Mathematics Stage 4 (Year 7) assessment task notification

Portfolio

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## Task description

**Type of task**: portfolio

**Core outcomes being assessed**:

* compares, orders and calculates with integers to solve problems **MA4-INT-C-01**
* represents and operates with fractions, decimals and percentages to solve problems **MA4-FRC-C-01**
* operates with primes and roots, positive-integer and zero indices involving numerical bases and establishes the relevant index laws **MA4-IND-C-01**
* generalises number properties to operate with algebraic expressions including expansion and factorisation **MA4-ALG-C-01**

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You are to collect work samples as evidence of your learning throughout lessons, reflecting on what you have learned and how your understanding has changed.

# Portfolio development

## Work samples

Throughout lessons, you need to collect work samples that represent what you know and understand and what you are able to do.

## Reflections

You need to complete reflections on each selected work sample that you decide to include in your final portfolio. These reflections can be completed using the template on pages 4–5.

## Final portfolio

You can collect and reflect on as many work samples as you wish, but will need to select 2 work samples to submit for each topic by the due date.

When selecting your work samples, you should consider the marking guidelines provided.

# Reflection template

Reflection – [title of work sample]

Use the tables below to document your reflection of the task.

|  |  |
| --- | --- |
| Write an ‘I can’ statement about what you can do now that you have completed this task | Date |
|  |  |

|  |
| --- |
| Explain how you completed the task, giving examples |
|  |

|  |
| --- |
| Describe what you found challenging in the task and anything you found helpful in overcoming those challenges |
|  |

|  |
| --- |
| Describe what you learned from the task, such as something you know now that you didn’t know before |
|  |

# Submission details

Students should submit the following:

## Integers

2 work samples

2 reflections

## Fractions

2 work samples

2 reflections

## Decimals and percentages

2 work samples

2 reflections

## Indices

2 work samples

2 reflections

## Algebra

2 work samples

2 reflections

# What is the teacher looking for?

This outline uses the criteria points from the marking guidelines to list the skills and knowledge that your teacher will be looking for in your chosen work samples and reflections.

In your work samples, the teacher is looking to see how well you:

* solve a range of problems correctly
* show your working
* use representations where they are relevant
* choose efficient strategies.

In your reflections, the teacher is looking to see how well you:

* show an understanding of the topic
* use examples from your work samples when explaining your learning
* explain why calculations work the way they do
* show an understanding of what is represented by a question
* use representations of problems where they are relevant
* use mathematical language to communicate your thinking, reasoning and justifications.

# Marking guidelines

The assessment marking guidelines in Table 1 are general and can be used to assess student performance in the outcomes **MA4-INT-C-01**, **MA4-FRC-C-01**, **MA4-IND-C-01** and **MA4-ALG-C-01**. Teachers are encouraged to review student work with these guidelines in mind before using Table 1 to make a determination on the level to which each outcome has been demonstrated.

**Note**: **MA4-FRC-C-01** has been split into 2 separate topics to be assessed. The first topic, ‘Fractions’ focuses mostly on the concept of fractions and operations with them. The second topic, ‘Decimals and percentages’ focuses mostly on these representations of numbers and their relationship to fractions. This distinction is important when considering which lessons and work samples students would draw from as evidence of their learning for each topic. This choice has been made to reflect the balance of lessons and opportunities for work samples in the NSW Department of Education sample lessons ([bit.ly/departmentresources](https://bit.ly/departmentresources)).

Table 1 – assessment marking guidelines

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Working towards developing | Developing | Developed | Well developed | Highly developed |
| Student attempts to solve problems in selected work samples.  Uses very limited mathematical language to reflect upon their work samples. | Student accurately solves multiple problems in selected work samples.  Describes mostly procedural aspects of the relevant mathematics.  Uses limited mathematical language to reflect upon their work samples. | Student accurately solves some of the problems involving up to 3 steps in selected work samples.  Identifies connections with underlying concepts when reflecting on work samples.  Includes and demonstrates some understanding of accurate representations of the relevant concepts.  Uses some appropriate mathematical language associated with relevant mathematical concepts to reflect upon their work samples. | Student accurately solves most problems of up to 3 steps and some problems of more than 3 steps in selected work samples.  Identifies and explains connections with underlying concepts when reflecting on work samples.  Provides some examples of accurate representations of the relevant concepts in work samples, demonstrating some understanding of the connections between multiple representations in reflections.  Effectively uses appropriate mathematical language associated with relevant mathematical concepts to reflect upon their work samples and the relationship to some underlying concepts. | Student consistently and accurately solves problems involving multiple steps in selected work samples.  Identifies and explains connections with underlying concepts when reflecting on work samples, citing relevant examples.  Provides examples of accurate representations of the relevant concepts in work samples, demonstrating an extensive understanding of the connections between multiple representations and their usefulness in reflections.  Consistently and effectively uses precise mathematical language associated with relevant mathematical concepts to reflect upon their work samples and expertly explains the relationship to underlying concepts. |

