 Year 11 Mathematics Standard

Unit title: MS-M2 Working with Time

This document references the [Mathematics Standard Stage 6 Syllabus](https://syllabus.nesa.nsw.edu.au/mathematics-standard-stage6/) © 2017 [Copyright Board of Studies NSW](http://syllabus.nesa.nsw.edu.au/copyright/) for and on behalf of the Crown in right of the State of New South Wales.

Duration: 2 weeks

Rationale

Students develop awareness of being a global citizen, and appreciate the relationships between different countries in terms of location, distance and time.

Topic focus

The principal focus of this subtopic is to understand concepts related to locations on Earth’s surface and calculation of time differences using time zones.

Students develop awareness of being a global citizen and the relationships between different countries in terms of location, distance and time.

Within this subtopic, schools have the opportunity to identify areas of Stage 5 content which may need to be reviewed to meet the needs of students.

Prior knowledge required

* performs calculations of time that involve mixed units, and interprets time zones MA4-15MG
* interprets very small and very large units of measurement, uses scientific notation, and rounds to significant figures. MA5.1-9MG

Language considerations

* The difference between ‘latitude’ and ‘longitude’ need to be explicitly taught.
* Students should understand the terms “Coordinated Universal Time (UTC)”, and the “International Date Line (IDL)”

Outcomes

A student:

* solves problems involving quantity measurement, including accuracy and the choice of relevant units MS11-3
* performs calculations in relation to two-dimensional and three-dimensional figures MS11-4
* uses appropriate technology to investigate, organise and interpret information in a range of contexts MS11-9
* justifies a response to a given problem using appropriate mathematical terminology and/or calculations MS11-10

Assessment (including formative and summative)

Formative Assessment

* [A Diagnostic Test for Time](http://numeracyskills.com.au/images/pdfs/Mathematics_Stage_4_Diagnostic_Tasks.pdf) (Stage 4) is available: <http://numeracyskills.com.au/images/pdfs/Mathematics_Stage_4_Diagnostic_Tasks.pdf>
* Informal assessment could include a student verbally, or diagrammatically, explaining time zone changes from one location to another.

Summative Assessment

| Content | Teaching and learning strategies and evidence of learning | Resources |
| --- | --- | --- |
| * indicate positions on the Earth’s surface
	+ locate points on Earth’s surface using latitude, longitude or position coordinates with a globe, an atlas and digital technologies, for example, a smartphone or GPS device  Information and communication technology capability icon
 | Key Ideas:* Students can locate their positions on a ‘spherical’ Earth, and recognise the impact that a round surface has on apparent time.

Teaching Strategies:* Use a globe and flashlight to model the passing of daylight over a day. To do this, you need a globe mounted so that it can be rotated, and a stationary light source. Place a location pin into the globe to monitor the amount of light it receives. This can be extended to explain why the amount of daylight is fairly constant at the equator, but varies with the seasons at the poles. The video link attached is a good explanation of this model. The video from Bill Nye extends the basic model.

