

CLASS-3

Ocean and Offshore Navigation (O'Nav)

Plane Sailing

1). Using plane sailing formulae, find the final position in each case:-

Initial Position	Track	Distance
a. $35^{\circ}42'N, 71^{\circ}22'W$	308°	428'
b. $40^{\circ}06'N \ 56^{\circ}07'W$	145°	377'

2). Using plane sailing formulae, find the course and distance between each case.

	A	B
a.	$31^{\circ}12'N \ 30^{\circ}56'W$	$33^{\circ}47'N \ 25^{\circ}03'W$
b.	$18^{\circ}48'S \ 89^{\circ}12'E$	$23^{\circ}34'S \ 86^{\circ}51'E$

3). Using Plane sailing formulae, find the set and drift in each case.

	D.R. Position	Observed Position
a.	$45^{\circ}18'S \ 000^{\circ}21'W$	$44^{\circ}56'S \ 000^{\circ}14'E$
b.	$58^{\circ}20'N \ 093^{\circ}21'E$	$59^{\circ}04'N \ 092^{\circ}58'E$

Parallel Sailing

1. Leaving Position $34^{\circ} 18'S \ 172^{\circ} 10'E$, a ship steams due East until longitude $151^{\circ} 20'W$ is reached. Find the distance steamed and the average speed if the steaming time is 2 days 15 hours 24m.
2. From position $50^{\circ} 00'N \ 8^{\circ} 00'W$, a ship steamed due West for 345 miles. Find the longitude of arrival.
3. A ship in south latitude, on longitude $48^{\circ} 40'E$, steams due East for 2418 miles and arrives in longitude $90^{\circ} 28'E$. Find the parallel of Latitude along which the ship steamed.
4. From position $52^{\circ} 33'N \ 144^{\circ} 47'W$ a ship steamed 180 miles due South, 180 miles due East, 180 miles due North and 180 miles due West. Find the final position and the final distance from the starting point.
5. Find the speed of rotation of the earth's surface at:
 - (a) $80^{\circ} 00'N$.
 - (b) $80^{\circ} 00'S$
 - (c) $60^{\circ} 00'N$
 - (d) The Equator.

Mercator Sailing

1. A vessel leaves position $20^{\circ}14'S$ $9^{\circ}43'W$ and makes good a ground track of $316^{\circ}T$ and a distance of 4135 miles. By Mercator Sailing calculate the arrival position.
2. A vessel leaves position $29^{\circ}47'N$ $24^{\circ}36.0'W$ and makes good a ground track of $211^{\circ}T$ and a distance of 960 miles. By Mercator Sailing calculate the arrival position.
3. A vessel leaves position $30^{\circ}11'N$ $159^{\circ}49'E$ and makes good a ground track of $111^{\circ}T$ and a distance of 4915 miles. By Mercator Sailing calculate the arrival position.
4. A vessel in position $22^{\circ} 31'N$, $147^{\circ} 25'E$ receives a distress message from a vessel in position $11^{\circ} 34'N$, $155^{\circ} 26'E$. She is to proceed directly to assist the vessel in distress. What course must she steer and how long will it take to arrive on scene if her speed is 19.5 knts.
5. A vessel in position $13^{\circ} 18'N$, $179^{\circ} 23'W$, steers a course of $219^{\circ}(T)$. In what longitude will the vessel cross the equator?

DAYS WORK

1. At noon on 14th Sept, a ship in position $40^{\circ}12.0'N$ $076^{\circ}46.0'W$ set course $250^{\circ}(C)$ (Varn $6^{\circ}W$, Devn $4^{\circ}W$) at an engine speed of 16 kts. At 1600, course was altered to $287^{\circ}(C)$ (Varn $6^{\circ}W$, Devn $2^{\circ}E$) and engine speed was decreased to 14 kts. At 2200, course was again altered to $340^{\circ}(C)$ (Varn $5^{\circ}W$, Devn $5^{\circ}E$) and engine speed was maintained at 14 kts till 0600 next morning, when course was altered to $277^{\circ}(C)$ (Varn $5^{\circ}W$, Devn $2^{\circ}W$) and speed increased to 15 kts and this course and speed was maintained till noon on 15th Sept. Find EP on 15th noon, the course and distance made good, if a current was setting $027^{\circ}(T)$ at 2 kts throughout.

2. On 16th Jan a ship in position $00^{\circ} 10.0'N$ $068^{\circ}09'E$ set courses as follows –

	Time	Co (C)	Varn	Devn	L'way	Wind	Log
i.	1200	126°	$4^{\circ}E$	$2^{\circ}E$	3°	SW	000
ii.	1800	149°	$4^{\circ}E$	$3^{\circ}E$	2°	NE	089
iii.	2300	210°	$5^{\circ}E$	$1^{\circ}W$	3°	SE	168
iv.	0700	240°	$5^{\circ}E$	$2^{\circ}E$	Nil	W	290
v.	1200	270°	$4^{\circ}E$	0°	3°	N	368

A current set the v/l $183^{\circ}(T)$ at 1.5kts throughout. Find the EP at next noon and the course and distance made good ?

3. At noon on 14th Dec, a light house in $05^{\circ} 56.0'N$ $080^{\circ}36.0'E$ bore $000^{\circ}(C)$, error $4^{\circ}W$, distance 10 miles. Course was then set to $220^{\circ}(C)$, Devn $1^{\circ}E$, Varn $2^{\circ}W$, log 0. At 2000, engines broke down and the log showing 82, was hauled in. At 2200, engines were repaired and course was reset to $200^{\circ}(C)$ Devn nil, Varn

2°W, log 0. Ship maintained this course till noon next day when log showed 140. A current was estimated to set 350° (T) at 2 kts throughout. Find the EP at noon on 15th Dec ?

4. At noon on 20th July, Pargo Point (32° 48.0'N 017° 16.0'W) bore 080° (C) 10 miles off while steaming 219° (C) (Devn 3°E Varn 18°W). Ship maintained this course at a steady speed of 15 kts till next day. Clocks were retarded 12 minutes at 0200 hrs. Find the DR at 1200 hrs on 21st July, if the fix then was 27° 12.0'N 020° 05.0'W, find the set and drift / rate of current experienced during the above periods.

5. A ship steams the following courses by Gyro (error nil) –

Time	Co (G)	Speed
13 th Jan / 1200	236°	15.0
1700	284°	16.0
2000	262°	15.0

14th Jan/ 0400 198° 14.5, and continued thus till noon, 14th Jan.

