisie's number could have been any of the four number cards, so we know that her number must be 78 841 as it is the only one left!

My number is
79 000 to the
nearest 1000.



Rounding Reasoning 2b



Work with your partner to solve the second question on your **Rounding Reasoning Talk Partners Activity Sheet**.

Rounding Reasoning

I can solve reasoning problems by rounding numbers to a required degree of accuracy.

Rounding Reasoning 1	Rounding Reasoning 2
<p>Ava thinks of two 3-digit numbers. They both round to 400 to the nearest hundred, and their sum is 780. Which numbers could Ava be thinking of?</p> <p>Show your working out:</p> <p> Ava</p>	<p>These children each have one of these number cards.</p> <p>Can you work out which child has which number card?</p> <p><input type="text" value="45 673"/> <input type="text" value="45 642"/> <input type="text" value="45 589"/></p> <p> My number rounds to 46 000 to the nearest 1000.</p> <p> My number rounds to 45 600 to the nearest 100.</p> <p> My number rounds to 45 590 to the nearest 10.</p> <p>Oliver Chelsea Martin</p>
<p>Answer</p> <p>Ava's numbers:</p>	<p>Answer</p> <p>Oliver: Chelsea: Martin:</p>
Rounding Reasoning 3	
<p>Can you give a number that rounds to 9.83 to the nearest hundredth and has a digit sum of 24? Show your working out:</p>	
<p>Answer</p> <p>Number:</p>	

Rounding Reasoning 2b



Work with your partner to solve the second question on your **Rounding Reasoning Talk Partners Activity Sheet**.

45 673

45 642

45 589

My number
rounds to
46 000 to the
nearest 1000.



Oliver

My number
rounds to
45 600 to the
nearest 100.



Chelsea

My number
rounds to
45 590 to the
nearest 10.



Martin

Rounding Reasoning 2b



Work with your partner to solve the second question on your **Rounding Reasoning Talk Partners Activity Sheet**.

45 673

45 642

45 589

We can see that Oliver's number could be any of the three on the number cards. Chelsea's number could be any except 45 673. Martin's number must be 45 589. So we can now match Chelsea to 45 642, and Oliver's number must be 45 673.



My number
rounds to
46 000 to the
nearest 1000.

Oliver



My number
rounds to
45 600 to the
nearest 100.

Chelsea



My number
rounds to
45 590 to the
nearest 10.

Martin

Rounding Reasoning 3a



Start by reading the question.

These four numbers all round to 15.1 to the nearest tenth.
The numbers each have a different digit sum.

15.073



$$1 + 5 + 0 + 7 + 3 \\ = 16$$

15.13



$$1 + 5 + 1 + 3 \\ = 10$$

15.128



$$1 + 5 + 1 + 2 + 8 \\ = 17$$

15.057



$$1 + 5 + 0 + 5 + 7 \\ = 18$$

Can you give another number that rounds to 15.1 to the nearest tenth
and also has a digit sum of 20?

Rounding Reasoning 3a



Then, highlight the key information.

These four numbers all round to 15.1 to the nearest tenth.
The numbers each have a different digit sum.

15.073



$$1 + 5 + 0 + 7 + 3 \\ = 16$$

15.13



$$1 + 5 + 1 + 3 \\ = 10$$

15.128



$$1 + 5 + 1 + 2 + 8 \\ = 17$$

15.057



$$1 + 5 + 0 + 5 + 7 \\ = 18$$

Can you give **another number** that **rounds to 15.1 to the nearest tenth**
and also has a **digit sum of 20**?

Rounding Reasoning 3a



Next, we think about what we already know.

These four numbers all round to 15.1 to the nearest tenth.
The numbers each have a different digit sum.

15.073

15.13

15.128

15.057

Can you give **another number** that **rounds to 15.1 to the nearest tenth**
and also has a **digit sum of 20**?

We know that the digits
5, 6, 7, 8 and 9 tell us to
round up.

We know that the digits 1,
2, 3 and 4 tell us to
round down.

We know that we need a
number between 15.05
and 15.14.

Rounding Reasoning 3a



Next, we think about what we already know.

These four numbers all round to 15.1 to the nearest tenth.
The numbers each have a different digit sum.

15.073

15.13

15.128

15.057

Can you give **another number** that **rounds to 15.1 to the nearest tenth**
and also has a **digit sum of 20**?

We know that the digits
5, 6, 7, 8 and 9 tell us to
round up.

Numbers to 2 decimal places between 15.05 and 15.14 do not have high enough digit sums. For example, 15.05 has a digit sum of 11. 15.14 also only has a digit sum of 11. Even 15.09 only has a digit sum of 15. We can't get a digit sum of 20 by using numbers to 2 decimal places. We must need to use numbers to three decimal places.

Rounding Reasoning 3a



Next, we think about what we already know.

These four numbers all round to 15.1 to the nearest tenth.
The numbers each have a different digit sum.

