 Year 12 Mathematics Advanced

**Assessment task:** MA-S3 Random variables

**Driving question:** Is a normal distribution appropriate?

Outcomes

* MA12-8 solves problems using appropriate statistical processes
* MA12-9 chooses and uses appropriate technology effectively in a range of contexts, models and applies critical thinking to recognise appropriate times for such use
* MA12-10 constructs arguments to prove and justify results and provides reasoning to support conclusions which are appropriate to the context

All outcomes referred to in this unit come from [Mathematics Advanced](http://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/stage-6-learning-areas/stage-6-mathematics/mathematics-advanced-2017) Syllabus  
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Learning across the curriculum

General capabilities

* Critical and creative thinking
* Information and communication technology capability
* Literacy
* Numeracy
* Work and enterprise

Task

Part A and part B of this assignment should form a 1000 word (minimum) report that includes evidence of all steps involved in the process and methods undertaken.

Part A: Collect primary data and analyse

You are to collect primary data using a survey question that is likely to be normally distributed. Examples can include:

* height
* weight
* IQ scores (or examination marks)
* salaries
* Travel times to work/school
* Birthweight

1. What survey question are you asking people?
2. How are you collecting your data? You will need a minimum of 50 responses. Provide evidence of your methods. (considerations below)
3. What were your results? Provide evidence including a histogram from a spreadsheet. (considerations below)
4. Is your data normally distributed? What are the features in common with a normal distribution? (considerations below)

Considerations

* Using an online survey platform, such as www.surveymonkey.com or Google Forms, and then placing your link on social media could assist you to gain a large number of responses, which are necessary.
* Google Sheets or Microsoft Excel can be used to create your appropriate histogram.
* Consider all features of a normally distributed random variable. Include the mean, mode and median of your data, and discuss the symmetry and percentage distributions about the mean, comparing it to the standard deviation.

Part B: Model your survey using a normal distribution

Assume your survey can be modelled as a Normally Distributed Random Variable.

1. Based on your survey from Part 1, decide what the values of the mean and standard deviation should be, and hence write down the equation of your normal distribution. Explain how you made these decisions.
2. Explain and discuss the differences between your survey results and the normally distributed random variable you have just created. Is it reasonable to model this survey using a Normally Distributed Random Variable? Is this model accurate? [Considerations below]

Considerations

* Compare the proportions of results in between whole z-scores. What changes would you need to make to your original survey to match the equation you have formed? Use appropriate terminology from mathematics and statistics.
* Consider using graphical displays from appropriate software to justify your final conclusion.

Success criteria

| Fluency, understanding and communication | Problem solving, reasoning and justification |
| --- | --- |

| Criteria | Working towards developing | Developing | Developed | Well developed | Highly developed |
| --- | --- | --- | --- | --- | --- |
| 1. Construct a survey  **MA12-8** | Student describes the survey question. The question chosen can be understood. | Student describes the survey question. The question chosen is clear and demonstrates consideration of the intended audience. |  |  |  |
| 2. Collect Responses **MA12-8**  **MA12-9** | Student chooses methods to collect responses and communicates them. Methods of collecting responses is adequate. | Student chooses methods to collect responses and communicates them. Methods of collecting responses demonstrates consideration of factors such as audience habits and ease of organising results. |  |  |  |
| 3. Display your results  **MA12-8**  **MA12-9** | Student displays the data using an appropriate chart or graph. | Student displays the data using an appropriate chart or graph and demonstrates knowledge and understanding of how to use the chosen technology to best display their results. |  |  |  |
| 4. Analyse and discuss results  **MA12-8**  **MA12-10** | Student discusses their results, referring to a calculation. | Student discusses their results with conclusions based on measures of location and a judgement comparing the results to normal distribution. | Student discusses their results, drawing conclusions based on measures of location and spread, and provides multiple factors comparing the results to a normal distribution using appropriate statistical terminology. | Student discusses their results, drawing conclusions based on all available data and measures. Student provides a final judgement of their collected data’s comparison to a normal distribution based on all available considerations, using sophisticated statistical terminology. |  |
| 5. Construct a normally distributed random variable  **MA12-8**  **MA12-10** | Student selects a mean and standard deviation for their random variable and writes down an equation. | Student selects a mean and standard deviation for their random variable, giving reasons, and writes down an accurate equation based on these decisions. | Student selects a mean and standard deviation for their random variable, giving logical reasons based on their previous comparison to a normal distribution, and writes down an accurate equation based on these decisions. | Student selects a mean and standard deviation for their random variable, giving logical reasons based on their previous comparison to a normal distribution and considerations of spread and symmetry, and writes down an accurate equation based on these decisions. |  |
| 6. Final decision: Is a normal distribution model appropriate?  **MA12-8**  **MA12-9**  **MA12-10** | Student identifies some similarities and differences between their actual results and their constructed model, and makes a final decision about whether the model is good or poor. | Student identifies similarities and differences between their actual results and their constructed model, and makes a final decision about whether the model is good or poor, justifying this decision with some relevant statistical factors. | Student identifies and communicates a relevant list of similarities and differences between their actual results and their constructed model, and makes a final decision about whether the model is good or poor, justifying this decision effectively with some relevant statistical factors. Student uses appropriate statistical terminology. | Student constructs a thorough argument for their final assessment about the effectiveness of their chosen normally distributed random variable, including a strong and well ordered list of similarities and differences between their actual results and their chosen model. They use this list effectively to justify their decision with a convincing discussion, using appropriate and relevant calculations, technology and terminology. | Student constructs an extensive argument for their final assessment about the effectiveness of their chosen normally distributed random variable, using similarities and differences between their chosen model and actual statistics expertly to convey their reasoning in a logical manner. They use appropriate and relevant calculations, technology and terminology to justify their decision with a highly convincing and well-structured body of mathematical evidence. |

Note**s**

* Any non-attempt in a section will be deemed zero. Marks can only be attributed to attempted responses.

Note to staff

The success criteria above has been designed for students and staff alike to use. Students should be presented the rubric as part of the assessment task package. Students and staff follow the process of the task downwards through the rubric and the depth of responses, for each element, across the rubric. Students should be encouraged to use the rubric to self-assess their progress as an assessment-as-learning strategy.

The aim of the assessment task is to develop students’ deep content knowledge. This is reflected in the descriptors, **working towards developing** through to **highly developed**. The level of skill and understanding required in each part of the task is different; some parts require **highly developed** or **well-developed** skills, other parts only capture a **developing** skill set.

None of the working mathematically elements are distinct and when demonstrating one element, you are invariably demonstrating another. As an example, communication runs concurrently through all the other working mathematically elements. Students cannot respond to this assessment without communicating in some form. However, it is envisaged that there is a general progression through the working mathematically elements, starting with fluency and leading to understanding, problem solving, reasoning and justification, with increasingly higher levels of communication accompanying each element. Careful consideration has been given to the position of the success criteria statements so they reflect the working mathematically elements demonstrated.

This assessment task has been designed to illuminate the style of questions and the types of responses needed to elicit deep content knowledge, however, staff are encouraged to use and adapt the assessment task and the success criteria to their school context. Staff may like to enhance or amend sections of the task. Staff may like to adapt the rubric to assign marks to the descriptors in order to differentiate between responses that address the same statement. All changes are the responsibility of the staff using the assessment.