PICTON HIGH SCHOOL

Creating Opportunities Achieving Success

YEAR 12

HSC MATHEMATICS GENERAL 2

Due Date: Tuesday 6th February 2018, 3:20pm	**Assessment Name:** PROJECT – Water Resources
Mark: /25	**Weighting: 10%**

SYLLABUS OUTCOMES TO BE ASSESSED:

MG2H-1 **uses** mathematics and statistics to **evaluate** and **construct** arguments in a range of familiar and unfamiliar contexts

MG2H-2 **analyses** representations of data in order to make inferences, predictions and conclusions

MG2H-4 **analyse** two dimensional and three dimensional models to solve practical problems, ~~including those involving spheres and non-right angled triangles~~

MG2H-5 **interprets** the results of measurements and calculations and makes **judgements** about reasonableness including the degree of accuracy of measurements and calculations and the conversion to appropriate units

MG2H-9 chooses and uses appropriate technology to locate and **organise** information from a range of contexts

MG2H-10 **uses** mathematical argument and reasoning to **evaluate** conclusions drawn from other sources, communicating a position clearly to others, and **justifies** a response.

DIRECTIVES TO BE ASSESSED:

Analyse	Identify components and the relationship between them; draw out and relate implications
Construct	Make; build; put together items or arguments
Evaluate	Make a judgement based on criteria; determine the value of
Interpret	Draw meaning from
Organise	Arrange into a structured whole; order.
Judgement	The forming of an opinion, estimate, notion, or conclusion, as from circumstances presented
Justify	Support an argument or conclusion

TASK DESCRIPTION:

Scenario:

You are building a new house and you have been told that council requires all new builds to have a 25,000 litre water tank installed on the property for household usage. This tank will retain rainwater and could also be filled through the purchase of water if needed.

Your house block is 700m^2 and your house is 220m^2. The tank that you will eventually purchase must fit onto your house block. You have chosen to look at cylindrical and rectangular prism tanks.

<u>You must complete:</u>

<u>Part A:</u> (12 marks) MG2H-1, MG2H-4, MG2H-5

Calculate the dimensions of **TWO** water tanks (one cylindrical and one rectangular prism) and **interpret** your calculations to **construct** an argument for which tank would best fit your house block. **Analyse** these tanks and **evaluate** the dimensions of each of the two water tanks based on the conditions given above. **Judge** whether your results are reasonable within the degree of accuracy required. Sketch your water tank, showing the dimensions you have found. Show all working and calculations within 2 decimal places. Convert your calculated volume from m^3 into litres.

Part B: (4 marks) MG2H-2 & MG2H-9
Analyse your household water usage data using **Table 1**. **Use** this data to make inferences, predictions and conclusions about the monthly household water usage by completing the calculations in **Table 2**. Choose and use the appropriate websites to locate and **organise** information for the historical mean monthly rainfall of Picton. Complete **Table 3** using this data.

Part C: MG2H-10 **(9 marks)**
Using the calculations and collected data from Part A and Part B, **evaluate** the suitability of the council's tank requirement as it relates to your new home and family usage, **justifying** your response with mathematical reasoning.

ASSESSMENT CRITERIA – STUDENT CHECKLIST:
Make sure you:

- Completed Part A on the paper scaffold attached, showing *diagrams* and *full solutions*
- Completed Part B on the paper scaffold attached, showing *full solutions*
- Completed Part C on the paper scaffold attached, showing *full solutions*
- *Submit this entire package, including marking guidelines*

