MA99 EDUCATION

Focus area 6 Time and location: Summary

06

NSW MATHEMATICS STANDARD 11-12 SYLLABUS 2024 FOR HSC 2028 AND LATER

Time and location, the whole focus area

Positions on the Earth's surface

Idea	What to remember
Latitude	Angle north or south of the **equator**, 0° to 90°. Lines of equal latitude are parallels.
Longitude	Angle east or west of the **prime meridian** through Greenwich, 0° to 180°. Lines of equal longitude are meridians.
Position coordinates	Latitude first, then longitude, with letters: Sydney $(34^\circ\text{S},\ 151^\circ\text{E})$.
Minutes of angle	$1^\circ = 60'$. Decimal part $\times 60$ gives minutes; minutes $\div 60$ gives the decimal part.
Digital tools	Decimal degrees, latitude first; negative latitude is S, negative longitude is W: $-33.8568,\ 151.2151$ is $(33^\circ 51'\text{S},\ 151^\circ 13'\text{E})$.
Differences	Same side of the reference line: subtract. Opposite sides: add.

Longitude and time

Fact or rule	Detail
$15^\circ = 1$ hour	On the HSC reference sheet. Comes from 360° in 24 hours.
$1^\circ = 4$ minutes	Multiply a longitude difference by 4 to get minutes.
East is ahead	Add the time difference going east, subtract going west.
Through Greenwich	East positive, west negative, subtract: 151°E and 158°W differ by 309°, or 20 h 36 min.
Not clock time	Clocks follow time zones. Perth at 116°E is 7 h 44 min ahead of Greenwich by the Sun but uses $\text{UTC}+8$.

Units, formats and elapsed time

Fact or rule	Example
1 h = 60 min = 3600 s	8000 s = 133 min 20 s = 2 h 13 min 20 s
Decimal hours: decimal part $\times 60$	3.4 h = 3 h 24 min; 2 h 45 min = 2.75 h
am: same digits; 12 am hour is 00	12:40 am = 0040; 7:05 am = 0705
pm: add 12; 12 pm hour stays 12	7:05 pm = 1905; 12:30 pm = 1230
Elapsed time: count up through midnight	2140 to 0615 next day = 8 h 35 min
Several days: whole days, then adjust	1630 Mon to 0910 Thu = 72 h − 7 h 20 min = 64 h 40 min

Australian time zones and daylight saving

Where	Standard	Daylight saving
WA	AWST, $\mathrm{UTC}+8$	none
NT	ACST, $\mathrm{UTC}+9{:}30$	none
SA, and Broken Hill NSW	ACST, $\mathrm{UTC}+9{:}30$	ACDT, $\mathrm{UTC}+10{:}30$
Qld	AEST, $\mathrm{UTC}+10$	none
NSW, ACT, Vic, Tas	AEST, $\mathrm{UTC}+10$	AEDT, $\mathrm{UTC}+11$

Standard time: first Sunday in April to first Sunday in October



Daylight saving: first Sunday in October to first Sunday in April



Figure 1 · the mainland time zones in standard time and in daylight saving

Daylight saving starts at 2:00 am on the first Sunday in October (clocks to 3:00 am) and ends at 3:00 am on the first Sunday in April (clocks back to 2:00 am). For 2026 to 2027: Sunday 4 October 2026 to Sunday 4 April 2027.

Coordinated Universal Time

Rule	Example
Offset: hours ahead (+) or behind (−) UTC	Guatemala $\mathrm{UTC}-6$, Malaysia $\mathrm{UTC}+8$
Time difference = difference of offsets	$8-(-6)=14$ hours, shown on a number line
Local to UTC: subtract the offset	9:30 pm in Sydney at $\mathrm{UTC}+11$ is 10:30 am UTC
UTC to local: add the offset	10:20 am UTC is 10:20 am in London at $\mathrm{UTC}+0$
Northern hemisphere daylight saving is in the opposite season	Sydney and London are 9, 10 or 11 h apart

How to answer the question

Task	Recipe
Arrival time from longitudes	Longitude difference, $\div 15$; convert the departure to the destination's time; add the flight time; write the day.
Arrival time with UTC	Departure to UTC; add the flight time; UTC to the destination's offset on that date; write the day.
Flight time from two local times	Both times to UTC (or both to one place's time); subtract.
An Australian time on a date	Standard zones; then is daylight saving on, and at which of the two places?

