



NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2009

NAUTICAL SCIENCE: PAPER I

MARKING GUIDELINES

Time: 3 hours

Marks: 150

These marking guidelines were used as the basis for the official IEB marking session. They were prepared for use by examiners and sub-examiners, all of whom were required to attend a rigorous standardisation meeting to ensure that the guidelines were consistently and fairly interpreted and applied in the marking of candidates' scripts.

At standardisation meetings, decisions are taken regarding the allocation of marks in the interests of fairness to all candidates in the context of an entirely summative assessment.

The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines, and different interpretations of the application thereof. Hence, the specific mark allocations have been omitted.

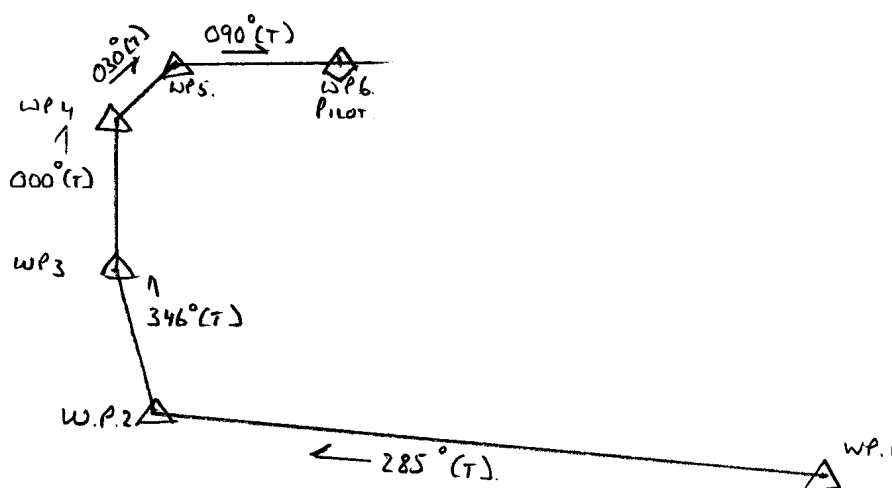
Please note that learners who provided alternate correct responses to those given in the marking guidelines will have been given full credit.

SECTION A PRACTICAL CHARTWORK**QUESTION 1**

As Navigating Officer you are required to prepare a passage plan for a voyage to Cape Town from Port Elizabeth. Given the following Way Points (WP):

WP 1	34° 30,2'S	018° 50,0'E	
WP 2	34° 23,3'S	018° 19,0'E	
WP 3	34° 10,0'S	018° 15,0'E	
WP 4	34° 01,0'S	018° 15,0'E	
WP 5	33° 52,5'S	018° 21,0'E	
WP 6	33° 52,5'S	018° 24,0'E	Pilot Station

- 1.1 Lay off the courses on the chart SAN 3002. (10)



- 1.2 Draw up a table with the True courses and distances between each WP. (5)

WAY	POSITION		COURSE (T)	DISTANCE (miles)
WP 1	34° 30,2'S	018° 50,0'E	285°	26,8
WP 2	34° 23,3'S	018° 19, 0'E	346°	13,8
WP 3	34° 10,0'S	018° 15, 0'E	000°	9,0
WP 4	34° 01,2'S	018° 50, 0'E	030°	10,0
WP 5	33° 52,2'S	018° 50, 0'E	090°	2,5
WP 6	33° 52,2'S	018° 50, 0'E	Pilot station	

- 1.3 What is the steaming time from WP 1 to the Pilot Station if the vessel's speed averages 16 knots? (5)