MARKING GUIDELINES - Part A	
MG2H-5, MG2H-4, MG2H-1	**Mark**
MG2H-5 **Extensive** interpretation the results of measurements and calculations and makes judgements about reasonableness including the degree of accuracy of measurements and calculations and the conversion to appropriate units MG2H-4 **Extensive** analysis of two dimensional and three dimensional models to solve practical problems MG2H-1 **Extensive** use of mathematics and statistics to evaluate and construct arguments in a range of familiar and unfamiliar contexts ● Correct solutions with extensive reasoning given	12
MG2H-5 **Thorough** interpretation the results of measurements and calculations and makes judgements about reasonableness including the degree of accuracy of measurements and calculations and the conversion to appropriate units MG2H-4 **Thorough** analysis of two dimensional and three dimensional models to solve practical problems MG2H-1 **Thorough** use of mathematics and statistics to evaluate and construct arguments in a range of familiar and unfamiliar contexts ● Mostly correct solutions with thorough reasoning given	9-11
MG2H-5 **Sound** interpretation the results of measurements and calculations and makes judgements about reasonableness including the degree of accuracy of measurements and calculations and the conversion to appropriate units MG2H-4 **Sound** analysis of two dimensional and three dimensional models to solve practical problems MG2H-1 **Sound** use of mathematics and statistics to evaluate and construct arguments in a range of familiar and unfamiliar contexts ● Mostly correct solutions with sound reasoning given	6-8
MG2H-5 **Basic** interpretation the results of measurements and calculations and makes judgements about reasonableness including the degree of accuracy of measurements and calculations and the conversion to appropriate units MG2H-4 **Basic** analysis of two dimensional and three dimensional models to solve practical problems MG2H-1 **Basic** use of mathematics and statistics to evaluate and construct arguments in a range of familiar and unfamiliar contexts ● Partly correct solutions with basic reasoning given	3-5
MG2H-5 **Limited** interpretation the results of measurements and calculations and makes judgements about reasonableness including the degree of accuracy of measurements and calculations and the conversion to appropriate units MG2H-4 **Limited** analysis of two dimensional and three dimensional models to solve practical problems MG2H-1 **Limited** use of mathematics and statistics to evaluate and construct arguments in a range of familiar and unfamiliar contexts ● No attempt or limited reasoning given	0-2

MARKING GUIDELINES - Part B	
MG2H-2, MG2H-9	**Mark**
MG2H-2 Analyses representations of data in order to make inferences, predictions and conclusions MG2H-9 Chooses and uses appropriate technology to locate and organise information from a range of contexts ● Indicates number of adults and children in household ● Gives full solutions for calculations in Table 2 ● Indicates source used to complete Table 3 ● Completes Table 3 correctly	4
MG2H-2 Analyses representations of data in order to make inferences, predictions and conclusions MG2H-9 Chooses and uses appropriate technology to locate and organise information from a range of contexts ● Completes all parts with only one or two errors	3
MG2H-2 Analyses representations of data in order to make inferences, predictions and conclusions MG2H-9 Chooses and uses appropriate technology to locate and organise information from a range of contexts ● Completes most of the parts with 3 or 4 errors	2
MG2H-2 Analyses representations of data in order to make inferences, predictions and conclusions MG2H-9 Chooses and uses appropriate technology to locate and organise information from a range of contexts ● Completes some of the parts with more than 4 errors	1
MG2H-2 Analyses representations of data in order to make inferences, predictions and conclusions MG2H-9 Chooses and uses appropriate technology to locate and organise information from a range of contexts ● No attempt or entirely incorrect	0

MARKING GUIDELINES-Part C	
MG2H-10	**Mark**
MG2H-10 **Extensive** use of mathematical argument and reasoning to evaluate conclusions drawn from other sources, communicating a position clearly to others, and justifies a response. ● Completes all calculations, showing full solutions ● Makes reference to data and calculations to make position clear ● Clearly explains the relevance of other factors	8-9
MG2H-10 **Thorough** use of mathematical argument and reasoning to evaluate conclusions drawn from other sources, communicating a position clearly to others, and justifies a response. ● Completes most of the above	6-7
MG2H-10 **Sound** use of mathematical argument and reasoning to evaluate conclusions drawn from other sources, communicating a position clearly to others, and justifies a response. ● Completes some of the above	4-5
MG2H-10 **Basic** use of mathematical argument and reasoning to evaluate conclusions drawn from other sources, communicating a position clearly to others, and justifies a response. ● Completes little of the above	2-3
MG2H-10 **Limited** use of mathematical argument and reasoning to evaluate conclusions drawn from other sources, communicating a position clearly to others, and justifies a response. ● Completes very little or none of the above	0-1

PART A: Tank Calculations Scaffold /12

Sketch TWO different water tanks in the spaces below. Add in the dimensions you have found that allows the total capacity to lie between 24 900 litres and 25 100 litres.

