 Year 11 Mathematics Standard

| MS-M2 Working with Time | Unit duration |
| --- | --- |
| Measurement involves the application of knowledge, skills and understanding of numbers and geometry to quantify and solve problems in practical situations.Knowledge of measurement enables completion of daily tasks such as making time estimations, measuring medicine, finding weights and understanding areas of materials or substances.Study of measurement is important in developing students’ ability to make reasonable estimates for quantities, apply appropriate levels of accuracy to particular situations, and apply understanding of aspects of measurement such as length, area, volume and similarity to a variety of problems. | 2 weeks |

| Subtopic focus | Outcomes |
| --- | --- |
| The principal focus of this subtopic is to understand concepts related to locations on Earth’s surface and calculation of time differences.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. | 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

**Related Life Skills outcomes**: MALS6-3, MALS6-4, MALS6-13, MALS6-14 |

| Prerequisite knowledge | Assessment strategies |
| --- | --- |
| Student should build on the prior learning of time calculations involving mixed units and interpreting time zones. | * Informal assessment could include a student verbally, or diagrammatically, explaining time zone changes from one location to another.
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All outcomes referred to in this unit come from [Mathematics Standard Stage 6](https://syllabus.nesa.nsw.edu.au/mathematics-standard-stage6/) Syllabus
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Glossary of terms

| Term | Description |
| --- | --- |
| Coordinated Universal Time (UTC) | UTC is the primary [time standard](https://en.wikipedia.org/wiki/Time_standard) by which the world regulates clocks and time. It is within about 1 second of [mean solar time](https://en.wikipedia.org/wiki/Solar_time#Mean_solar_time) at [0° longitude](https://en.wikipedia.org/wiki/Prime_meridian), and is not adjusted for [daylight saving time](https://en.wikipedia.org/wiki/Daylight_saving_time). In some countries, the term [Greenwich Mean Time](https://en.wikipedia.org/wiki/Greenwich_Mean_Time) is used. |
| International Date Line (IDL) | Is an imaginary line extending between the [North Pole](https://www.britannica.com/place/North-Pole) and the [South Pole](https://www.britannica.com/place/South-Pole) and arbitrarily demarcating each [calendar](https://www.britannica.com/science/calendar) [day](https://www.britannica.com/science/day) from the next. It corresponds along most of its length to the 180th [meridian](https://www.britannica.com/science/meridian-geography) of longitude travellers moving eastward across the line set their calendars back one day, and those traveling westward set theirs a day ahead. |
| Latitude | Latitude is a measurement on a globe or [map](https://www.britannica.com/science/map) of location north or south of the [Equator](https://www.britannica.com/place/Equator). Given in degrees, minutes, and seconds, latitude is the arc subtended by an angle at Earth’s centre and measured in a north-south plane poleward from the Equator. Thus, a point at 30°15′20″ N subtends an angle of 30°15′20″at the centre of the globe; similarly, the arc between the Equator and either geographic pole is 90° |
| Longitude | Longitude is a measurement of location east or west of the prime [meridian](https://www.britannica.com/science/meridian-geography) at [Greenwich](https://www.britannica.com/place/Greenwich-meridian), the specially designated imaginary north-south line that passes through both geographic poles and Greenwich, London. Measured also in degrees, minutes, and seconds, longitude is the amount of arc created by drawing first a line from the Earth’s centre to the intersection of the Equator and the [prime meridian](https://www.britannica.com/place/Greenwich-meridian) and then another line from the Earth’s centre to any point elsewhere on the Equator. Longitude is measured 180° both east and west of the prime meridian.  |

| Lesson sequence | Content | Suggested teaching strategies and resources  | Date and initial | Comments, feedback, additional resources used |
| --- | --- | --- | --- | --- |
| Locating positions with latitude and longitude(1 lesson) | * 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, eg a smartphone or GPS device  Information and communication technology capability icon
* Understand and use the link between longitude and time to find time differences
 | Introducing the Earth * [How to Model the Seasons with a Lamp and Globe](https://www.youtube.com/watch?v=IIzmJ7FMr_k) - 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. [Bill Nye explains Seasons](https://www.youtube.com/watch?v=KUU7IyfR34o) extends the basic model.
* This can also be demonstrated using [Google Earth](https://www.google.com/earth/)
* Teacher to explain the difference between [Latitude and Longitude](https://www.thoughtco.com/teach-latitude-and-longitude-6803)

