 FSRe1 Water availability and usage

Outcomes

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-3 makes predictions about situations based on mathematical models, including those involving cubic, hyperbolic or exponential functions

MG2H-4 analyses 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-7 answers questions requiring statistical processes, including the use of the normal distribution, and the correlation of bivariate data

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.

New South Wales Board of Studies (2012), Mathematics General Stage 6 Syllabus, pp13-14

Rainfall data is widely available on the internet. Useful information and data can be found at the Australian Bureau of Meteorology and Sydney Water websites.

| Content | Teaching strategies and activities | Resources |
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| Interpret information about a household’s water usage, e.g. a household water bill. | Discuss water usage and how it is monitored and paid for in a household or business. Introduce the terminology associated with water usage and units used to measure it. Students could make a definition list for this task.  Access sample water usage statements and discuss the components of the statement with students (see Resource 1). Students could be given a copy of a sample statement to annotate as the discussion is held. Sydney water readily provides information about how to read a bill, with an example. Other companies also do this. Check with your local provider.  Provide examples of how to read and calculate various components from a water usage statement e.g. amount of water used, sewerage costs, total cost etc. Students solve a variety of problems (see Resource 2 and Resource 3). | A useful website for water usage statements (there are more)   * <http://www.sydneywater.com.au/sw/accounts-billing/understanding-your-bill/about-your-bill/index.htm>   Commercial textbooks, worksheets and study guides.  Past HSC papers |
| Collect and interpret data and calculate statistics on household and personal water usage. | Determine the amount and cost of water used by various household activities, including showering and bathing, washing clothes, watering the garden, washing a car, and using the toilet (see Resource 1). Use an online calculator to compare what the calculator says you should be using to actual household use.  Students log their water use over a one-week period and use this to estimate personal water usage and costs over longer time periods. Compare this to the average consumption per person in Australia (see Resource 2) and discuss the trends shown.  Provide examples of how to calculate household and personal water usage. Students solve a variety of problems involving water usage (see Resource 3 and Resource 4). | An online calculator that estimates how much water your household uses.   * <http://www.hunterwater.com.au/Save-Water/Water-Usage-Calculator.aspx>   Looks at average consumption per person in Australia over a period of time.   * <http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/1370.0~2010~Chapter~Water%20consumption%20per%20person%20(6.3.3)> * <http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/1301.0~2012~Main%20Features~Household%20water%20use%20and%20conservation~274>   Commercial textbooks, worksheets and study guides  Past HSC papers |
| Investigate household water usage in different Australian and international locations. | Access online statistics to investigate water usage across Australia and around the world (see Resource 1).  If possible provide students with raw data and get them to create a graph to compare the data. | A graph that compares some countries water usage against others. Good discussion starting point.   * <http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/1370.0~2010~Chapter~International%20comparisons%20(6.3.8)>   Statics on household water usage across Australia   * <http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/4610.0Main%20Features32012-13?opendocument&tabname=Summary&prodno=4610.0&issue=2012-13&num=&view>=   Commercial textbooks, worksheets and study guides |
| Construct and interpret rainfall graphs. | Provide students with rainfall data and use a spreadsheet or graphing tool to create graphs or to calculate summary statistics e.g. mean rainfall over a 3 year period.  Provide examples of rainfall data or graphs and have students answer specific questions about the data. Students solve a variety of problems (see Resource 2 and Resource 3). | A graph that summarises over 100 years of data for Australian rainfall. Makes notes about various interesting weather events and how it relates to the data displayed.   * <http://www.bom.gov.au/climate/cdo/about/cdo-rainfall-feature.shtml>   Use websites to find rainfall data both in Australia and Internationally   * <http://www.bom.gov.au/climate/data/> * <http://www.bom.gov.au/climate/extreme/records.shtml> * <http://www.currentresults.com/Weather/Australia/Cities/precipitation-annual-average.php> * <http://data.worldbank.org/indicator/AG.LND.PRCP.MM>   Commercial textbooks, worksheets and study guides |
