YM Session 5

- Compasses
  - Compass
  - Variation
  - Deviation
- Use of the Portland Plotter and Chart Rose, including Variation
- Bearings Exercise

AXE YACHT CLUB

1

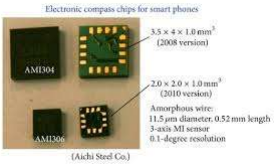
Gyroscopic Compass

- Normally large ship equipment
- Uses a spinning flywheel
- Set up initially so that the axle of the flywheel points to the Geographic North Pole

2

Electronic (Fluxgate) Compass

- Now fairly common
  - Watch / phone etc
- Digital or analogue display
- Used in autohelms / radar /chart plotter etc
- Point to magnetic north



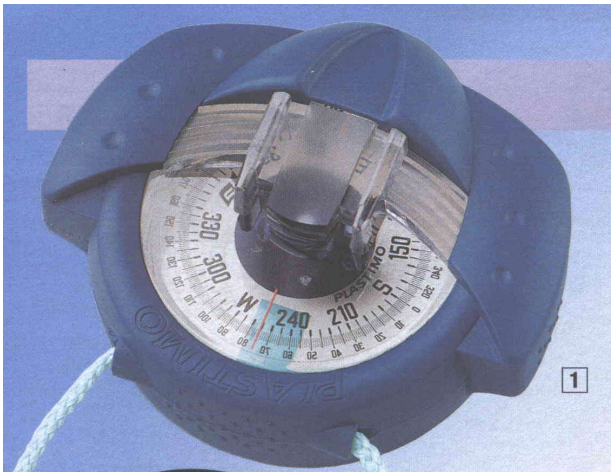
3

Magnetic Compass

- Common on recreational boats
- Point to Magnetic North
- Siting of compass is important

4

Handbearing Compass



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Using the Handbearing Compass

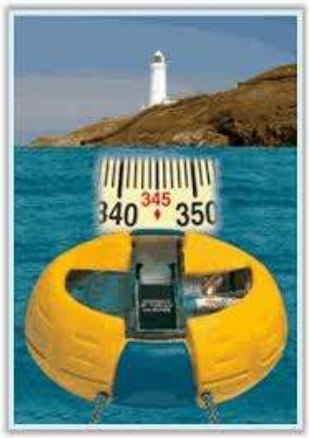

Image from:

www.skippertips.com

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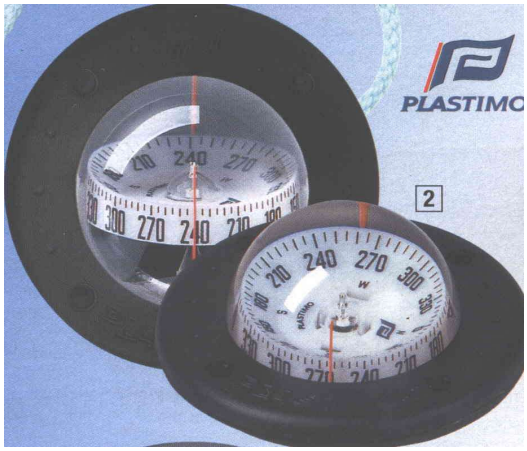
Steering Compass



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MAGNETIC VARIATION

RYA

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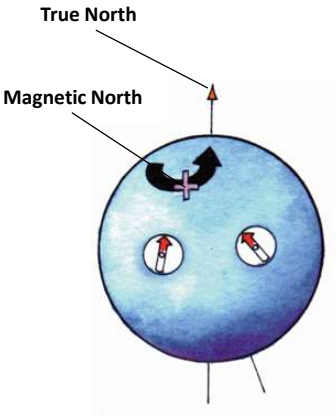
True North & Magnetic North

