Mathematics Stage 4   
(Year 8)

Question bank (Further multiplicative thinking and Ratio and rates)

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# About this resource

## Purpose of resource

The following is a bank of questions designed to complement the Stage 4 department units of learning, Unit 12 – further multiplicative thinking and Unit 13 – ratio and rates. The question bank focuses on assessing the Working mathematically outcome. Teachers may use these questions to add to an existing test, or as a bank of questions to aid in designing a task. **This resource is not a test.**

## Target audience

This resource can be used by teachers to facilitate discussions about improving their class tests to incorporate questions that allow students to demonstrate the skills from the Working mathematically outcome.

## When and how to use

This resource has been designed as a bank of sample questions to model the inclusion of Working mathematically in a test. Teachers might take and adapt these questions to modify existing summative assessment tasks. They may also choose to use this bank of questions as a model to consider how to incorporate the Working mathematically outcome by adjusting questions in existing assessments. When choosing questions, teachers should consider the time needed by students to complete the question, and the extent of exposure to different visual representations during the teaching of the topics. A general rule of thumb for timing is that it takes a student double the time it takes a teacher to complete a question. Teachers will need to time themselves completing the questions.

## Marks and grades

A marking criteria and sample solutions have been provided for each question. Students may use different solution paths other than those provided in the sample solutions.

The marking criteria have been designed to accommodate all possible responses.

A total mark has been allocated for the whole question. This allows for differentiated levels of student engagement with the question. To further differentiate these questions for your students, you may choose to provide further scaffolding in the questions or remove parts of the question.

Grades that align with the course performance descriptors or common grade scale have not been provided, as the question bank forms part of an assessment. The assessment will need to be looked at in full for an overall grade to be determined.

# Task description

**Type of task**: Question bank for tests

**Outcomes being assessed**

A student:

* develops understanding and fluency in mathematics through exploring and connecting mathematical concepts, choosing and applying mathematical techniques to solve problems, and communicating their thinking and reasoning coherently and clearly **MAO-WM-01**
* represents and operates with fractions, decimals and percentages to solve problems  
  **MA4-FRC-C-01**
* solves problems involving ratios and rates, and analyses distance–time graphs **MA4-RAT-C-01**
* generalises number properties to operate with algebraic expressions including expansion and factorisation **MA4-ALG-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**
* solves linear equations of up to 2 steps and quadratic equations of the form **MA4-EQU-C-01**

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# Outcome and content group mapping guide

All questions have been mapped to the syllabus outcomes and content groups, with some questions covering multiple outcomes or content groups. For ease of navigation, the question numbers in the table have been hyperlinked to where the questions are in the document.

**Note**: the Working mathematically outcome **MAO-WM-01** is embedded in all the questions in the question bank.

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

Table 1 – fractions, decimals and percentages mapping grid

|  |  |
| --- | --- |
| Content group | Questions |
| Solve problems that involve the use of percentages | [1](#_Question_1_(2), [2](#_Question_23_(3), [5](#_Question_5_(2_1), [6](#_Question_6_(3), [7](#_Question_7_(3), [8](#_Question_8_(2_1) |

**Ratio and rates** – solves problems involving ratios and rates, and analyses distance–time graphs **MA4-RAT-C-01**

Table 2 – ratios and rates mapping grid

|  |  |
| --- | --- |
| Content group | Questions |
| Recognise and simplify ratios | [3](#_Question_3_(2_1), [10](#_Question_10_(3_1) |
| Solve problems involving ratios | [4](#_Question_4_(2_1), [9](#_Question_30_(3), [13](#_Question_13_(2_1), [16](#_Question_16_(3_1) |
| Recognise and simplify rates | [12](#_Question_33_(2) |
| Solve problems involving rates | [11](#_Question_11_(4), [14](#_Question_14_(3), [15](#_Question_15_(3) |
| Interpret and construct distance-time graphs from authentic data | [17](#_Question_17_(3), [18](#_Question_18_(3_1) |

**Algebraic techniques** – generalises number properties to operate with algebraic expressions including expansion and factorisation **MA4-ALG-C-01**

Table 3 – algebraic techniques mapping grid

|  |  |
| --- | --- |
| Content group | Questions |
| Extend and apply the distributive law to the expansion of algebraic expressions | [19](#_Question_19_(2_1), [20](#_Question_20_(2_1), [21](#_Question_21_(4_1), [22](#_Question_22_(2), [23](#_Question_19_(2), [24](#_Question_20_(2) |
| Factorise algebraic expressions by identifying numerical and algebraic factors | [22](#_Question_2_(4), [23](#_Question_19_(2), [24](#_Question_20_(2), [25](#_Question_25_(3), [26](#_Question_26_(3), [27](#_Question_27_(2), [28](#_Question_28_(2), [29](#_Question_29_(4) |

**Indices** – operates with primes and roots, positive-integer and zero indices involving numerical bases and establishes the relevant index laws **MA4-IND-C-01**

Table 4 – indices mapping grid

|  |  |
| --- | --- |
| Content group | Questions |
| Use index notation to establish the index laws with positive integers indices and the zero index | [30](#_Question_32_(2), [31](#_Question_31_(2), [32](#_Question_34_(2_1), [33](#_Question_35_(2), [34](#_Question_36_(2), [35](#_Question_37_(2), [36](#_Question_38_(2), [37](#_Question_37_(3_1) |

**Equations** – solves linear equations of up to 2 steps and quadratic equations of the form **MA4-EQU-C-01**

Table 5 – equations mapping grid

|  |  |
| --- | --- |
| Content group | Questions |
| Solve linear equations up to 2 steps | [21](#_Question_21_(4_1) |

# Question bank

##### **Question 1** (3 marks)

A shop owner buys 150 fidget toys for $750. He sells each fidget toy for $4.95.