At 1800 on 13th Jan, a light house in position 48° 28.5'N 067° 05.0'E bore 4 points on the starboard bow and at 1845 it was abeam. Find the 14th noon DR, the course and distance made good noon to noon ?

GREAT CIRCLE SAILING

- Find by great circle sailing the distance, the initial and final tracks from 22°10'N 74°56'W to 49°27'N 10°46'W.
- Find by great circle sailing the distance, the initial and final tracks from 37°06'N 126°46'W to 34°14'N 146°22'W.
- Find by great circle sailing the distance, the initial and final tracks from 04°07'N 98°55'E to 41°00'S 33°58'E
- Find by great circle sailing the distance, the initial and final tracks from Balboa 08° 53'N 079° 30'W to Snares Island 47°50'S 167° 50'E

COMPOSITE GREAT CIRCLE SAILING (NAPIERS' RULES)

- Find the initial and final tracks on the great circle track between 51°23'N 09°36'W and 46°00'N 49°00'W. Find also the latitude and longitude of the vertex.
- Find the distance and initial and final tracks on the G.C. track between 33°52'S 151°16'E and 12°04'S 77°14'W. Find also the Latitude of the point where the great circle track crosses the 180° meridian.
- Find the initial and final track and also the distance on the G.C. track from position 35°55'S 37°21'W to position 27°14'N 52°39'E. Find the latitude & longitude of the vertex and the latitude in which the great circle crosses the longitude of 17°21'W and 22°39'E.
- Find the great circle distance and the initial track from position 40°42'N 10°05'W to position 40°42'N 50°15'W.
 - Find the position where the vessel's true track becomes 270°.

- c. Determine the difference in distance if the vessel had steamed along the parallel between the two positions.
5. A vessel leaves $47^{\circ}50'N$ $52^{\circ}06'W$ and follows a G.C. track towards $50^{\circ}52'N$ $07^{\circ}23'W$ making good a ground speed of 15 Knots.
- Calculate the time taken to reach the most northerly latitude.
 - Calculate the expected position after steaming 1500 miles along the G.C. track.

Azimuth – Sun

- On 11th October at about 0930 LMT in DR Lat. $54^{\circ} 46'N$, Long. $000^{\circ}17'W$ the sun bore $144^{\circ}C$. A chronometer, known to be 4m 18s slow on GMT showed 9h 32m 14s. If the variation is $9.5^{\circ}W$, find the compass error and the deviation.
- On 7th January at about 1535 LMT in DR Lat. $32^{\circ} 48'S$, Long $31^{\circ}10'E$ the sun was observed bearing $284^{\circ}C$. A chronometer which was 3m 14s fast on GMT showed 1h 35m 27s. If the variation was $21^{\circ}W$, find the compass error and the deviation.
- On 10th June at 1421 LMT in DR Lat. $28^{\circ}00'N$ Long $050^{\circ}00'E$ the sun was observed bearing $261^{\circ}C$. If the variation was $2.5^{\circ}E$, find the compass error and the deviation.
- On 10th July at about 0800 LMT in DR Lat. $23^{\circ}15'N$ Long. $31^{\circ}36'W$ the sun was observed bearing $093^{\circ}C$. The chronometer, which was 5m 20s slow on GMT showed 10h 02m 04s. If variation is $10^{\circ}W$ find the compass error and the deviation.

Azimuths - Stars

- On 13th September at 01h 41m 51s GMT in DR Lat. $57^{\circ} 30'N$ Long. $002^{\circ} 00'E$ the star DUBHE was observed bearing $028^{\circ}C$. If the variation was $3^{\circ}E$ find the compass error and the deviation.
- On 24th December at about 0146 LMT in DR Lat. $19^{\circ} 17'S$ Long. $155^{\circ} 32'W$ the star ALDEBARAN was observed bearing $300^{\circ}C$. A chronometer, which was 2m 12s slow on GMT showed 12h 08m 19s. If the variation was $2^{\circ}W$, find the compass error and deviation.
- On 26th September at 0321 LMT in DR Lat. $25^{\circ} 33'N$ Long. $095^{\circ}15'W$ the star FOMALHAUT was observed bearing $239^{\circ}C$. If the variation was NIL, find the compass error and deviation.
- On 17th December at about 2115 LMT in DR Lat. $32^{\circ} 00'S$ Long $49^{\circ} 43'W$ the star ALPHERATZ was observed bearing $333^{\circ}C$. A chronometer, which was 5m 03s fast on GMT showed 0h 39m 29s. If the variation was $8^{\circ}W$, find the compass error and deviation.
- On 27th September at about 0230 LMT in DR Lat. $40^{\circ} 12'N$ Long. $136^{\circ} 15'W$ the star CAPELLA was observed bearing $050^{\circ}C$. A chronometer, known to be correct on GMT showed 11h 35m 24s. If the variation was $19^{\circ}E$, find the compass error and deviation.

Azimuths - Planets

1. On 1st Dec, PM at ship in DR 36°27'N 144°44'E, Venus bore 235°(C) at 09h 18m 08s chrono time (error 10m 04s fast). Variation was 2.5°E, find the deviation for the ship's head ?
2. On 23rd Sep, at about 0019 at ship in DR 36°08'S 078°50'W, Saturn bore 286°(C). If ship's time difference was 5h from GMT and variation was 3°W, find the deviation for ship's head ?
3. On 01st May, AM at ship in DR 40°26'N 060°40'E, Mars bore 096° (C) at 11h 51m 14s by chrono (error 04m 06s slow). Variation was 3.7°W, calculate the deviation of the compass ?
4. On 18th Jan, in DR 00°00' 062°40'E, Venus bore 120°(C) at 0310 ship's time (4h from GMT). If variation was 2°W, find compass error and deviation ?

Azimuth – Moon

1. On 06th Mar, in DR 30°30N' 140°11'E, Moon bore 105°(C) at 07h 35m 02s Chrono time (error 04m 06s fast). If variation was 2°E, find the deviation ?
2. On 19th Jan, PM at ship in DR 40°58' 175°20'W, Moon's bore 100°(C) at 07h 40m 59s chrono time (error 02m 06s fast) . If variation was 6°W, find compass error and deviation ?
3. On 31st Aug, PM at ship in DR 36°03N' 146°50'E, the Moon's bore 230°(C) at 08h 14m 56s chrono time (error 02m 06s fast) . If variation was 3°W, find compass deviation ?
4. On 30th Nov, at 1950 at ship in DR 20°29S' 017°46'E, Moon's bore 280°(C). If ship's time difference was (GMT + 1h) and variation was 3.5°E, find compass error and deviation ?

