

## Mark Scheme

Q1.

Question number	Answer	Mark
	(i) <b>4h 36m</b> LST = RA of objects on meridian, i.e. 10h42m – 6h 6m	(2) (1)
	(ii) <b>4h 36m</b> Mention of LST or RA of objects on meridian	(2) (1)

Q2.

Question number	Answer	Notes	Marks
		Viewed from <b>London</b> (Latitude: 52°N)	Viewed from <b>Brazil</b> (Latitude: 16°S)
	<b>Pole Star</b>	C	N
	<b>Sun</b> at midday on June 21 <sup>st</sup>	R	R
	<b>Sirius</b> (Declination: -16°)	R	Z
	<b>Orion's Belt</b> (Declination: 0°)	R	R
	6 correct 4 or 5 correct 2 or 3 correct 0 or 1 correct		<b>3</b> <b>2</b> <b>1</b> <b>0</b>

Q3.

Question number	Indicative content	Mark
	<ul style="list-style-type: none"> <li>• Readings taken either side of local noon</li> <li>• Measurements taken on whole numbers of minutes</li> <li>• Intervals in readings are too large</li> <li>• Around noon, the Sun is moving one or two degrees between readings</li> <li>• An error of even one degree in latitude represents a substantial distance at sea [~70 miles]</li> <li>• Using the Sun's altitude as the independent variable may have been a more effective method</li> <li>• Altitude of Sun at noon correctly assessed from data (42°)</li> <li>• Latitude calculation is incorrect: <u>Co</u>-latitude + 8° = 42°, giving correct latitude of <u>56</u>°.</li> </ul>	(6)

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	<ul style="list-style-type: none"> <li>• A few inadequacies in the data are noted</li> <li>• A few shortcomings of the method used are identified</li> <li>• Some mention of relevant astronomical theory is made</li> <li>• At least one feasible suggestion for improving the method is made.</li> </ul>
Level 2	3-4	<ul style="list-style-type: none"> <li>• The major inadequacies in the data are noted</li> <li>• These are each linked to a particular shortcoming of the method used are identified</li> <li>• Relevant astronomical theory is used</li> <li>• Feasible suggestions for improving the method are made.</li> </ul>
Level 3	5-6	<ul style="list-style-type: none"> <li>• All inadequacies in the data are noted</li> <li>• These are each linked to a particular shortcoming of the method used are identified</li> <li>• Relevant astronomical theory is used to justify each of the above points</li> <li>• Detailed suggestions for improving the method are made by systematically addressing each of the identified issues.</li> </ul>

Q4.

Question number	Answer	Additional guidance	Mark
(i)	Altitude of Polaris = latitude (to nearest degree) = $56^\circ$ (1)  Polaris is the North Star hence azimuth = $0^\circ$ (due North) (1)	Accept $360^\circ$ for azimuth	(2)

Question number	Answer	Additional guidance	Mark
(ii)	Working: Celestial equator has meridian altitude of $90 - 55^\circ 57' = 34^\circ 03'$ (1)  + Vega's declination of $38^\circ 45'$  = $72^\circ 48'$ (1)	Award full marks for correct numerical answer without working	(2)

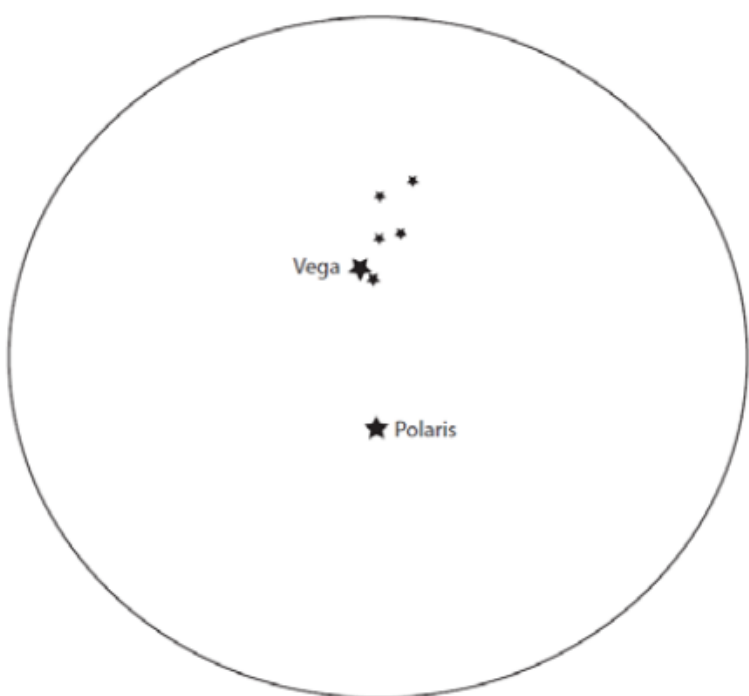
Question number	Answer	Additional guidance	Mark
(iii)	Local Sidereal Time (in Edinburgh) = RA of meridian = 18 h 30 min (1)  Greenwich is $3^\circ 15''$ east of Edinburgh which adds $3^\circ 15'' \times 4 = 13$ min (1)  hence Greenwich ST = LST + adjustment for longitude of Edinburgh  = 18 h 30 min + 13 min = 18 h 43 min (1)	Award full marks for correct numerical answer without working	(3)

Q5.

Question number	Answer	Acceptable Answers	Marks
(i)	C $50^\circ$  <b>The only correct answer is C</b>  A is not correct because it is not equal to the observer's latitude  B is not correct because it is not equal to the observer's latitude  D is not correct because it is not equal to the observer's latitude		1

(ii)	<p><b>B 40°</b></p> <p><b>The only correct answer is B</b></p> <p>A is not correct because it is not equal to the observer's co-latitude</p> <p>C is not correct because it is not equal to the observer's co-latitude</p> <p>D is not correct because it is not equal to the observer's co-latitude</p>		1
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Q6.

Question number	Answer	Mark
	<p>Lyra located in correct position (on opposite side of Polaris) (1)</p> <p>Orientation of Lyra and Vega correct (180° rotation about Polaris) (1)</p> 	(2)

Q7.

Question number	Answer	Mark
	<p><i>Any 1 of:</i></p> <ul style="list-style-type: none"> <li>• Altitude of Celestial Equator on meridian is <math>90^\circ - 42^\circ = 48^\circ</math></li> <li>• Altitude of Aldebaran (<math>64^\circ 30'</math>) therefore = Dec + <math>48^\circ</math></li> <li>• <i>Establishing NCP as <math>42^\circ</math> above northern horizon and Aldebaran's co-declination as <math>138^\circ - 64^\circ 30' = 73^\circ 30'</math>.</i></li> </ul>	(1)
	<p><i>Labelled diagram illustrating one of the above.</i></p>	(1)

Q8.

Question number	Answer	Mark
	<p><i>Any 2 of the following points, established by diagram or otherwise:</i></p> <ul style="list-style-type: none"> <li>• RA of observer's meridian is 10h 42m</li> <li>• First Point of Aries is 10h 42m from meridian</li> <li>• Aldebaran is 6h 6m from meridian</li> <li>• RA of Aldebaran = 10h 42m - 6h 6m</li> <li>• i.e. 4h 36m from First Point of Aries.</li> </ul>	(2)
	<p><i>Diagram supporting on of the above.</i></p>	(1)