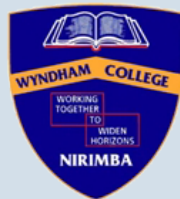


## STD 1: Measurement (Std 1) M2 Working with Time (Y11)

Teacher: Kirtana Hariharan

Exam Equivalent Time: 46.5 minutes (based on HSC allocation of 1.5 minutes approx. per mark)



### LEARNING FROM 2 UNIT GENERAL HISTORY

- MS-M2 *Working with Time* content has been significantly diminished when compared to the old Gen2 course.
- It is expected that calculating time differences from *longitudinal differences* is no longer examinable (notwithstanding some ambiguity in the syllabus document, most commentators subscribe to this interpretation).
- Many past HSC questions retained in the database have been adjusted, omitting content no longer examinable, to reflect the current syllabus.

### ANALYSIS - Common pitfalls

- The Standard 2 content of this topic area has been relatively well answered in the past, with most questions around the band 4 difficulty level. Note the exception of the surprisingly poorly answered 2009 HSC Q26b which should be reviewed.
- Exposure to Universal Coordinated Time (UTC) and similar terminology is an important feature of database questions.
- Some distance between locations (or "arc length" questions) have been adjusted from past HSC questions and included. We regard this as an obvious cross topic application within measurement which is fair game, provided the radius is explicitly stated in the question.
- Syllabus changes are expected to significantly reduce the mark allocation of this topic area.

## Questions

### 1. Measurement, STD2 M2 SM-Bank 27 MC

Part of a train timetable is shown.

<i>New Castle</i>	13.17	13.28	...	13.58
<i>Hamilton</i>	13.23	...	14.00	14.07
<i>Waratah</i>	...	14.03	...	14.16
<i>Blue Haven</i>	14.01	14.16	14.23	14.28
<i>Jeb's Bush</i>	14.22	14.32	...	14.44
<i>Gosford</i>	14.36	...	14.51	14.58

Kalyn arrives at Newcastle station at 1.25 pm and needs to get to Gosford as quickly as possible.

Assuming all trains run to schedule, what is the EARLIEST time that Kalyn can arrive at Gosford station?

- A. 2.32 pm
  - B. 2.36 pm
  - C. 2.51 pm
  - D. 2.58 pm
- 

### 2. Measurement, 2UG 2011 HSC 3 MC

Perth in Western Australia is 8 hours ahead of Coordinated Universal Time (UTC). Cape Town in South Africa is 2 hours ahead of UTC.

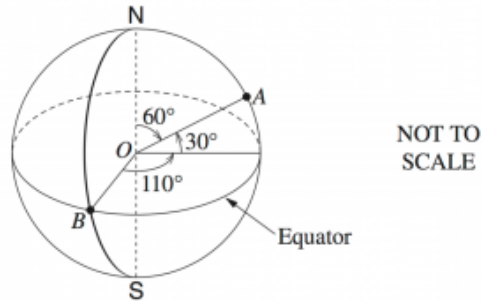
What is the time in Cape Town when it is 1 pm in Perth?

- (A) 3 am
  - (B) 7 am
  - (C) 7 pm
  - (D) 11 pm
-

### 3. Measurement, 2UG 2010 HSC 15 MC

⚡ RAP Data - Bottom 17%: School result (66%) was 4% above state average (62%)

In this diagram of the Earth,  $O$  represents the centre and  $B$  lies on both the Equator and the Greenwich Meridian.



What is the latitude and longitude of point A?

- (A)  $30^\circ\text{N } 110^\circ\text{E}$
- (B)  $30^\circ\text{N } 110^\circ\text{W}$
- (C)  $60^\circ\text{N } 110^\circ\text{E}$
- (D)  $60^\circ\text{N } 110^\circ\text{W}$

### 4. Measurement, 2UG 2007 HSC 20 MC

Kim lives in Perth. He wants to watch an ice hockey game being played in Toronto starting at 10.00 pm on Wednesday.