Amplitude – Sun

1. December 30th at 0706hrs LMT in DR Lat 33° 24'N Long 020° 31'E the sun rose bearing 126° C. If the Variation is 1° W find the compass error and the deviation.
2. January 11th at 1954hrs LMT in DR Lat 46° 34'S Long 121° 12'W the sun set bearing 208° C. If the Variation is 26°E find the compass error and the deviation.
3. October 7th Lat 1718hrs LMT in DR Lat 56° 10'N Long 003° 18'E the sun set bearing 264° C. If the Variation is 6°W find the compass error and the deviation.
4. June 9th in DR Lat 8° 04'S Long 028° 50'W the sun rose bearing 090°C when a chronometer, known to be 2m 53s slow on GMT showed 8h 03m 10s. If the Variation is 28°W find the compass error and Deviation.
5. July 14th in DR Lat 30° 00'N Long 135° 28'E the sun rose bearing 076°C when the chronometer, which had no error showed 8h 05m 27s. If the Variation is 5°W find the compass error and the deviation.
6. September 10th in DR Lat 47° 30'N Long 048° 16'W the sun set bearing 303°C. If the Variation is 27°W find the compass error and the deviation.

7. (i) From the following information find the compass error and deviation for the direction of the ship's head? Date at the ship 19th February, in DR position 29°29'S 105°51'E. The Sun rose bearing 108.5°C
Variation 08°W
- (ii) Briefly explain the considerations to be taken into account before taking the above amplitude?

Amplitude – Moon

1. On 2nd Sept, in DR 40° 02'S 173° 18'E, the Moon set bearing 243°C. If the Variation is 2°W, find the deviation of compass for the ship's head ?
2. On 02nd May, in DR 20° 12'S 164° 40'E, the Moon set bearing 290°C. If the Variation is 2°W find the compass error and the deviation for the ship's head ?
3. On 31st Aug, in DR 00° 01'N 174° 56'W, the Moon rose bearing 102°C. If the Variation is 1.7°E find the deviation for the compass ?
4. On 4th Mar, in DR 42° 20'N 064° 18'W, the rising moon bearing 089°C. If the Variation is 10°E find the compass deviation ?
5. On 2nd Sept, in DR 35° 06'S 074° 12'E, the Moon set bearing 260°C. If the Variation is 12°W find the compass error and the deviation ?

Latitude by Meridian Altitude :

Sun :

1. On 23rd Sept, in DR 23° 40'N 161° 56'E, the sextant meridian altitude of Sun's lower limb (LL) was 66° 10.6'. If IE was 2.3' on the arc and HE was 10.5m, find the PL and the position through which PL passes ?
2. On 21st Jan, in DR 24° 36'S 110° 20'W, the sextant meridian altitude of Sun's lower limb (LL) was 85° 05.5'. If IE was 1.6' on the arc and HE was 10m, find the PL and the position through which PL passes ?
3. On 1st Sept, in DR equator 050° 276'E, the sextant meridian altitude of Sun's upper limb (UL) was 66° 10.6'. If IE was 2.3' on the arc and HE was 10.5m, find the PL and the position through which PL passes ?
4. On 1st May, in DR 179° 58'E, the observed altitude of Sun's lower limb (LL) on the meridian was 64° 35.9' South of the observer. If HE was 15m, find the PL and the position through which PL passes ?
5. On 1st Dec, in DR 06° 35'N 064° 18'W, owing to hazy horizon to the South, a back angle observation of Sun's lower limb (LL) on the meridian was made and the sextant altitude was found to be 118° 11.8'. If IE was 2.4' on the arc and HE was 14m, find the PL and the position through which PL passes ?

6. (i) On the 19th May, in DR position $61^{\circ} 43.1'S$ $170^{\circ} 42'E$ the sextant altitude of the sun's lower limb on the meridian was $08^{\circ} 19'N$. If the height of eye was 2.0metres and the index error was 1.5' off the arc, find:
- the UTC of meridian passage?
 - the latitude of the observer?
- (ii) If the sun was bearing $358^{\circ}G$ at the time of meridian passage calculate the gyro error.

Moon:

- On 25th Feb, in DR $10^{\circ} 05'N$ $103^{\circ} 16'E$, the sextant meridian altitude of Moon's Upper limb (UL) was $56^{\circ} 14.9'$. If IE was 1.6' on the arc and HE was 12m, find the PL and the position through which PL passes ?
- On 1st Dec, in DR $20^{\circ} 12'S$ $164^{\circ} 40'E$, the observed meridian altitude of Moon's lower limb (LL) was $56^{\circ} 40.3'$. If HE was 14m, find the PL and the position through which PL passes ?
- On 21st July, in DR $37^{\circ} 22'N$ $096^{\circ} 36'W$, the sextant meridian altitude of Moon's Upper limb (UL) was $62^{\circ} 01.1'$. If IE was 0.4' off the arc and HE was 17m, find the PL and the position through which PL passes ?
- On 26th Feb, in DR $50^{\circ} 10'S$ $064^{\circ} 12'E$, the observed altitude of Moon's lower limb (LL) on the meridian was $63^{\circ} 58.0'$. If HE was 20m, find the PL and the position through which PL passes ?
- On 29th Nov, in DR longitude $140^{\circ} 12WE$, the sextant meridian altitude of Moon's lower limb (LL) was $62^{\circ} 15.6'$ North of the observer. If IE was 0.6' on the arc and HE was 10m, find the PL and the position through which PL passes ?

Star :

- On 1st Dec, AM at ship in DR $45^{\circ} 20'S$ $075^{\circ} 00'E$, the sextant meridian altitude of star Procyon was $39^{\circ} 28.8'$. If IE was 1.5 off the arc and HE was 25m, find the PL and the position through which PL passes ?
- On 4th Mar, in DR $45^{\circ} 10'N$ $120^{\circ} 30'W$, the sextant meridian altitude of star Antares was $18^{\circ} 26.2'$. If IE was 3.2' off the arc and HE was 10m, find the PL and the position through which PL passes ?
- On 12th Sept, in DR $43^{\circ} 05'S$ $072^{\circ} 20'E$, the sextant meridian altitude of star Aldebaran was $30^{\circ} 40.2'$. If IE was nil and HE was 18m, find the PL and the position through which PL passes ? State the GMT of Meridian passage ?
- On 22nd Sept, in DR longitude $090^{\circ} 06'E$, the observed altitude of star Rigel on the meridian was $73^{\circ} 24.2'$ North of the observer. If HE was 15m, find the PL and the position through which PL passes ? State the GMT of meridian passage ?