Activities:* Run an orienteering challenge around your school using smartphones and coordinates to guide students around the course.
* Discuss how navigation systems in cars, or on the phone, utilise GPS coordinates to plot a route.
* Google Compass can also be turned on to determine accurate latitude and longitude for a route plotted using Google maps. This could be used to help students recognise the difference between “Bearing from A to B” and “Bearing from B to A”
* Location games or treasure hunts such as “Geocaching” could be used if time permits. Geocaching is a free online game where participants use a Global Positioning System receiver or mobile device and other navigational techniques to hide and seek containers, called Geocaches.
 | * [How to Model the Seasons with a Lamp and Globe](https://www.youtube.com/watch?v=IIzmJ7FMr_k): https://www.youtube.com/watch?v=IIzmJ7FMr\_k
* [Bill Nye explains Seasons](https://www.youtube.com/watch?v=KUU7IyfR34o): https://www.youtube.com/watch?v=KUU7IyfR34o
* [Google Earth](https://www.google.com/earth/): https://www.google.com/earth/ and [Google Maps](https://www.google.com.au/maps/): https://www.google.com.au/maps/ are great resources for investigating position.
* [The World: Latitude and Longitude](http://www.eduplace.com/kids/socsci/books/applications/imaps/maps/g3_u6/): http://www.eduplace.com/kids/socsci/books/applications/imaps/maps/g3\_u6/
* [Teaching Latitude and Longitude](https://www.thoughtco.com/teach-latitude-and-longitude-6803): https://www.thoughtco.com/teach-latitude-and-longitude-6803
* [Google Compass](http://googlecompass.com/): http://googlecompass.com/
* [Video explaining Geocaching](https://www.youtube.com/watch?v=1YTqitVK-Ts): https://www.youtube.com/watch?v=1YTqitVK-Ts
 |
| * calculate times and time differences around the world AAM ◊
	+ review using units of time, converting between 12-hour and 24-hour clocks and calculating time intervals
	+ review how to interpret timetables, for example, bus, train and ferry timetables, and use them to solve problems Personal and social capability icon Civics and citizenship icon
 | Key Ideas:* Students can read and understand timetables which use 12-hour and 24-hour time.

Teaching Strategies:* Review basic Time Measurements
	+ 60 seconds = 1 minute
	+ 60 minute = 1 hour
	+ 24 hours = 1 day
* Discuss and compare 12 hour time (am/pm) and 24 hour time.

Activities:* Why do we have 12 hour and 24 hour time? Who uses 24 hour time and why is it important to them or their job? (Armed forces, Business execs, so they turn up at correct times) Why do so many timetables still use 24-hour time?
* Use listed resource to discuss how to convert from each time.
* 12 hour = 0.00am to 12.00pm (morning) then 12.00pm to 12.00am (afternoon/night)
* 24 hour = 4 digit number starting at 0000(midnight) to 2359(1 minute before midnight)
* Easy rule for conversion when past midday add 12 hours to 12 hour time
* Example 3:24pm = (3+12) = 1524 (24 hour time)
* Your calculator can also be used for time calculations as degrees, minutes and seconds follow the same base-60 system as time does. This is not a coincidence [as explained here](https://www.livescience.com/44964-why-60-minutes-in-an-hour.html).
* Travel websites (such as FlightAware) can be used to discuss the common notation used for time zones. For example AEST means Australian Eastern Standard Time. By using actual flight information, students can discuss the difference between the arrival and departure times, or compare the time difference to the actual travel time. Can someone “arrive” before they leave?
 | * This [video demonstrates how to use a Casio calculator](https://www.youtube.com/watch?v=rDX93WuCCUw) to perform calculations with time. (Please note there is a speed example using miles/hour) https://www.youtube.com/watch?v=rDX93WuCCUw
* Resource 1 – Time calculations using DMS key on the calculator
* Time – [AM/PM vs 24 Hour Clock](https://www.mathsisfun.com/time.html): https://www.mathsisfun.com/time.html
* [With a login, teachers can use the 24 hour time memory game](https://www.teachstarter.com/teaching-resource/24-hour-time-memory-game/): https://www.teachstarter.com/teaching-resource/24-hour-time-memory-game/
* [Keeping time](https://www.livescience.com/44964-why-60-minutes-in-an-hour.html): https://www.livescience.com/44964-why-60-minutes-in-an-hour.html
* [Flight Aware](https://flightaware.com/live/): https://flightaware.com/live/
 |
| * + solve problems involving time zones in Australia and in neighbouring nations, making any necessary allowances for daylight saving Asia and Australia’s engagement with Asia icon Personal and social capability icon Civics and citizenship icon
 | Key Ideas:* Students appreciate how different time zones within a country affect business and travel.

Teaching Strategies:* Australia is one of only a few countries with multiple time zones, including a half-time zone. This is compounded in summertime when only some states utilise daylight saving.
* Use maps to explain the different time zones in Australia.