Magnetic variation

...the difference between the two is called variation



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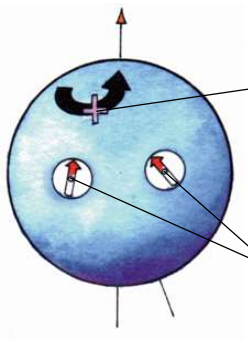
True North & Magnetic North

Magnetic variation

The position of Magnetic North changes slowly at a steady rate



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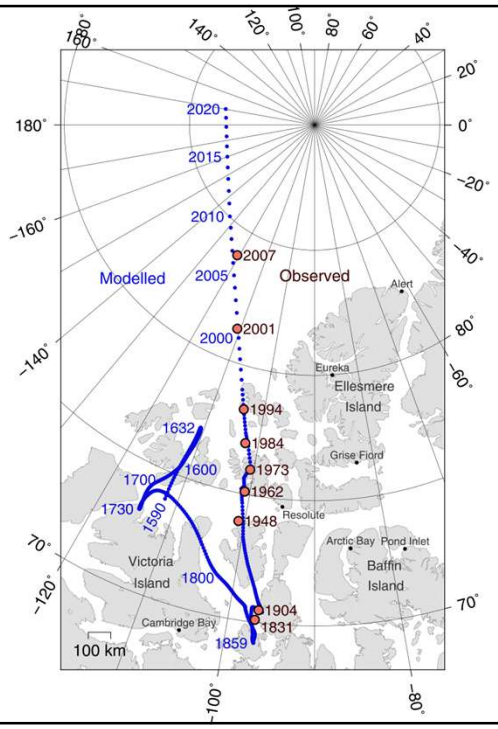

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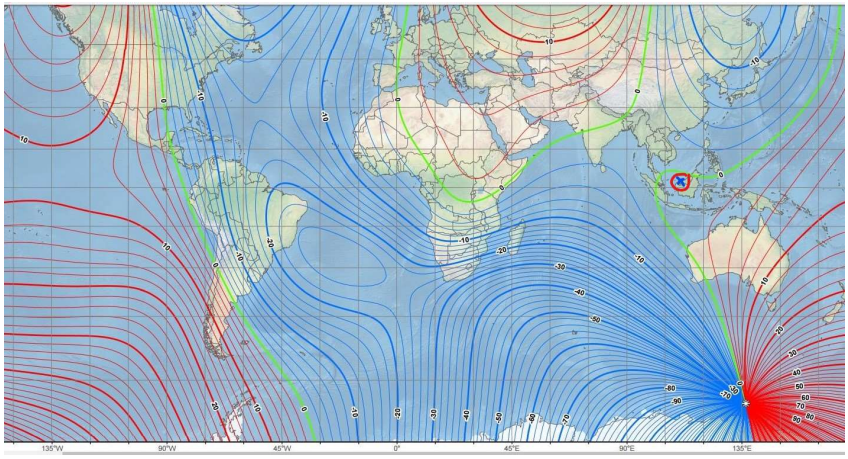

Variation currently ranges from 30 degrees west (south-eastern tip of Africa) to 26 degrees east (southern tip of New Zealand)

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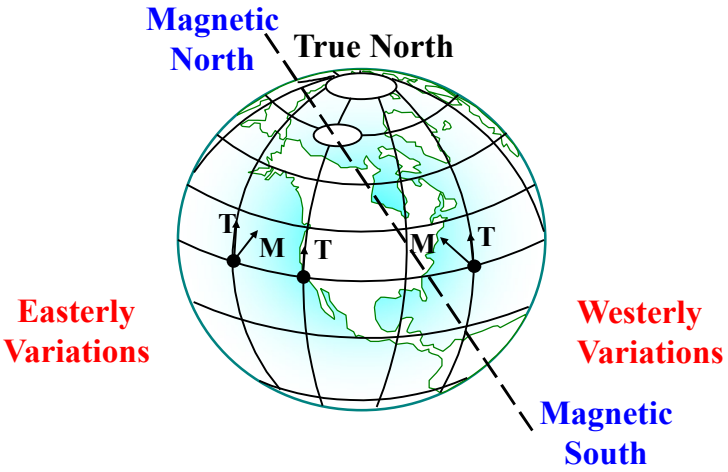
VARIATION