1. Will the shop owner make a profit or loss? Justify your decision.
2. Find the profit or loss as a percentage of the cost price.
3. If the shop owner wanted to make a profit of 5%, what price should he charge?

Table 6 – suggested solution and marking criteria question 1

|  |  |
| --- | --- |
| **Suggested solution** | 1. The shop owner will make a loss.   The shop owner paid $5 per toy.  He sold them for $4.95, losing 5 cents per toy.  The shop owner made a loss of 1%.  He needs to charge $5.25 per toy. |
| **Marking criteria** | **3 marks**   * Demonstrates understanding of mathematical terminology by accurately determining whether the shop owner will make a profit or loss, providing a clear and coherent explanation with supporting calculations * Responses connect mathematical concepts and techniques are applied effectively to provide accurate calculations   **2 marks**   * Accurately determines whether the shop owner will make a profit or loss, accurately calculates some questions and provides limited explanations   **1 mark**   * Attempts to determine profit or loss but provides incomplete or incorrect reasoning or calculations |

##### **Question 2** (3 marks)

Explain why you can divide by 11 to find the GST amount included in the total advertised price in Australia.

Table 7 – suggested solution and marking criteria question 2

|  |  |
| --- | --- |
| **Suggested solution** | GST in Australia is 10%. When the GST is added to the original price, the total price becomes 110% of the original price, 100% plus 10%.  So, to find just that 10%, you can divide the total price by 11 because 110% ÷ 11 = 10%. This splits the total price into 11 equal parts, with 1 part representing the GST.  For example, if the total price is $220, $220 ÷ 11 = $20  This means $20 is the GST included in the total price. |
| **Marking criteria** | **3 marks**   * Demonstrates a strong understanding and fluency by providing a clear and coherent explanation of why dividing by 11 gives the GST amount * The response accurately connects mathematical concepts such as percentages, ratios, and proportional reasoning, and communicates the reasoning effectively   **2 marks**   * Demonstrates partial understanding and fluency by explaining why dividing by 11 gives the GST amount with mostly correct reasoning * The response shows some connection to mathematical concepts (for example, percentages or proportional reasoning) but may lack full clarity or depth in explanation   **1 mark**   * Demonstrates basic understanding by attempting to explain why dividing by 11 gives the GST amount or by attempting to provide an example calculation * The response shows limited connection to mathematical concepts and may contain errors or incomplete reasoning |

##### Question 3 (2 marks)

Which of the ratios are equivalent?

Use mathematical calculations to support your reasoning where appropriate.

Table 8 – suggested solution and marking criteria question 3

|  |  |
| --- | --- |
| **Suggested solution** | Ratio A and B are equivalent as they simplify to 3:5. Whilst C is the same numbers, the order is important in ratios so . |
| **Marking criteria** | **2 marks**   * Demonstrates understanding and fluency by identifying the correct equivalent ratios with clear justifications * Communicates their thinking and reasoning coherently and clearly, using appropriate mathematical language and logical explanations   **1 mark**   * Demonstrates partial understanding and fluency by identifying the correct equivalent ratios without justifying * Communication may lack clarity or completeness but shows some connection to mathematical concepts |

##### Question 4 (2 marks)

James bought 6 donuts for $5 and Maddie bought 4 donuts for $3.50. Who got the better deal? Justify your answer.

Table 9 – suggested solution and marking criteria question 4

|  |  |
| --- | --- |
| **Suggested solution** | Price per one donut:  James  Maddie  James had the better deal as his donuts were cheaper per donut. |
| **Marking criteria** | **2 marks**   * Demonstrates understanding and fluency by accurately finding the price per donut (or using an equivalent method) for both and draws a clear and justified conclusion * Communicates their thinking and reasoning coherently and clearly, using appropriate mathematical language   **1 mark**   * Demonstrates partial understanding and fluency by correctly calculating the price per donut for either James or Maddie, without completing the task for both or drawing a conclusion * Communication may be incomplete but shows some evidence of connecting mathematical concepts or techniques |

##### **Question 5** (2 marks)

A store is having a sale and offering a 25% discount on all items. Emma found a jacket she liked that originally cost $120. She states, ‘When I decrease the price by 25%, I just found 75% of the original price.’

1. Calculate the sale price of the jacket.
2. Justify Emma’s approach to finding the discount price.

Table 10 – suggested solution and marking criteria question 5

|  |  |
| --- | --- |
| **Suggested solution** | A rectangle with the number 100 written inside it. Underneath this rectangle is another rectangle with the number 75 inside it. Alongside this rectangle is a rectangle with the number 25 inside it. The 2 rectangles together are the same length as the first 100 rectangle. |
| **Marking criteria** | **2 marks**   * Demonstrates understanding and fluency by accurately finding the percentage of a quantity * Correctly justifies the percentage decrease method used, demonstrating reasoning and the ability to connect mathematical concepts * Communicates their thinking and reasoning clearly and coherently, using appropriate mathematical language   **1 mark**   * Partially demonstrates understanding and fluency by either correctly finding the percentage of a quantity or providing a partial justification for the percentage decrease method used * Shows some evidence of reasoning or application of mathematical techniques, though communication or connections may be incomplete or unclear |

##### Question 6 (3 marks)

Samantha is researching smartphones online. She finds 2 identical products.

Two phones.
First phone has the following information: $1090 including GST.
Second phone has the following information: $1000 plus GST.

1. Which phone will cost Samantha the least? Justify your answer.
2. Can you obtain the same result using a second method?

