



Appendix F9 – Course Diagrams and Tables

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1. Range and bearing

When using a GPS and the tables to assist with mark laying, the position of each mark is defined by the range and bearing from a known point. For simplicity one point is used for all marks. For want of a better name this single point is call the **Reference Point**. It allows the position of each mark to be found independently of any other. The final position of the mark should be adjusted to account for the actual wind conditions in that part of the course.

There is nothing unique or special about the reference point, however, some points are more convenient than others. Once the beat length is close to 1 nautical mile or more any of the first three reference points described below will allow a good course to be laid using the tables. The tables have been calculated using the middle of the mark 4 gate. Total course distances have been calculated using this reference point.

Mark layers familiar with entering the reference point by latitude and longitude do not need to go to the starting area therefore maximising the time to carry out their tasks and minimising travel time and fuel required. When there is more than one mark layer competence in sharing coordinates of the positions of marks allows a course to be swung from any mark for course changes.

1.1 Reference Point is the middle of the mark 4 Gate (or Mark 3 of a Triangular course)

Pros

- (a) Mark 1 directly upwind of middle of the starting line and mark 4 for accurate inner loop beats.
- (b) Lengths of other legs are proportional to the distance from the reference point to mark 1.
- (c) The reference point is the “turning point” for the inner loop for course changes.
- (d) The tables are set up using this point.

Cons

- (a) Depends on the relationship between the starting line length and the distance above the starting line of Mark 4 gate.
- (b) Requires use of the “Project Location” or similar to determine the latitude and longitude
- (c) Is an imaginary point – nothing gets laid there. Its position needs to be given to mark boats by a latitude and longitude.

1.2 Reference Point is the middle of the starting line

Pros

- (a) Mark 1 directly up wind of the middle of the starting line for accurate first beat.
- (b) Only dependent on the starting line length.
- (c) Most likely when there is no mark just above the starting line (e.g. Optimist course)

Cons

- (a) Inner and outer loops different lengths.
- (b) Requires use of the “Project Location” or similar to determine the latitude and Longitude

- (c) Is an imaginary point – nothing gets laid there. Its position needs to be given to mark boats by a latitude and longitude.

1.3 Reference Point is the location of the signal boat

Pros

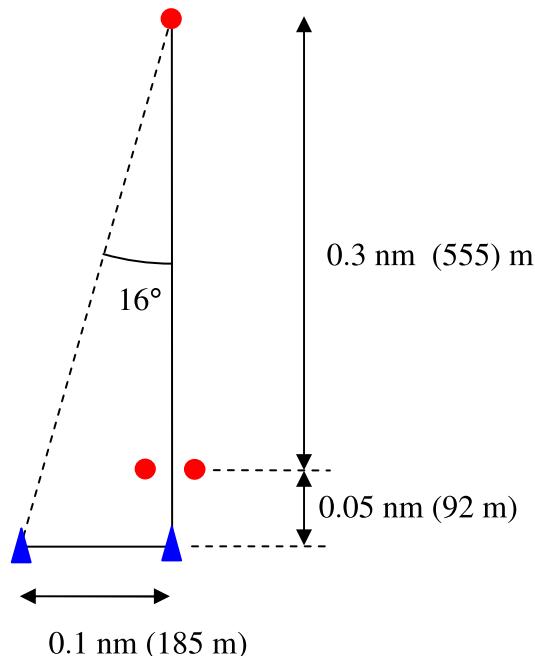
- (a) Easy to calculate as it is the signal boat's location, thus the signal boat GPS has this information at all times without calculation.
- (b) An actual identified point which can be “pinged” by a mark boat thus preventing the need to transmit the information.
- (c) A point which can be seen from other parts of the course as the signal boat is at this position.
- (d) If the gate is placed directly upwind of the signal boat, the signal boat can signal a change of course.

Cons

- (a) For long starting lines and short courses the pin end of the starting line is skewed.

Example:

First beat 0.35 nm (650 m)
 Starting line length 0.1 nm (185 m)
 If the signal boat is directly downwind of mark 1 the pin end is skewed by 16°



- (b) Inner and outer loops will be different lengths.