15.073

15.13

15.128

15.057

Can you give **another number** that **rounds to 15.1 to the nearest tenth**
and also has a **digit sum of 20**?

We know that the digits
1, 2, 3 and 4 tell us to
round down.

We can try 15.051, 15.052, 15.053 up to 15.099, and
15.111, 15.112, 15.113 up to 15.149. This is a lot of
numbers! To make it a bit simpler, we know that we have to
have 15 at the start of the number. The digit sum of 1 and 5 is
6, so we know that the digit sum of the three other digits has
to be 14 in order for the number to have a digit sum of 20.

Rounding Reasoning 3a



Next, we think about what we already know.

These four numbers all round to 15.1 to the nearest tenth.
The numbers each have a different digit sum.

15.073

15.13

15.128

15.057

Can you give **another number** that **rounds to 15.1 to the nearest tenth**
and also has a **digit sum of 20**?

We know that we need a
number between 15.05
and 15.14.

15.059 rounds to 15.1 to the nearest tenth
and has a digit sum of 20.

Can you find any more examples?

Rounding Reasoning 3a



Finally, we need to check our answer by looking back at the question.

These four numbers all round to 15.1 to the nearest tenth.
The numbers each have a different digit sum.

15.073

15.13

15.128

15.057

Can you give **another number** that **rounds to 15.1 to the nearest tenth**
and also has a **digit sum of 20**?

We came up with 15.059.
There are several other possibilities, including
15.068, 15.077, 15.086, 15.095 and 15.149.

Rounding Reasoning 3b



Work with your partner to solve the third question on your **Rounding Reasoning Talk Partners Activity Sheet**.

Rounding Reasoning

I can solve reasoning problems by rounding numbers to a required degree of accuracy.

Rounding Reasoning 1	Rounding Reasoning 2
<p>Ava thinks of two 3-digit numbers. They both round to 400 to the nearest hundred, and their sum is 780. Which numbers could Ava be thinking of?</p> <p>Show your working out:</p>  <p>Ava</p>	<p>These children each have one of these number cards.</p> <p>Can you work out which child has which number card?</p> <p>45 673 45 642 45 589</p>  <p>Oliver</p> <p>My number rounds to 46 000 to the nearest 1000.</p>  <p>Chelsea</p> <p>My number rounds to 45 600 to the nearest 100.</p>  <p>Martin</p> <p>My number rounds to 45 590 to the nearest 10.</p>
<p>Answer</p> <p>Ava's numbers:</p>	<p>Answer</p> <p>Oliver: Chelsea: Martin:</p>
Rounding Reasoning 3	
<p>Can you give a number that rounds to 9.83 to the nearest hundredth and has a digit sum of 24? Show your working out:</p>	
<p>Answer</p> <p>Number:</p>	

Rounding Reasoning 3b



Work with your partner to solve the third question on your **Rounding Reasoning Talk Partners Activity Sheet**.

Can you give a number that rounds 9.83 to the nearest hundredth and has a digit sum of 24?

We know that the digit sum of 9.83 is 20, so to make a digit sum of 24, we just need to put a 4 in the thousandths place. We know that 4 means we round down to 9.83, so 9.834 could be one possible answer.

Explain Yourself!



The Y6 class at Anywhere School have been learning about rounding numbers. Some of the children have solved reasoning problems using their rounding skills.

On your **Explain Yourself! Reasoning Activity Sheet** you will see the children talking about their answers to the problems. Read the questions and their answers, and think about whether you agree or disagree with the children.

Explain your ideas, writing about why you agree or disagree, and referring to rounding numbers in your explanations.



Planetary Problem



Venus is one of the closest planets to Earth.

The diameter of Venus is 8000 miles (to the nearest thousand) and the diameter of Earth is 7900 miles (to the nearest hundred).

Saif makes a statement about the two planets.

Venus must be bigger than Earth because 8000 is bigger than 7900.

Do you agree with him?
Talk to your partner about your thoughts.



Planetary Problem



Saif isn't quite right. Venus might be bigger than Earth, but we can't know from the information we have.

The diameter of Venus is 8000 miles rounded to the nearest thousand. We don't know the actual diameter – it could be anything between 7500 and 8499.

The diameter of Earth is 7900 miles rounded to the nearest hundred. The actual diameter could be anything between 7850 and 7949.

So Venus could be smaller! We don't know from these figures because they are rounded to different degrees of accuracy. They are not the exact diameters.

Aim



- I can solve reasoning problems by rounding numbers to a required degree of accuracy.

Success Criteria

- I can break down complex problems into smaller steps.
- I can use mathematical language to explain solutions to problems.



Number and Algebra | Rounding Reasoning

I can solve reasoning problems by rounding numbers to a required degree of accuracy.		
I can break down complex problems into smaller steps.		
I can use mathematical language to explain solutions to problems.		

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Number and Algebra | Rounding Reasoning

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