Common errors

1. Latitude first. A latitude above 90° means the coordinates are swapped.
2. Adding longitudes on the same side, or subtracting across the prime meridian.
3. Reading 3.4 h as 3 h 40 min.
4. Writing 12:30 am as 1230.
5. Assuming Queensland, the NT or WA change their clocks.
6. Using Australian daylight saving dates for an overseas place.
7. Mixing the 15° rule and real time zones in one answer.
8. Leaving out the day.

Checklist

- [ ] Name the city at $(36^\circ\text{N},\ 140^\circ\text{E})$ and find its latitude difference from Sydney (Tokyo, 70°)
- [ ] Convert $-37.8136,\ 144.9631$ to degrees and minutes ($37^\circ 49'\text{S}, 144^\circ 58'\text{E}$)
- [ ] Find the longitude time difference between 12°E and 78°W (6 h)
- [ ] Write 9500 s in hours, minutes and seconds (2 h 38 min 20 s)
- [ ] Find the elapsed time from 2235 Friday to 0610 Saturday (7 h 35 min)
- [ ] Give the time in Adelaide when it is 9:00 am in Brisbane on 9 November 2026 (9:30 am)
- [ ] Give the length of a 10:00 pm to 6:00 am shift on the night of 3 October 2026 in Sydney (7 h)
- [ ] Find the Sydney start of a 7:30 pm Los Angeles concert on 5 December 2026 (2:30 pm Sunday)

> If a question gives a date, it is telling you to think about daylight saving.

Written to the NSW Mathematics Standard 11-12 Syllabus (2024), the syllabus Year 11 has studied since 2026, first examined in the 2027 HSC. Students in Year 11 in 2027 sit the HSC in 2028.

About this resource

MA99 EDUCATION

Scope

NSW Mathematics Standard, Year 11. Written to the NSW Mathematics Standard 11-12 Syllabus (2024), focus area 6, Time and location (MST-11-06), for students sitting the HSC in 2028 and later years. Every value, identity and solution was re-derived independently by computer algebra before printing. Contexts in the questions are invented unless a source is named.

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MA99 EDUCATION

Focus area 6 Time and location: Practice Questions

06

NSW MATHEMATICS STANDARD 11-12 SYLLABUS 2024 FOR HSC 2028 AND LATER

How to use this set

Where this sits

Focus area 6 of the eight Year 11 Mathematics Standard focus areas, in the Measurement area of study, outcome MST-11-06: solves problems involving time and location in practical contexts. It has two content groups, **Positions on the Earth's surface** and **Time and time differences**, and it is common to Standard 1 and Standard 2.

Year 11 is assumed knowledge for both HSC examinations and may be examined.

Band	What the questions ask	Marks here
Foundation	One idea, applied once	10
Standard	Two steps, or one step plus a decision	10
Advanced	Three or more steps, or a method you must choose first	10
Exam-style	Multi-part, written the way the HSC writes them	11

Total 41 marks. Every fact you need is in the question, apart from the Australian time zones and daylight saving rules, which you are expected to know. Daylight saving for 2026 to 2027 runs from Sunday 4 October 2026 to Sunday 4 April 2027.

Questions

FOUNDATION One idea, applied once.

Question 1

1 MARK

Which position coordinates describe a point in the southern hemisphere and west of the prime meridian?

A $(23^\circ\text{S},\ 43^\circ\text{W})$
B $(23^\circ\text{N},\ 43^\circ\text{W})$
C $(23^\circ\text{S},\ 43^\circ\text{E})$
D $(23^\circ\text{N},\ 43^\circ\text{E})$

Question 2

1 MARK

Using $15^\circ = 1$ hour, what is the time difference between places at longitudes 30°E and 45°W?