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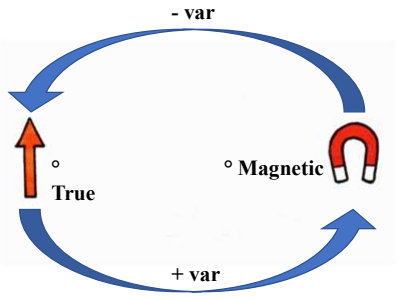
Magnetic variation

Applying variation

...so you must apply variation to bearings from and to the chart



Mag to Grid get rid
Grid to Mag add

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Converting between Magnetic and True

- Grid to Mag ----- (T) to (M) add
- Mag To Grid get rid (M) to (T) minus
- Treat West as a positive East a negative number.

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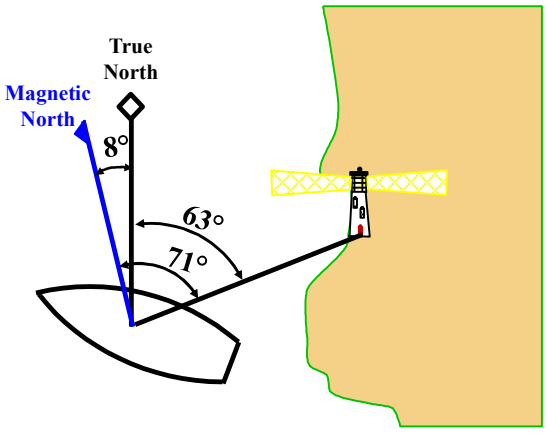
MAGNETIC to TRUE



BEARING

Magnetic Bearing	071°M
Variation	8°W
True Bearing	063°T

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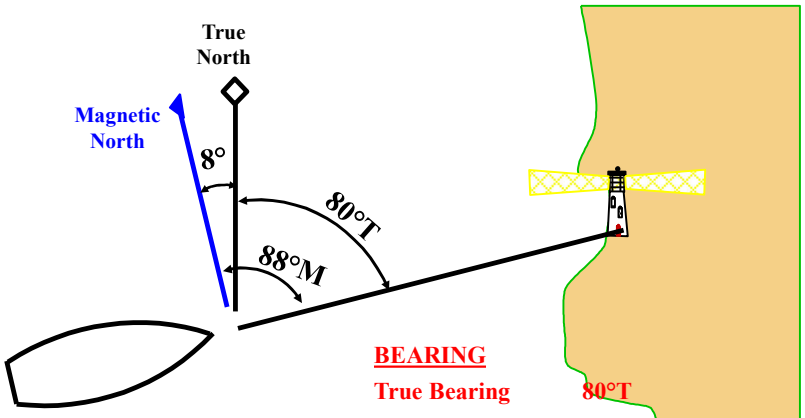
TRUE to MAGNETIC



BEARING

True Bearing	80°T
Variation	8°W
Magnetic Bearing	088°M

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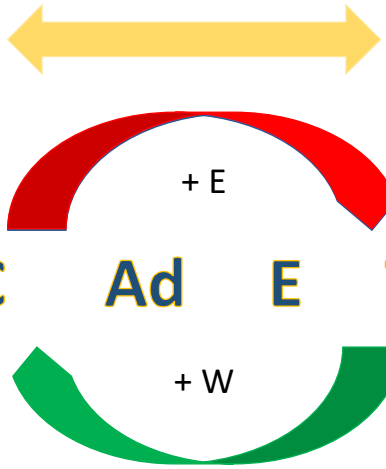
Correcting bearings



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Converting Mag to True

Mag To Grid get rid (M) to (T) minus 8 ° W variation

Compass 40 °(M) = 32 °(T)