Table 11 – suggested solution and marking criteria question 6

|  |  |
| --- | --- |
| **Suggested solution** | **Method 1 – GST on phone 2**  Phone 1 is the cheapest.  **Method 2 – find GST on both phones**  Phone 1  or  Phone 2  Phone 1 is the cheapest.  **Method 3 – find the pre-GST cost of phone 1**  or   Phone 1 is the cheapest. |
| **Marking criteria** | **3 marks**   * Demonstrates understanding and fluency by correctly using 2 valid methods to calculate GST or an equivalent quantity * Demonstrates the ability to connect mathematical concepts and explore alternative approaches by drawing a clear and accurate conclusion based on the results of both methods * Communicates reasoning and calculations coherently and clearly, using appropriate mathematical language   **2 marks**   * Demonstrates understanding and fluency by correctly using one valid method to calculate GST or an equivalent quantity * Demonstrates evidence of mathematical reasoning and application of techniques by drawing a correct conclusion based on the method used * Communication is mostly clear, with minor errors or omissions   **1 mark**   * Attempts to calculate GST or an equivalent quantity |

##### Question 7 (3 marks)

In the Boxing Day sales t-shirts were 30% off or 3 for $60. If the original cost of a t-shirt is $27, use 2 different methods to show that 30% off is the largest discount.

Table 12 – suggested solution and marking criteria question 7

|  |  |
| --- | --- |
| **Suggested solution** | **Compare 3 t-shirts**  with a discount of 30%  the biggest discount.  **Price of one t-shirt**  If  A discount of 30% the biggest discount. |
| **Marking criteria** | **3 marks**   * Demonstrates understanding and fluency by correctly using 2 valid methods to calculate equivalent quantities of t-shirts * Communicates reasoning and calculations coherently and clearly, using appropriate mathematical language   **2 marks**   * Demonstrates understanding and fluency by correctly using one valid method to calculate equivalent quantities of t-shirts * Demonstrates evidence of reasoning and application of mathematical techniques by making a correct conclusion based on the method used * Communication is mostly clear, with minor errors or omissions   **1 mark**   * Recognises the need to calculate the price of 3 t-shirts or one t-shirt |

##### Question 8 (2 marks)

Increase 40 by 30% using 2 different methods.

Table 13 – suggested solution and marking criteria question 8

|  |  |
| --- | --- |
| **Suggested solution** | **Method 1**  **Method 2**  **Method 3**  **Method 4** |
| **Marking criteria** | **2 marks**   * Demonstrates understanding and fluency by accurately solving the problem using 2 correct methods * Demonstrates reasoning by showing clear working and appropriate use of mathematical language to explain each method   **1 mark**   * Demonstrates partial understanding by solving the problem using one correct method, with clear working and a correct solution * Shows evidence of reasoning or application of mathematical concepts, though communication may lack detail |

##### Question 9 (3 marks)

It takes 3 painters 15 days to paint the interior walls of a house. Justin claims that the ratio of painters to days is 1:5 meaning that it will take 1 person 5 days to paint this house. Is Justin correct?

Table 14 – suggested solution and marking criteria question 9

|  |  |
| --- | --- |
| **Suggested solution** | 3:15 as a ratio simplifies to 1:5, however with ratios of workers, each person is doing 15 days of work so This would mean that one worker alone would take 45 days to do the same amount of work. |
| **Marking criteria** | **3 marks**   * Clearly demonstrates understanding by correctly analysing the relationship between painters and days * Explains that Justin’s claim is incorrect using appropriate calculations and mathematical reasoning * Communicates reasoning clearly and coherently   **2 marks**   * Demonstrates partial understanding by correctly explaining why Justin’s claim is incorrect, but without fully exploring the relationship between painters and days * Provides a reasonable explanation, though the mathematical reasoning may be incomplete or lacks clarity in places   **1 mark**   * Recognizes that Justin’s claim is incorrect but provides limited reasoning or does not perform the necessary calculations * Shows some understanding but may rely on vague statements or incomplete mathematical justification |

##### Question 10 (3 marks)

Three siblings contribute money to buy a house.

Mary contributes $40 000, Barry contributes $50 000 and Steve contributes $20 000.

Write 3 different ratios to express their investments.

Table 15 – suggested solution and marking criteria question 10

|  |  |
| --- | --- |
| **Suggested solution** | M : B : S  40 000 : 50 000 : 20 000  M : B : S  4 : 5 : 2  B : M : S  5: 4 : 2  Other variations can be given. Ratios can be simplified, equivalent, or in any order. If the ratio is in a different order, this needs to be indicated. |
| **Marking criteria** | **3 marks**   * Demonstrates a clear understanding of how to express ratios in different forms, including simplification, equivalency, and changing the order * Communicates the reasoning clearly, with appropriate use of mathematical language, showing fluency in working with ratios   **2 marks**   * Demonstrates a good understanding of how to express ratios but may not fully explore or explain the different forms of ratios or the different orders   **1 mark**   * Provides one correct ratio |

##### Question 11 (4 marks)

A family plans a road trip of 1200 kilometres. The family is considering 2 cars:

|  |  |
| --- | --- |
| Car X. | Car Y. |
| Car X  10 L / 100 km  Uses premium fuel  $1.85 per litre | Car Y  12 L/100 km  Uses regular fuel  $1.50 per litre |

1. Which car would you choose for the journey?
2. If choosing the cheaper car, how many more kilometres could they travel?