1.4 Reference Point is the centre of the course area circle. See diagrams on next two pages.

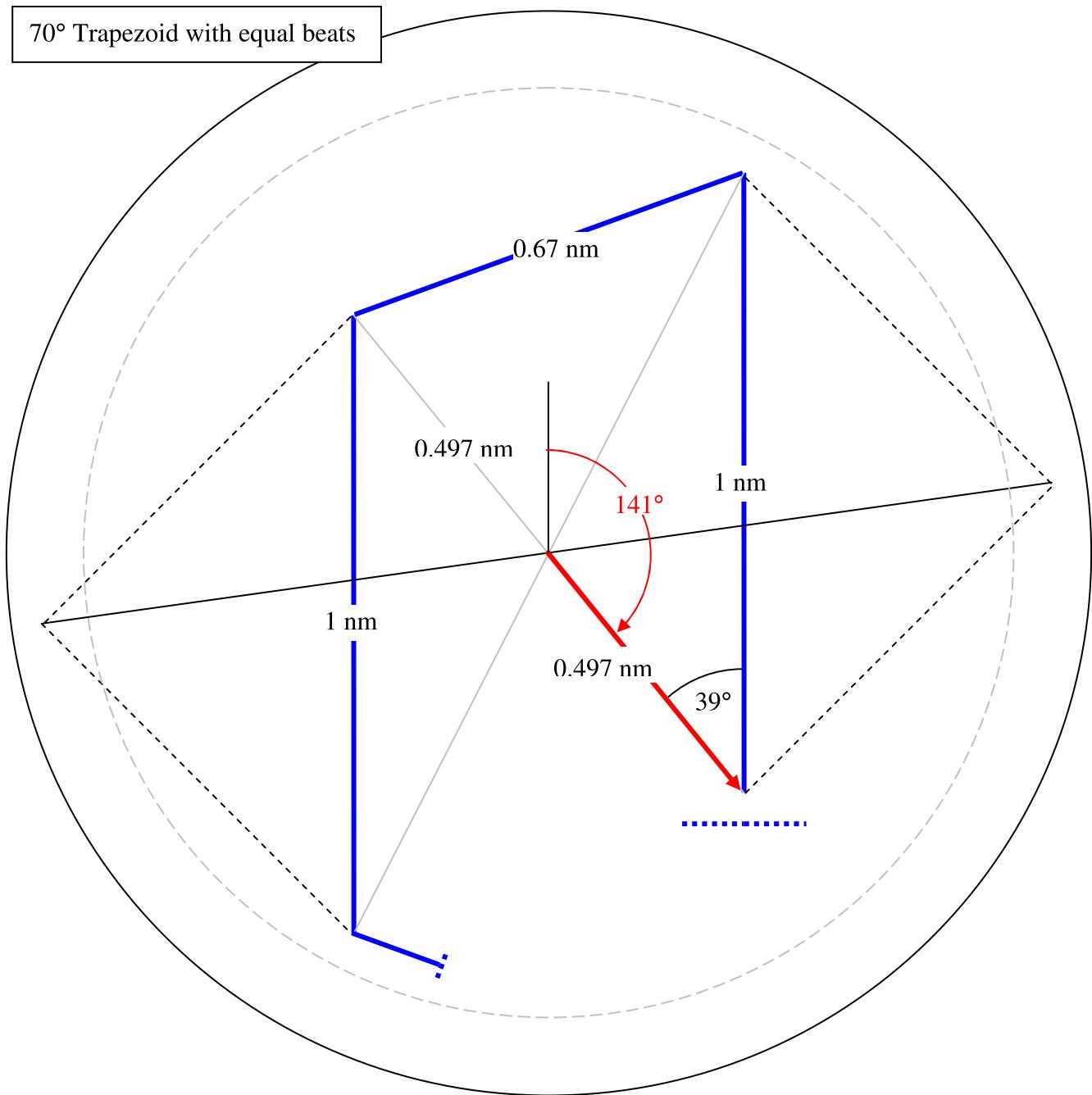
Pros

- (a) Ensures the course is as close as possible to the centre of a designated circle.
- (b) Useful as an initial point to calculate a reference point which centres the course on the course circle.

Cons

- (a) Difficult to relate other marks to the wind direction.

