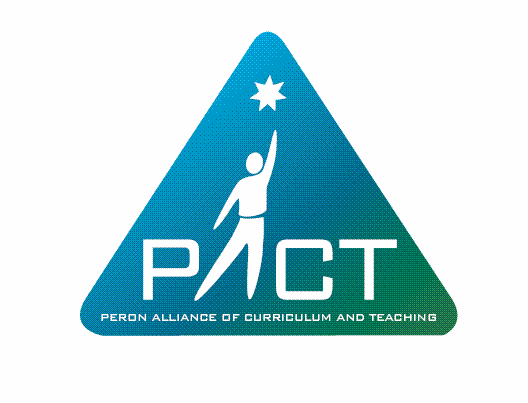
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| Name: | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | | |  |
| Baldivis logo cropped | **Mathematics Applications Unit 3 & 4 Year 12**  **Investigation 2, 2020**  **Topic – Networks Investigation** | | | |  |
| **Equipment:** | *SCSA Formula sheets, CAS calculator* | | | | |
|  | | | | | |
| **Date out:** | | *Week \_\_\_\_ Date \_\_\_\_\_\_\_\_* | **Date Due:** | *Week \_\_\_\_ Date \_\_\_\_\_\_\_\_* | |
| **Task Weighting:** | | *5% of the year* |  |  | |
| **Important Information:**  In this topic (Graphs and Networks) you have studied ways of constructing different types of networks to model practical situations. For this investigation you are required to decide on a tour around local places of interest. Your mathematical investigation will be recorded in a report, the suggested format of which is on page 3. | | | | | |

**Chinese postman problem:**

This problem involves minimising the total distance walked by a postman delivering mail. The postman must begin and end his journey at one vertex of the network and must visit each edge of the network at least once.

It is based on **Euler’s** findings of **traversable** graphs.

Remember that a traversable graph is one that can be drawn without taking a pen from the paper and without retracing an edge.

In graph theory you are trying to find an **Eulerian Trail** if one exists.

**Travelling salesman problem:**

This problem involves minimising the total distance travelled by a salesman to visit a range of different places. The salesman must begin and end his journey at one vertex within the network and must visit each vertex at least once.

Ideally, you want to find a **Hamiltonian Cycle** (where each vertex is visited exactly once, starting and finishing at the same vertex) of minimum weight.

**No one has yet found an algorithm to solve this problem!**

The only way to minimise the tour is to find all of them and pick the shortest, which in most cases is not practical as there are too many possibilities.

**Part 1: Formulate the problem to be solved**

A group of exchange students will be visiting Baldivis Secondary College later in the year. You have been asked to plan a tour for them to show them some of the top tourism locations in the Perth metropolitan area over three days. The intention is to give the visitors a good idea of the history and culture of Perth.

Your task is to design an itinerary for the entire time. You should describe the route in detail, giving estimates of the journey distance between each place and the next, the time you are allowing for each part of the journey and the time to be spent at each stop for activities planned.

You need to include the following locations:

* WA Maritime Museum
* Kings Park
* Rockingham foreshore
* Rottnest Island
* Cottesloe Beach
* As well as 5 other locations and activities of your choice that helps paint a picture of Perth.

The exchange students will be living in Baldivis.

**Part 2: Solve the basic problem**

Create the network diagram from the basic information you have collected and solve the problem(s) you have posed.

You will need to be clear about the types of transport used. You are permitted to use a mix of transport. You will also need to be provide details of your choice of travel route.

**Part 3: Investigate the effects of possible changes**

Provide a contingency plan should COVID-19 restrictions be increased in Western Australia, clearly show what changes will occur.

Restrictions include:

* Beaches being closed
* A maximum of 60 minutes allowable in public spaces like parks
* Travel restricted to within postcode regions with only essential services being exempt

**Part 4: Conclusion**

Analyse and compare your results from Part 2 and 3, including the reasonableness of your prediction. Your discussion should include consideration of the effects of simplifying assumptions and the limitations on the practicality and reliability of your solution.

**Writing up your work**

* Provide an outline of the problem to be explored
* Explain how you identified and found the appropriate data
* Explain the method you used to find a solution
* Explain the application of the mathematics involved, including:
  + Generation or collection of relevant data and information, with a summary of the process of collection
  + Mathematical calculations and results, with appropriate representations
  + Discussion and interpretation of results, including consideration of the reasonableness of your results.
* Draw conclusions and summarise your findings
* A bibliography and appendices if appropriate

The format of an investigation report may be written or multimodal.

The report should be a maximum of six pages, including diagrams, if written or the equivalent in multimodal form.

SCSA Grade descriptions have been provided to give you information on what to include in your report in order to maximise your achievement.