Table 16 – suggested solution and marking criteria question 11

|  |  |
| --- | --- |
| **Suggested solution** | **Part A**  Car X    Fuel cost:    Car Y    Fuel cost:    Car Y is cheaper by $6.  **Part B**  Number of L extra:  Using unitary method: |
| **Marking criteria** | **4 marks**   * Correctly compares the fuel cost of both cars and justifies the choice of Car Y based on the cheaper fuel cost * Demonstrates a full understanding of the relationship between fuel consumption and distance * Demonstrates fluency in problem-solving, calculation, and the ability to explain the process clearly   **3 marks**   * Correctly identifies Car Y as the cheaper option, with accurate fuel cost calculations * Provides a correct explanation and method to calculate the additional distance, but with minor calculation errors or omissions in reasoning * Demonstrates a good understanding of the problem and communicates the process clearly, but with some gaps or minor inaccuracies   **2 marks**   * Correctly identifies Car Y as the cheaper option but makes minor errors in calculating the additional distance or in interpreting the fuel consumption   **1 mark**   * Correctly calculates litres needed to travel 1200 km |

##### Question 12 (2 marks)

Bruce was trying to work out the conversion from 50 km/hr to m/sec. Identify any errors he has made and calculate the correct conversion.

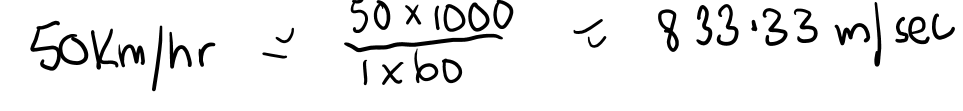


Table 17 – suggested solution and marking criteria question 12

|  |  |
| --- | --- |
| **Suggested solution** | Bruce has correctly converted kilometres to metres. He has correctly converted hours to minutes but needs to multiply the denominator by another 60 to get the rate in seconds. |
| **Marking criteria** | **2 marks**   * Demonstrates reasoning by clearly explaining the error made, using mathematical language to justify their understanding * Demonstrates an understanding of the mathematical concepts by providing the correct solution with logical steps   **1 mark**   * Partially demonstrates reasoning by either identifying and explaining the error made or providing the correct solution without fully addressing both * Uses some mathematical language but may lack clarity or depth in reasoning |

##### Question 13 (2 marks)

Jillian has 3 types of pens in her store. The ratio of blue to red pens is 4:5. The ratio of red to black is 7:10. She used the following working to find the ratio of blue : red : black. Can you explain her thinking?

Table 18 – suggested solution and marking criteria question 13

|  |  |
| --- | --- |
| **Suggested solution** | Jillian has reduced the red part of the ratio to 1 so should she could compare all 3 components together. She did this for the blue and the red by dividing by 5 and the red and the black by dividing by 7. Once she had the ratio with 3 parts she simplified it into whole numbers. |
| **Marking criteria** | **2 marks**   * Demonstrates understanding of the method Jillian used to equalize the red parts to combine the ratios correctly   **1 mark**   * Provides a correct statement about the need to equalize the ratios (for example, mentions the red part but with limited explanation or mathematical justification) |

##### Question 14 (3 marks)

A tank holds 1500 litres of water and is filled by a pump that delivers water at a rate of 25 litres per minute.

1. How long will it take to fill the tank?
2. A new pump is added after 10 minutes which doubles the rate. Will this halve the remaining time? Provide a mathematical argument to justify your decision.

Table 19 – suggested solution and marking criteria question 14

|  |  |
| --- | --- |
| **Suggested solution** | 1. Water in tank after 10 minutes:   Remaining volume:  Time to fill remaining at a rate of :  As the time left to fill after 10 minutes was 50 minutes, this has halved the remaining time. |
| **Marking criteria** | **3 marks**   * Provides a correct mathematical argument to support the conclusion that the remaining time is halved after the second pump is added * Justifies the conclusion with a clear and coherent mathematical explanation, showing an understanding of the relationship between flow rate and time   **2 marks**   * Correctly calculates the time to fill the tank, the volume delivered after 10 minutes, and the new flow rate * Provides a reasonable explanation of how the second pump affects the remaining time, though the argument may be incomplete or lack clarity   **1 mark**   * Correctly calculates the time to fill the tank (60 minutes) but does not fully explore or justify the impact of the second pump on the remaining time |

##### Question 15 (3 marks)

A train travels at an average speed of 72 km/h.

1. How long will it take to travel 432 km?
2. The train increases its average speed by 20%. Describe the effects this increase in speed has on the journey.

Table 20 – suggested solution and marking criteria question 15

|  |  |
| --- | --- |
| **Suggested solution** | 1. New speed:   Time for journey:  The train now travels at 86.4 km/h and takes 5 hours to complete the journey. |
| **Marking criteria** | **3 marks**   * Demonstrates understanding of the impact of a 20% increase in speed by explaining how the new speed reduces the time to complete the journey * Provides a clear and coherent explanation of how the increase in speed affects the journey, using appropriate mathematical reasoning and language   **2 marks**   * Correctly calculates the original time and the new speed * Provides a reasonable explanation of the effects of the speed increase on the journey, though the reasoning may be incomplete or unclear   **1 mark**   * Correctly calculates the time for the original journey |

##### Question 16 (3 marks)

A chemical solution is made by mixing acid A, acid B, and water in the ratio 3:1:6.

1. If there are 9 litres of acid A in the solution, how much water is needed?
2. How much water is needed if the total solution volume is 50 litres?
3. Both Part A and B are asking the same ‘How much water is needed?’ Using bar graphs, show the difference between the 2 parts.

Table 21 – suggested solution and marking criteria question 16

|  |  |
| --- | --- |
| **Suggested solution** | Therefore, 18 L of water.  Therefore, 30 L of water.   1. Part A gives the amount of acid A whereas Part B gives the amount of the total.   Three bars one underneath each other. Each bar is split into 3 sections shaded in the order of green, orange and blue. The green colour represents acid A, the orange colour represents acid B and the blue colour represents water. The total length of one entire bar represents 50 L. Bar 1 is green 3 parts, orange 1 part and blue 6 parts. Bar 2 is green 9 parts, orange no amount given and blue 18 parts. Bar 3 is green no amount given, orange no amount given and blue 30 parts. |
| **Marking criteria** | **3 marks**   * Correctly calculates the amount of water needed in both parts * Demonstrates an understanding of how the volume being allocated to different parts of the ratio affects the water amount * Communicates the reasoning and mathematical process clearly and coherently, using visual representations where necessary   **2 marks**   * Correctly calculates the amount of water needed for both parts * Provides a reasonable explanation of the difference between the 2 parts but may lack clarity or full detail * Attempts to communicate reasoning using visual representations   **1 mark**   * Correctly calculates the amount of water needed for one part |

##### Question 17 (3 marks)

Below is a journey graphed on a distance-time graph. Write a narrative to describe the journey.