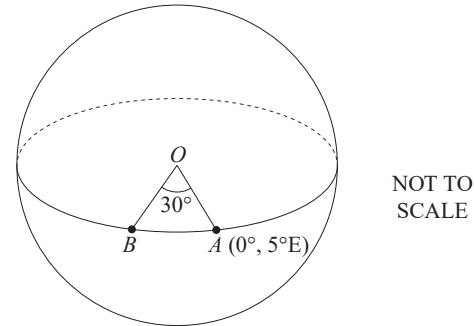
Toronto is 13 hours behind Perth.

What is the time in Perth when the game starts?

- (A) 9.00 am on Wednesday
- (B) 7.40 pm on Wednesday
- (C) 12.20 am on Thursday
- (D) 11.00 am on Thursday

### 5. Measurement, STD2 M2 SM-Bank 01

Island A and island B are both on the equator. Island B is west of island A. The longitude of island A is  $5^\circ\text{E}$  and the angle at the centre of Earth ( $O$ ), between A and B, is  $30^\circ$ .



What is the latitude and longitude of island B? (2 marks)

### 6. Measurement, STD2 M2 SM-Bank 02

Bert is in Moscow, which is three hours behind of Coordinated Universal Time (UTC).

Karen is in Sydney, which is eleven hours ahead of UTC.

- a. Bert is going to ring Karen at 9 pm on Tuesday, Moscow time. What day and time will it be in Sydney when he rings? (1 mark)
- b. Karen is going to fly from Sydney to Moscow. Her flight will leave on Wednesday at 8 am, Sydney time, and will take 15 hours. What day and time will it be in Moscow when she arrives? (2 marks)

### 7. Measurement, 2UG 2013 HSC 27e

⚠ Part i: RAP Data - Bottom 5%: School result (63%) was -1% below state average (64%)

Karin is in Athens, which is two hours ahead of Greenwich Mean Time. Marco is in New York, which is five hours behind Greenwich Mean Time.

- (i) Karin is going to ring Marco at 10 pm on Tuesday, Athens time.  
What day and time will it be in New York when she rings? (1 mark)
- (ii) Marco is going to fly from New York to Athens. His flight will leave on Wednesday at 9 am, New York time, and will take 11 hours.  
What day and time will it be in Athens when he arrives? (2 marks)

## 8. Measurement, 2UG 2006 HSC 26d

Cassie flew from London to Manila. Manila is 8 hours ahead of London.

Her plane left London at 9.30 am Monday (London time), stopped for 5 hours in Singapore and arrived in Manila at 4.00 pm Tuesday (Manila time).

What was the total flying time? (Ignore time zones.) (2 marks)

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## 9. Measurement, STD2 2016 HSC 27e

Melbourne time is 6 hours ahead of Dubai time.

A plane leaves Melbourne on Friday at 11.30 pm. The flight time to Dubai is 15 hours.

What will be the time and the day in Dubai when the plane is due to land? (2 marks)

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## 10. Measurement, 2UG 2018 HSC 29a

The time in Brisbane is  $4\frac{1}{2}$  hours ahead of the time in New Delhi. John flew from New Delhi to

Brisbane via Singapore. His plane left New Delhi at 11.30 am (New Delhi time), stopped for 3 hours in Singapore, and arrived in Brisbane at 9.00 am the following day (Brisbane time).

What was the plane's total flying time? (3 marks)

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## 11. Measurement, STD2 M2 SM-Bank 03

An aircraft travels at an average speed of 913 km/h. It departs from a town in Kenya ( $0^\circ, 38^\circ\text{E}$ ) on Tuesday at 10 pm and flies east to a town in Borneo ( $0^\circ, 113^\circ\text{E}$ ).

(i) Calculate the distance, to the nearest kilometre, between the two towns, using

$$l = \frac{\theta}{360} \times 2\pi r$$

where  $\theta = 75^\circ$  and  $r = 6400$  km (2 marks)

(ii) How long will the flight take? (Answer to the nearest hour.) (1 mark)

(iii) What will be the day and local time in Borneo when the aircraft arrives? (Assume that Borneo is 5 hours ahead of Kenya.) (1 mark)

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## 12. Measurement, STD2 M2 SM-Bank 04

Lee wants to call home to Sydney ( $34^\circ\text{S}, 151^\circ\text{E}$ ) from Papeete, Tahiti ( $17^\circ\text{S}, 149^\circ\text{W}$ ) when it is 7 pm on Friday in Sydney.