5. On 1st May, in DR 30° 18'N 135° 02'W, a back angle sextant meridian altitude of star Regulus was 108° 16.5'. If IE was 2.4' on the arc and HE was 14m. Required the PL, the position through which PL passes and the GMT of meridian passage ?

Planets :

1. On 15th June, in DR 45° 00'S 091° 10'E, the sextant meridian altitude of Jupiter was 35° 14.2'. If IE was 0.5' on the arc and HE was 9m, find the PL and the position through which PL passes ?
2. On 5th May, in DR 50° 10'S 064° 15'W, the observed meridian altitude of Saturn was 56° 00.3'. If HE was 10m, find the PL and the position through which PL passes ? Also, the nearest second, the GMT of meridian passage ?
3. On 17th Jan, in DR longitude 036° 40'E, the sextant meridian altitude of Jupiter was 37° 43.5' bearing North. If IE was 0.3' on the arc and HE was 12m, find the PL and the position through which PL passes ?
4. On 14th Oct, in DR longitude 110° 20'W, the sextant meridian altitude of Mars was 61° 14.5' South of the observer. If IE was 3.6' off the arc and HE was 17m, find the PL and the position through which PL passes ?
5. On 30th Nov, in DR 56° 07'N 120° 04'E, the sextant meridian altitude of Saturn was 16° 24.0'. If IE was 0.6' on the arc and HE was 12m, find the PL and the position through which PL passes ?

Latitude by Ex-meridian Altitude :-

Sun:

1. On 4th March, in DR 27° 18'N 168°11'W, the sextant altitude of Sun's LL near the meridian was 56° 19.8' when the chrono showed 11h 13m 24s (error 01m 20s slow). If IE was 2.8' on the arc and HE was 12m, find the direction of PL and a position through which to draw it ?
2. On 1st Sept, in DR 23° 18'N 165° 02'E, the sextant altitude of Sun's UL near the meridian was 75° 01.7' when the chrono showed 00h 45m 51s (error 03m 21s slow). If IE was 3.2' off the arc and HE was 20m, find the direction of PL and a position through which to draw it ?
3. On 2nd May, in DR 15° 36'S 080°11'W, the sextant altitude of Sun's LL near the meridian was 58° 25.6' when the chrono showed 05h 40m 06s (error 02m 18s fast). If IE was 1.6' on the arc and HE was 15m, find the direction of PL and a position through which to draw it ?

4. On 6th March, in EP $52^{\circ} 12'N 170^{\circ}40'E$, the sextant altitude of Sun's UL near the meridian was $31^{\circ} 59.8'$ when the chrono showed 01h 29m 20s (error 01m 50s fast). If IE was 2.3' on the arc and HE was 40m, find the direction of PL and a position through which to draw it ?
5. On 21st Jan, in DR $00^{\circ} 00' 097^{\circ} 48'W$, the sextant altitude of Sun's LL near the meridian was $69^{\circ} 28.7'$ when the chrono showed 06h 13m 27s (error 01m 50s fast). If IE was 2.0' on the arc and HE was 12m, find the direction of PL and a position through which to draw it ?

Stars :

1. On 2nd March, PM at ship in DR $16^{\circ} 12'N 092^{\circ} 101'E$, the sextant altitude of the star Capella near the meridian was $60^{\circ} 29.4'$ when the chrono showed 00h 30m 12s (error 01m 06s slow). If IE was 2.0' on the arc and HE was 48m, find the direction of PL and a position through which to draw it ?
2. On 12th Sept, AM at ship in DR $00^{\circ} 30'S 160^{\circ} 20'W$, the sextant altitude of the star Aldebaran near the meridian was $73^{\circ} 09.5'$ when the chrono showed 03h 59m 29s (error 05m 03s fast). If IE was 1.2' on the arc and HE was 9m, find the direction of PL and a position through which to draw it ?
3. On 2nd May, PM at ship in DR $44^{\circ} 11'S 102^{\circ} 40'E$, the sextant altitude of the star Pollux near the meridian was $17^{\circ} 14.6'$ when the chrono showed 10h 52m 08s (error 02m 12s slow). If IE was 3.6' on the arc and HE was 12m, find the direction of PL and the latitude where it cuts the DR longitude ?
4. On 20th Jan, during morning twilight in DR $44^{\circ} 07'N 064^{\circ} 47'E$, the sextant altitude of the star Arcturus near the meridian was $64^{\circ} 58.8'$ when the chrono showed 02h 04m 54s (error 10m 58s slow). If IE was 3.1' off the arc and HE was 18m, find the direction of PL and a position through which to draw it ?
5. On 21st Sept, AM at ship in DR $20^{\circ} 50'N 062^{\circ} 30'E$, the observed altitude of the star Capella near the meridian was $23^{\circ} 07.1'$ when the chrono showed 01h 15m 06s (error 00m 04s slow). If HE was 10m, find the direction of PL and the lat where it cuts the DR longitude ?

Planets:

1. On 30th Nov, AM at ship in DR $34^{\circ} 57'N 119^{\circ} 50'E$, the sextant altitude of Mars near the meridian was $13^{\circ} 23.1'$ when the chrono showed 08h 00m 39s (error 05m 01s slow). If IE was 0.4' on the arc and HE was 17m, find the direction of PL and a position through which to draw it ?
2. On 3rd May, PM at ship in DR $40^{\circ} 11'N 065^{\circ} 30'W$, the sextant altitude of Jupiter near the meridian was $60^{\circ} 45.4'$ when the chrono showed 00h 13m 50s (error 04m 10s slow). If IE was 0.3' on the arc and HE was 14m, find the direction of PL and the latitude where it cuts the longitude ?
3. On 30th Nov, PM at ship in DR $56^{\circ} 04'N 120^{\circ} 04'E$, the sextant altitude of Saturn near the meridian was $16^{\circ} 05.6'$ when the chrono showed 09h 01m 49s (error 02m 05s fast). If IE was nil and HE was 17m, find the direction of PL and the latitude where it cuts the DR Longitude ?
4. On 14th Otc, during morning twilight DR $63^{\circ} 55'N 110^{\circ} 20'W$, the observed altitude of the Mars near the meridian was $49^{\circ} 09.5'$ when the chrono showed 01h 15m 20s (error 01m 00s slow). If HE was 10m, find the direction of PL and a position through which to draw it ?