2. Size of the course circle (70° 110° trapezoid)

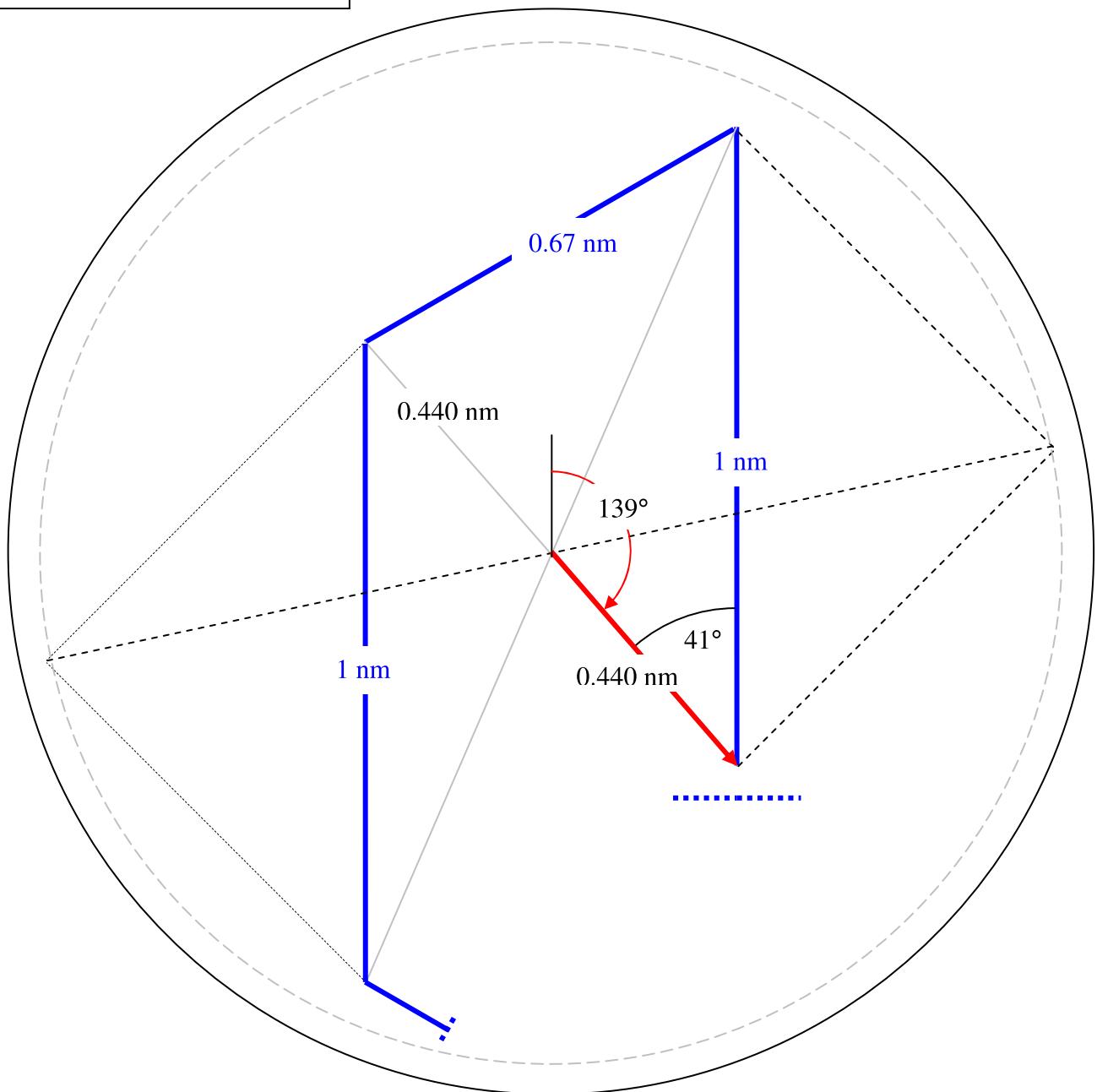


For a 1 nm beat the diameter of the circle is 1.5 nm if there is to be a 0.05 (90 m) room around marks 1 and 3, or 1.75 nm if there is to be 0.05 nm clearance around the extremities of the 4-1 and 3-2 beats.

The reference point for the course (Mark 4) should be set at wind direction plus 141° and a distance of 0.5 times the beat length from the centre of the circle if the course to be centred on the course area circle.