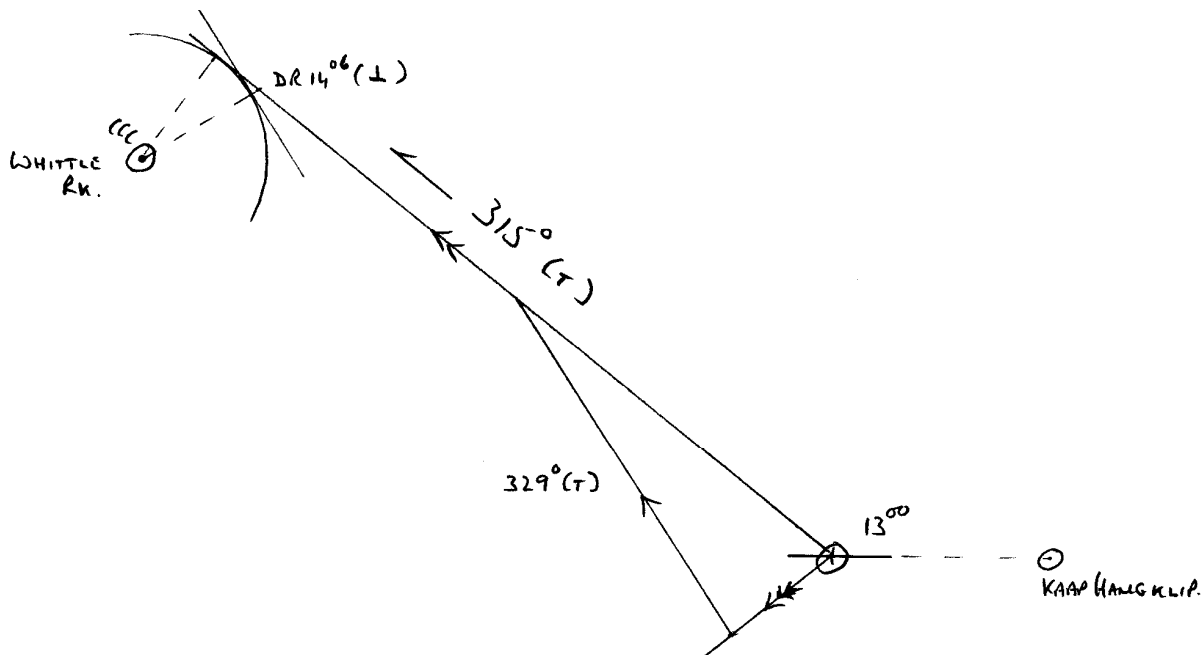
Total distance = 62,1 miles
@ 16 kts = 3hrs 53mins.

[20]

QUESTION 2

At 13:00 hrs a vessel is in position with Kaap Hangklip Lt. bearing 090° (T) x 3,0 miles, and wishes to pass 1 mile off Whittle Rock Racon Buoy in Valsbaai. The current is setting 225° (T) at 3 knots. The speed of the vessel is 12 knots.

- 2.1 Find the compass course to steer, to pass, 1 mile off Whittle Rock Racon Buoy. (16)



From 13:00 position to Whittle Rock abeam 1 M	=	315° x 13'
True course to steer to counter current	=	329° (T)
Variation	=	24° W
Magnetic course	=	353° (M)
Deviation	=	2° E
Compass course	=	<u>351° (C)</u>

- 2.2 At what time will the buoy be abeam? (4)

Distance over ground in ½	=	5,8'
Speed over ground	=	11,6 knots
Distance to Whittle Rock abeam	=	12,8 M
@ 11,6 kts	=	1h 6m
ETA Whittle Rck abeam	=	<u>14:06</u>

[20]

QUESTION 3

Cape Point Lt. Hse. was observed to bear 270° (C) when the ship's head was 210° (C), while the vertical sextant angle was observed to be 0° 12,5'.

The sextant index error is 1,2' on the arc. The state of the tide is estimated to be 1,0 m below MHWS.

Plot the position on the chart. What are the Latitude and Longitude coordinates of the vessel?

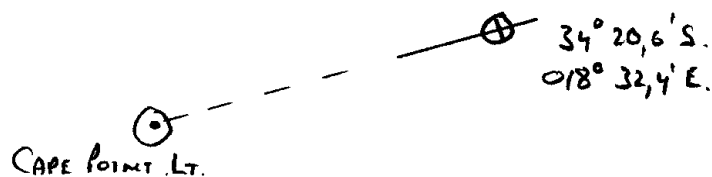
Sextant angle	=	01° 12,5'	Height of Lt.Hse	=	87 m
i.e.	=	1,2' (on)	State of tide	=	1 m
Observed angle	=	01° 11,3'	Corrected height	=	88 m

Dist off Lt. Hse = {88 x 1,86} / 71,3
 = **2,3 miles**

Compass brg = 270° (C)
Dev = 4° E
Magnetic brg = 274° (M)
Variation = 24° W
True brg = **250° (T)**