Locating places on the Earth* Student activity: [Latitude and longitude quiz](https://www.tes.com/en-au/teaching-resource/infoquiz-where-in-the-world-cities-latitude-longitude-coded-message-11874437) Given 30 cities and their country, students match them with the correct Latitude and Longitude to decode the message.
* Latitude and longitude may be entered in [Google Maps](https://www.google.com.au/maps/) to find a location or can be found for a location. **Resource:** [Latitude and longitude in Google maps](https://support.google.com/maps/answer/18539?co=GENIE.Platform%3DDesktop&hl=en)
* Student activity: Discuss how navigation systems in cars, or on the phone, utilise GPS coordinates to plot a route. Students then complete the [GPS activity](https://blog.doublehelix.csiro.au/how-global-positioning-system-gps-works/) to simulate how GPS works
* Student activity: Location games or treasure hunts such as “[Geocaching](https://www.youtube.com/watch?v=1YTqitVK-Ts)” 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.
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| Interpreting timetables using 12- and 24- hour time(2 lessons) | * 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, eg bus, train and ferry timetables, and use them to solve problems Personal and social capability icon Civics and citizenship icon
 | Review 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.
* 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?

**Converting between 12 and 24 hour time*** Discuss how we write time and how to convert from each time. **Resource:** [AM/PM vs 24 Hour Clock](https://www.mathsisfun.com/time.html)
* 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)
* Student activity: Student practise converting between 12 and 24 hour timeResources:
* [Time tools: 24-hour to the minute](http://splash.abc.net.au/res/i/L9642/index.html),
* [24 hour to the minute: Time challenge](http://www.scootle.edu.au/ec/viewing/L9646/index.html)

Calculating time intervals* Teacher to demonstrate how a calculator can be used for time calculations as degrees, minutes and seconds follow the same base-60 system as time does. ([Time calculations using a Casio calculator](https://www.youtube.com/watch?v=rDX93WuCCUw))
* Look at the website [Why 60 minutes?](https://www.livescience.com/44964-why-60-minutes-in-an-hour.html) to see why this isn’t a coincidence
* Student activity: Students [Calculate time intervals in 12-hr system and 24-hr system](http://www.onlinemathlearning.com/time-interval.html)
* Student activity: Students work out how long it would take them to watch a number of movies back to back ([Movie time intervals](http://www.transum.org/Software/SW/Starter_of_the_day/starter_September9.ASP))
* Student activity: students plan a trip to their favourite (or choose one from a few the teacher selects) recreational destination in Sydney (or another Australian city) by public transport.
* Students must search for the timetables they will need for the trip and save this as evidence for their work
* Give students a time they must get to the destination and a time they must reach home.
* Have students plan three possible routes that they could take that uses different modes of transport or show different lengths to the journey
* Make sure they include what time they will need to leave home and how long the journey will takeResources:
	+ [Sydney trains timetables](http://www.sydneytrains.info/timetables/#landingPoint)
	+ [Sydney bus and ferry route timetables](https://transportnsw.info/routes#/)
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| Solve problems involving Australian time zones(1 lesson) | * solve problems involving time zones in Australia and in neighbouring nations, making any necessary allowances for daylight saving (ACMEM163) Asia and Australia’s engagement with Asia icon Personal and social capability icon Civics and citizenship icon
 | Australian time zones* 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 [Australian time zones and daylight saving](http://www.australia.gov.au/about-australia/facts-and-figures/time-zones-and-daylight-saving)
* Travel websites (such as [Flight Aware](https://flightaware.com/live/) ) 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?
* Read the article on [Why daylight savings divides a nation](http://www.news.com.au/national/politics/timezone-terror-why-daylight-saving-divides-the-nation/news-story/2d99c18e59725a4881ade6cf978e73c6). 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.
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| Solve problems involving International time zones(2 lessons) | * solve problems involving Coordinated Universal Time (UTC), and the International Date Line (IDL)
* understand and use the link between longitude and time to find time differences
* find time differences between two places on Earth using recognised international time zones (ACMEM165) Intercultural understanding icon Personal and social capability icon
 | Using longitude to find time differences* The Earth takes 24 hours to rotate through 360o of longitude. Therefore it takes 1 hour to rotate through 15o of longitude.
* Hence every 15o difference in longitude results in a time difference of 1 hour.