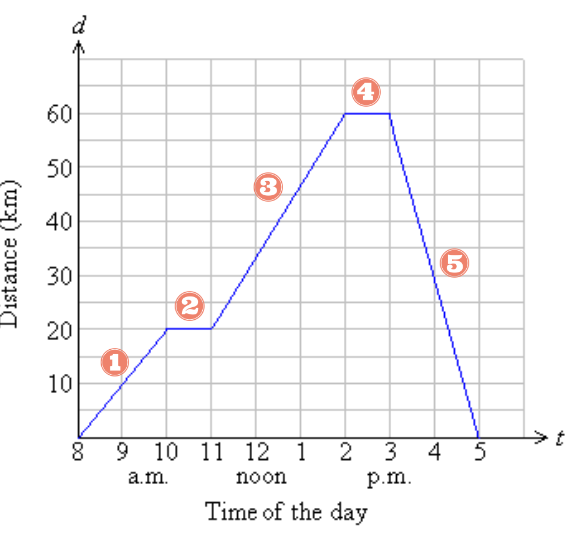


Table 22 – suggested solution and marking criteria question 17

|  |  |
| --- | --- |
| **Suggested solution** | Key aspects include:   * First 2 hours at 10 km/h away from start. * Stopped for an hour. * Travelled for another 3 hours at 13.3 km/h away from the start. * Stopped for an hour. * Returned to start in 2 hours at 30 km/h. |
| **Marking criteria** | **3 marks**   * Provides a complete narrative describing the journey, including all relevant details: speeds, directions and times * Demonstrates understanding of the distance-time graph and communicates the journey coherently using appropriate mathematical language   **2 marks**   * Includes the speed, direction and time for most stages of the journey but may omit some details or have minor inaccuracies * Provides a reasonably clear narrative of the journey, but the explanation may lack full clarity or completeness   **1 mark**   * Makes a correct statement about the journey but does not fully describe the journey with all necessary components |

##### Question 18 (3 marks)

A truck driver cannot exceed 100 km per hour, and it is suggested that drivers take a break every 2 hours to avoid fatigue. Is the driver described in the graph a safe driver? Justify why.

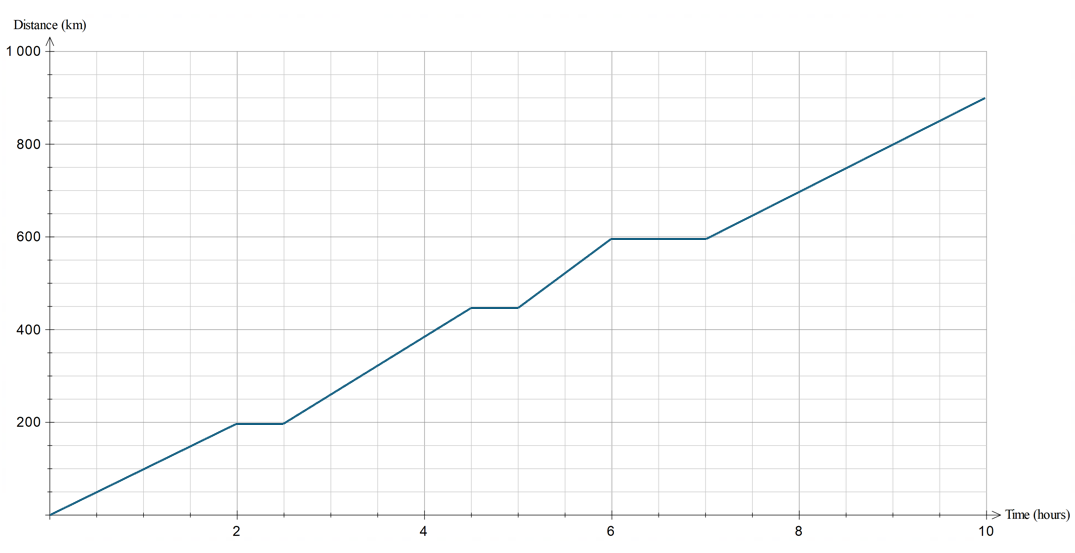


Table 23 – suggested solution and marking criteria question 18

|  |  |
| --- | --- |
| **Suggested solution** | The driver is not compliant. During the fifth hour of the trip, the driver travels faster than 100 km/h and has not had a break in the last 3 hours. |
| **Marking criteria** | **3 marks**   * Provides a correct conclusion that the driver is not safe, supported by 2 valid reasons * Demonstrates clear understanding of how to interpret the graph to support these reasons * Communicates reasoning coherently, using appropriate mathematical and logical language   **2 marks**   * Provides a correct conclusion about the driver's safety based on the graph * Supports the conclusion with a correct interpretation of the graph but may not fully explain both reasons or the reasoning may be incomplete or unclear   **1 mark**   * Correctly interprets some aspect of the graph but does not fully address the driver’s safety or provide a complete reasoning process |

##### Question 19 (2 marks)

Expand the expression using a visual and algebraic method.

