



**DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA**  
**MINISTRY OF PORTS AND SHIPPING**  
**MERCHANT SHIPPING SECRETARIAT**

**CERTIFICATE OF COMPETENCY EXAMINATION**

**GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)**  
**SUBJECT : NAVIGATION**  
**DATE : 03<sup>rd</sup> July 2018 0900 hrs to 1200 hrs.**

Time allowed THREE hours

Total marks : 200

ANSWER ALL QUESTIONS

Pass marks : 70%

Formulae and all intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches wherever required. Electronic devices capable of storing and retrieving are **not** allowed.

1. A vessel is to make passage by Great Circle from Port San Luis, California, USA  $35^{\circ} 10.0' N$   $120^{\circ} 45.0' W$  to, Auckland, New Zealand  $36^{\circ} 51.0' S$ ,  $174^{\circ} 49.0' E$ .

Calculate EACH of the following:

- a. The total distance from California to Auckland; (15 marks)  
b. The initial course on passage; (10 marks)  
c. The final course on passage; (10 marks)

2. At 1920 hrs, a vessel in DR position  $25^{\circ} 30' S$   $073^{\circ} 42' E$  on a course of  $230^{\circ} T$  at 22 knots makes the following observations:

Time	Star	Azimuth	Intercept
1950	A	$282^{\circ}$	2'.5 towards
1945	B	$140^{\circ}$	0'.6 away
1935	C	$350^{\circ}$	4'.5 away

The same DR was used for all intercepts. Find, by plotting, the vessel's Most Probable Position at 1935. (25 marks)

3. i. Explain the factors to be considered when appointing an On scene Co-ordinator in a Search and Rescue incident.

(10 marks)

- ii. Following are data related to a Search and Rescue Operation.

- The distress vessel position for 1000 GMT / Position source known
- Weather- N'ly Wind 20 kts and Sea 1.2 m
- Vessel arriving at 1200 hrs
- Water current 225° x 2.0 kts
- Wind driven current WSW x 1.5 kts
- Abandon in a 15 man life raft without drogue
- Visibility 10 nm
- Search speed 12 kts
- Search time 2.0 hrs

Using the above information;

- a. With an aid of a sketch show the new datum point for the search and rescue operation.

(10 marks)

- b. Find the track spacing and the search area.

(05 marks)

- c. With aid of a sketch explain Parallel Track Search.

(10 marks)

4.

- . Vessels engaged on passages across the North Atlantic Ocean may encounter icebergs.

- i. Describe the sources and type of information that are available to the Master regarding icebergs.

(15 marks)

- ii. Outline the factors that should be considered by a prudent Master when determining the risks involved in encountering dangerous ice.

(20 marks)

- iii. Outline the reporting procedure that is to be followed by the Master on encountering dangerous ice.

(10 marks)

5. SOLAS chapter V requires a master to have in place a voyage plan prior to the commencement of a passage.

- (a) State 10 factors to be considered when undertaking the appraisal stage when determining the choice of route.

(10 marks)

- (b) State 4 factors to be considered when undertaking the planning stage to determine an appropriate distance to pass off a headland.

(05 marks)

- (c) With reference to the Bridge Procedure Guide, list the 10 circumstances when the master must be called.

(10 marks)

6. During severe weather an engine room rating suffers a serious injury after falling in the engine room.

At 1000 hrs UT on the 17<sup>th</sup> September the rating's condition starts to deteriorate and contact is made with an American warship which agrees to rendezvous with the vessel at sunrise the following day, to render medical assistance.

After consultation between the two vessels it is agreed that own vessel will maintain present heading of 083<sup>0</sup> (T) and speed of 13.0 knots.