3. Size of the course circle (60° 120° trapezoid)

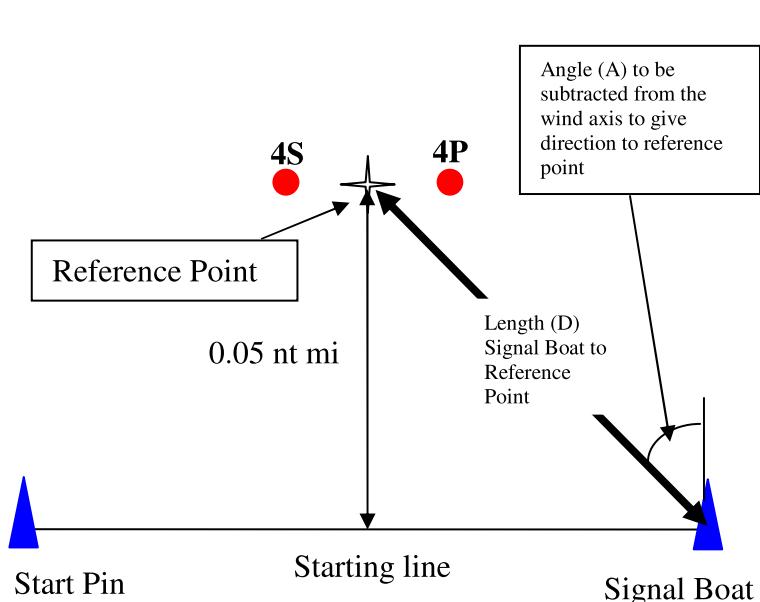
60° Trapezoid with equal beats



For a 1 nm beat the diameter of the circle is 1.6 nm if there is to be a 0.05 nm (90 m) room around mark 1 and the finish or 1.7 nm if there is to be 0.05 clearance around the extremities of the 4-1 and 3-2 beats.

The reference point for the course (Mark 4) should be set at wind direction plus 139° and 0.44 times the beat length from the centre of the circle if the course is to be centred on the course area circle.

4. Determining the Reference Position as the middle of the mark 4 gate from the signal boat using projection location (see below for GPS instructions)



Starting Line		Length (D) Signal Boat to Reference Point	Length (D) Signal Boat to Reference Point	Angle(A) to subtract from Course Axis.
Length (m)	Length (Nt mi)			
84 - 101	0.05	0.06	27	
102 - 120	0.06	0.06	31	
121 - 138	0.07	0.06	35	
139 - 157	0.08	0.06	39	
158 - 175	0.09	0.07	42	
176 - 194	0.1	0.07	45	
195 - 212	0.11	0.07	48	
213 - 231	0.12	0.08	50	
232 - 250	0.13	0.08	52	
251 - 268	0.14	0.09	55	
269 - 287	0.15	0.09	56	
288 - 305	0.16	0.09	58	
306 - 324	0.17	0.1	60	
325 - 343	0.18	0.1	61	
344 - 361	0.19	0.11	62	
362 - 379	0.2	0.11	63	
381 - 398	0.21	0.12	65	
399 - 416	0.22	0.12	66	
417 - 435	0.23	0.13	67	
436 - 453	0.24	0.13	67	
454 - 472	0.25	0.13	68	
473 - 490	0.26	0.14	69	
491 - 509	0.27	0.14	70	
510 - 527	0.28	0.15	70	
528 - 546	0.29	0.15	71	
547 - 564	0.3	0.16	72	

5. Finding the Reference Position using the Garmin 76 from the signal boat

Before going to sea create a waypoint named “REFERENCE”

Determine the Start line length (see next page), and then use the table above to find:

- **the angle (A) to be subtracted from the course axis; and**
- **the distance (D) from the Signal Boat to the reference point.**

**When the course axis is determined by the Race Officer, subtract angle A from the course axis.
This is the bearing from the Signal boat to the reference position.**

On the GPS:

MENU MENU

Scroll to Points ENTER

Scroll to Waypoints ENTER

Scroll to REFERENCE ENTER ENTER

You should now have the screen headed up Waypoint REFERENCE

MENU

Scroll to Project Location ENTER

Check that the location to project from is CURRENT LOCATION

Scroll up to Distance ENTER

Input the correct distance using the rocker bar ENTER

Scroll down to Bearing

Input the correct angle (Course axis minus A) using the rocker bar ENTER

Scroll down to Save ENTER

This screen gives the correct Latitude and Longitude of the reference point. It can now be transmitted to the Mark boats.