**SCSA Grade Descriptors**

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| **A** | **Identifies and organises relevant information**  Identifies and organises relevant information for complex problems involving a series of steps or processes.  Defines variables from text to draw networks and diagrams.  Organises data in a concise, clear format and appropriately presents it in tabular, diagrammatic and/or graphical form.  Identifies the underlying assumptions related to the relevant mathematics of an investigation. |
| **Chooses effective models and methods and carries through the methods correctly**  Accurately applies mathematical knowledge and understanding to solve unstructured problems using sub-problems.  Generalises and extends models from previous parts of the question.  Translates between representations in unpractised ways.  Selects appropriate calculator techniques to solve multi-step problems in unfamiliar contexts.  Selects and appropriately uses numerical, graphical, symbolic and statistical methods to develop mathematical ideas.  Produces results, carries out analysis and generalises in situations requiring investigative techniques. |
| **Follows mathematical conventions and attends to accuracy**  Follows mathematical conventions and attends to accuracy in non-routine situations.  Provides concise and accurate solutions to mathematical problems set in applied and theoretical contexts.  Selects, extends and applies mathematical and/or statistical procedures to investigate a problem. |
| **Links mathematical results to data and contexts to reach reasonable conclusions**  Recognises implied conditions in real-life applications and defines and explains the limitations of models.  Interprets the result and draws the correct conclusion about the effect of changing conditions.  Considers the strengths and limitations of an investigation and refines the results to make sensible conclusions. |
| **Communicates mathematical reasoning, results and conclusions**  Sets out the steps of the solution in a clear and logical sequence, including suitable justification and explanation of methods and processes used.  Adds a detailed diagram to illustrate and use in the solution of a problem.  Presents work with the final answer clearly identified, using the correct units and relating to the context of the question.  Communicates investigation findings with a comprehensive interpretation of mathematical results in the context of the investigation. |

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| **B** | **Identifies and organises relevant information**  Identifies and organises relevant information for problems involving a few steps or processes.  Draws a network or diagram and labels with appropriate variables.  Organises data clearly and appropriately presents it in tabular, diagrammatic and/or graphical form.  Identifies suitable variables and constant parameters related to various aspects of an investigation. |
| **Chooses effective models and methods and carries through the methods correctly**  Selects an appropriate strategy and applies mathematical knowledge to solve problems that contain a few steps.  Translates between representations in practised ways.  Selects appropriate calculator techniques to solve multi-step problems.  Selects and appropriately uses numerical, graphical, symbolic and statistical methods to develop mathematical ideas.  Attempts to analyse and calculate specific cases of generalisation in situations requiring investigative techniques. |
| **Follows mathematical conventions and attends to accuracy**  Interprets and uses mathematical terminology, symbols and conventions in routine situations.  Rounds, unprompted, to suit context or correctly to specified accuracy.  Completes mostly accurate solutions to mathematical problems set in applied and theoretical contexts.  Selects and applies mathematical and/or statistical procedures previously learnt to investigate a problem. |
| **Links mathematical results to data and contexts to reach reasonable conclusions**  Identifies specified conditions in real-life applications, recognises and rejects inappropriate solutions.  Links the effect of changing conditions to the original solution.  Uses examples in mathematical analysis of an investigation and draws valid conclusions related to a given context. |
| **Communicates mathematical reasoning, results and conclusions**  Carries through calculations and simplifications in a clear sequence, showing a logical line of reasoning.  Defines variables associated with a given diagram and uses them in the working of a problem.  Presents work with the final answer clearly identified and using the correct units.  Communicates investigation findings in a systematic and concise way using mathematical language and relating the solution to the original problem or statement. |

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| **C** | **Identifies and organises relevant information**  Identifies and extracts key information needed to solve a familiar problem.  Identifies variables in a network or diagram.  Organises some data and presents it in tabular, diagrammatic and/or graphical form.  Identifies some mathematical content related to various aspects of an investigation in a given context. |
| **Chooses effective models and methods and carries through the methods correctly**  Selects a strategy and applies mathematical knowledge to answer structured questions that require short responses.  Recognises and uses information in different representations.  Uses familiar calculator applications to solve routine problems.  Selects appropriate numerical, graphical, symbolic and statistical methods to carry through a single thread of reasoning in situations requiring investigative techniques. |
| **Follows mathematical conventions and attends to accuracy**  Applies mathematical definitions, rules and procedures in practised situations.  Applies basic conventions for diagrams and graphs.  Rounds appropriately in a given context and to specified accuracy in short responses.  Generates some accurate and generally complete solutions to mathematical problems set in applied and theoretical contexts.  Selects and applies, with direction, mathematical and/or statistical procedures previously learnt to investigate a problem. |
| **Links mathematical results to data and contexts to reach reasonable conclusions**  Identifies specified conditions in real-life applications and recognises inappropriate solutions in routine problems.  Recognises that changing conditions will affect the outcome.  Makes inferences from analysis and uses these to draw conclusions related to an investigation. |
| **Communicates mathematical reasoning, results and conclusions**  Shows adequate working and supports answers with simple or routine statements.  Relates the working to a labelled diagram that has been given as part of the question.  Presents a solution but the final answer is not always clearly identified.  Communicates investigation findings in a systematic way using some mathematical expression and everyday language. |