A 1 hour
B 5 hours
C 15 hours
D 75 hours

Question 3

1 MARK

What is 2.6 hours in hours and minutes?

A 2 h 6 min
B 2 h 60 min
C 2 h 36 min
D 1 h 56 min

Question 4

1 MARK

It is 4:00 pm on Friday 15 January 2027 in Sydney. In which city do clocks show 3:00 pm?

A Melbourne
B Adelaide
C Perth
D Brisbane

5 (a) Write 7:45 pm in 24-hour time. (b) Write 0020 in 12-hour time. (2 marks)

6 Perth is $(32°\text{S},\ 116°\text{E})$ and Hong Kong is $(22°\text{N},\ 114°\text{E})$. Find (a) the difference in latitude, (b) the difference in longitude. (2 marks)

7 (a) Write 4 h 18 min in hours, as a decimal. (b) Write 9500 seconds in hours, minutes and seconds. (2 marks)

STANDARD Two steps, or one step plus a decision.

8 A bus leaves at 2235 on Friday and arrives at 0610 on Saturday, in the same time zone. How long is the trip? (2 marks)

9 Cairo is $(30°\text{N},\ 31°\text{E})$ and Lima is $(12°\text{S},\ 77°\text{W})$. Using $15° = 1$ hour, find the time difference, and the time in Lima when it is noon in Cairo. (2 marks)

10 A football match kicks off in Sydney at 7:50 pm on Saturday 12 December 2026. What time is kick-off in (a) Brisbane, (b) Perth? (2 marks)

11 Guatemala is $\text{UTC}-6$ and Malaysia is $\text{UTC}+8$. (a) How many hours is Malaysia ahead of Guatemala? (b) It is 8:30 am on Thursday in Kuala Lumpur. What time and day is it in Guatemala City? (2 marks)

12 A pilot flies three legs taking 6 h 40 min, 3.75 h and 2 h 50 min. Find the total flying time in hours and minutes. (2 marks)

ADVANCED Three or more steps, or a method you must choose first.

13 A nurse in Melbourne starts a shift at 9:00 pm on Saturday 3 April 2027 and finishes when the clock shows 7:00 am on Sunday 4 April 2027. How many hours did she work? Explain. (2 marks)

14 A plane leaves Perth at 11:55 pm on Tuesday 20 October 2026, Perth time, and lands in Sydney at 7:05 am on Wednesday 21 October, Sydney time. How long is the flight? (3 marks)

15 Town A is at longitude $15°\text{E}$ and town B at $120°\text{W}$. A plane leaves A at 1:30 pm on Friday, A time, and flies for 13 h 20 min. Using $15° = 1$ hour, find the local time and day in B when it lands. (3 marks)

16 A map app shows a point in central Melbourne at $-37.8136,\ 144.9631$. Write its position coordinates in degrees and minutes, to the nearest minute, with N, S, E or W. (2 marks)

EXAM-STYLE Multi-part, written the way the HSC writes them.

Question 17

5 MARKS

A flight leaves Sydney at 10:15 pm on Friday 15 January 2027 for Los Angeles. On that date Sydney is $\text{UTC}+11$ and Los Angeles is $\text{UTC}-8$. The flight takes 13 h 25 min.

(a) Find the departure time and day in UTC. 1 MARK

(b) Find the local time and day in Los Angeles when the flight lands. 2 MARKS

(c) Explain why the flight lands at an earlier clock time than it left, on the same calendar day. 1 MARK

(d) On landing a passenger phones home. What time and day is it in Sydney? 1 MARK

Question 18 — 6 MARKS

New York is at $(41°\text{N},\ 74°\text{W})$ and Beijing at $(40°\text{N},\ 116°\text{E})$.

(a) Find the difference in longitude, measured through the prime meridian. 1 MARK

(b) Using $15° = 1$ hour, find the time difference and state which city is ahead. 2 MARKS

(c) Using your answer to (b), find the time and day in Beijing when it is 9:00 pm on Monday in New York. 1 MARK

(d) On 15 January 2027 New York is $\text{UTC}-5$ and Beijing is $\text{UTC}+8$. Find the actual difference between their clocks, and explain why it is not the answer to (b). 2 MARKS

Worked solutions · Foundation

1

(A) South is S and west is W, latitude first: $(23°\text{S},\ 43°\text{W})$, close to Rio de Janeiro.