Sydney is eleven hours ahead of UTC. Papeete is ten hours behind UTC.

Give the time and day in Papeete when she should make the call. (Ignore time zones.) (2 marks)

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## 13. Measurement, 2UG 2009 HSC 26b

 Part ii: RAP Data - Bottom 14%: School result (46%) was 3% above state average (43%)

John lives in Denver and wants to ring a friend in Osaka.

(i) In Denver it is 9 pm Monday. Given Osaka has a UTC of +9 and Denver has a UTC of -7, what time and day is it in Osaka then? (1 mark)

(ii) John's friend in Osaka sent him a text message which happened to take 14 hours to reach him. It was sent at 10 am Thursday, Osaka time.

What was the time and day in Denver when John received the text? (2 marks)

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## 14. Measurement, STD2 2011 HSC 27b

Pontianak has a longitude of  $109^\circ\text{E}$ , and Jarvis Island has a longitude of  $160^\circ\text{W}$ .

Both places lie on the Equator.

(i) Calculate the shortest distance between these two places, to the nearest kilometre, using

$$l = \frac{\theta}{360} \times 2\pi r$$

where  $\theta = 91^\circ$  and  $r = 6400$  km (1 mark)

(ii) The position of Rabaul is  $4^\circ$  to the south and  $48^\circ$  to the west of Jarvis Island. What is the latitude and longitude of Rabaul? (2 marks)

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## Worked Solutions

### 1. Measurement, STD2 M2 SM-Bank 27 MC

1st train - Kalyn arrives at Newcastle late

2nd train - doesn't stop at Gosford

3rd train - arrives 2.51 pm

4th train - arrives 2.58 pm

$\Rightarrow C$

### 2. Measurement, 2UG 2011 HSC 3 MC

Perth is 6 hrs ahead of Cape Town

$\therefore$  1pm in Perth = 7 am in Cape Town

$\Rightarrow B$

### 3. Measurement, 2UG 2010 HSC 15 MC

Since A is  $30^\circ$  North of the Equator

$\Rightarrow$  Latitude is  $30^\circ N$

Since A is  $110^\circ$  East of Greenwich

$\Rightarrow$  Longitude is  $110^\circ E$

$\therefore A$  is  $30^\circ N 110^\circ E$

$\Rightarrow A$

### 4. Measurement, 2UG 2007 HSC 20 MC

$\therefore$  Time in Perth

= 10 pm (Wed) + 13 hours

= 11 am on Thursday

$\Rightarrow D$

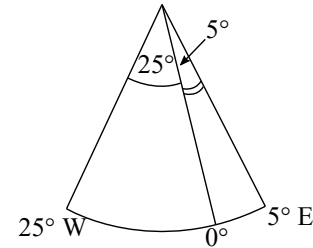
## Worked Solutions

### 5. Measurement, STD2 M2 SM-Bank 01

Longitude (island  $B$ ) =  $5 - 30$

=  $-25$

=  $25^\circ W$



$\therefore$  Island  $B$  is  $(0^\circ, 25^\circ W)$ .

### 6. Measurement, STD2 M2 SM-Bank 02

a. Bert is 14 hours behind Karen.

