# Mathematics Standard 1 Year 12

# Sample Assessment Task Algebra

## Applications of Algebra: Modelling for Profit

***Sample for implementation for Year 12 from Term 4, 2018***

### Context

Students have engaged in learning for the subtopic, Types of Relationships. They have participated in activities to develop knowledge of the concepts of graphing and interpretation of relationships, and skills to solve a variety of problems.

Students will require approximately three hours of independent preparation; including class time to discuss the notification and task requirements.

The task notification includes two parts. Both Part A and Part B including the marking criteria will be handed out with the notification.

### Notes to teacher

Throughout the development of the task, teachers should monitor authorship and the progress of student work. All responses will be submitted on the same day.

When individual feedback is provided after marking, there will be opportunity to discuss the challenges of the task with the class and consider future learning activities to assist student learning.

# Applications of Algebra – Modelling for Profit

|  |  |  |
| --- | --- | --- |
| Task number: 2 | Weighting: 30% | Timing: Term 1, Week 6 |
| Outcomes assessed  * uses algebraic and graphical techniques to evaluate and construct arguments in a range of familiar and unfamiliar contexts MS1-12-1 * represents the relationships between changing quantities in algebraic and graphical forms MS1-12-6 * chooses and uses appropriate technology effectively and recognises appropriate times for such use MS1-12-9 * uses mathematical argument and reasoning to evaluate conclusions, communicating a position clearly to others MS1-12-10 | | |
| Nature of the task This assignment involves the use of algebraic relationships and graphs to solve real world problems. It comprises two parts:   * Part A of the task is to be completed on the solution page provided with the assignment. * Part B of the task can be submitted as hard copy or in digital form.   All parts of the task are to be completed individually. When working during class time, students can access all class notes and practice questions. Students will need to access digital technologies during class time. | | |
| Marking criteria You will be assessed on how well you:   * accurately solve a variety of problems based on the scenarios * select and use appropriate mathematical processes, technologies and language to investigate, organise and interpret graphs and relationships * provide reasoning to evaluate conclusions. | | |
| Feedback provided The teacher will provide feedback outlining strengths and areas for improvement to build on knowledge, understanding and skills for future learning. | | |