6. ILLUSTRATING THE COURSE

Course designations:

I	inner trapezoid, reaching finish
O	outer trapezoid reaching finish
IW	inner trapezoid with beat to finish
OW	outer trapezoid with beat to finish
L	windward/leeward finishing to leeward
W	windward/leeward finishing to windward
LG	windward/leeward with a reaching finish to starboard following a leeward leg
LR	windward/leeward with a reaching finish to port following a leeward leg
WG	windward/leeward with a reaching finish to starboard following a windward leg
WR	windward/leeward with a reaching finish to port following a windward leg
TL	triangular with leeward finish
TW	triangular with windward finish
IA, IWA, LA, WA, TLA, TWA	Mark 1 has a corresponding offset mark 1a
IS, OS and LS	mean the designated trapezoid or windward/leeward with a slalom finish.
M	windward/leeward, finishing to leeward, marks to starboard, for match racing.
IOD	Optimist course

Other course diagram standards:

The number following the course designation indicates the number of beats (windward legs) to be sailed.

An offset mark following Mark 1 is designated Mark 1a set approximately 60 m at 80° – 90° off the wind.

For fleet racing courses, gates are designated 3s, 3p, and 4s, 4p, depending on the course. 3s and 4s are the gate marks a boat will leave to starboard; 3p and 4p are the marks a boat will leave to port.

The gate on Course L or W is designated 4s and 4p.

Course M uses Mark 1 for the windward mark and Mark 2 for the leeward mark.

Starting marks are labeled SS (Starting mark starboard end), SP (Starting mark port end)

Finishing marks are labeled FS (Finishing mark starboard end), FP (Finishing mark port end)

Marks should be described by size (large, small), colour and shape (tetrahedral, spherical, cylindrical or conical).

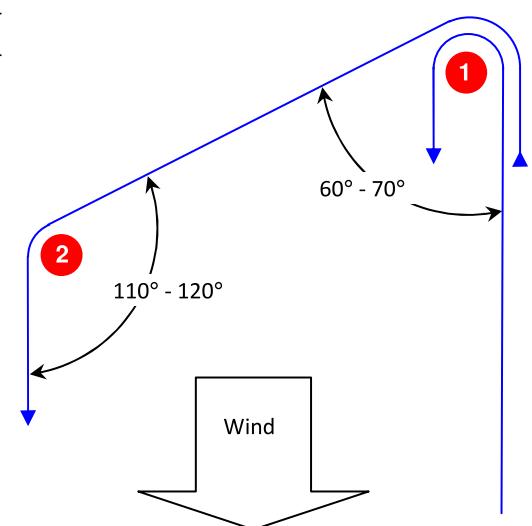
When a mark of a gate is used before a reaching leg, only the mark being rounded should be specified in the course description. E.g. the mark before the finish in an I or O course is 3p. The other mark (3s) is not a mark of the course even though it may still be laid.

The interior angles of a trapezoid course should be approximately 70°, 110° for non spinnaker boats and 60°, 120° for boats carrying spinnakers.

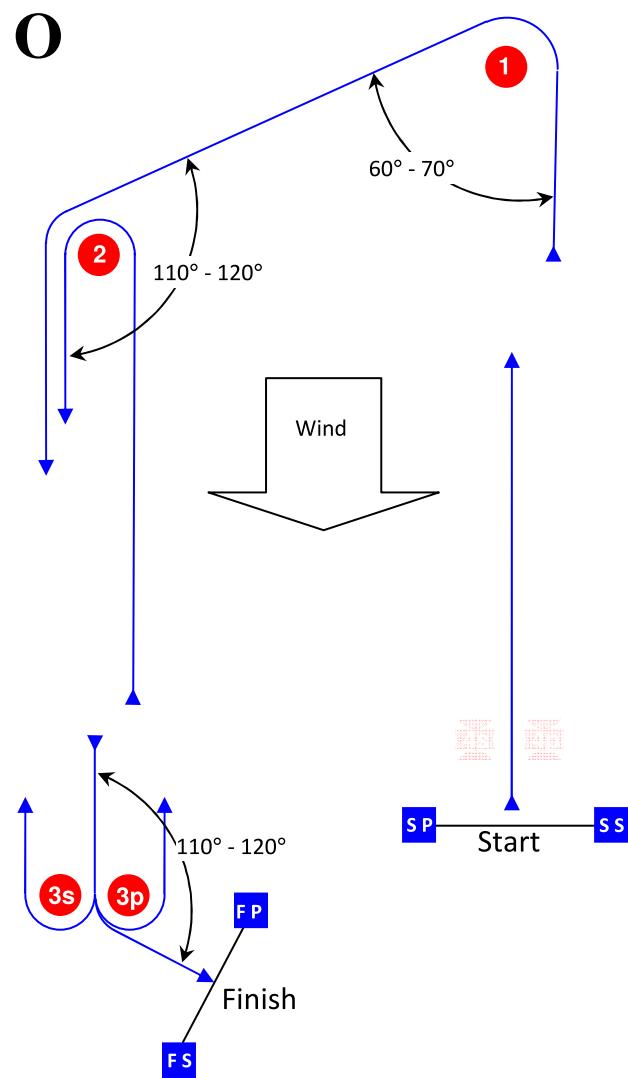
A slalom should take approximately 2 minutes. The angles between slalom marks should be 15° - 20° (100° off the wind from the gate to S1).