Activities:* Read the article on daylight savings time. The students discuss the varying opinions on daylight savings time and the implications that this would have on Australian businesses.
* Discuss why South Australia has one of the few “half” time zones in the world. How does this impact business with Western Australian vs Victoria/Eastern Australia.
 | * [Australian time zones and daylight saving:](http://www.australia.gov.au/about-australia/facts-and-figures/time-zones-and-daylight-saving) http://www.australia.gov.au/about-australia/facts-and-figures/time-zones-and-daylight-saving
* Resource 2 – Longitude and Time
* [Article on the confusion of daylight savings time](http://www.news.com.au/national/politics/timezone-terror-why-daylight-saving-divides-the-nation/news-story/2d99c18e59725a4881ade6cf978e73c6) http://www.news.com.au/national/politics/timezone-terror-why-daylight-saving-divides-the-nation/news-story/2d99c18e59725a4881ade6cf978e73c6
 |
| * + solve problems involving Coordinated Universal Time (UTC), and the International Date Line (IDL) (ACMEM164)
	+ find time differences between two places on Earth using recognised international time zones (ACMEM165) Intercultural understanding icon Personal and social capability icon
 | Key Ideas:* Students appreciate that in a spherical world, we need a start point (the prime meridian) and an IDL.

Teaching Strategies:* Blow-up globes are useful for discussing these concepts. Terry’s Chocolate Oranges also demonstrate lines of longitude reasonably well (and are memorable).

Activities:* Why is UTC located at Greenwich? Why is this opposite the IDL?
* Discuss why latitude and longitude form a coordinate grid on the earth’s surface which we can use for location, as well as finding time differences.
* A literacy activity could be used to get students to recognise the different abbreviations used for UTC (GMT etc.).
* Investigate why the International Date Line does not follow exactly the 180 meridian line. The YouTube videos or newspaper article can be used to aid this discussion.
 | * What is the [International Date Line (IDL)?:](https://www.timeanddate.com/time/dateline.html) https://www.timeanddate.com/time/dateline.html
* [Samoa loses a day](https://youtu.be/NKgSmDMGnZ4) https://youtu.be/NKgSmDMGnZ4 (2:15mins)
* Or: [What in the world](http://www.youtube.com/watch?v=m31uoDPUm5c) http://www.youtube.com/watch?v=m31uoDPUm5c (First 1:35mins of a 3:23 min video)
* Or a [newspaper article on Samoa changing the IDL](http://www.abc.net.au/news/2011-12-30/samoa-skips-friday-in-time-zone-change/3753350): http://www.abc.net.au/news/2011-12-30/samoa-skips-friday-in-time-zone-change/3753350
 |
| * + solve practical problems, for example, travelling east and west, incorporating time zones, or internet and phone usage across time zones, or the timing of events broadcast live from states of countries between different time zones Critical and creative thinking icon  Information and communication technology capability icon Intercultural understanding icon Personal and social capability icon
 | Key Idea:* Students recognise that the difference in time between two locations is dependent on their relative positions.

Teaching Strategies:* By teaching time zones on a ‘number line’ with Greenwich Mean Time as zero, East as the positive and West as the negative, helps students to calculate time differences between standard time zones.
* Linked to the discussion on the different notation used on the FlightAware website, students could connect the idea that going East means “losing” time, while travelling West means “gaining” time”.
* The importance of time zones can be highlighted through a discussion of the world as a global economy. TV coverage of major sporting events, as well as business and travel, are affected by time zone changes.

Activities:* Sample problems could include:
	+ What time should you arrange a video conference between offices in Spain, Sydney and San Francisco to minimise overtime payments?
	+ My mother is going to Italy, departing on the 1300 flight from Sydney. When should I expect her to call me to tell me she has arrived? What time will it be in Italy when she lands?
	+ If the Olympics start at 8pm in the host country, what time should I start watching in Australia?
 | * [Flight Aware:](https://flightaware.com/live/airport/YSSY) https://flightaware.com/live/airport/YSSY
 |

Reflection and evaluation: