



NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2017

NAUTICAL SCIENCE: PAPER I
MARKING GUIDELINES

Time: 3 hours

150 marks

These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.

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. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.

SECTION A PRACTICAL CHART WORK**QUESTION 1**

1.1

	COURSE	Cape Point brg.	Slangkoppunt Lt
Compass 16:00	022°	084°	042°
Deviation	4° E	4° E	4° E
Magnetic	026°	088°	046°
Variation	26° W	26° W	26° W
True	000°	062°	020°

16:00 to WP.1 course to make good 008° (T) 29,6 m

WP.1 to WP.2 course to make good 030° (T) 9,7 m

WP.2 to WP.3 (Pilot) course to make good 090° (T) 2,7 m

Total distance = 42,0 m. (*See chart for full answer*)

1.2 From 16:00 to WP.1

Course to make good 008°(T)

Course to counter current 001°(T) *See chart*

Leeway 5° -

Course to steer 356°(T)

Variation 26° W

Magnetic course 022°(M)

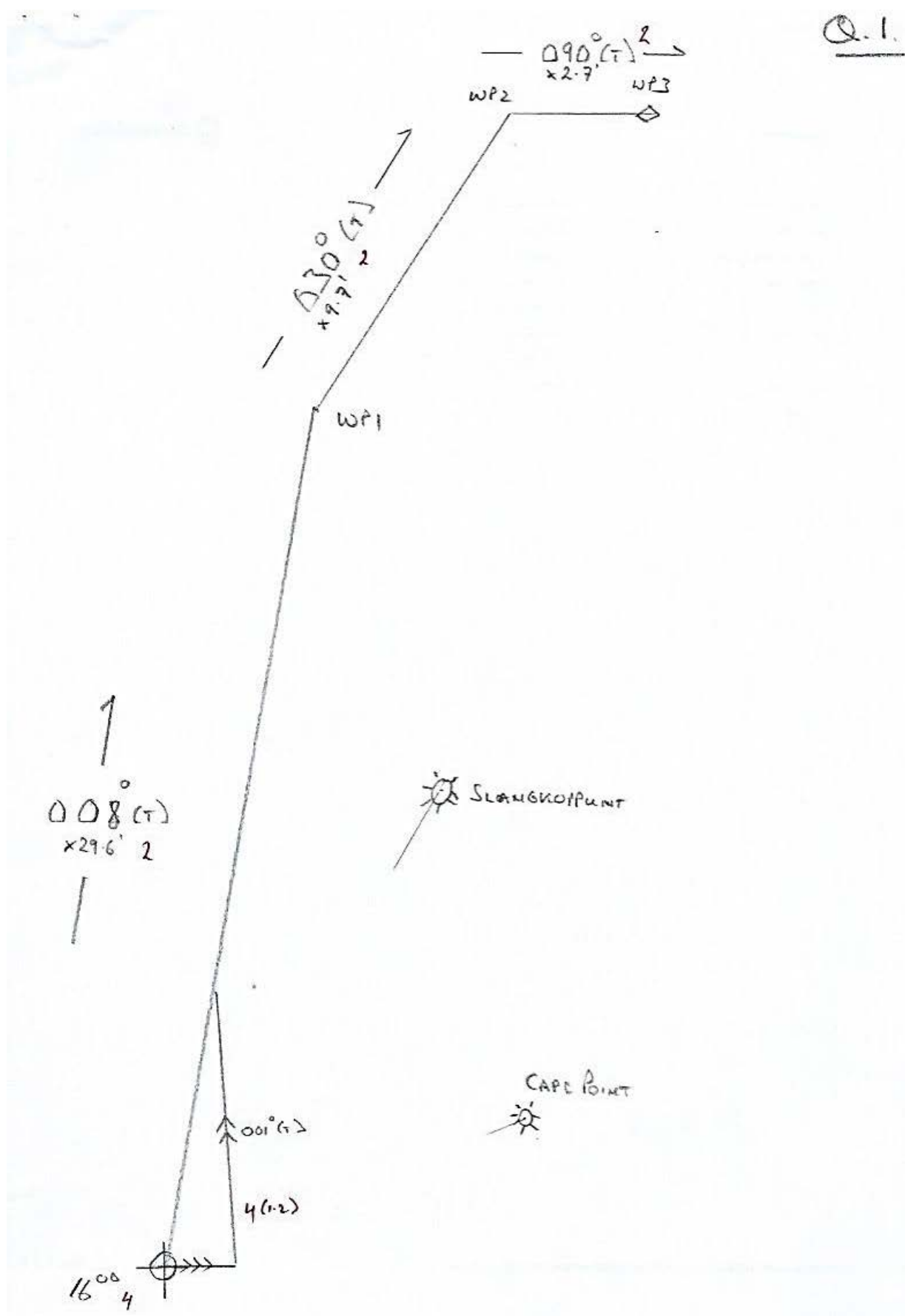
Deviation 4° E

Compass course to steer 018°(C)

1.3 Distance to go from 16:00 is 42,0 m

Speed 14 kts, duration 3 hrs, ETA Pilot 19:00

Q1 (ctd.)



QUESTION 2

- 2.1 Bearing between Hangberg & Chapman's 148/328°
Dissect at 90° for centre of position circle

Bearing between Chapman's Peak & Slangkoppunt 030/210°
 $90^\circ - 98^\circ = 8^\circ$

Slangkop $030^\circ + 8^\circ = 038^\circ$

Chapman's Peak $210^\circ - 8^\circ = 202^\circ$

V/l position $34^\circ 06' \text{ S } 018^\circ 20' \text{ E}$ (*see chart for full answer*)

- 2.2 Depth of water in that position is $\geq 30 \text{ m}$.

- 2.3 The index error will be checked by observing a star directly through the sextant with the following procedure:

- Set the sextant index arm to 0° .