Course Illustration – Trapezoid

I



O



Course: Inner Trapezoid

Signal	Mark Rounding Order
--------	---------------------

I2 Start – 1 – 4s/4p – 1 – 2 – 3p – Finish

I3 Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – Finish

I4 Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – Finish

Course: Outer Trapezoid

Signal	Mark Rounding Order
--------	---------------------

02 Start – 1 – 2 – 3s/3p – 2 – 3p – Finish

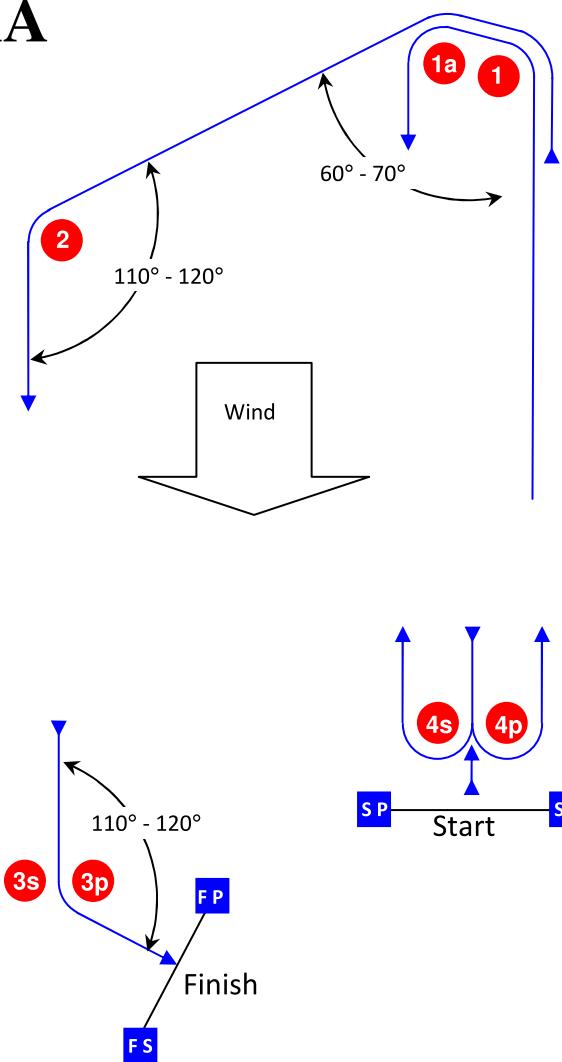
03 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – Finish

04 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – Finish

Mark	Description
1	
2	
3s	
3p	
4s	
4p	
SS	Starting mark starboard end
SP	Starting mark port end
FS	Finishing mark starboard end
FP	Finishing mark port end