15o = 1 hour = 60 minutes 1o = 4 minutes * Even though the local time varies by one hour for every 15o of longitude, in practice it would lead to confusing situations in places relatively close. Therefore the Earth is divided into time zones. Places within each time zone use the same time.
* Student activity: Use Google maps to find the longitude of two towns in Australia. Calculate the time difference between them using their longitudes. Compare this to the actual time difference between (according to Australian time zones). Reinforce the practicalities of time zones.

International time zones* Blow-up globes are useful for discussing these concepts. Terry’s Chocolate Oranges also demonstrate lines of longitude reasonably well (and are memorable). This [Interactive Time zones map](https://www.timeanddate.com/time/map/) can also be useful
* Why is UTC located at Greenwich? Why is this opposite the IDL?
* Investigate why the [International Date Line (IDL)](https://www.timeanddate.com/time/dateline.html) does not follow exactly the 180 meridian line.
* Discuss the concept of [Samoa loses a day](https://youtu.be/NKgSmDMGnZ4) or [Samoa skips Friday in time zone change](http://www.abc.net.au/news/2011-12-30/samoa-skips-friday-in-time-zone-change/3753350)
* Student activity: [Time zone activity](https://www.tes.com/en-au/teaching-resource/time-zones-6419756) A Time Zone map and a sheet for pupils to complete using the information provided. Work out the time in different cities of the world.
* 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.
* Student activity: [Time zone loop cards](https://www.tes.com/en-au/teaching-resource/time-zone-loop-cards-11499637) Students start with one card, find the answer on another card and then do the question on the new card. If they answer the questions correctly, they should end up back where they started.
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| Solve problems involving time zones(2 lessons) | * solve practical problems, eg 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
 | Solving time zone problems* 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.
* Students will need to know the common [Time Zone Abbreviations](https://www.timeanddate.com/time/zones/) in order to understand TV programs etc from other states or countries
* Student activity: [Music festival challenge](http://www.scootle.edu.au/ec/viewing/L7840/index.html) Students work out a program for the Auckland music festival. Find the flight times and other travel details for acts coming from different parts of Australia, New Zealand and Norfolk Island. Calculate the earliest and latest times they can perform. Check for extra information, like changes in time zones, connecting flights, or Stage 1 bookings. Place each act into a timetable slot that allows for their set-up time, act length and any special needs. Create the final program for the festival.
* Student activity: Compare TV guides for live broadcasts of events in different states of Australia.
* Have students calculate the time they would get to watch popular/favourite TV shows in their state. e.g. What is the earliest time and date I can watch the premiere of Season 7 of Game of Thrones if it is airing on HBO at 9pm, 17 July 2017 in the USA?
* Have students calculate what time they would be watching live events happening in other parts of the world e.g. the Olympic Games, FIFA World Cup, NBA Finals etc.
* Teachers provide the event, dates and times and students must calculate when they will watch it in Sydney (or their hometown). Daylight saving must be taken into account to keep it realistic. This can be made more difficult if students also have to calculate the viewing time in a country or city that is in a different time zone.
* Alternatively, students can also research the dates and times themselves for some given events (or chosen by students in the class) and then work out the time they will watch it in their hometown
* Student activity: Students work out when it would be appropriate to call/Skype/Facetime friends or family overseas.
* Example scenario – one of your school friends has moved to Berlin, Germany for an exchange program for six months. You plan to Skype them weekly.
* If you cannot call during your school hours and their school hours and they will be sleeping after 12AM their time, between what hours can you Skype them?
* Some further questions to consider– are the times realistic for you or for them? What may be some difficulties? Would one of you have to compromise your sleep or meal times?
* Example scenario – your family in India love to hear from you every Saturday when they get together for dinner from 7:00PM. What time would you have to call them in Sydney to talk to them?
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Reflection and evaluation

Please include feedback about the engagement of the students and the difficulty of the content included in this section. You may also refer to the sequencing of the lessons and the placement of the topic within the scope and sequence. All ICT, literacy, numeracy and group activities should be recorded in the ‘Comments, feedback, additional resources used’ section.