Mathematics Stage 5   
(Year 9) – assessment task notification

How can we provide for tomorrow’s healthcare?

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# How can we provide for tomorrow's healthcare?

**Type of task:** Presentation

**Outcomes being assessed:**

* 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 **MA0-WM-01**
* solves financial problems involving simple interest, earning money and spending money **MA5-FIN-C-01**
* determines the midpoint, gradient and length of an interval, and graphs linear relationships, with and without digital tools **MA5-LIN-C-01**
* graphs and interprets linear relationships using the gradient/slope-intercept form  
   **MA5-LIN-C-02**

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# Task description

How can we provide for tomorrow’s healthcare? As the population expands and gets older, the cost of health care increases.

You are to select a health sector profession and research the current and future salary levels and staffing numbers necessary within this profession You will also research incentives that could be used to increase employment numbers within your chosen profession.

## Presentation

You will create a presentation for the NSW government that outlines the projected spending on employee wages over the next 30 years, and incentives to increase employment numbers within your chosen health sector profession. The government will be using this presentation as the basis for their budget proposal for the health sector, so all calculations are to be submitted to support the presentation.

The following headings are to guide your thinking. How you organise and present the content is up to you.

### Current workforce modelling

You are to inform the government of how many employees they should be budgeting for over the next 30 years.

1. Use the NSW health ‘Allied health workforce modelling’ website ([bit.ly/healthworkforcemodelling](https://bit.ly/healthworkforcemodelling)) to select a health care profession. Assume your audience will have limited understanding of the profession so a brief explanation of what the profession does and why it is important should be included.
2. Using the 2021 and 2040 headcount numbers, construct a linear model, consisting of a graph and an equation, for the chosen profession. Present your model explaining how you formulated it and its important features (using the marking rubric as a guide to the details needed).
3. Use the model to determine the workforce numbers for next year, as well as for 2030 and 2050.
4. Identify and describe any limitations of your linear model in the practical context.

### Health care costs

You are to inform government of the amount of money to budget per employee in your chosen health care profession.

1. Use the ‘Salary in Australia’ website ([au.talent.com/salary](https://au.talent.com/salary)) to find the average entry-level, median and experienced salaries for your chosen profession.
2. Explain why there are different salaries for employees within the same profession.
3. Salary packages typically include the base salary as well as other components such as superannuation, leave loading and sick leave. Calculate the following for a median level employee, and state what percentage of their salary, each of the following represents:

* PAYG tax (assuming they claim the tax-free threshold)
* Leave loading
* Sick leave (10 days).

### Increasing and retaining staff

To keep up with the cost of living, the government has decided to adjust salaries to increase and retain employees.

1. Using the median salary, graph the linear model and show the equation of this model. Explain what this linear model represents and why it may not be the best model for an employee.
2. If salaries were to increase by 3% each year, use the simple interest formula, to find the salary for all types of employees (entry-level, median and experienced) in the chosen profession in 2040. Use this to determine the minimum cost to the government in 2040 using the number of employees needed and their salary.
3. Create a linear model, to find the value of the median salary at any point in time if salaries increase by 3% each year. Identify and describe any limitations of your linear model in the practical context.
4. The government needs to attract people to the profession but has a limited budget. Read the infographic below titled ‘Employment incentives’. By spending no more than 5% of current salary levels, choose and justify 2 incentives from different sections that the government could introduce to retain staff and increase staff numbers.

Employment incentives infographic showing various employment incentives including:
Financial - sign on bonus, loyalty bonus, increase in salary.
Working conditions - work from home, flexible working week, part time work options.
Professional - mentoring programs, fast track promotional programs, professional development.
Added Extras - rental assistance, company car, travel allowance.
Health and wellbeing - gym membership, flu vaccinations, wellbeing service.
Social recognition - employee of the month, birthday celebrations, morning tea Friday.

1. Create a linear model for each of your chosen incentives. The model should show the cost of a median employee at any point in time. Explain what effect your chosen incentives have on the equation or graph in your model, compared to the equation or graph of other incentives, such as increasing salaries by 3%. Justify which of your 2 chosen incentives would be preferable for employees.

# Submission details

## Presentation format

This assessment task will be delivered as a presentation, which could be in a range of formats including, but not limited to a:

* live presentation
* video presentation
* speech with a poster.

## What to submit

Students should submit the following:

Presentation, including the slides and/or poster

Working and calculations

Notes, script or speech

Bibliography.

# What is the teacher looking for?

This outline uses the criteria points from the marking guidelines to articulate the features required in your presentation to best demonstrate your skills and knowledge. It highlights what is expected in chosen work samples and reflections.

The teacher is looking to see how well you:

* choose and apply mathematical techniques to solve problems
* communicate your thinking and reasoning
* justify your decisions when solving problems
* solve linear equations arising from substituting into formulas
* represent word problems as linear equations
* calculate weekly, fortnightly and monthly earnings
* calculate leave loading
* calculate incentives and other methods of pay
* use tables, online calculators, or calculations to calculate tax payable
* justify what payments are additional costs for an employer
* apply the simple interest formula
* graph linear relationships using coordinates and features of linear equations
* identify gradients and intercepts and explain their effect on the graph
* find the equation of a line
* recognise and describe linear relationships in real-life contexts.

# Marking guidelines

The assessment marking guidelines in Table 1 are organised into the skills students have the opportunity to demonstrate within the outcomes being assessed, **MAO-WM-01**, **MA5-FIN-C-01**, **MA5-LIN-C-01** and **MA5-LIN-C-02**. Teachers are encouraged to review the student presentation and submissions with these skills in mind before using Table 1 to decide on the level to which the skill has been demonstrated.

Table – assessment marking guidelines

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Criteria | Working towards developing | Developing | Developed | Well developed | Highly developed |
| Working mathematically  MAO-WM-01 | Communicates with very limited mathematical language and attempts to use informal mathematical reasoning. | Uses limited mathematical language.  Uses informal mathematical reasoning. | Uses mathematical language to communicate and explain solutions.  Uses informal mathematical reasoning to prove or justify results. | Uses appropriate mathematical language effective to communicate reasoning, explain solutions and justify results. | Uses precise mathematical language consistently and effectively to communicate reasoning, explain solutions and justify results. |
| Working mathematically  MAO-WM-01  Financial mathematics  MA5-FIN-C-01 | Displays limited understanding of why employees are paid differing amounts. | Provides some reasoning for why there are different salaries for employees within the same profession. | Provides detailed explanation of why there are different salaries for employees within the same profession. |  |  |
|  | Shows understanding that daily and weekly pay will be less than a salary. | Correctly calculates daily and weekly pay from a salary. |  |  |  |
|  | Uses an online tool to calculate PAYG tax for a given salary ([bit.ly/onlinetaxcalc](https://bit.ly/onlinetaxcalc)). | Attempts to find PAYG tax by using a published tax table ([bit.ly/ATOtaxtables](https://bit.ly/ATOtaxtables)) | Correctly calculates PAYG tax by using a published tax table ([bit.ly/ATOtaxtables](https://bit.ly/ATOtaxtables)). | Calculates PAYG tax by using published tax brackets ([bit.ly/ATOincometaxrates](https://bit.ly/ATOincometaxrates)) |  |
|  | Calculates a percentage of a quantity. | Calculates a percentage increase of a quantity. | Correctly calculates total pay for the holiday period. |  |  |
|  |  | Uses the simple interest formula with minor errors. | Consistently uses the simple interest formula with different amounts, interest rates and time periods. |  |  |
|  | States an appropriate bonus or incentive that may be used to attract more staff. | Provides calculations or attempts to provide reasoning to support chosen bonus or incentive. | Provides a brief explanation of 2 incentives to attract staff and uses some calculations to support their reasoning. | Detailed explanation and justification of 2 incentives that could be used to retain and increase staff numbers. Explanation includes a comparison of the 2 methods with supporting calculations to demonstrate that the incentive will comply with the 5% spending limit. | Sophisticated explanation and justification of 2 incentives that could be used to retain staff and increase staff numbers. Explanation includes a comparison of the 2 methods and supporting calculations to demonstrate that the incentive will comply with the 5% spending limit. Explanation considers the effect of incentives on different salary levels. |
| Working mathematically  MAO-WM-01  Linear relationships A  MA5-LIN-C-01  Linear relationships B  MA5-LIN-C-02 | Attempts to create a table of values and/or plots points to create a linear graph. | Constructs a table of values and/or plots 2 or more points to create a linear graph. | Creates a linear graph with appropriate scales for each axis. |  |  |
|  | Attempts to calculate the gradient of the graph by finding either the rise or the run.  Can identify the y-intercept of a line. | Calculates the gradient of linear model from the graph. | Correctly calculates the gradient of linear model using 2 points.  Finds the equation of the linear graph. | Interprets the y-intercept and gradient of the graph within the given context.  Provides an explanation of how the linear model was created. | Provides a detailed explanation of the method used to create the linear model and accurately interprets the y-intercept and gradient for the given context. |
|  | Attempts to use the graph to interpolate workforce numbers for next year and 2030. | Correctly uses the graph to interpolate workforce numbers for next year and 2030. | Correctly uses the graph to extrapolate workforce numbers for 2050 or uses the equation to find workforce numbers. | Correctly calculates workforce numbers and identifies a limitation of the linear model within the context. | Correctly calculates workforce numbers and provides a detailed explanation of the limitations of the linear model within the context. |
|  |  | Correctly states the equation of the line | Correctly graphs the line , and states the equation of the line. | Correctly creates a model for and provides an explanation of what this model represents. | Correctly creates a model for and provides an explanation of what this model represents, justifying why this may not be the best model for an employee. |
|  |  | Attempts to create a linear model involving either a table of values, or a graph, which incorporates a chosen incentive. | Creates a simple linear model that incorporates a chosen incentive. | Creates linear models for the 2 chosen incentives and provides a brief explanation of the affect the incentives have had on the model. | Creates a linear model that includes the 2 chosen incentives. Provides a detailed explanation of the effect that the incentives have on the model by comparing and contrasting this model with previous models. |

# Teacher notes

The examples in this package are provided so that schools and teachers may choose relevant information and adjust the assessment for their contexts and school-based practices. Relevant information should be transferred onto the school’s assessment task template.

## Presentation formats

This assessment task is a presentation. Students should be given the choice of how they wish to deliver their presentation to match their knowledge and skills. Depending on student access and computer literacy, we suggest students could use the following software:

* [Microsoft PowerPoint](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/116?clearCache=147dc940-ae6c-ca26-43ab-afcde2068176)
* [Microsoft Sway](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/123?clearCache=8ebabd9c-a046-3ede-e007-f2945133f7d0)
* [Flip](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/184?clearCache=9c5d1087-d352-3faf-4314-453c56efd142)
* [Google Slides](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/70?clearCache=ad0d2f1a-332d-523e-ab5-70e5e274d723)
* [Desmos](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/139?clearCache=a1c2b906-adf1-332d-501d-3ee829b3bf)
* [Loom](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/623?clearCache=2bdd804a-63e1-a05f-d27-dfa38a2f3d59).

## Suggested opportunities for differentiation

* Some students may benefit from scaffolding the task and/or handing out one section or question at a time.
* The teacher can model the use of the website to identify numbers needed to start the task.
* Students can use online software, such as Desmos, to help create their models.
* To extend students, teachers could have them research other payment considerations such as bonuses, allowances and superannuation when looking at costs associated with an employee.
* Scaffolds can be provided for calculations to enable student entry points.
* Students can be provided with some of the graphs to comment on, rather than graphing their own.
* Students could be extended by looking into compound interest and non-linear graphs to better represent the situation.

## Sample solution

These solutions are not intended as marking guidelines, and do not necessarily show correct answers. They are designed to provide an example of a typical response from a student working at a Year 9 level.

A variety of responses are expected for this task.

For attracting and retaining staff, students could suggest:

* increasing the rate of the pay rise per year to a number higher than 3%.
* increasing staff salaries higher than what they are presently.
* giving staff a bonus every year of a given amount.

A sample video solution is available by [clicking this link](https://players.brightcove.net/6197335233001/default_default/index.html?videoId=6345907008112).

### Sample marking guidelines

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
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| Working mathematically  MAO-WM-01 | Communicates with very limited mathematical language and attempts to use informal mathematical reasoning. | Uses limited mathematical language.  Uses informal mathematical reasoning. | Uses mathematical language to communicate and explain solutions.  Uses informal mathematical reasoning to prove or justify results. | Uses appropriate mathematical language effective to communicate reasoning, explain solutions and justify results. | Uses precise mathematical language consistently and effectively to communicate reasoning, explain solutions and justify results. |

**Comment:** the student shows consistent use of mathematical language to communicate throughout the presentation. Their approach to each section uses mathematical reasoning to explain and justify every choice made to create their models and solve problems. This can be seen in their use and explanations of how to find the gradient and how that effects the line graphically and algebraically.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Criteria | Working towards developing | Developing | Developed | Well developed | Highly developed |
| Working mathematically  MAO-WM-01  Financial mathematics  MA5-FIN-C-01 | Displays limited understanding of why employees are paid differing amounts. | Provides some reasoning for why there are different salaries for employees within the same profession. | Provides detailed explanation of why there are different salaries for employees within the same profession. |  |  |
|  | Shows understanding that daily and weekly pay will be less than a salary. | Correctly calculates daily and weekly pay from a salary. |  |  |  |
|  | Uses an online tool to calculate PAYG tax for a given salary ([bit.ly/onlinetaxcalc](https://bit.ly/onlinetaxcalc)). | Attempts to find PAYG tax by using a published tax table ([bit.ly/ATOtaxtables](https://bit.ly/ATOtaxtables)) | Correctly calculates PAYG tax by using a published tax table ([bit.ly/ATOtaxtables](https://bit.ly/ATOtaxtables)). | Calculates PAYG tax by using published tax brackets ([bit.ly/ATOincometaxrates](https://bit.ly/ATOincometaxrates)). |  |
|  | Calculates a percentage of a quantity. | Calculates a percentage increase of a quantity. | Correctly calculates total pay for the holiday period. |  |  |
|  |  | Uses the simple interest formula with minor errors. | Consistently uses the simple interest formula with different amounts, interest rates and time periods. |  |  |
|  | States an appropriate bonus or incentive that may be used to attract more staff. | Provides calculations or attempts to provide reasoning to support chosen bonus or incentive. | Provides a brief explanation of 2 incentives to attract staff and uses some calculations to support their reasoning. | Detailed explanation and justification of 2 incentives that could be used to retain and increase staff numbers. Explanation includes a comparison of the 2 methods with supporting calculations to demonstrate that the incentive will comply with the 5% spending limit. | Sophisticated explanation and justification of 2 incentives that could be used to retain staff and increase staff numbers. Explanation includes a comparison of the 2 methods and supporting calculations to demonstrate that the incentive will comply with the 5% spending limit. Explanation considers the effect of incentives on different salary levels. |

**Comment:** the student explains why there are different salaries for employees with reference to experience in the role and moving higher in the managing ranks as you progress through your career. The tax was calculated using the published online tables. This could be improved by using the published tax brackets to show they can calculate tax algebraically. The student uses correct strategies to find the total pay for the holiday period, inclusive of finding the percentage increase. They also used their skills in substitution to effectively and consistently use the simple interest formula. The student thought deeply about the incentives chosen, stating benefits to the employee and benefits to the employer in terms of the cost outlay as well as wellbeing and morale, and in doing so have compared the 2 incentives selected. They have also shown mathematically that they meet the 5% threshold with strong communication, making it easy to see in a table format. They have also shown the difference, or lack of, for each level employee, showing that this can change the cost to the employer.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Criteria | Working towards developing | Developing | Developed | Well developed | Highly developed |
| Working mathematically  MAO-WM-01  Linear relationships A  MA5-LIN-C-01  Linear relationships B  MA5-LIN-C-02 | Attempts to create a table of values and/or plots points to create a linear graph. | Constructs a table of values and/or plots 2 or more points to create a linear graph. | Creates a linear graph with appropriate scales for each axis. |  |  |
|  | Attempts to calculate the gradient of the graph by finding either the rise or the run.  Can identify the y-intercept of a line. | Calculates the gradient of linear model from the graph. | Correctly calculates the gradient of linear model using 2 points.  Finds the equation of the linear graph. | Interprets the y-intercept and gradient of the graph within the given context.  Provides an explanation of how the linear model was created. | Provides a detailed explanation of the method used to create the linear model and accurately interprets the y-intercept and gradient for the given context. |
|  | Attempts to use the graph to interpolate workforce numbers for next year and 2030. | Correctly uses the graph to interpolate workforce numbers for next year and 2030. | Correctly uses the graph to extrapolate workforce numbers for 2050 or uses the equation to find workforce numbers. | Correctly calculates workforce numbers and identifies a limitation of the linear model within the context. | Correctly calculates workforce numbers and provides a detailed explanation of the limitations of the linear model within the context. |
|  |  | Correctly states the equation of the line | Correctly graphs the line , and states the equation of the line. | Correctly creates a model for and provides an explanation of what this model represents. | Correctly creates a model for and provides an explanation of what this model represents, justifying why this may not be the best model for an employee. |
|  |  | Attempts to create a linear model involving either a table of values, or a graph, which incorporates a chosen incentive. | Creates a simple linear model that incorporates a chosen incentive. | Creates linear models for the 2 chosen incentives and provides a brief explanation of the affect the incentives have had on the model. | Creates a linear model that includes the 2 chosen incentives. Provides a detailed explanation of the effect that the incentives have on the model by comparing and contrasting this model with previous models. |

**Comment:** the student created multiple graphs that displayed appropriate scales, creating graphs that were easy to interpret and read. The student provided details including explaining using the x-axis when plotting horizontal lines and explained what it meant to have a horizontal graph, and how to find the equation of lines using the data provided. They explained that the y-intercept was their current wage and used this as a base for their model moving forward. When calculating the workforce numbers for 2030 and 2050 the student shows they were competent in calculating the values but would improve by including an explanation of the limitation they mentioned in their presentation. The student justified to the employee what option was in their best interest, including the horizontal line of the salary not changing. They compared all the models not only in context, but also mathematically, such that someone else may be able to adjust the model to changes in the future such as a change in gym membership costs.

# References

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