Course Illustration – Trapezoid with offset mark

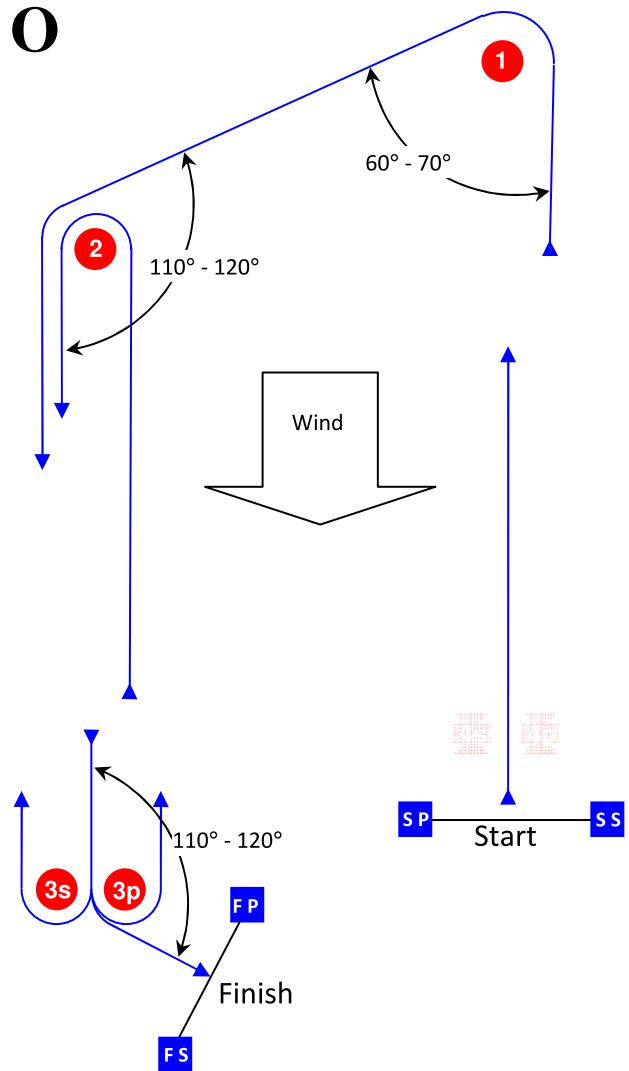
IA



Course: Inner Trapezoid

Signal	Mark Rounding Order
IA2	Start – 1 – 1a – 4s/4p – 1 – 1a – 2 – 3p – Finish
IA3	Start – 1 – 1a – 4s/4p – 1 – 1a – 4s/4p – 1 – 1a – 2 – 3p – Finish
IA4	Start – 1 – 1a – 4s/4p – 1 – 1a – 4s/4p – 1 – 1a – 4s/4p – 1 – 1a – 2 – 3p – Finish

O



Course: Outer Trapezoid

Signal	Mark Rounding Order
02	Start – 1 – 2 – 3s/3p – 2 – 3p – Finish
03	Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – Finish
04	Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – Finish

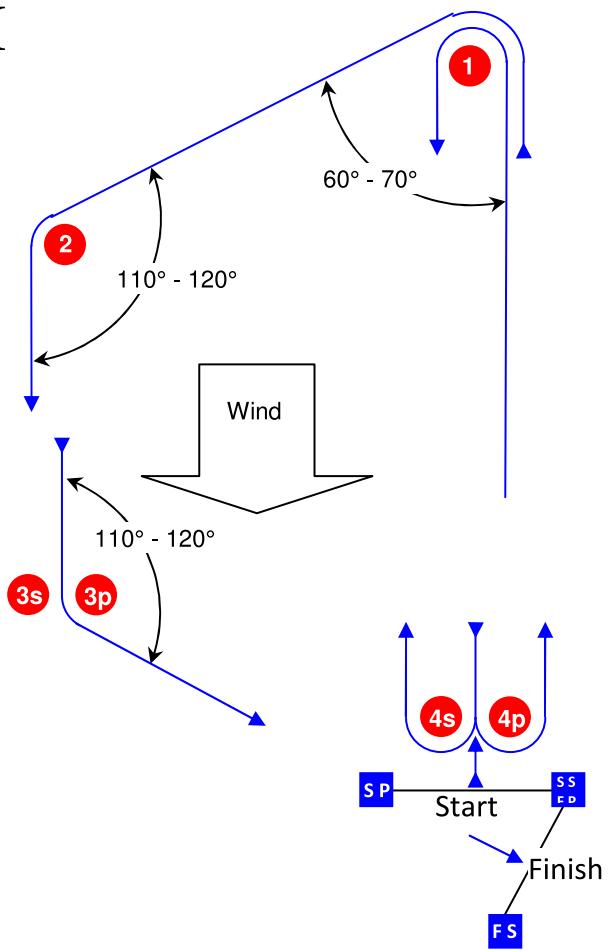
Mark

Description

1	2	
1a		
3s	3p	
4s	4p	
ss	Starting mark starboard end	
sp	Starting mark port end	
fs	Finishing mark starboard end	
fp	Finishing mark port end	