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Converting True to Magnetic

- Grid to Mag ----- (T) to (M) add

So with 8 °W variation

276° (T) becomes 284 °(M)

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Converting Mag To True Easterly variation

- Mag To Grid get rid (M) to (T) minus

With 8 °E (treat as a minus)

40 °(M) = 48 ° (T) 40 –(-8)

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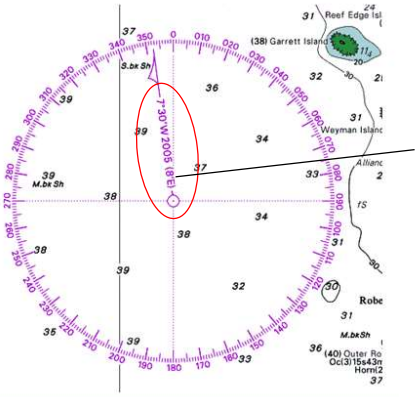
Variation on the chart

Magnetic variation



Look for nearest compass rose

The variation is changing by a few minutes each year

Changing by 8´ East annually

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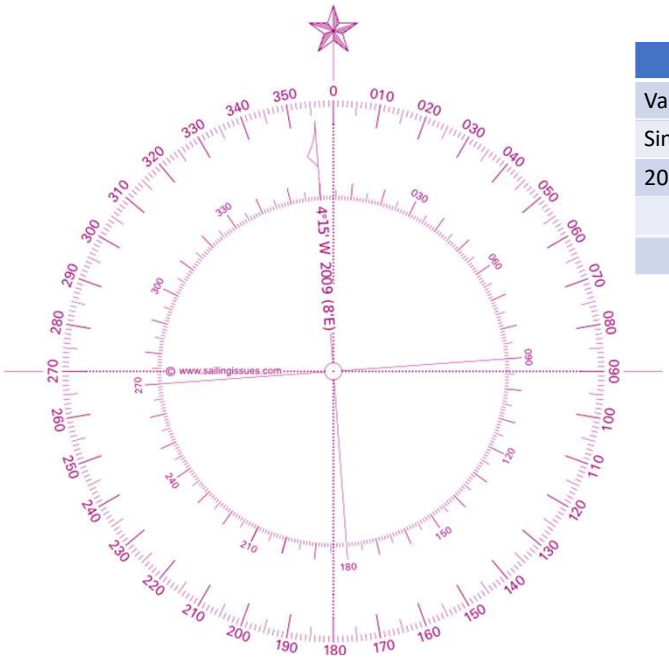

Variation 2009	4°15’ W	
Since 2009 14 x 8’E	1°52’ E	(112’) E
2023 Variation	2°23’W	

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Find current variation from Chart RYA 3 Beaufort Bay – NE corner

What was variation in 2005? How much does it change each year since?

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Find current variation from Chart RYA 3 Beaufort Bay – NE corner

2005 = 7°20'W by 2023 Variation changes 18 years x 8' = 144' = 2° 24' E
-2° 24'E

= 4° 56'W approximates to 5°W

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Find current variation from RYA Chart RYA 3 Beaufort Bay – NE corner

2005 = 7°20'W 2023 Var 18 x 8'E = 144' E = 2° 24' E
-2° 24'E

=4° 56'W approximates to 5°W

Convert boat course 180°(M) to a True bearing

Convert chart bearing 015° (T) to a Magnetic bearing

Convert 091° (M) to ° (T)

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Current variation from RYA Chart RYA 3 Beaufort Bay – NE corner

5°W

Convert boat course 180°(M) to a True bearing

180° (M) - 5° = 175° (T)

Convert chart bearing 15° (T) to a Magnetic bearing

15° (T) + 5° = 020° (M)

Convert 91° (M) to ° (T)

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Current variation from RYA Chart RYA 3 Beaufort Bay – NE corner

approximates to 5°W

Convert boat course 180°(M) to a True bearing

180° (M) - 5° = 175° (T)