- Observe the star and adjust the index arm to bring the star and the reflected object together so the two coincide perfectly.
- The reading will then be the Index Error (IE).

If it is 0° there is no IE. If the reading is +ve, or ON the arc, then the IE is subtracted. If it is -ve, or OFF the arc, then the IE is added.

QUESTION 3

- 3.1

	Course	13:15 Bearing	13:45 Bearing
Compass	349°	304°	259°
Deviation	2° E	2° E	2° E
Magnetic	351°	306°	261°
Variation	26° W	26° W	26° W
True	325°	280°	235°

Position at 13:45 $34^\circ 12.6' \text{ S } 018^\circ 38' \text{ E}$ (*See chart for full answer*)

- 3.2 Distance off Whittle Rk. at 13:45 is 3,8 miles.

QUESTION 4

- 4.1 Height of tide required = Draught + UKC + drying height
= 10,7 + 2,0 + 1,1
= 13,8 m
- 4.2
- Currents are permanent or seasonal horizontal movements of water flowing in a particular direction.
 - The result is a uniform movement of water in a given direction that transports a vessel bodily without affecting the ship's head.
 - Tidal streams are also the horizontal movement of water but caused by tidal forces.
 - They can be rectilinear (flowing in two directions called ebb and flood), or rotary, changing direction 360° in a cycle.
- 4.3 Information about tidal streams and currents can be found on the chart, in the Sailing Directions and in a special Tidal Stream Atlas.

SECTION B ASTRO-NAVIGATION**QUESTION 5**

Observation	☉ Sun	
Chron (given)		09h 14m 21s
Chron (AM)	18.08.1987	09h 14m 21s
Error (fast)		- 01m 25s
UT/GMT	18.08.1987	09h 12m 56s (Z)

Tab GHA ☉	314° 00,8'
HA Inc ☉	+ 003° 14,0'
E Longitude	+ 012° 07,0'
LHA ☉	329° 21,8'
Tab Dec ☉	N 13° 13,5'
(d - 0,8') Corr	- 000° 00,2'
Dec ☉	N 13° 13,3'
DR Latitude	25° 35,0' S
Lat + Dec	38° 48,3' N
Lat and Dec	S/N Opp -