Position

Lat.34° 20,6'S Long 018° 32,4'E



[20]

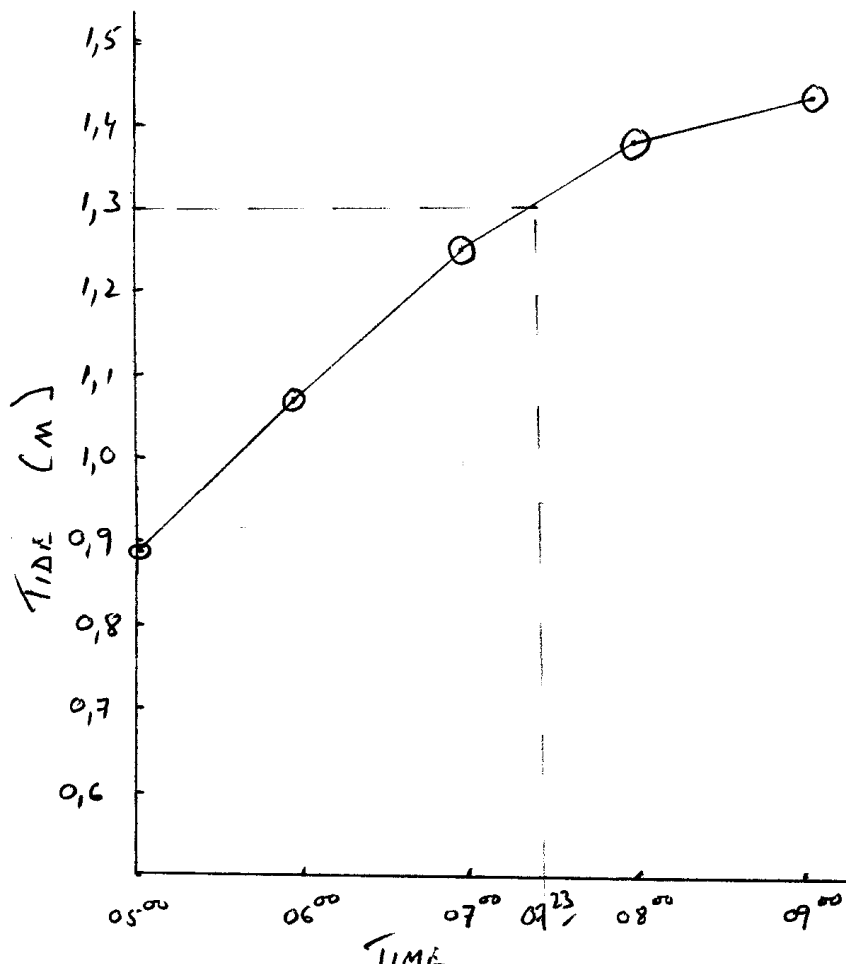
QUESTION 4

Your vessel is due to sail from Knysna on the rising tide during the morning of 1 December 2007. The channel through Knysna Heads is 5,2 m. You are required to have a minimum clearance at all times of 2,5 m beneath the keel, and the draught of your vessel is 4,2 m.

If the steaming time from where your vessel is berthed to the Heads is 45 minutes, what is the latest time that you may depart in order to cross through the Heads on the rising tide?

Draught	=	4,2 m
Clearance	=	2,5
Depth required	=	6,7
Chart depth	=	5,4
Height of tide	=	1,3 m

From the Tide Tables, cross at	07h 23m	1 December
Steaming time from the berth	=	00h 45m
Latest time to depart the berth	=	<u>06h 28m</u>
		1 December



[20]

QUESTION 5

- 5.1 What is a suitable anchorage for a container vessel with a draught of 12 m in December (summer) off Cape Town?

Mark the position on the Chart SAN 3002, and state the position on your answer sheet with reference to the bearing and range to Green Point Lt. Hse. (5)

A suitable anchorage recommended on the chart for summer is west of Green Point Lt Hse.

e.g. Green Pt. Lt. bearing 111° x 1,5 miles.