Own vessel position at 1000 hrs UT	35 <sup>0</sup> 24'.0N	146 <sup>0</sup> 42'.0E
Warship position at 1000 hrs UT	33 <sup>0</sup> 36'.0N	149 <sup>0</sup> 04'.0E

Calculate EACH of the following:

- (a) the UT of Sunrise (15 marks)
- (b) the rendezvous position (10 marks)
- (c) the course and speed required by the warship to make the rendezvous. (10 marks)

## ANSWERS

### Answer - 1

$$\begin{aligned} \cos \text{ distance} &= (\cos \text{ dlong} \times \cos \text{ lat A} \times \cos \text{ lat B}) + (\sin \text{ lat A} \times \sin \text{ lat B}) \\ &= (\cos 64^\circ 26.0 \times \cos 35^\circ 10'.0 \times \cos -36^\circ 51'.0) + \\ &\quad (\sin 35^\circ 10'.0 \times \sin -36^\circ 51'.0) \\ &= 93^\circ 37'.1 \\ &= 5617'.1 \end{aligned}$$

Using the cosine formula to resolve the initial and final courses;

$$\begin{aligned} \cos I \text{ Co.} &= (\sin \text{ lat B} - (\sin \text{ lat A} \times \cos \text{ dist})) \div (\cos \text{ lat A} \times \sin \text{ dist}) \\ &= (\sin -36^\circ 51'.0 - (\sin 35^\circ 10'.0 \times \cos 93^\circ 37'.1)) \div \\ &\quad (\cos 35^\circ 10'.0 \times \sin 93^\circ 37'.1) \end{aligned}$$

$$\begin{aligned} \text{Initial Co.} &= N 133.67^\circ W \\ &= 226\frac{1}{2}^\circ \text{ (to the nearest } \frac{1}{2}^\circ \text{)} \end{aligned}$$

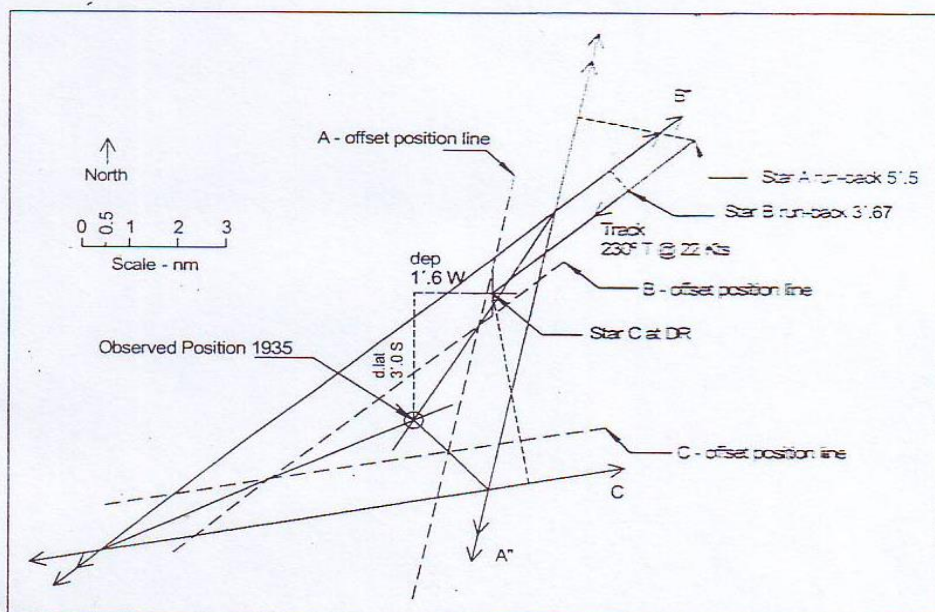
$$\cos RF \text{ Co.} = (\sin \text{ lat A} - (\sin \text{ lat B} \times \cos \text{ dist})) \div (\cos \text{ lat B} \times \sin \text{ dist})$$

$$\text{Recip F Co.} = N 47.64^\circ E$$

$$\begin{aligned} \text{Final Co.} &= S 47.64^\circ W \\ &= 227\frac{1}{2}^\circ \text{ (to the nearest } \frac{1}{2}^\circ \text{)} \end{aligned}$$