Convert the capacity required by council to m^3 _____ **/1**

WATER TANK ONE - Cylinder

- ❑ Sketch your water tank clearly and label
- ❑ Calculate feasible dimensions (radius and height) of water tank
- ❑ Converts final volume found of the water tank from m^3 to litres
- ❑ Ensure the capacity meets the requirements of accuracy (between 24 900 and 25 100 litres)
- ❑ Volume calculations are correct and submitted

/5

WATER TANK TWO - Rectangular prism

- ❑ Sketch your water tank clearly and label
- ❑ Calculate feasible dimensions (height, width, depth) of water tank
- ❑ Converts final volume found of the water tank from m^3 to litres
- ❑ Ensure the capacity meets the requirements of accuracy (between 24 900 and 25 100 litres)
- ❑ Volume calculations are correct and submitted

/5

Your house block is $700m^2$ and your house is $220m^2$. The tank that you will eventually purchase must fit onto your house block.

◯ **Interpret** your calculations for each tank to **justify** which tank would best fit your house block.

Refer to your calculations in your answer.

/1

PART B: Water Use and Rainfall Recording Scaffold /4

TABLE 1: This shows the amount of water used for each of the purposes listed:
(Use the information from this table to complete Table 2)

Purpose	Water used
Toilet	13 litres per flush
Bath	120 litres per bath
Shower	250 litres per shower
Dish Washing	60 litres per wash
Clothes Washing	265 litres per load
Hand Washing	5 litres per wash
Teeth cleaning	5 litres per person per clean
Drinking	2 litres per person per day

TABLE 2: You must calculate the total monthly household water usage for **YOUR** HOUSEHOLD of:
.. .……adults (over 14yrs) and
……..children, based on the average water usage shown in TABLE 1. **/2**

Purpose	Average use per day per family	Provide your answer here, showing all calculations: Monthly water usage (30 days) for YOUR household
Toilet	5 times per day per person	
Bath	1 bath per day per child	
Shower	1 shower per day per adult	
Dish Washing	1 Dish Washing per family per day	
Clothes Washing	1 load per family per day	
Hand Washing	Each person 7 times per day	
Teeth cleaning	Each person 2 times per day	
Drinking	Each person has 2 litres per day	

TABLE 3: You are to look up the historical mean monthly rainfall for Picton, using either of the websites provided and complete the following table.

- http://weather.mla.com.au/climate-history/nsw/picton SOURCE A
- http://www.bom.gov.au/climate/averages/tables/cw_068052.shtml SOURCE B

Circle the source above you have used to complete the table below.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

/2

PART C - Tank Suitability Scaffold /9

1. Using your data collected in Part B, calculate:
    a. the TOTAL historical mean rainfall for ONE YEAR in Picton (mm) /1

    b. the total water likely to be collected in one year by your roof (nearest cubic m) /1

    c. your total annual household water usage (nearest kL) /1

2. Show calculations to predict if this tank will provide for all your water needs for one year:
    a. Calculate your deficit or surplus of rainwater, referring to Q1 above, to the nearest kL /1

    b. *If in deficit*, calculate the volume and **cost** of water needed to be purchased from Sydney Water (or alternatively, get a quote from a local water carter). *If in surplus*, calculate the total money saved by using rainwater instead of buying all your water for household use. /1

http://www.sydneywater.com.au/SW/accounts-billing/understanding-your-bill/prices-for-your-home/index.htm

3. Considering your answers to Q1 and Q2 above:
    a. Briefly comment on the suitability of the council's regulation water tank size to your family. Make reference to your collected data and solutions in Q1 and Q2 /2

    b. List at least **four** (4) other factors that should be taken into consideration in this discussion and describe the impact they may have on your calculations or decision-making. /2