Convert chart bearing 15° (T) to a Magnetic bearing

015° (T) + 5° = 020° (M)

Convert 91° (M) to ° (T)

91° (M) - 5° = 86° (T)

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Find current variation from RYA Chart RYA 3 Beaufort Bay – NW corner
approximates to 5°W

Convert boat course 180°(M) to a True bearing which can be plotted

180° (M) - 5° = 175° (T)

Convert chart bearing 15° (T) to a magnetic bearing

15° (T) + 5° = 020° (M)

Convert 91° (M) to ° (T)

91° (M) - 5° = 86° (T)

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Imray local charts – what is the current variation off:

Seaton

Plymouth

30

Sources of Compass Error

Natural variation plus compass influenced by :

- Magnets, iron or steel.
- Current carrying wires.
- Loudspeakers.
- Mobile phones, stuff in pockets, wrist watch, another compass….

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Headings

Compass deviation

The magnetic influences on board will vary as the boat's heading and heel changes ...

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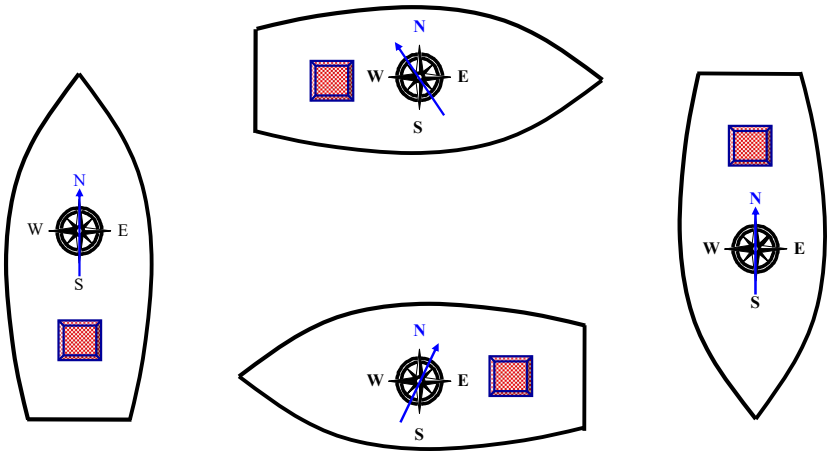
EFFECT OF COMPASS DEVIATION



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DEVIATION

Similar in application to variation

Varies with boat's heading

Need a current Deviation Chart for each fixed compass on board

Not used with handbearing compass (but need to check for gross errors)

Need to swing compass annually and check deviation

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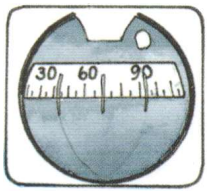
Checking for deviation

Magnetic variation

...will be deviation



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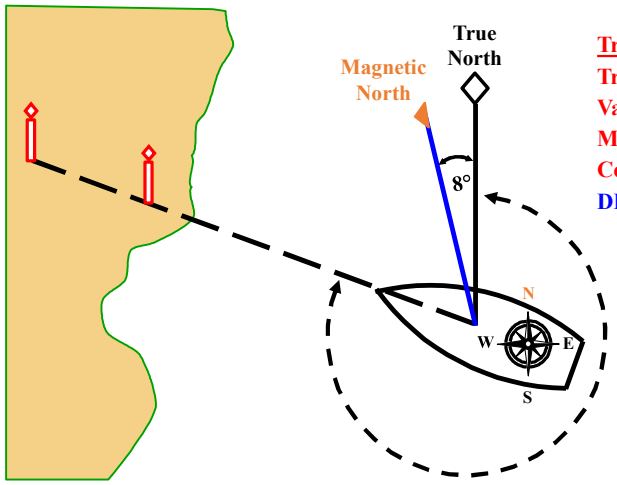
DEVIATION CHECK