- 5.2 What is the variation to apply to the true bearing in the year 2009 on the compass rose SW of Cape Point on Chart SAN 3002? (5)

The variation to apply is

1999 Var 23° 35'W

2'W p.a. x 9 years = 18'W

2009 Var. = 23° 53'W

- 5.3 What do the cardinal marks indicate on the Racon buoy at Whittle Rock in Valsbaai? (2)

Whittle Rock Racon buoy has top mark two cones points outwards or diametrically opposed indicate safe water to pass to the East of the buoy.

- 5.4 Describe the characteristics of Slangkoppunt Light House. (8)

Slangkoppunt Lt Hse

White light flashing sequence 4 every 30 seconds;

Height of the light is 41 meters above MHWS;

Range of visibility is 30 miles.

[20]

100 marks

QUESTION 6

On 19th August 1987 your vessel is in D R position Lat. 28° 00'S Long. 010° 05'E, and the sextant altitude of the sun's lower limb was observed to be 35° 23,7' when the chronometer read 08h 53m 23s. The chronometer error was 45 seconds slow on GMT.

Index error of the sextant: 1,0' on the arc
Observer's height of eye: 6,2 metres

6.1 Determine the position line on which the ship was situated using the intercept method. (20)

Chron	=	08h 53m 23s	GHA	=	299° 04,0'	Dec	=	12°54,9' N
error (slow)	=	00 00 45 -	Inc 52m 38s	=	013° 09,5'	'd'	=	0,7' -
GMT at obs.	=	08 52 38	GHA	=	312° 13,5'	Dec	=	12°54,2' N
			Long E	=	010° 05,0' +			
			LHA	=	322° 18,5'			

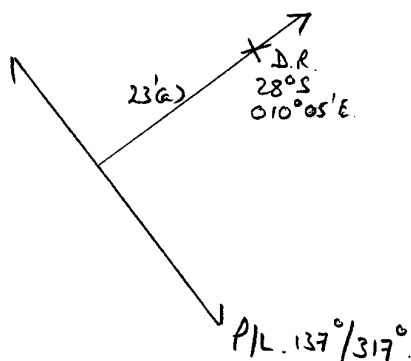
$$\begin{aligned}\sin \theta &= \cos LHA \times \cos Lat \times \cos Dec \pm \sin Lat \times \sin Dec \\ &= \cos 322^\circ 18,5' \times \cos 28^\circ \times \cos 12^\circ 54,2' \pm \sin 28^\circ \times \sin 12^\circ 54,2' \\ &= 0,681 - 0,105 \\ &= 0,576 \\ \theta &= 35^\circ 10,2'\end{aligned}$$

$$\begin{aligned}\text{Sext Alt} &= 35^\circ 23,7' \\ \text{Index error} &= 1,0' \\ \text{Obs. Alt} &= 35^\circ 22,7' \\ \text{Dip (6,2m)} &= 4,4' - \\ \text{App. Alt.} &= 35^\circ 18,3' \\ \text{Total error} &= 14,9' + \\ \text{TrueAlt.} &= 35^\circ 33,2' \\ \text{Calc. Alt.} &= 35^\circ 10,2' \\ \text{Intercept} &= 23,0' \text{ away}\end{aligned}$$

$$\begin{aligned}A &= 0,689 \text{ N} \\ B &= 0,370 \text{ N} \\ C &= 1,059 \text{ N}\end{aligned}$$

$$\begin{aligned}\text{Az.} &= \text{N } 47^\circ \text{ E} \\ \text{P/L} &= 137^\circ / 317^\circ\end{aligned}$$

6.2 Plot the DR position, azimuth and position line schematically on your answer sheet. (5)



[25]

QUESTION 7

On 19th August 1987 your vessel is steering 302° (C) in D R position Lat. 27° 30'S Long. 010° 15'E. The sun was observed to rise bearing 085° (C). The magnetic variation in the area is 24°W.