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| --- | --- | --- | --- | --- |
| Student Name: | | | | |
| Modelling for Profit | | | | |
| Part A – 20 marks Understanding, Fluency and Communication | | | | Marks |
| Kim has decided to balance her further studies with part-time work. She works as a waitress at a local café and also does some tutoring. Kim cannot work for more than hours per week. | | | |  |
|  | Let represent the hours of tutoring Kim will do and the hours of waitressing. Using these variables, write an equation that shows the relationship between the hours Kim works in each area. | | | **1** |
|  |  | | |  |
|  | What values of and are feasible in this problem? Explain your reasoning. | | | **2** |
|  |  | | |  |
|  | Graph the equation on the number plane below. Clearly indicate the values of the intercepts. | | | **3** |
|  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | | |  |
|  | What is value of the vertical intercept? |  |  | **1** |
|  | What is the meaning of the vertical intercept in this context? | | | **1** |
|  |  | | |  |
|  | What is the gradient of the line? |  |  | **1** |
|  | Explain what the gradient means in the context of this problem. | | | **1** |
|  |  | | |  |
|  | Kim only wants to do between 3 and 8 hours of tutoring. **Use shading on your graph** to indicate the part of your graph that satisfies this condition. | | | **2** |
| Kim is paid $15 per hour for waitressing and $21 per hour for tutoring. | | | | |
|  | Write an expression for the total income that Kim earns for doing hours of tutoring and hours of waitressing. | | | **2** |
|  |  | | |  |
|  | Calculate the income Kim would earn if she did 5 hours of tutoring and 12 hours of waitressing. | | | **2** |
|  |  | | |  |
|  | **On your graph**, locate the point that represents the situation where Kim does 5 hours of tutoring and 12 hours of waitressing. Label the point . | | | **1** |
|  | Kim needs to decide how many hours in each type of work she should do in order to earn the greatest possible income. Use your graph to determine Kim’s greatest possible income and the number of hours she should work in order to achieve it. Support your working with calculations and reasoning. | | | **3** |
|  |  | | |  |
| Part B – 20 marks Problem Solving, Reasoning and Justification | | | | Marks |
| 1. | The Year 11 Jersey Committee is trying to decide on the company from which they will purchase their commemorative jersey. They have to decide between the following two options:  Company A supplies jerseys at a base price of $39.95 each. For each jersey, a personalised logo on the front will cost $6.95, a name on the back costs $4.95 and a number on the back costs $4.95. There is no setup fee but they charge a delivery fee of $250.  Company B charges a set-up fee of $1000 that includes the logo on the front and the names and numbers on the back. Jerseys then cost $40 each. There is no additional delivery fee.  From past experience, both companies produce jerseys of equivalent quality.  What advice would you give the committee to help them decide between the two companies?  Use your knowledge of linear functions and graphing technologies to support your advice with visual displays and reasoning. | | | **10** |
| 2. | A graph illustrating the cumulative number of apps downloaded from the Apple App Store can be viewed at <https://www.statista.com/statistics/263794/number-of-downloads-from-the-apple-app-store/>.   1. Describe the growth in the number of apps downloaded from the Apple store as illustrated in the graph. 2. Comment on the validity of the presentation of the information. 3. Using spreadsheets and graphing technologies find an approximate equation that models the information from March 2012 to September 2016. Provide an explanation of your strategy that includes screenshots of your work. 4. Use your model to predict the cumulative number of apps that will be downloaded from the Apple App Store by December 2017. 5. Explain the strengths, limitations and validity of your model and state any assumptions that you have made. | | | **10** |

**End of task**

### Marking guidelines

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| Part A – Understanding, Fluency and Communication | | Mark |
| (a) | * Correct answer | **1** |
| (b) | * Correct answer for supported by a correct reason * Correct answer for supported by a correct reason | **1**  **1** |
| (c) | * Displays at least three correctly plotted points * Displays a correctly drawn line * Clearly indicates the intercepts | **1**  **1**  **1** |
| (d) | * Correct answer for given graph | **1** |
| (e) | * Correct answer | **1** |
| (f) | * Correct answer | **1** |
| (g) | * Correct explanation of meaning | **1** |
| (h) | * Shading indicates a minimum of 3 hours * Shading indicates a maximum of 8 hours | **2** |
| (i) | * Displays the correct part of the expression involving * Displays the correct part of the expression involving | **1**  **1** |
| (j) | * Demonstrates correct substitution clearly, but an incorrect answer * Demonstrates correct substitution clearly and a correct answer | **2** |
| (k) | * Correct answer for provided graph | **1** |
| (l) | * Correct greatest possible income * Indicates correct hours to be worked to achieve that income * Demonstrates clear and concise communication of workings | **1**  **1**  **1** |

|  |  |
| --- | --- |
| Part B – Problem Solving, Reasoning and Justification(Each question is worth 10 marks; each question is marked separately) | Mark range |
| A student: |  |
| * demonstrates a thorough understanding of the mathematics involved in solving the problem * uses appropriate mathematical processes in solving the problem without error * communicates in a concise and systematic manner and justifies conclusions using appropriate mathematical language, notation and symbols | **8–10** |
| * demonstrates understanding of the mathematics involved with appropriate calculations with either a minor arithmetic or calculation error OR all mathematical calculations have been carried out without error but the final conclusion is incorrect * communicates in a concise and systematic manner and justifies conclusions using some mathematical language, notation and symbols | **5–7** |
| * demonstrates progress towards a solution with some error * demonstrates a developing understanding of what it means to work mathematically with some use of mathematical language, notation and/or symbols | **3–4** |
| * demonstrates a limited understanding of the mathematics involved in solving the problem * demonstrates limited use of mathematical language | **1–2** |