Table 24 – suggested solution and marking criteria question 19

|  |  |
| --- | --- |
| **Suggested solution** | **Method 1**  An area model showing 2 orange ones on the left hand side of the grid and a green cross and 3 orange ones on the top of the grid. In the grid there are 2 green crosses and 6 orange ones.  Answer is: .  **Method 2**  . |
| **Marking criteria** | **2 marks**   * Chooses and applies 2 appropriate techniques to correctly expand the expression   **1 mark**   * Chooses and applies one technique to correctly expand the expression |

##### Question 20 (2 marks)

Cameron was asked to expand the following expression .

His working out is shown below:

The first line of working out is: -2(5x-3) with a red arrow drawn from -2 to 5x and another red arrow drawn from -2 to 3.
The second line of working out is -10x-6.

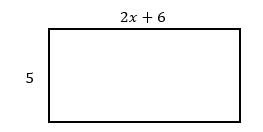
Has Cameron expanded the expression correctly? Explain your answer.

Table 25 – suggested solution and marking criteria question 20

|  |  |
| --- | --- |
| **Suggested solution** | Cameron has not expanded the expression correctly.  Cameron needs to change the sign in front of the 6 from a minus to a plus as to give the correct answer of . |
| **Marking criteria** | **2 marks**   * Demonstrates reasoning by clearly explaining the error Cameron made, using mathematical language to justify their understanding * Provides the correct solution with logical steps, showing understanding of the mathematical concepts involved   **1 mark**   * Partially demonstrates reasoning by either identifying and explaining the error Cameron made or providing the correct solution without fully addressing both * Uses some mathematical language but may lack clarity or depth in reasoning |

##### Question 21 (4 marks)

1. Tell me everything you know about this rectangle.



1. If the perimeter was 34, what would the length and area be?

Table 26 – suggested solution and marking criteria question 21

|  |  |
| --- | --- |
| **Suggested solution** | Possible responses:  The width is 5.  The length is .  The perimeter is:  The area is:  .  If the perimeter is 34:  When *,* |
| **Marking criteria** | **4 marks**   * Demonstrates a clear understanding of rectangles by finding length, width, perimeter and area * Demonstrates connections to the expanding of algebraic expressions in their solutions for both perimeter and area in the most simplified form * Solves a linear equation to find a value for and uses it to find the length and area   **3 marks**   * Demonstrates some understanding of rectangles * Demonstrates connections to the expanding of algebraic expressions in their solutions for both perimeter and area * Solves a linear equation to find a value for   **2 marks**   * Demonstrates some understanding of rectangles * Demonstrates some understanding of algebraic expressions by substituting in numbers to find length, perimeter or area * Creates a linear equation using an algebraic expression from the rectangle or finds appropriate values for the length and area   **1 mark**   * Demonstrates any relevant information related to rectangles |

##### **Question 22** (2 marks)

Sasha and Jordan were asked to fully factorise the expression .

Their solutions are:

Sasha:

Jordan:

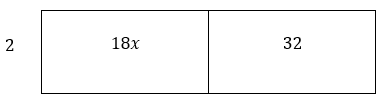
One of the solutions is not fully factorised. Can you explain which solution this is and why?

Table 27 – suggested solution and marking criteria question 22

|  |  |
| --- | --- |
| **Suggested solution** | Sasha’s solution is not fully factorised because the numbers in the bracket have a common factor. |
| **Marking criteria** | **2 marks**   * Demonstrates reasoning by clearly explaining which solution is not fully factorised and using mathematical language to justify their understanding   **1 mark**   * Partially demonstrates reasoning by identifying the not fully factorised solution and attempting to explain why |

##### Question 23 (2 marks)

Harry was asked to factorise . He started by drawing the area model below.



Explain how this area model may have helped Harry get the correct answer of .

Table 28 – suggested solution and marking criteria question 23

|  |  |
| --- | --- |
| **Suggested solution** | Harry found the highest common factor of and was 2 and placed it alongside both terms so he could work out 2 times the numbers that would give and .  and.  Harry then wrote the answer placing the highest common factor of 2 outside the brackets and what he multiplied by inside the brackets to give the answer . |
| **Marking criteria** | **2 marks**  Clear explanation of how to get the answer using the area model, including information on finding the highest common factor  **1 mark**  For any correct information drawn on the area model diagram in the question |

##### Question 24 (2 marks)

Vivienne was asked to factorise . She wrote down the answer

1. How can Vivienne check if her answer is correct?
2. How could she correct her answer?

Table 29 – suggested solution and marking criteria question 24

|  |  |
| --- | --- |
| **Suggested solution** | 1. Vivienne can expand her answer. When she does this she gets . This does not match the question. 2. Vivienne needs to add the number 2 in front of the so when she multiplies by 10 she gets . |
| **Marking criteria** | **2 marks**   * Applies mathematical techniques and clearly explains how expanding can be used to verify the factorisation and provides the correct modification needed to make the answer work   **1 mark**   * Provide the correct answer with no explanation of how Vivienne’s answer was checked |

##### Question 25 (3 marks)

Liam says that the highest common factor of 36 and 54 is 9.

Is he correct? Explain your thinking.

Table 30 – suggested solution and marking criteria question 25

|  |  |
| --- | --- |
| **Suggested solution** | **Factors of 36**  1, 2, 3, 4, 6, 9, 12, 18, 36  **Factors of 54**  1, 2, 3, 6, 9, 18, 27, 54  Liam is not correct as there is a higher factor that is common to both numbers. The highest common factor is 18. |
| **Marking criteria** | **3 marks**   * Demonstrates understanding and fluency by correctly finding the factors of 36 and 54 and providing a clear, coherent explanation. Has demonstrated an appropriate method to determine the factors   **2 marks**   * Demonstrates some understanding and fluency by correctly finding the factors of 36 and 54 and including partial reasoning with an incomplete written explanation   **1 mark**   * Demonstrates basic understanding by finding either the factors of 36 or 54 or attempting to explain why Liam is incorrect |

##### **Question 26** (3 marks)

Find the common factors and the highest common factor for 12a and 48 using the Venn diagram below.