Transit bears:	
True	305° (T)
Variation	8°W
Magnetic	313°(M)
Compass	308° (M)
DEVIATION	5°E

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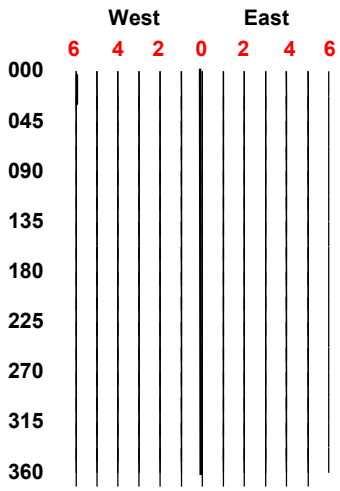
COMPASS DEVIATION TABLE



Ship's Head Compass (C)	Deviation	Ship's Head Magnetic (M)
000	4W	356
022.5	2W	020.5
045	0	045
067.5	2E	069.5
090	4E	094
112.5	5E	117.5
135	6E	141
157.5	5E	162.5
180	4E	184
202.5	2E	204.5
225	0	225
247.5	2W	245.5
270	4W	266
292.5	5W	287.5
315	6W	309
337.5	5W	332.5
360	4W	356

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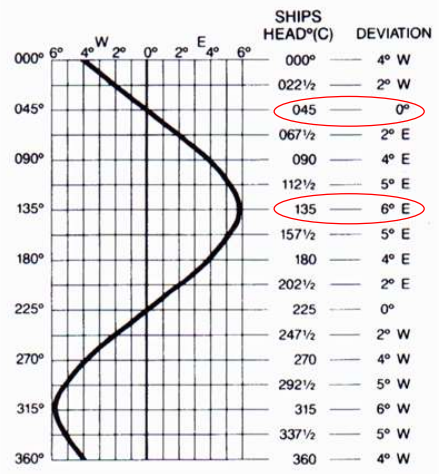
Deviation card

Compass deviation



...would give 6° East deviation

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COMPASS CORRECTIONS

- **Variation** is the angle between True North and Magnetic North
- **Deviation** is the difference between the compass bearing and magnetic bearing
- **Compass Error** is the combined effect of Variation and Deviation **(Compass Error = Variation + Deviation)**

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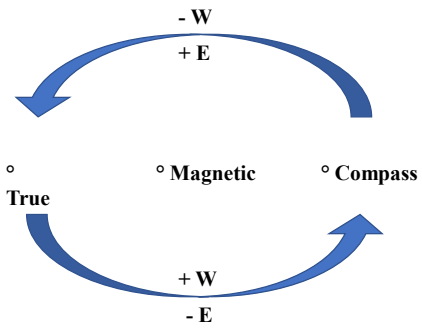
Applying deviation

Magnetic variation

Deviation is applied in a similar manner to variation



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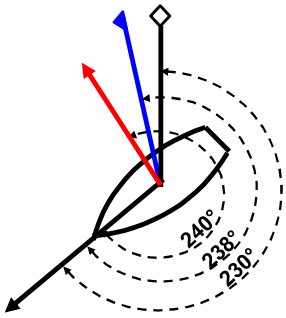
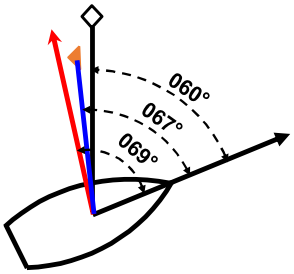
DEVIATION CONVERSIONS

Compass to True



Compass Course Steered	240°(C)
Deviation (from table)	2° W
Variation (from chart)	8° W
Compass Error	10°W
True Course (to plot on chart)	230°(T)

True to Compass



True Course (from chart)	060°(T)
Variation (from chart)	9°W
Deviation (from table)	2°E
Compass error	7°W
Compass Course to Steer	067°(C)