- On 4th May, AM at ship in DR 52° 13'N 064° 15'W, the observed altitude of the Saturn near the meridian was 53° 07.8' when the chrono showed 10h 59m 51s (error 01m 51s fast). If HE was 20m, find the direction of PL and the latitude where it cuts the DR longitude ?

Moon :

- On 29th Nov, in DR 36° 08'S 096° 40'E, the sextant altitude of Moon's UL near the meridian was 68° 53.7' when the chrono showed 09h 18m 24s (error 05m 01s slow). If IE was 0.2' off the arc and HE was 14m, find the direction of PL and a position through which to draw it ?
- On 2nd Sept, in DR 39° 57'N 179° 56'E, the sextant altitude of Moon's UL near the meridian was 29° 14.2' when the chrono showed 04h 03m 49s (error 02m 23s fast). If IE was 0.3' off the arc and HE was 18m, find the direction of PL and a position through which to draw it ?
- On 26th Feb, in DR 45° 04'S 000° 20'W, the sextant altitude of Moon's LL near the meridian was 68° 58.1' when the chrono showed 06h 59m 00s (error 02m 30s slow). If IE was 0.1' on the arc and HE was 14m, find the direction of PL and the latitude where it cuts the DR longitude ?
- On 6th March, in EP 45° 40'N 060° 12'W, the sextant altitude of Moon's UL near the meridian was 52° 19.4' when the chrono showed 04h 47m 16s (error 14m 12s slow). If IE was 0.4' off the arc and HE was 15m, find the direction of PL and a position through which to draw it ?
- On 1st Dec, in DR 46° 12'S 090° 20'E, the sextant altitude of Moon's UL near the meridian was 49° 46.8' when the chrono showed 11h 03m 58s (error 05m 09s fast). If IE was 0.6' off the arc and HE was 10m, find the direction of PL and a position through which to draw it ?

Latitude by Pole Star Observations :

Stars :

- On 1st Sept, AM at ship in DR 18°00'N 178°11'E, the sextant altitude of the Pole Star was 18° 47.4, at 05h 21m 08s by chrono (error 01m 18s slow) if IE was 1.6' on the arc and HE 12.5m. Required PL and the position through to draw the PL ? If the Azimuth was 001° C, Variation was 1.3° E. find the deviation for ship's head ?
- On the morning of 1st Dec, in DR 47° 16'N 143° 26'E, the sextant altitude of the Pole Star was 46° 50.7N 178° 11'E, at 08h 51m 15s by chrono (error 05m 11s slow) if IE was 2.1' off the arc and HE 17m. Required PL and the position through to draw the PL ?
- At about 0330 ship's time on 1st May, in DR longitude 150° 00'E, the observed altitude of the Pole Star was 50° 46.8, bearing 005°C at 05h 30m 30s by chrono (error nil) if HE 14m, variation 1°E.. Required PL and the position through to draw the PL and deviation for ship's head ?
- On 06th March, at 0200 ship's time in DR 20° 37'N 000° 00', the Pole Star was 356°C. If variation was 3.7'W, find the deviation for the compass ?

5. On 13th Sept, PM at ship in DR $37^{\circ} 26'N$ $072^{\circ} 46'E$, the Pole Star bore $350^{\circ}C$ at 03h 59m 03s by chrono (error 10m 03s slow) if IE was 1.6' on the arc and HE 12.5m. Required PL and the position through to draw the PL ? If variation was $10^{\circ}E$, find deviation for the ship's head ?
6. (i) On the 28th of June, AM a vessel in DR position $43^{\circ}10'N$ $037^{\circ}30'W$ observed the sextant altitude of Polaris during twilight to be $43^{\circ} 41'$. The chronometer, which was 6m 27s fast on UTC showed 6h 17m 03s. If I.E. was 1'.5 on the arc and H.E. was 8.5metres, find:
 - (a) the direction of the position line?
 - (b) the latitude at which it crosses the DR longitude?
 (ii) Briefly explain the use of the Nautical Almanac and outline the main contents.

Longitude by Chronometer :-

Sun :

1. On 29th Nov, in DR $26^{\circ} 27'N$ $130^{\circ} 27'W$, the sextant altitude of Sun's Upper Limb (UL) East of meridian was $28^{\circ} 11.0'$ when chron (error 01m 31s fast) showed 05h 49m 20s. If IE was 2.3' off the arc and HE was 10m, find the PL and the position through which PL passes ?
2. On 31st Aug, PM at ship in DR $10^{\circ} 11'S$ $000^{\circ} 00'$, the sextant altitude of Sun's Lower Limb (LL) was $39^{\circ} 15.0'$ when chron (error 01m 30s fast) showed 03h 11m 20s. If IE was 2.5' on the arc and HE was 17m, find the PL and the position through which to draw the PL?
3. On 30th April, in DR $00^{\circ} 20'N$ $060^{\circ} 12'W$, the sextant altitude of Sun's Upper Limb (UL) East of meridian was $44^{\circ} 13.4'$ when chron (error 03m 09s slow) showed 00h 57m 43s. If IE was 3.1' off the arc and HE was 20m, find the PL and the longitude where it crosses the DR lat ?
4. On 19th Jan, at about 1530 at ship in DR $40^{\circ} 16'S$ $175^{\circ} 31'E$, the sextant altitude of Sun's Lower Limb (LL) was $43^{\circ} 27.4'$ when chron (error 02m 12s fast) showed 03h 50m 12s. If IE was 1.5' on the arc and HE was 22m, find the PL and the position through which PL passes ?
5. On 22nd Sept, PM at ship in DR $48^{\circ} 20'N$ $085^{\circ} 40'E$, the sextant altitude of Sun's Upper Limb (UL) East of meridian was $20^{\circ} 14.8'$ when chron (error 06m 18s slow) showed 10h 03m 20s. If IE was 2.2' on the arc and HE was 25m, find the PL and the position through which PL passes ?