A Venn diagram with a blue and pink circle crossing over.
The blue circle has 12a written at the top. The pink circle has 48 written at the top.

Table 31 – suggested solution and marking criteria question 26

|  |  |
| --- | --- |
| **Suggested solution** | A Venn diagram with a blue and pink circle crossing over. The blue circle has 12a written at the top. The pink circle has 48 written at the top. In the centre of the blue circle are the terms a, 2a, 3a, 4a, 6a, 12a. In the centre of the pink circle are the terms 8, 16, 24, 48. In the cross over section of the circles are the terms 1, 2, 3, 4, 6, 12.  The highest common factor is 12. |
| **Marking criteria** | **3 marks**   * Communicates their thinking by correctly placing all the factors of the given numbers in the Venn diagram and accurately identifying the highest common factor (HCF)   **2 marks**   * Partially communicate their thinking and reasoning by either correctly placing all the factors in the Venn diagram or accurately finding the highest common factor   **1 mark**   * Partially communicate their thinking and reasoning by correctly placing some of the factors in the Venn diagram |

##### Question 27 (2 marks)

Given the factors in the Venn diagram below, can you find the 2 products?

A Venn diagram with a blue and pink circle crossing over.
The blue circle has 'Factors of' written at the top. The pink circle has 'Factors' of written at the top.
In the centre of the blue circle are the terms 2, 10, a, 2a, 5a, 10a.
In the centre of the pink circle are the terms 3, 15, b, 3b, 5b, 15b.
In the cross over section of the circles are the terms 1, 5.

Table 31 – suggested solution and marking criteria question 27

|  |  |
| --- | --- |
| **Suggested solution** | The products are 10a and 15b.  A Venn diagram with a blue and pink circle crossing over. The blue circle has factors of 10a written at the top. The pink circle has factors of 15b written at the top. In the centre of the blue circle are the terms 2, 10, a, 2a, 5a, 10a. In the centre of the pink circle are the terms 3, 15, b, 3b, 5b, 15b. In the cross over section of the circles are the terms 1, 5. |
| **Marking criteria** | **2 marks**   * Communicates their thinking and reasoning by correctly interpreting the information in the Venn diagram to find both terms   **1 mark**   * Partially communicate their thinking and reasoning by incorrectly interpreting the information in the Venn diagram to find one of the terms |

##### Question 28 (2 marks)

Jake incorrectly simplified the expression:

What error has Jake made and how could he correct it?

Table 33 – suggested solution and marking criteria question 28

|  |  |
| --- | --- |
| **Suggested solution** | Jake has multiplied the base number twos together, . He can correct it by changing the base number to 2 and write . |
| **Marking criteria** | **2 marks**   * Demonstrates reasoning by clearly explaining the error Jake made, using mathematical language to justify their understanding * Provides the correct solution with logical steps, showing understanding of the mathematical concepts involved   **1 mark**   * Partially demonstrates reasoning by either identifying and explaining the error Jake made orproviding the correct solution without identifying and explaining the error * Uses some mathematical language to explain the error but may lack clarity or depth in reasoning |

##### Question 29 (4 marks)

Two algebraic terms multiply to give .

List as many combinations of 2 terms as you can and explain how you found different combinations.

Table 34 – suggested solution and marking criteria question 29

|  |  |
| --- | --- |
| **Suggested solution** | Solutions contain factors of 24: and algebraic terms with a base of and exponents that add to to make .  Some solutions are:  , , , , , |
| **Marking criteria** | **4 marks**   * Lists correct combinations of 2 terms that multiply to , showing flexibility in exploring possible variations * Identifies a strategy to list the terms that use the factors 24 and the algebraic terms in various combinations   **3 marks**   * Can list several correct combinations, with some variety in factors * Attempts to identify a strategy that may find many of the factors   **2 marks**   * Can list a few correct combinations, primarily relying on straightforward or repetitive variations * May attempt to identify a strategy that would find some of the factors   **1 mark**   * Demonstrates minimal understanding by listing only one or 2 correct combinations, with limited variety |

##### Question 30 (2 marks)

Kane incorrectly simplified the expression:

What error has Kane made and how could he correct it?

Table 35 – suggested solution and marking criteria question 30

|  |  |
| --- | --- |
| **Suggested solution** | Kane has multiplied the exponents (powers) together, . He can correct it by adding the exponents together and writing . |
| **Marking criteria** | **2 marks**   * Demonstrates reasoning by clearly explaining the error Kane made, using mathematical language to justify their understanding * Provides the correct solution with logical steps, showing understanding of the mathematical concepts involved   **1 mark**   * Partially demonstrates reasoning by either identifying and explaining the error Kane made or providing the correct solution without fully addressing both * Uses some mathematical language to explain the error but may lack clarity or depth in reasoning |

##### Question 31 (2 marks)

Lucy incorrectly simplified the expression:

What error has Lucy made and how could she correct it?

Table 36 – suggested solution and marking criteria question 31

|  |  |
| --- | --- |
| **Suggested solution** | Lucy has added the exponents (powers) together, . She can correct it by multiplying the exponents together to equate to . |
| **Marking criteria** | **2 marks**   * Demonstrates reasoning by clearly explaining the error Lucy made, using mathematical language to justify their understanding * Provides the correct solution with logical steps, showing understanding of the mathematical concepts involved   **1 mark**   * Partially demonstrates reasoning by either identifying and explaining the error Lucy made orproviding the correct solution without fully addressing both * Uses some mathematical language to explain the error but may lack clarity or depth in reasoning |

##### Question 32 (2 marks)

Dave incorrectly simplified the expression:

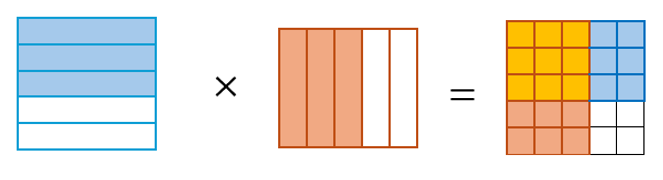
What error has Dave made and how could he correct it?