| Calculate the probability of rainfall in a locality. | Collect and tabulate rainfall data to predict the probability of rain, e.g. by tabulating rainfall data from the Bureau of Meteorology, the number of days with rain in Mudgee for the past three summers can be found (see Resource 1). This data can be used to predict the probability of rain in summer in Mudgee. This could easily be extended to predict the probability of two rainy days in succession in summer in Mudgee.  Provide examples of how to calculate the probability of rainfall in a particular locality. Students solve a variety of problems (see Resource 2 and Resource 3). | A few useful websites for rainfall data (there are many more)   * <http://www.bom.gov.au/> * <http://www.bom.gov.au/climate/data/index.shtml?bookmark=136> * <http://www.weatherzone.com.au/climate/station.jsp> * <http://www.water.gov.au/WaterAvailability/Whatisourtotalwaterresource/Rainfalldistribution/index.aspx?Menu=Level1_3_1_2>   Commercial textbooks, worksheets and study guides  Past HSC papers |
| Compare rainfall in different regions, states and countries. | Collect average rainfall data from different regions, states and countries and record the data in a spreadsheet (see Resource 1 and Resource 2).  Students should use the spreadsheet to create graphs to display two or more sets of data, e.g. the rainfall in Cape York compared to the rainfall in Broken Hill or the rainfall in Australia compared to New Zealand etc.  Set specific parameters for students to research and graph data. Use graphs to discuss comparisons between different locations. Discuss and record possible reasons for the differences or similarities between different locations. | Useful map of Australia that compares the states in a simple snapshot. You can modify time period and area (within Australia)   * <http://www.bom.gov.au/jsp/ncc/climate_averages/rainfall/index.jsp>   See previous content resources plus those listed below for more websites for this task.   * <http://data.worldbank.org/indicator/AG.LND.PRCP.MM> * <http://www.climatedata.eu/>   Commercial textbooks, worksheets and study guides |
| Collect and interpret data and calculate statistics on water availability and usage at local, state and national levels. | Collect data on water availability in different locations around Australia. Compare this with the data collected regarding water usage in previous content taught. This content could be taught simultaneously with rainfall data etc. (see Resource 1 and Resource 2).  Discuss the data found and compare the water usage to water availability in different locations. Use a spreadsheet to record usage against availability and graph using an appropriate tool.  Draw conclusions about future decisions that may have to be made regarding water availability in Australian locations. | Current information about dam levels around Australia.   * <http://water.bom.gov.au/waterstorage/awris/> * http://www.water.nsw.gov.au/realtime-data/storages   A few useful websites for water availability and usage around Australia (there are many more)   * <http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/1301.0~2012~Main%20Features~Water~279> * [http://www.water.gov.au](http://www.water.gov.au/WaterUse/AustralianBureauofStatisticswateraccounts/index.aspx?Menu=Level1_4_1)   Commercial textbooks, worksheets and study guides |
| Calculate the volume of water held by tanks of various shapes and sizes. | Investigate the use and benefits of installing rainwater tanks in Australian homes. Students use various websites (see Resource 1) to find and list the advantages and disadvantages of installing a rainwater tank.  Access some different sized and shaped water tanks with dimensions provided (see Resource 1). Work in groups or as a class to calculate the volume of water that will fit inside the tank.  NOTE: Teachers may have to do some cutting and clipping of diagrams as many have the dimensions and capacity recorded.  Provide examples of how to calculate the volume of different tanks. Students solve a variety of problems (see Resource 2 and Resource 3). | A few useful websites for credit card statements (there are many more)   * <https://www.sydneywater.com.au/SW/your-home/saving-water-at-home/Rainwatertanks/index.htm> * <http://www.environment.nsw.gov.au/households/rainwater-tanks.htm> * <http://tankworld.com.au/> * <http://www.rainwatertanksdirect.com.au/>   Commercial textbooks, worksheets and study guides  Past HSC papers |
| Investigate the costs of water usage at local, state and national levels, using published data. | Teachers may want to discuss the term ‘costs’ in relation to water usage.  Does cost refer to the financial amount charged to consumers for water usage or does it refer to the environment impact of water usage in the local, state and national level?  Investigate different ‘costs’ involved in water usage from the financial to the environmental (see Resource 1).  Students could work in groups or individually to research costs for different locations (local, state and national). Costs could then be shared in a Google Document and comparison graphs created. | A few useful websites for credit card statements (there are many more)   * <https://www.sydneywater.com.au/SW/accounts-billing/understanding-your-bill/our-prices/index.htm> * <http://www.water.nsw.gov.au/water-management/fees-and-charges> * [http://www.water.gov.au](http://www.water.gov.au/WaterUse/AustralianBureauofStatisticswateraccounts/index.aspx?Menu=Level1_4_1) * <https://www.sawater.com.au/accounts-and-billing/current-water-and-sewerage-rates/residential-water-supply> * <http://www.citywestwater.com.au/residents/charges_explained.aspx> * <http://www.melbournewater.com.au/> * <http://www.urbanutilities.com.au/residential/accounts-and-billing/how-your-bill-is-calculated> * <http://www.watercorporation.com.au/my-account/your-bill-and-charges> * <http://www.taswater.com.au/Your-Account/Water-and-Sewerage-Charges>   Commercial textbooks, worksheets and study guides |