Moon :

1. On 25th Feb, AM at ship in DR 20° 04'S 090° 04'W, the sextant altitude of Moon's Upper Limb (UL) was 52° 26.8' at 02h 56m 17s chron time (error 04m01 fast). If IE was 0.6' off the arc and HE was 19m, find the PL and the position through which PL passes ?
2. On 1st Sept, PM at ship in DR 20° 58'N 120° 19'W, the sextant altitude of Moon's Lower Limb (LL) was 33° 06.6' at 02h 35m 55s chron time (error 10m 42s slow) . If IE was 0.3' off the arc and HE was 30m, find the PL and the position through which to draw the PL?
3. On 22nd Sept, AM at ship in DR 10° 02'S 076° 50'E, the sextant altitude of Moon's Lower Limb (LL) was 44° 31.7' at 00h 17m 21s chron time (error 07m 28s slow) . If IE was 0.6' on the arc and HE was 14m, find the PL and the position through which passes the PL?
4. On 6th March, AM at ship in DR 00° 00' 060° 50'W, the sextant altitude of Moon's Upper Limb (UL) was 44° 28.9' at 02h 44m 48s chron time (error 11m 16s slow) . If IE was 0.4' off the arc and HE was 15m, find the PL and the position through which to draw the PL?
5. On 30th Nov, PM at ship in DR 27° 45'S 140° 20'W, the observed altitude of Moon's Upper Limb (UL) was 40° 18.8' at 11h 10m 08s chron time (error 00m 02s slow) . If HE was 10m, find the PL and the longitude where it cuts the DR lat?

Stars :

1. On 23rd Aug, PM at ship in DR 34° 31'S 003° 30'W, the sextant altitude of star Spica was 45° 27.2' at 06h 15m 00s chron time (error 02m 19s slow) . If IE was 2.1' on the arc and HE was 11m, find the PL and the position through which to draw the PL?
2. On 29th Nov, AM at ship in DR 25° 30'S 107° 20'W, the sextant altitude of star Rigel was 35° 10.3' at 11h 32m 10s chron time (error 02m 50s fast) . If IE was 2.8' on the arc and HE was 12m, find the PL and the position through which passes the PL?
3. On 22nd Sept, PM at ship in DR 60° 10'N 092° 27'E, the sextant altitude of star Arcturus was 25° 01' when Chron (error 05m 01s slow) showed 00h 46m 31s . If IE was 0.2' on the arc and HE was 17m, find the PL and the longitude where it cuts the DR lat ?
4. On 19th Jan, at about 1900 at ship in DR 00° 02'N 170° 50'E, the sextant altitude of star Betelgeuse was 43° 11.1' when chrono showed 07h 35m 02s (error 01m 18s fast) . If IE was 1.3' off the arc and HE was 18m, find the PL and the position through which to draw the PL?
5. On 31st Aug, AM at ship in DR 40° 30'N 064° 56'E, the sextant altitude of star Diphda was 21° 23.4' at 00h 20m 26s chron time (error nil) . If IE was 0.9' off the arc and HE was 9m, find the PL and the position through which to draw the PL?

Planets:

1. On 21st Aug, in DR 60° 06'N 066° 18'W, the sextant altitude of Mars was 41° 32.4' at 08h 15m 02s GMT . If IE was 2.1' on the arc and HE was 10m, find the PL and the position through which to draw the PL?

2. On 17th Jan, AM at ship in DR 31° 41'N 100° 10'E, the sextant altitude of Venus was 19° 48.6' when the chrono showed 11h 41m 44s (error 02m 06s fast) . If IE was 2.1' on the arc and HE was 12m, find the PL and the position through which to it ?
3. On 1st Dec, PM at ship in DR 29° 56'S 106° 14'E, the sextant altitude of Saturn was 46° 21.8' at 12h 18m 33s chron time (error 05m 01s slow) . If IE was 1.3' off the arc and HE was 14m, find the PL and the position through which to draw the PL?
4. On 22nd Sept, PM at ship in DR 40° 21'S 140° 12'W, the sextant altitude of Saturn was 54° 58.6' when chrono showed 04h 15m 42s (error 11m 31s fast) . If IE was 3.2' on the arc and HE was 20m, required the direction of PL and a position through which to draw the PL?
5. On 1st May, PM at ship in DR 19° 54'S 179° 58'W, the sextant altitude of Jupiter was 52° 38.5' at 06h 21m 52s chron time (error 01m 10s fast) . If IE was 0.2' off the arc and HE was 17m, find the PL and the position through which to draw the PL?

Intercept :-

Sun :

1. On 29th Nov, in DR 26° 27'N 130° 27'W, the sextant altitude of Sun's Upper Limb (UL) East of meridian was 28° 11.0' when chron (error 01m 31s fast) showed 05h 49m 20s. If IE was 2.3' off the arc and HE was 10m, find the PL and the position through which PL passes ?
2. On 31st Aug, PM at ship in DR 10° 11'S 000° 00', the sextant altitude of Sun's Lower Limb (LL) was 39° 15.0' when chron (error 01m 30s fast) showed 03h 11m 20s. If IE was 2.5' on the arc and HE was 17m, find the PL and the position through which to draw the PL?
3. On 30th April, in DR 00° 20'N 060° 12'W, the sextant altitude of Sun's Upper Limb (UL) East of meridian was 44° 13.4' when chron (error 03m 09s slow) showed 00h 57m 43s. If IE was 3.1' off the arc and HE was 20m, find the PL and the longitude where it crosses the DR lat ?
4. On 19th Jan, at about 1530 at ship in DR 40° 16'S 175° 31'E, the sextant altitude of Sun's Lower Limb (LL) was 43° 27.4' when chron (error 02m 12s fast) showed 03h 50m 12s. If IE was 1.5' on the arc and HE was 22m, find the PL and the position through which PL passes ?
5. On 22nd Sept, PM at ship in DR 48° 20'N 085° 40'E, the sextant altitude of Sun's Upper Limb (UL) East of meridian was 20° 14.8' when chron (error 06m 18s slow) showed 10h 03m 20s. If IE was 2.2' on the arc and HE was 25m, find the PL and the position through which PL passes ?