### Answer - 2

Star A 1935 - 1950 = 15 minutes back = 5'.5 run-back  
 Star B 1935 - 1945 = 10 minutes back = 3'.67 run-back  
 Star C 1935 - 1935 = 0



d.lat	= 3'.0 S	departure	= 1'.6 W
mean lat	= DR lat + ½ d.lat	= 25° 30' S + 1'.5 S =	25° 31'.5 S
d.long	= dep / cos mean lat	= 1'.6 / cos 25° 31'.5	= 1'.8 W
DR lat	25° 30'.0 S	long	073° 42'.0 E
d.lat	<u>3'.0 S</u>	d.long	<u>1'.8 W</u>
Position	1935		<u>073° 40'.2 E</u>
			<u>25° 33'.0 N</u>

**Answer – 3(ii)(b)**

TS =5.1 nm

Search area= 110.2 nm<sup>2</sup>

**Answer - Q6**

1

### 1<sup>st</sup> Approximation

	h	m	
LMT Sun rise	05	49	22 <sup>nd</sup> .
LIT	-11	10	

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LMT S-12	18	39	21 <sup>st</sup> .
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Local LMT	8	30	
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diff	10	09	
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Spd	18 kts		
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$$\text{dist} = 10.15 \times 18 = 182.7$$

$$\begin{aligned} d \text{ lat} &= \text{dist} \times \cos \text{Co} \\ &= 182.7 \times \cos 15 \\ &= 176.48 \\ &= 2^{\circ} 56.5 \end{aligned}$$

$$\begin{array}{r} \text{lat} = 21^{\circ} 30' \text{N} \\ \quad 2^{\circ} 56.5 \\ \hline 24^{\circ} 26.5 \text{ N} \end{array}$$

$$\text{Me lat} = 21^{\circ} 30' \text{N} + 1^{\circ} 28.3 \text{ N} = 22^{\circ} 58.3 \text{ N}$$

$$\text{dep} = \text{dist} \times \sin \text{Co}$$

$$= 182.7 \times \sin 15 = 47.3'$$

$$d \text{ long} = \frac{\text{dep}}{\cos \text{true lat}}$$

$$= \frac{47.3}{\cos 22^\circ 58'.3} = 51.4'$$

$$\text{long} = 167^\circ 24' \text{ E}$$

$$- 50. 51.4' \text{ W}$$


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$$166^\circ 32.6' \text{ E}$$


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2<sup>nd</sup> Approximation

	h	m	
LMT SR	05	49	
LIT	11	06	
<hr/>			
GMT SR	18	43	21 <sup>ST</sup>
initial GMT	8	30	
<hr/>			
diff	10	13	
<hr/>			
dist =	18 x 10.2 = 183.6		



$$d \text{ lat} = \text{dist} \times \cos \omega$$

$$= 183.6 \times \cos 15$$

$$= 177.3$$

$$\text{dep} = \text{dist} \times \sin \omega$$

$$= 183.6 \times \sin 15$$

$$= 47.5$$

③

$$\text{Mean lat} = 21^{\circ} 30' N$$

$$+ 128.7 N$$


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$$22^{\circ} 58.7' N$$


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$$d \text{ long} = \frac{\text{dep}}{\cos \text{M. lat}} = \frac{47.5}{\cos 22^{\circ} 58.7'} = 51.6$$

Rendezvous Pos<sup>n</sup>

$$\text{lat} = 21^{\circ} 30' N + 2^{\circ} 57.3' = 24^{\circ} 27.3' N$$

$$\text{long} = 167^{\circ} 24' E - 51.6 = 166^{\circ} 32.4' W$$

Wanship Pos <sup>n</sup>	24° 54' N	172° 36.0 E
Rendezvous Pos <sup>n</sup>	24° 27.3 N	166° 32.4 E

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d lat	26.7	6° 3.6'
		= 363.6 d long.

$$\text{M. lat} = 24^{\circ} 27.3$$

$$\quad \quad \quad 13.3$$


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$$24^{\circ} 40.6 N$$


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$$\text{dep} = d \text{ long} \times \cos \text{lat-M} = 363.6 \times \cos 24^{\circ} 40.6' = 330.3$$