LHA > 180°

East of Ship

ZX = QZ + QX

ZX = (L + D)

N	✓
X	
Q	
Z	
S	

or

$$\sin H_c = \cos LHA \cdot \cos L \cdot \cos D - \sin L \cdot \sin D$$

$$\sin H_c = (\cos LHA - 1) \cdot \cos L \cdot \cos D + \cos (L + D)$$

$$\sin H_c = (0,65672)$$

$$H_c = 41^\circ 03' 01,2''$$

$$H_c \Rightarrow 41^\circ 03,0'$$

$$\cos CZD = \cos LHA \cdot \cos L \cdot \cos D - \sin L \cdot \sin D$$

$$\cos CZD = (\cos LHA - 1) \cdot \cos L \cdot \cos D + \cos (L + D)$$

$$\cos CZD = (0,65672)$$

$$CZD = 48^\circ 56' 58,8''$$

$$CZD \Rightarrow 48^\circ 57,0'$$

A = Tan L ÷ Tan HA	0,80836 N
B = Tan D ÷ Sin HA	0,46105 N
C = A + B	1,26941 N
∠Z	41,13386°
Zc	N 41° E
Zn	041°T

(Nearest $\frac{1}{2}^\circ$)

(Nearest $\frac{1}{2}^\circ$)

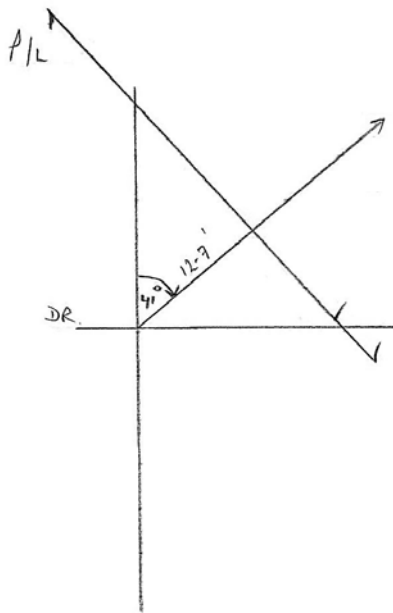
LOP Direction	131°T ~ 311°T →
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Hs ☉ LL	41° 07,9'
IE (on)	- 01,0'
OA ☉ LL	41° 06,9'
Dip (12,0m)	- 06,1'
AA ☉ LL	41° 00,8'
TC ☉ LL (Aug)	+ 14,9'
Ho ☉	41° 15,7'
Hc ☉	41° 03,0'
Intercept	12,7 miles
	Towards

(Ho > Hc)

TZD ☉	48° 44,3'
CZD ☉	48° 57,0'
Intercept	12,7 miles
	Towards

(TZD < CZD)

**QUESTION 6**

- 6.1
- | | | | |
|------------------|---|-----------------|-----------------|
| LMT Sunset 15° N | | 18 ^H | 22 ^M |
| Long. 10° 25' W | + | | 42 ^M |
| GMT | | 19 ^H | 04 ^M |
| Zone (+1) | - | 1 ^H | 00 ^M |
| Sunset v/l time | | 18 ^H | 04 ^M |
| Dec 18 Aug 19:00 | | 13° | 05.4' |
| 'd' (-0.8) | | | 00.1' |
| Dec 19:04 | | 13° | 05.3' |
- 6.2
- | | | |
|-------------|---|-------------------------|
| Sin Amp. | = | Sin Dec. / Cos Lat |
| | = | Sin 13° 05.4' / Cos 15° |
| | = | 0.234470708 |
| Amp. | = | W13 1/2° N |
| True brg. | = | 283 1/2° |
| Comp. brg. | = | 302° |
| Comp. error | = | 18 1/2° W |
| Var. | = | 26° W |
| Dev. | = | 7 1/2° E |
- 6.3
- | | |
|--------------|-------------|
| Comp. course | 276°(C) |
| Error | 18 1/2° W |
| True course | 257 1/2°(T) |

Total: 150 marks