Moon :

1. On 25th Feb, AM at ship in DR 20° 04'S 090° 04'W, the sextant altitude of Moon's Upper Limb (UL) was 52° 26.8' at 02h 56m 17s chron time (error 04m01 fast). If IE was 0.6' off the arc and HE was 19m, find the PL and the position through which PL passes ?
2. On 1st Sept, PM at ship in DR 20° 58'N 120° 19'W, the sextant altitude of Moon's Lower Limb (LL) was 33° 06.6' at 02h 35m 55s chron time (error 10m 42s slow) . If IE was 0.3' off the arc and HE was 30m, find the PL and the position through which to draw the PL?
3. On 22nd Sept, AM at ship in DR 10° 02'S 076° 50'E, the sextant altitude of Moon's Lower Limb (LL) was 44° 31.7' at 00h 17m 21s chron time (error 07m 28s slow) . If IE was 0.6' on the arc and HE was 14m, find the PL and the position through which passes the PL?
4. On 6th March, AM at ship in DR 00° 00' 060° 50'W, the sextant altitude of Moon's Upper Limb (UL) was 44° 28.9' at 02h 44m 48s chron time (error 11m 16s slow) . If IE was 0.4' off the arc and HE was 15m, find the PL and the position through which to draw the PL?
5. On 30th Nov, PM at ship in DR 27° 45'S 140° 20'W, the observed altitude of Moon's Upper Limb (UL) was 40° 18.8' at 11h 10m 08s chron time (error 00m 02s slow) . If HE was 10m, find the PL and the longitude where it cuts the DR lat?

Stars :

1. On 23rd Aug, PM at ship in DR 34° 31'S 003° 30'W, the sextant altitude of star Spica was 45° 27.2' at 06h 15m 00s chron time (error 02m 19s slow) . If IE was 2.1' on the arc and HE was 11m, find the PL and the position through which to draw the PL?
2. On 29th Nov, AM at ship in DR 25° 30'S 107° 20'W, the sextant altitude of star Rigel was 35° 10.3' at 11h 32m 10s chron time (error 02m 50s fast) . If IE was 2.8' on the arc and HE was 12m, find the PL and the position through which passes the PL?
3. On 22nd Sept, PM at ship in DR 60° 10'N 092° 27'E, the sextant altitude of star Arcturus was 25° 01' when Chron (error 05m 01s slow) showed 00h 46m 31s . If IE was 0.2' on the arc and HE was 17m, find the PL and the longitude where it cuts the DR lat ?
4. On 19th Jan, at about 1900 at ship in DR 00° 02'N 170° 50'E, the sextant altitude of star Betelgeuse was 43° 11.1' when chrono showed 07h 35m 02s (error 01m 18s fast) . If IE was 1.3' off the arc and HE was 18m, find the PL and the position through which to draw the PL?
5. On 31st Aug, AM at ship in DR 40° 30'N 064° 56'E, the sextant altitude of star Diphda was 21° 23.4' at 00h 20m 26s chron time (error nil) . If IE was 0.9' off the arc and HE was 9m, find the PL and the position through which to draw the PL?

Planets:

1. On 21st Aug, in DR 60° 06'N 066° 18'W, the sextant altitude of Mars was 41° 32.4' at 08h 15m 02s GMT . If IE was 2.1' on the arc and HE was 10m, find the PL and the position through which to draw the PL?

2. On 17th Jan, AM at ship in DR 31° 41'N 100° 10'E, the sextant altitude of Venus was 19° 48.6' when the chrono showed 11h 41m 44s (error 02m 06s fast) . If IE was 2.1' on the arc and HE was 12m, find the PL and the position through which to it ?
3. On 1st Dec, PM at ship in DR 29° 56'S 106° 14'E, the sextant altitude of Saturn was 46° 21.8' at 12h 18m 33s chron time (error 05m 01s slow) . If IE was 1.3' off the arc and HE was 14m, find the PL and the position through which to draw the PL?
4. On 22nd Sept, PM at ship in DR 40° 21'S 140° 12'W, the sextant altitude of Saturn was 54° 58.6' when chrono showed 04h 15m 42s (error 11m 31s fast) . If IE was 3.2' on the arc and HE was 20m, required the direction of PL and a position through which to draw the PL?
5. On 1st May, PM at ship in DR 19° 54'S 179° 58'W, the sextant altitude of Jupiter was 52° 38.5' at 06h 21m 52s chron time (error 01m 10s fast) . If IE was 0.2' off the arc and HE was 17m, find the PL and the position through which to draw the PL?

Computation of Altitudes:

1. On 23rd Sept, in DR 23° 40'N 161° 56'E, compute the sextant meridian altitude of Sun's LL if IE was 2.3' on the arc and HE was 10.5m ?
2. On 25th Feb, in DR 10° 13'N 103° 16'E, compute the sextant meridian altitude of Moon's UL if IE was 1.6' on the arc and HE was 12m ?
3. On 1st Sept, in DR 17° 54'N 178° 11'E, compute the sextant altitude of Pole Star at 05h 21m 08s Chrono time (error 01m 18s slow) if IE was 1.6' on the arc and HE was 12.5m ?
4. On 23rd Aug, in DR 34° 31'S 003° 30'W, compute the sextant altitude of star Spica when chrono showed 06h 15m 00s (error 02m 19s slow) if IE was 2.1' on the arc and HE was 11m ?
5. On 6th March, in DR 00° 00' 065° 50'W, compute the sextant altitude of moon's UL at 02h 44m 48s chrono time (error 11m 16s fast) if IE was 0.4' on the arc and HE was 15m ?
6. On 5th May, in DR 50° 16'S 064° 15'W, compute the sextant meridian altitude of Saturn, if IE was nil and HE was 10m ?

Simple Errors in Sight :-

1. Using DR 44° 36'N 089° 23'E, a celestial observation gave an intercept of 1.7' Towards Az 130° T. It was subsequently discovered that the IE of 2.4' ON the arc had been applied OFF the arc. Find the new intercept ?