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Correcting Bearings

Yum
Yum

C D M V T

Compass → +/- Deviation → Magnetic → +/- Variation → True

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CDMVT

Compass Course	= 219 ° (M)
Deviation for 219 ° (from curve)	= 1 ° E
Magnetic Course	= 220° (M)
Variation	= 7 ° W
True Course	= 213° W

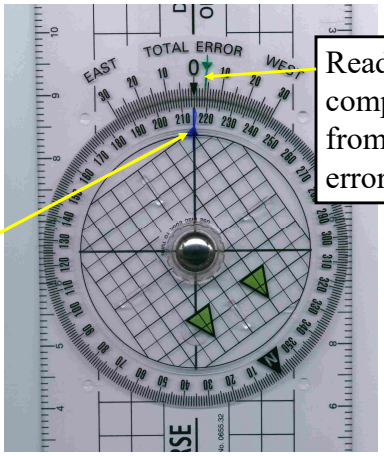
Compass Corrections

- Steering compass corrected for **VARIATION** and **DEVIATION.**
- Handbearing compass corrected for **VARIATION** only.
- For most excercises on this course we ignore **DEVIATION**

Solve with the Plotter

True Course from Chart	= 215 ° (T)
Variation	= 4 ° W
Compass Course	= 219 ° (M)

Set 215 ° against the 0° error mark



Read off compass course from the 4 ° W error mark

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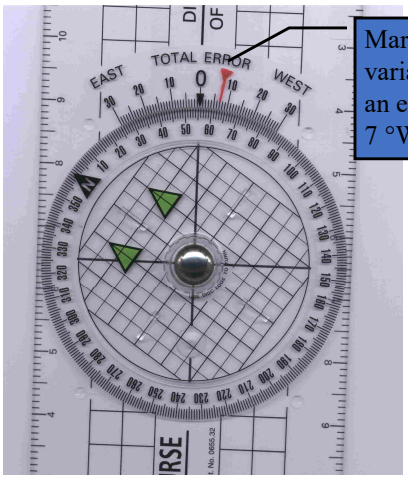
Using the Portland Plotter

Handbearing Compass

Compass Brg = 154°(M)

Variation = 7°W

True Brg = ?



Mark variation as an error of 7 °W

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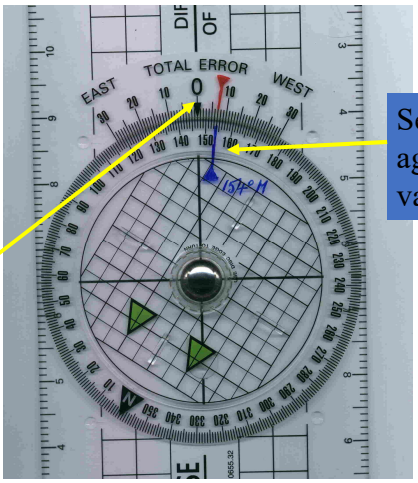
Using the Portland Plotter

Handbearing Compass

Compass Brg = 154°(M)

Variation = 7°W

True Brg = 147°(T)



Read True Brg at 0 error mark

Set 154°(M) against the 7°W variation mark

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Find current variation from RYA Chart RYA 3 Beaufort Bay – NW corner
approximates to 5°W

Convert boat course 180°(M) to a True bearing which can be plotted

180° (M) - 5° = 175° (T)

Convert chart bearing 15° (T) to a magnetic bearing

15° (T) + 5° = 020° (M)

Convert 91° (M) to ° (T)

91° (M) - 5° = 86° (T)

Mark Plotter with 5°W and repeat above, plotting both courses (M) and (T) from Back Shoal Isolated Danger Fl(2)5s5m in Beaufort Bay

Coffee

AXE YACHT CLUB

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Session 5

- Compasses
  - Compass
  - Variation
  - Deviation
- Use of the Portland Plotter and Chart Rose, including Variation
- Bearings Exercise