(B) is north of the equator. (C) is east of the prime meridian. (D) is wrong on both counts.

2

(B) Opposite sides of the prime meridian, so add: $30° + 45° = 75°$, and $75 \div 15 = 5$ hours.

(A) subtracts the longitudes, $45 - 30 = 15$, then divides by 15. (C) subtracts and stops, reading $15°$ as 15 hours. (D) adds but forgets to divide by 15.

3

(C) $0.6 \times 60 = 36$, so 2.6 h = 2 h 36 min.

(A) reads the decimal as minutes. (B) reads 0.6 as 60 minutes. (D) correctly finds 156 min, then reads it as 1 h 56 min instead of 2 h 36 min.

4

(D) On 15 January daylight saving is in force in NSW, Victoria and SA. Sydney $\text{UTC}+11$; Brisbane $\text{UTC}+10$, one hour behind, so 3:00 pm.

(A) Melbourne also uses daylight saving: 4:00 pm. (B) Adelaide is $\text{UTC}+10{:}30$: 3:30 pm. (C) Perth is $\text{UTC}+8$: 1:00 pm.

5

(a) pm, so add 12 to the hour: 1945. (b) The 00 hour is the 12 am hour: 12:20 am.

WHERE THE MARKS ARE	
1 mark	1945
1 mark	12:20 am, with am

6

(a) Opposite sides of the equator, add: $32^\circ + 22^\circ = 54^\circ$. (b) Both east, subtract: $116^\circ - 114^\circ = 2^\circ$.

WHERE THE MARKS ARE	
1 mark	54°
1 mark	2°

Perth and Hong Kong are almost on the same meridian, which is why both keep $\mathrm{UTC}{+}8$.

7

(a) $18 \div 60 = 0.3$, so 4.3 h. (b) $9500 \div 60 = 158$ remainder 20: 158 min 20 s, and 158 min = 2 h 38 min, so 2 h 38 min 20 s.

WHERE THE MARKS ARE	
1 mark	4.3 h
1 mark	2 h 38 min 20 s

Worked solutions · Standard

8

2235 to 2300 is 25 min; 2300 to midnight is 1 h; midnight to 0610 is 6 h 10 min. Total 7 h 35 min.

WHERE THE MARKS ARE	
1 mark	Splits the time at midnight, or an equivalent method
1 mark	7 h 35 min

9

Opposite sides: $31^\circ + 77^\circ = 108^\circ$; $108 \times 4 = 432$ min = 7 h 12 min, Cairo ahead. Lima is behind, so noon − 7 h 12 min = 4:48 am.

WHERE THE MARKS ARE	
1 mark	7 h 12 min
1 mark	4:48 am

The latitudes are not needed. Time depends on longitude only.

10

12 December is daylight saving in NSW: Sydney $\mathrm{UTC}+11$. (a) Brisbane $\mathrm{UTC}+10$: 6:50 pm. (b) Perth $\mathrm{UTC}+8$: 4:50 pm.

WHERE THE MARKS ARE	
1 mark	6:50 pm
1 mark	4:50 pm

11

(a) $8-(-6)=$ 14 hours. (b) 8:30 am Thursday $-$ 14 h $=$ 6:30 pm Wednesday.

WHERE THE MARKS ARE	
1 mark	14 hours
1 mark	6:30 pm Wednesday, with the day

12

3.75 h $=$ 3 h 45 min. Hours: $6+3+2=11$; minutes: $40+45+50=135$ min $=$ 2 h 15 min. Total 13 h 15 min.

WHERE THE MARKS ARE	
1 mark	3.75 h as 3 h 45 min
1 mark	13 h 15 min

Worked solutions · Advanced

13

The clock readings are 10 h apart. Daylight saving ends at 3:00 am on Sunday 4 April 2027, when the clocks go back to 2:00 am, so the hour from 2:00 am to 3:00 am happens twice. She worked 11 hours.