2. Using DR $43^{\circ} 32' N$ an observed long $069^{\circ} 52.8' E$ and an Az of $043.8^{\circ} T$ was obtained. It was subsequently discovered that the HE used for the calculations was taken as 38m instead of 14m. Find where the PL should be drawn ?
3. An ex-meridian altitude of Sun gave Observed lat $43^{\circ} 12' N$, DR long $063^{\circ} 29' W$, AZ $177.4^{\circ} T$. It was then found that the UL correction (- 18.2') had been used in the calculations instead of LL correction (+ 14.1'). State where the PL should be drawn ?
4. Using lat $20^{\circ} 46' S$ an observation of the Sun gave an Obs Long of $119^{\circ} 17.8' W$ and Az of $201^{\circ} T$. Later it was found that Chron error of 02m 24s slow had not been applied. Find where the PL should be drawn ?
5. Using DR $36^{\circ} 29' N$ $116^{\circ} 14' E$, an intercept of 3.7' Towards from Az $302^{\circ} T$ was obtained. It was then discovered that the intercept used for 58m 12s was taken from Almanac for Sun instead of Aries. Find where the PL should be drawn ?
6. Using DR $46^{\circ} 55' S$ $133^{\circ} 48' W$, an intercept of 2.5' Away from Az $139^{\circ} T$ was obtained. It was subsequently discovered that the increment used for 44m 28s was taken from Almanac for the Sun instead of aries. Find where the PL should be drawn ?

Plotting Position Lines (Simultaneous Obs) :-

1. Using DR $51^{\circ} 25' N$ $006^{\circ} 10' W$, Star A Az $312^{\circ} T$ and Intercept 3.4' Towards, Star B Az $254^{\circ} T$ and Intercept 1.0' away. Find the vessel's position ?
2. Using DR $51^{\circ} 38.5' N$, $006^{\circ} 50.0' W$, the following information was obtained from simultaneous observations of two stars using -

Star A;	Azimuth 050°	Intercept	1.5' away.
Star B;	Azimuth 140°	Intercept	1.5' towards.

 Find the position of the vessel.
3. The following information was obtained from simultaneous observations of two stars using DR $51^{\circ} 30.8' N$, $006^{\circ} 45.0' W$ -

Star A;	Azimuth 077°	Intercept	3.0' away.
Star B;	Azimuth 170°	Intercept	1.2' towards.

 Find the position of the vessel.
4. In DR $20^{\circ} 36' N$ $146^{\circ} 11' W$, Star Spica bore $046^{\circ} T$ giving an obs long of $146^{\circ} 13.4' W$. At the same time star Deneb bore $130^{\circ} T$ giving an Obs long of $146^{\circ} 19.3' W$. Find the vessel's position ?
5. Using DR $48^{\circ} 24' N$ $179^{\circ} 59' E$, find the vessel's position from the following two observations –
 - i) Obs long $179^{\circ} 55.4' W$ Az $030^{\circ} T$, ii) Int 0.5' Towards Az $335^{\circ} T$,

6. Using DR $49^{\circ} 11'S$ $147^{\circ} 44'E$, an Obs long of $147^{\circ} 50.2'E$ and Az of $300^{\circ} T$ were obtained. A meridian altitude then gave latitude to be $49^{\circ} 14.5'S$. Find the vessel's position ?
7. In DR $60^{\circ} 41'N$ $052^{\circ} 27'W$, an intercept of 2.1' Away from Az $225^{\circ} T$ was obtained. At the same time, an ex-mer alt gave an Obs lat of $60^{\circ} 36.2'N$ and an Az $357^{\circ} T$. Find the vessel's position ?
8. In DR $40^{\circ} 01'N$ $110^{\circ} 30'E$, star Aldebaran – Obs long $110^{\circ} 34.2'E$, Az $120^{\circ} T$ was obtained. At the same time, Polaris – Obs lat $39^{\circ} 58.1'N$, bearing $002^{\circ} T$. Find the vessel's position ?

Running Fix (Staggered Obs) :-

1. At 0740 hrs in DR $51^{\circ} 24'N$ $006^{\circ} 51'W$, a vessel steering $056^{\circ} T$ at 7 knots obtains a sight of the Sun resulting in a bearing of $094^{\circ} T$ and an intercept of 1.9' towards. At 1200 hrs a newly charted oil production platform in position $51^{\circ} 41.0' N$ $006^{\circ} 15.6' W$ was observed bearing $267^{\circ} T$.
Find the position of the vessel at 1200 hrs?
2. At 0930 in DR position $51^{\circ} 22' N$ $006^{\circ} 10' W$ an observation of the Sun gave a bearing of $082^{\circ} T$ and an intercept 0.8' towards. Ship steering $310^{\circ} T$, Speed 8 knots. At 1200 hrs a Meridian Altitude of the Sun gave a Latitude of $51^{\circ} 37.0' N$.
Find the vessels position at 1200 ?
3. At 1015 in DR position $51^{\circ} 40' N$ $006^{\circ} 47.5' W$ a vessel is drifting South at a rate of 2.5. knots. At the same time a sight of the Sun produced a bearing of $068^{\circ} T$ and an intercept of 2.6' away.
At 1200 hrs a meridian altitude of the Sun gave a Latitude of $51^{\circ} 32.2' N$.
Determine the vessels position at both 1200 ?
4. At 0900 hrs in DR $51^{\circ} 21' N$ $006^{\circ} 50' W$ an observation of the Sun gave a bearing of $090^{\circ} T$ and an Intercept 1.0' towards. At 1200 hrs a Meridian Altitude of the Sun gave a Latitude of $51^{\circ} 35.6' N$. If the vessel was steering $025^{\circ} T$ at 5 knots throughout, find the vessels position at 1200 hrs?
5. In DR $18^{\circ} 41'S$ $179^{\circ} 56'E$, an intercept of 8.4' Towards Az $083^{\circ} T$ was obtained by stellar observation. The vessel then steered $121^{\circ} T$ for 70M by log when a meridian altitude gave an Obs lat of $19^{\circ} 14.9'S$. If a set of $224^{\circ} T$ and drift of 10M was experienced during the period. Find vessel's position at the time of second observation.
6. At 0600 in DR $01^{\circ} 20'N$ $179^{\circ} 58'W$, a stellar observation gave an Obs long of $179^{\circ} 54'E$ bearing $062^{\circ} T$. The vessel then steamed $131^{\circ} T$ at 14 kts. At 1600, using lat $00^{\circ} 11.8'S$, the Sun gave an Obs long of $178^{\circ} 12.7'W$ bearing $323^{\circ} T$. Find the vessel position at 1600 ?

7. In DR $36^{\circ} 48'S$ $110^{\circ} 37'E$, an Ex-meridian sight gave an Ob slat of $37^{\circ} 00'S$ and a PL of $100^{\circ} - 280^{\circ}T$. After steaming $000^{\circ}T$ for 87M and $270^{\circ}T$ for 101M, an intercept of 7.2N Away from Az $086^{\circ}T$ was obtained working from the earlier Ob slat. Find the position of the ship at the second observation ?