Table 37 – suggested solution and marking criteria question 32

|  |  |
| --- | --- |
| **Suggested solution** | Dave has made the error of dividing the base numbers, . He can correct it by changing the base number to 3 and equate the answer to . |
| **Marking criteria** | **2 marks**   * Demonstrates reasoning by clearly explaining the error Dave made, using mathematical language to justify their understanding * Provides the correct solution with logical steps, showing understanding of the mathematical concepts involved   **1 mark**   * Partially demonstrates reasoning by either identifying and explaining the error Dave made or providing the correct solution without fully addressing both * Uses some mathematical language to explain the error but may lack clarity or depth in reasoning |

##### Question 33 (2 marks)

Leanne was asked to find the answer to . Here is her working out:



Leanne’s answer is .

1. Can you explain how Leanne worked out her answer?
2. Can you show another way to find .

Table 38 – suggested solution and marking criteria question 33

|  |  |
| --- | --- |
| **Suggested solution** | 1. Leanne knows that squaring a number is the same as multiplying it by itself. So she drew by shading in 3 parts out of 5 horizontally and then the same vertically. To find the answer, she counted the number of shaded squares where the 2 images crossed each other and placed that number in the numerator and then counted the total number of squares for the denominator. 2. Another way: |
| **Marking criteria** | **2 marks**   * Demonstrates understanding and fluency by clearly and coherently explaining how Leanne worked out her answer and providing another valid way to solve the question * The response connects mathematical concepts and applies appropriate techniques to justify reasoning   **1 mark**   * Demonstrates partial understanding and fluency by either explaining how Leanne solved the question or providing another valid way to solve the question * The response shows some connection of mathematical concepts or application of techniques but may lack full clarity or coherence |

##### Question 34 (2 marks)

Is the same as ?

Explain your thinking.

Table 39 – suggested solution and marking criteria question 34

|  |  |
| --- | --- |
| **Suggested solution** | Yes.  When you multiply the fraction 6 times, it expands to give 6 fours on the numerator and 6 fives on the denominator. |
| **Marking criteria** | **2 marks**   * Demonstrates understanding and fluency by correctly identifying that the terms are equivalent andproviding a clear and coherent explanation of why * The response explores and connects mathematical concepts, applies appropriate techniques and communicates reasoning effectively   **1 mark**   * Demonstrates partial understanding and fluency by correctly identifying that the terms are equivalent and attempting to explain their thinking * The response shows some connection of mathematical concepts or application of techniques but may lack full clarity or depth in reasoning |

##### Question 35 (2 marks)

Can you simplify using 2 different methods? Leave your expression in index notation.

Table 40 – suggested solution and marking criteria question 35

|  |  |
| --- | --- |
| **Suggested solution** | **Method 1**  **Method 2**  7^5 divide 7^3 = 7x7x7x7x7 divide by 7x7x7. Three 7's are crossed off the top and bottom of the fraction in red. 7^5 divide 7^3 equals 7^2.  **Method 3**  7^5 divide 7^3 = 7^3 time 7^2 divide by 7^3. 7^3 crossed off in red on the top and bottom of the fraction.  7^5 divide 7^3 equals 7^2.  **Method 4** |
| **Marking criteria** | **2 marks**   * Chooses and applies 2 appropriate techniques to correctly divide the expression   **1 mark**   * Chooses and applies one technique to correctly divide the expression |

##### Question 36 (2 marks)

Tenley incorrectly simplified the expression:

What error could Tenley have made and how could he correct it?

Table 41 – suggested solution and marking criteria question 36

|  |  |
| --- | --- |
| **Suggested solution** | Tenley has incorrectly identified 4 in the numerator as and subtracted the indices as .  Tenley needs to write the 4 in the numerator as and then subtract the indices |
| **Marking criteria** | **2 marks**   * Demonstrates reasoning by clearly explaining the error Tenley made, using mathematical language to justify their understanding * Provides the correct solution with logical steps, showing understanding of the mathematical concepts involved   **1 mark**   * Partially demonstrates reasoning by either identifying and explaining the error Tenley made or providing the correct solution without fully addressing both * Uses some mathematical language but may lack clarity or depth in reasoning |

##### Question 37 (3 marks)

Miley gave the same answer to both of these expressions:

**Expression 1**

**Expression 2**

1. Which expression is incorrect?
2. Can you explain what error Miley made?
3. Can you write what the correct answer should be?

Table 42 – suggested solution and marking criteria question 37

|  |  |
| --- | --- |
| **Suggested solution** | 1. Expression 2 is incorrect. 2. Miley subtracted the exponents (powers) incorrectly, calculated instead of . 3. The correct answer is:   3^6 divided by 3^8 equals 3x3x3x3x3x3 divided by 3x3x3x3x3x3x3x3. Six threes crossed off the top and bottom of the fraction in red. 3^6 divided by 3^8 equals 1 divided by 3^2. |
| **Marking criteria** | **3 marks**   * Demonstrates understanding and fluency by correctly identifying the incorrect answer, providing a clear and coherent explanation of the error made, and presenting a correct solution   **2 marks**   * Demonstrates partial understanding and fluency by correctly identifying the incorrect answer and either explaining the error made or providing the correct solution   **1 mark**   * Demonstrates basic understanding by identifying the incorrect answer and attempting to either explain the error or provide a correct solution |

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