At 9 pm in Moscow:

Time in Sydney = 9 pm + 14 hours

= 11 am Wednesday

b. Arrival time = 8 am + 15 hours

= 11 pm Wednesday (Sydney time)

$\therefore$  Time in Moscow = 11 pm less 14 hours

= 9 am Wednesday

### 7. Measurement, 2UG 2013 HSC 27e

(i) Athens is Greenwich + 2 hours

New York is Greenwich - 5 hours

Athens is 7hrs ahead of New York

$\Rightarrow$  10pm Tuesday in Athens = 3pm Tuesday in New York

$\therefore$  It will be 3pm Tuesday when Karin rings

(ii) Flight takes 11 hours

If Marco leaves on Wed at 9am

$\Rightarrow$  He arrives at 9am + 11 hrs + 7 hours

$\therefore$  Marco arrives on Thurs at 3am

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### 8. Measurement, 2UG 2006 HSC 26d

$\therefore$  Flight time = 9:30 (Mon) to 4:00 pm (Tues)

– (stopover + time difference)

$$= 14.5 + 16 - (5 + 8)$$

$$= 17.5 \text{ hours}$$

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### 9. Measurement, STD2 2016 HSC 27e

Arrival time = 11:30 + 15 hours

$$= 14:30 \text{ (Melbourne time)}$$

$\therefore$  Arrival time in Dubai time

$$= 14:30 - 6 \text{ hours}$$

$$= 8:30 \text{ am on Saturday}$$

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### 10. Measurement, 2UG 2018 HSC 29a

11:30 am in New Delhi = 4 pm in Brisbane

Total travel time = 4 pm  $\rightarrow$  9 am (next day)

$$= 17 \text{ hours}$$

$\therefore$  Flying time = 17 – 3

$$= 14 \text{ hours}$$

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### 11. Measurement, STD2 M2 SM-Bank 03

(i) Angular difference in longitude

$$= 113 - 38$$

$$= 75^\circ$$

$$\therefore \text{Distance} = \frac{75}{360} \times 2 \times \pi \times 6400$$

$$= 8377.58\dots$$

$$= 8378 \text{ km (nearest km)}$$

(ii) Flight time =  $\frac{\text{Distance}}{\text{Speed}}$

$$= \frac{8378}{913}$$

$$= 9.176\dots$$

$$= 9 \text{ hours (nearest hr)}$$

(iii) Kenya is +5 hours

$\therefore$  Arrival time in Kenya

$$= 10 \text{ pm (Tues)} + 5 \text{ hrs} + 9 \text{ hrs (flight)}$$

$$= 12 \text{ midday on Wednesday}$$

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## 12. Measurement, STD2 M2 SM-Bank 04

Sydney is 21 hours ahead.

$$\begin{aligned}\therefore \text{Time in Papeete} \\ &= 7\text{pm (Fri) less 21 hours} \\ &= 10\text{pm (Thurs)}\end{aligned}$$

## 13. Measurement, 2UG 2009 HSC 26b

(i) Denver is behind Osaka time by 16 hours.

$$\begin{aligned}\therefore \text{Time in Osaka} &= 9 \text{ pm Monday plus 16 hours} \\ &= 1 \text{ pm Tuesday}\end{aligned}$$

(ii) Denver is 16 hours behind Osaka

♦ Mean mark 34%

$$\begin{aligned}\therefore \text{John will receive the text at 10 am Thursday} \\ \text{less 16 hours plus 14 hours.} \\ \text{(i.e. 8 am Thursday.)}\end{aligned}$$

## 14. Measurement, STD2 2011 HSC 27b

$$\begin{aligned}\text{(i) Shortest distance} &= \frac{91}{360} \times 2\pi r \\ &= \frac{91}{360} \times 2 \times \pi \times 6400 \\ &= 10\,164.79\dots \\ &= 10\,165 \text{ km (nearest km)}\end{aligned}$$

(ii) Latitude

♦♦ Mean mark 33%

4° South of Jarvis Island

Since Jarvis Island is on equator

$$\Rightarrow \text{Latitude is } 4^\circ\text{S}$$

Longitude

Jarvis Island is 160°W

Rubail is 48° West of Jarvis Island, or 208° West

which is 28° past meridian (180°)

$$\begin{aligned}\Rightarrow \text{Longitude} &= (180 - 28)^\circ\text{E} \\ &= 152^\circ\text{E}\end{aligned}$$

$$\therefore \text{Position is } (4^\circ\text{S}, 152^\circ\text{E})$$