7.1 Determine the following:

7.1.1 GMT and Zone time of sunrise (10)

$$\begin{array}{llll}
 \text{LMT Sunrise} = & 06\text{h } 28\text{m} & \text{Dec} = & 12^\circ 57,3' \text{ N} \\
 \text{Long in time} = & \underline{\quad 41\text{m} \quad} - & \text{'d'} = & \underline{\quad ,6 \quad} - \\
 & & \text{Sin Amp} = & \text{Sin Dec / Cos Lat} \\
 & & & = \text{Sin } 12^\circ 56,7' / \\
 & & & \text{Cos } 27^\circ 30' \\
 \text{GMT Sunrise} = & 05\text{h } 47\text{m} & \text{Dec} = & 12^\circ 56,7' \text{ N} \\
 & & \text{Amp} = & 0,253 \\
 & & & = \text{E } 14,6^\circ \text{ N } 075\frac{1}{2}^\circ
 \end{array}$$

7.1.2 The vessel's compass error (6)

$$\begin{array}{ll}
 \text{True brg} & = 075\frac{1}{2}^\circ \\
 \text{Compass brg} & = \underline{085^\circ} \\
 \text{Compass error} & = \underline{\underline{9\frac{1}{2}^\circ \text{ W}}}
 \end{array}
 \qquad
 \begin{array}{ll}
 \text{Ship's Head} & = 302^\circ \text{ (C)} \\
 \text{Dev} & = \underline{14\frac{1}{2}^\circ \text{ W}} \\
 \text{Heading} & = 287\frac{1}{2}^\circ \text{ (M)} \\
 \text{Var.} & = \underline{24^\circ \text{ W}} \\
 \text{True head} & = \underline{\underline{263\frac{1}{2}^\circ \text{ (T)}}}
 \end{array}$$

7.1.3 The deviation of the compass (2)

$$\begin{array}{ll}
 \text{Variation} & = 24^\circ \text{ W} \\
 \text{Deviation} & = \underline{\underline{14\frac{1}{2}^\circ \text{ W}}}
 \end{array}$$

7.1.4 The true course of the vessel (2)

7.2 Show by means of a sketch on the plane of the celestial horizon the following:

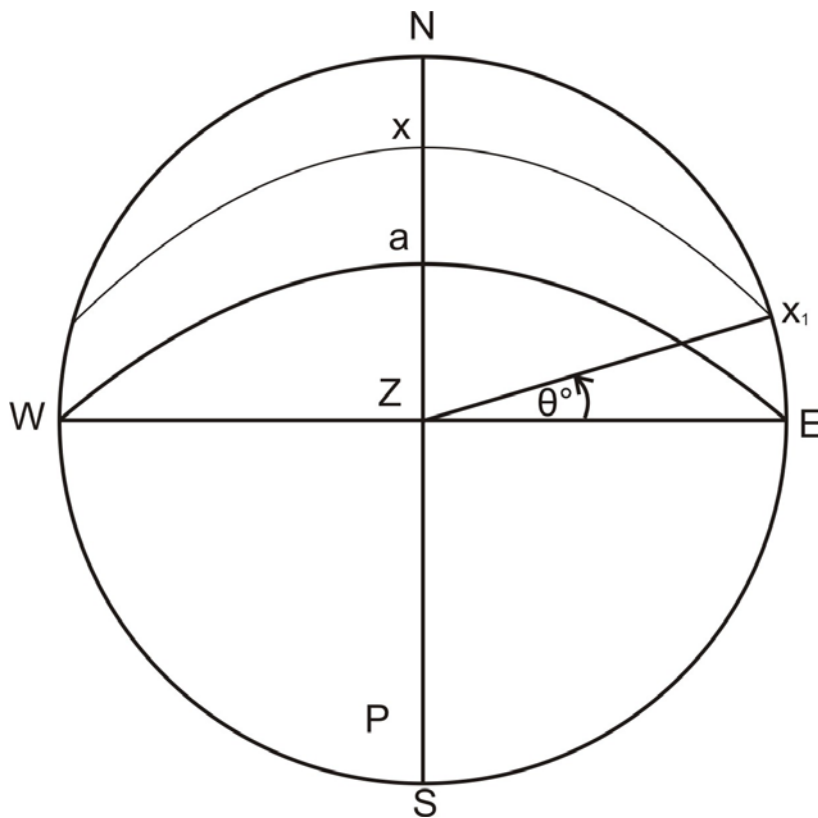
7.2.1 The declination (X) (1)

7.2.2 The celestial equator (Q) (1)

7.2.3 The zenith position (Z) (1)

7.2.4 The elevated pole (P) (1)

7.2.5 The amplitude of the sun (θ°) (1)



[25]

50 marks

Total: 150 marks