WHERE THE MARKS ARE	
1 mark	Recognises that the clocks go back an hour that night
1 mark	11 hours

14

On 20 October daylight saving is in force in NSW but not WA: Sydney $\mathrm{UTC}+11$, Perth $\mathrm{UTC}+8$, so Sydney is 3 h ahead. Landing time in Perth time: 7:05 am $-$ 3 h $=$ 4:05 am Wednesday. Flight: 11:55 pm to 4:05 am $=$ 4 h 10 min.

WHERE THE MARKS ARE	
1 mark	3 hours, with daylight saving applied to Sydney only
1 mark	Both times in one place's time
1 mark	4 h 10 min

Using the winter difference of 2 hours gives 5 h 10 min, and loses two marks.

15

Opposite sides: $15^\circ + 120^\circ = 135^\circ$, and $135 \div 15 = 9$ h; B is west, so 9 h behind. Departure in B time: 1:30 pm $-$ 9 h $=$ 4:30 am Friday. Landing: 4:30 am $+$ 13 h 20 min $=$ 5:50 pm Friday.

WHERE THE MARKS ARE	
1 mark	9 hours, B behind
1 mark	Departure moved to B time (or arrival from A time)
1 mark	5:50 pm Friday

16

Latitude negative, so S: $0.8136 \times 60 = 48.816$, so $49'$. Longitude positive, so E: $0.9631 \times 60 = 57.786$, so $58'$. $(37^\circ 49' \text{S},\ 144^\circ 58' \text{E})$

WHERE THE MARKS ARE	
1 mark	Decimal parts times 60, rounded correctly
1 mark	Letters S and E, latitude first

Worked solutions · Exam-style

17

(a) 10:15 pm $-$ 11 h $=$ 11:15 am Friday 15 January UTC.

(b) Landing in UTC: 11:15 am $+$ 13 h 25 min $=$ 12:40 am Saturday 16 January. Los Angeles is $\text{UTC}-8$: 12:40 am $-$ 8 h $=$ 4:40 pm Friday 15 January.

(c) Los Angeles is $11 - (-8) = 19$ hours behind Sydney, which is more than the 13 h 25 min flight. The clocks go back 19 hours while the flight uses up only 13 h 25 min, so the landing time is 5 h 35 min earlier by the clock, still on Friday.

(d) 12:40 am Saturday UTC $+$ 11 h $=$ 11:40 am Saturday 16 January in Sydney.

WHERE THE MARKS ARE	
1 mark	(a) 11:15 am Friday UTC
1 mark	(b) landing in UTC, 12:40 am Saturday
1 mark	(b) 4:40 pm Friday in Los Angeles, with the day
1 mark	(c) the 19 hour difference exceeds the flight time
1 mark	(d) 11:40 am Saturday

18

(a) East positive, west negative: $116 - (-74) = 190^\circ$.

(b) $190 \times 4 = 760$ min $=$ 12 h 40 min. Measured through the prime meridian Beijing is east, so Beijing is ahead.

(c) 9:00 pm Monday $+$ 12 h 40 min $=$ 9:40 am Tuesday.

(d) Actual difference: $8 - (-5) =$ 13 hours. Clock time follows time zones, not longitude. China uses one time zone, $\text{UTC}+8$, for the whole country, and New York uses $\text{UTC}-5$ in winter ($\text{UTC}-4$ in summer, when the gap is 12 hours). Zones follow borders and whole hours, so they only approximate the 15° rule.

WHERE THE MARKS ARE	
1 mark	(a) 190°
1 mark	(b) 12 h 40 min
1 mark	(b) Beijing ahead
1 mark	(c) 9:40 am Tuesday
1 mark	(d) 13 hours
1 mark	(d) zones follow borders and whole hours, so they differ from longitude time

Measured the other way round the Earth the longitude difference is 170°, 11 h 20 min, but the date line is then crossed, so the date changes by one day and the answer in (c) is reached only after that adjustment.

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