# Teacher notes

Teachers are encouraged to keep student work for their portfolio in well-organised folders in the classroom or staffroom, where students can add to them progressively throughout the units of learning.

## Work samples

It is largely impossible for students to know what their best work will be before it has been produced. Therefore, students should be regularly encouraged to include work samples in their portfolios that they believe reflect their best work. This could be as frequent as each lesson, as students can then make choices about which samples to include and which to remove at the end of a unit.

Students will need guidance as to which lessons relate to which outcome and how to categorise their work samples based on the outcomes being assessed. In this sample assessment task, this includes distinguishing between those lessons and work samples that demonstrate skills in fractions alone and those that focus more on the relationship between fractions, decimals and percentages.

## Reflections

Teachers are encouraged to regularly provide time for students to complete reflections of their selected work. A possible frequency for this activity could be to allocate a single, 30-minute session each week. During this time, students should be encouraged to make decisions about which samples could be chosen for a particular outcome and to complete a reflection for a single chosen work sample.

## Final portfolio

Teachers are encouraged to provide time for students to review their overall work in their portfolio and make decisions about the work that best displays their skills and understanding in the related outcome. A possible frequency for this activity could be to allocate part of a lesson at the end of each unit or the conclusion of work related to a specific outcome. During this time, students should be encouraged to consider the marking guidelines and how the work they have selected, including their reflections, represents the highest levels shown.

## Understanding the assessment task

In addition to providing the ‘What the teacher is looking for’ section, teachers should consider measures they can take to help students understand how to select work samples and complete reflections. Teachers could provide students with the sample student portfolio work on the following page and have them act as the teacher, determining the grade that has been demonstrated. In future years, actual student work from previous use of this portfolio assessment task can be anonymised and given to new groups of students to help them consider what to include in their own portfolio.

## Using this assessment task as summative and formative assessment

This assessment task can be used to assign each student a grade from A–E based on their demonstrated ability as shown in the annotated sample student portfolios. Teachers could use the sample student marking sheet on the follow page, both to determine grades demonstrated in the student portfolios against syllabus outcomes, as well as to provide overall feedback to students.

## Sample student marking sheet

Table 2 – assessment marking recording sheet

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Topic (outcome) | Working towards developing | Developing | Developed | Well developed | Highly developed |
| Integers  ****(MA4-INT-C-01)**** |  |  |  |  |  |
| Fractions  ****(MA4-FRC-C-01)**** |  |  |  |  |  |
| Decimals and percentages  ****(MA4-FRC-C-01)**** |  |  |  |  |  |
| Indices  ****(MA4-IND-C-01)**** |  |  |  |  |  |
| Algebra  ****(MA4-ALG-C-01)**** |  |  |  |  |  |

Comments:

# Sample student portfolios

## Mary

### Fractions (MA4-FRC-C-01)

#### Your turn problems

An image of three questions from a worksheet about representing operations on number lines. 

The first question asks how to represent 2 × 5, with two vectors shown on a number line, each going 5 units to the right, totalling 10 units from 0. 

The second question asks how to represent two-sixths added to one-sixth, with two vectors shown on a number line, one moving from zero to two-sixths and another from two-sixths to three-sixths. 

The third question asks how to represent four-sixths minus one-sixth, with two vectors shown on a number line. The first vector travels from 0 to four-sixths, to the right, the second then starts at four-sixths and travels back to three-sixths.

#### Independent practice

Represent each expression on the number line provided.

An image of four questions from a worksheet about representing operations on number lines. The first question asks how to represent one-half plus one-half plus one-half, with three vectors shown on a number line, each going half a unit to the right, totalling one and a half units from 0.

The second question asks how to represent one-half minus one-half minus one-half, with one vector to the right from 0 to one-half, then two vectors shown on a number line going one-half, each in the reverse direction, finishing on negative one-half.

The third question asks how to represent 2, minus one-quarter, plus three-quarters, with three vectors shown on a number line. The first vector travels eight-quarters to the right from 0, finishing at 2, with the second going in the reverse direction one-quarter, and the third then heading back in the original direction three-quarters, finishing at 2 and two-quarters, or two and a half.

The fourth question asks how to represent 3 minus 1 and one-third, then plus two-thirds. The number line then shows three vectors, starting with a vector travelling from 0 to the right nine- thirds, finishing at 3. The second vector then travels back four-thirds from 3, with a final vector travelling to the right two-thirds and finishing at 2 and one-third.

#### Reflection – addition with vectors problems

|  |  |
| --- | --- |
| Write an ‘I can’ statement about what you can do now that you have completed this task | Date |
| I can represent fraction additions on a number line. | 25/10/2023 |

|  |
| --- |
| Explain how you completed the task, giving examples |
| I drew vectors, which are arrows, starting from 0 and going the distance of the first fraction. I added vectors to show more fractions and went to the left when a fraction was subtracted. In Question 3, which is , I took 4 steps to the right, and then one to the left. This is because each step is one-sixth. |

|  |
| --- |
| Describe what you found challenging in the task and anything you found helpful in overcoming those challenges |
| The hardest part was interpreting the scale, or sometimes even creating it, and then also working out what to do with whole numbers. Converting whole numbers to fractions with the same denominator as the other fractions in the question was sometimes a bit hard. |

|  |
| --- |
| Describe what you learned from the task, such as something you know now that you didn’t know before |
| Fractions with the same denominator can be added because you just count how many steps you take. If they have different denominators, the fractions are a different size and can’t be counted in the same way. |

#### 

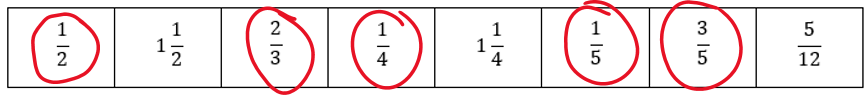
#### Fractions of quantities – Part 2

1. Write a statement about how you estimate a fraction of a quantity for each fraction listed in the table.

An image of a table with two columns and 9 rows. The first row has the title ‘Fraction’ and ‘How to find this fraction of a quantity’, which are the titles of the two columns in each row. Each subsequent row states a fraction in the first cell and then a student description in the second cell.

The second row has one half as the fraction, and the student has written 'Halve the amount, or split it in 2'. The third row has one and one-half as the fraction, and the student has written 'Get the answer from above and add it to the number you started with'. The fourth row has two-thirds as the fraction and the student has written 'A bit more than half. Closer to half than to the whole'. The fifth row has one-quarter as the fraction, and the student has written 'Exactly in the middle of half the quantity and 0'. The sixth row has one and one-quarter as the fraction and the student has written 'Add previous answer to the original amount'. The seventh row has one-fifth as the fraction and the student has written 'A bit less than one-quarter'. The eighth row has three-fifths as the fraction and the student has written 'A bit more than half but less than two-thirds'. The ninth row has five-twelfths as the fraction and the student has written 'A tiny bit less than half'.

1. Circle the fractions used in Part 1 that are less than 1 in the space below.



1. What do you notice about the fractions that are less than 1, when you multiply them with a quantity?



#### Reflection – estimations

|  |  |
| --- | --- |
| Write an ‘I can’ statement about what you can do now that you have completed this task | Date |
| I can estimate fractions of quantities. | 25/10/2023 |

|  |
| --- |
| Explain how you completed the task, giving examples |
| I used easy things like 0, 1, and to estimate fractions that are near these. I used the denominators to determine how close the fraction was to these known fractions. For example, is just less than one-half, whereas is less than half. So, when I find of 84 grams, I know that half of 84 grams is 42 grams, and that will be pretty close, maybe 35–40 grams. But is probably more like 25–30 grams, because it is further from half than . |

|  |
| --- |
| Describe what you found challenging in the task and anything you found helpful in overcoming those challenges |
| I found it hard to describe how to estimate. Sometimes fractions are close to one another, like is a bit larger than half, and so is , but they aren’t the same. It’s hard to make the estimates different because they are both just a bit bigger than half. To overcome this, I tried to say which is bigger because then if I was estimating both of them, I’d make sure the larger one ends up bigger. |

|  |
| --- |
| Describe what you learned from the task, such as something you know now that you didn’t know before |
| I found that if a fraction is more than 1, when we multiply by a quantity, the amount gets larger. If the fraction is less than 1, multiplying by a quantity gets smaller. This is because multiplying by 1 just gives us the starting quantity. |

## Sione

### Algebra (MA4-ALG-C-01)

#### Grid algebra

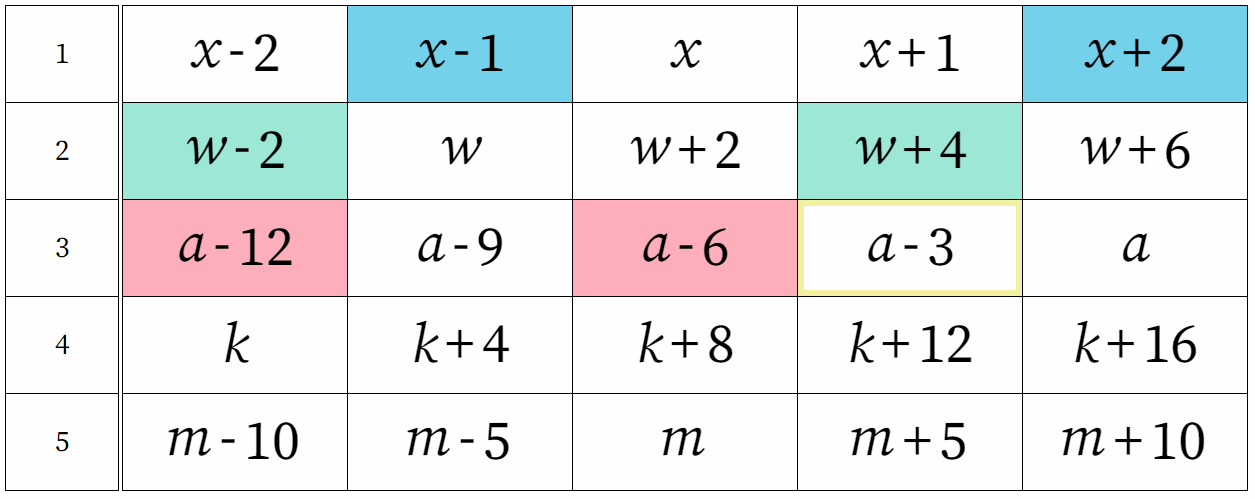


Image created using [Grid Algebra](https://gridalgebra.com/free).

#### Reflection – grid algebra

|  |  |
| --- | --- |
| Write an ‘I can’ statement about what you can do now that you have completed this task | Date |
| I can complete a grid using algebra with both plus and minus. | 25/10/2023 |

|  |
| --- |
| Explain how you completed the task, giving examples |
| The grid started with just the letters , and . I had to drag the letters to the cells left and right of them to show what an expression would look like in a new cell. So is in row ‘3’ and that means it goes up by 3 each time. Moving 2 spots to the left means we take 3 away twice and get . We then had to choose numbers for the variables, so for example, if I chose , then would be . |

|  |
| --- |
| Describe what you found challenging in the task and anything you found helpful in overcoming those challenges |
| When dragging the cells across, if I clicked on the wrong cell, it would give me a long expression. For example, if I clicked on and then dragged it to the left, it became . If I then clicked on and dragged it to the left, I know it is , but it became . To fix this, I always clicked on the pronumeral, , and and dragged from there. |

|  |
| --- |
| Describe what you learned from the task, such as something you know now that you didn’t know before |
| I can substitute any number for a pronumeral and get an answer. |

#### Algebra pyramids

In the algebra pyramids below, 2 terms beside one another are multiplied to make the term above. Use the algebraic terms in the pyramids to fill in the blanks. The first one is an example to help you.

An image that shows 8 pyramids, each with algebraic expressions for students to complete answers to. The first pyramid has three cells on the bottom row, containing the expressions 'x', '2' and '4x', two cells on the second row, containing the expressions '2x' and '8x' and one cell on top with the expression '16x squared'.

The second pyramid has three cells on the bottom row, containing the expressions '3', 'x' and '6', two cells on the second row, containing the expressions '3x' and '6x' and one cell on top with the expression '18x squared'. The second and top rows have been completed by the student.

The third pyramid has three cells on the bottom row, containing the expressions 'negative x', '2' and '3x', two cells on the second row, containing the expressions 'negative 2x' and '6x' and one cell on top with the expression 'negative 12x squared'. The second and top rows have been completed by the student.

The fourth pyramid has three cells on the bottom row, containing the expressions 'x', 'negative 4' and '5x', two cells on the second row, containing the expressions 'negative 4x' and 'negative 20x' and one cell on top with the expression '80x squared'. The second and top rows have been completed by the student.

The fifth pyramid has three cells on the bottom row, containing the expressions '2x', '4x' and '3x', two cells on the second row, containing the expressions '6x squared' and '12x squared' and one cell on top with the expression '72x to the power of 4'. The second and top rows have been completed by the student.

The sixth pyramid has three cells on the bottom row, containing the expressions '5', '2a' and '4', two cells on the second row, containing the expressions '10a' and '8a' and one cell on top with the expression '80a squared'. '5' in the first row, '8a' in the second row and '80 a squared' in the top row have been completed by the student.

The seventh pyramid has four cells on the bottom row, containing the expressions 'x', '2' '3' and 'x', three cells on the second row, containing the expressions '2x', '6' and '3x', two cells in the third row, containing the expressions '12x' and '18x' and one cell on top with the expression '216x squared'. The second, third and top rows have been completed by the student.

The eighth pyramid has four cells on the bottom row, containing the expressions '2b', 'b', '2' and 'b', three cells on the second row, containing the expressions '2b squared', '2b' and '2b', two cells on the third row, containing the expression '4b squared' in both cells and one cell on top with the expression '16b to the power of 4'. The third and top rows as well as the '2b' and '2' in the first row have been completed by the student.

#### Reflection – algebra pyramids

|  |  |
| --- | --- |
| Write an ‘I can’ statement about what you can do now that you have completed this task | Date |
| I can multiply algebraic terms. | 25/10/2023 |

|  |
| --- |
| Explain how you completed the task, giving examples |
| I took 2 terms that are listed beside one another and multiplied them to get the answer in the cell above. When multiplying, I multiplied the numbers together first, then combined the pronumerals. For example, in Question 7, at the top of the pyramid, I multiplied by by first multiplying by to get , then I multiplied by to get . |

|  |
| --- |
| Describe what you found challenging in the task and anything you found helpful in overcoming those challenges |
| There were a couple of occasions where I had to work backwards and go down the pyramid. To do this, I had to think about what I multiply to get an answer. For example, in Question 8, I had to multiply something by to get and I realised that what was missing was a and another , so the answer I was looking for was . |

|  |
| --- |
| Describe what you learned from the task, such as something you know now that you didn’t know before |
| When multiplying algebraic terms, multiply the numbers first and then combine the letters. |

## Sample grading annotations

The annotations below are examples of how the student work samples and reflections on pages 14–23 could be interpreted. They refer to the descriptions in the marking guidelines on pages 8–10.

### Mary – fractions

The student is demonstrating an extensive knowledge of the content and is performing at an A-grade level in the outcome **MA4-FRC-C-01**. The student has consistently and accurately solved all problems in their work samples, including those involving multiple steps, such as Question 7 in their first work sample. They compare fractions based on their overall size and the effect of adding, subtracting and multiplying with them. The student has used vectors to represent fractions and accurately explained the relationship between this representation and concepts related to fractions, such as the role that each of the numerator and denominator play in the size of the number. They consistently use precise language to describe the features of fractions and the effects and results of operating with them, including terms such as ‘numerator’, ‘denominator’ and ‘vector’.

### Sione – algebra

The student is demonstrating a sound knowledge of the content and is performing at a C-grade level in the outcome **MA4-ALG-C-01**. The student has solved most problems accurately, however, they have made some errors in their second work sample that they have not identified or fixed (Questions 5 and 8). They have also selected work samples that do not require more than 3 steps at any time. The student identifies the concept of pronumerals being used to represent unknown quantities. They do not acknowledge or explain any further concepts related to algebra, such as the need to use expressions to represent quantities in the grid in their first work sample owing to the unknown quantity, . The student has used only abstract representations. They have demonstrated a sound understanding of what is represented. The student uses mostly appropriate mathematical language, including ‘pronumeral’, ‘variable’ and ‘term’. They do occasionally use more informal language, such as ‘letter’.

# References

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