Course Illustration – Trapezoid with signal boat for start and finish

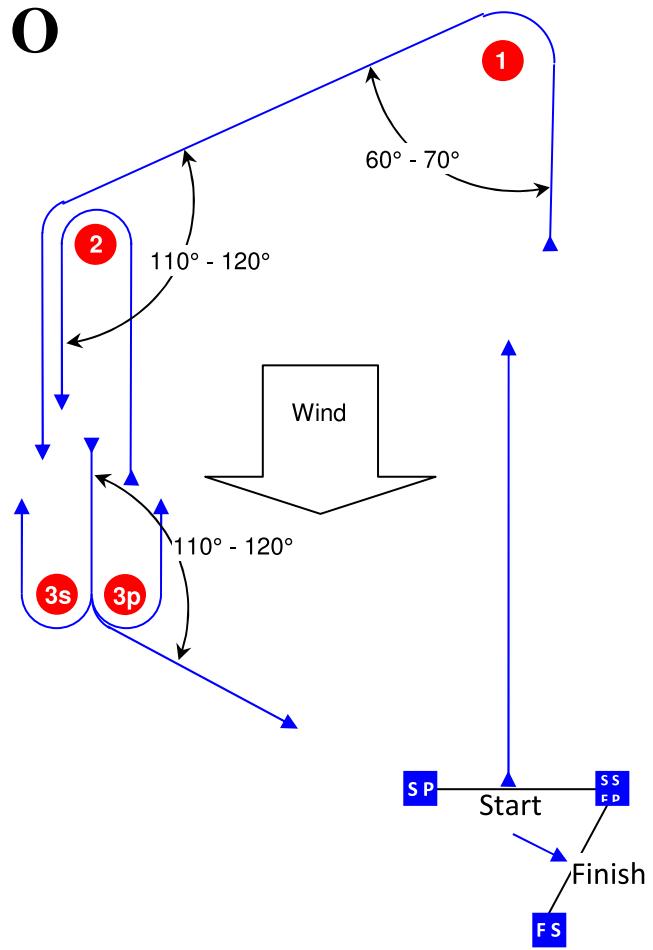
I



Course: Inner Trapezoid

Signal	Mark Rounding Order
I2	Start – 1 – 4s/4p – 1 – 2 – 3p – Finish
I3	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – Finish
I4	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – Finish

O



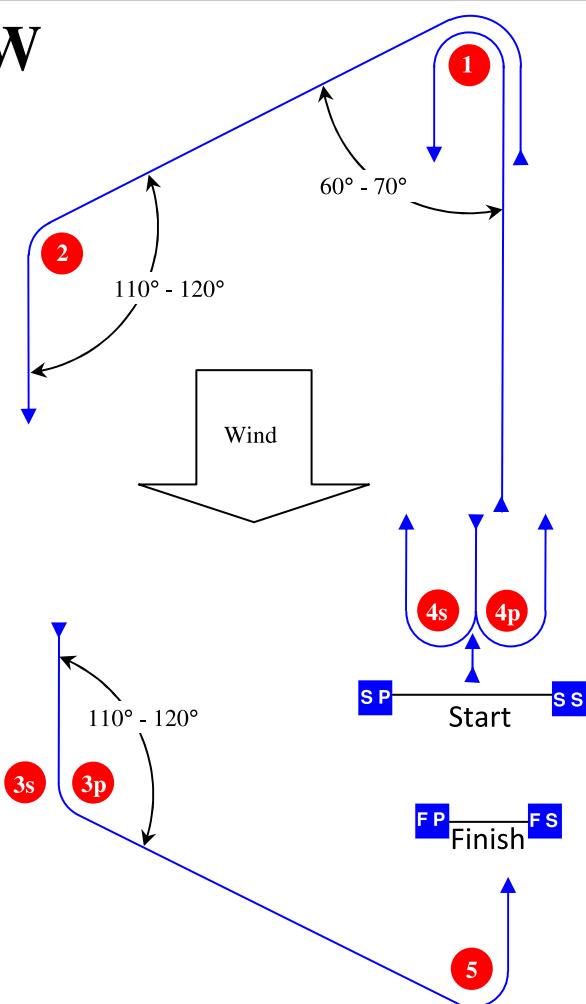
Course: Outer Trapezoid

Signal	Mark Rounding Order
02	Start – 1 – 2 – 3s/3p – 2 – 3p – Finish
03	Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – Finish
14	Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – Finish

Mark	Description
1 2	
3s 3p	
4s 4p	
SS	Starting mark starboard end
SP	Starting mark port end
FS	Finishing mark starboard end
FP	Finishing mark port end

Course Illustration – Trapezoid with beat to finish - separate finish

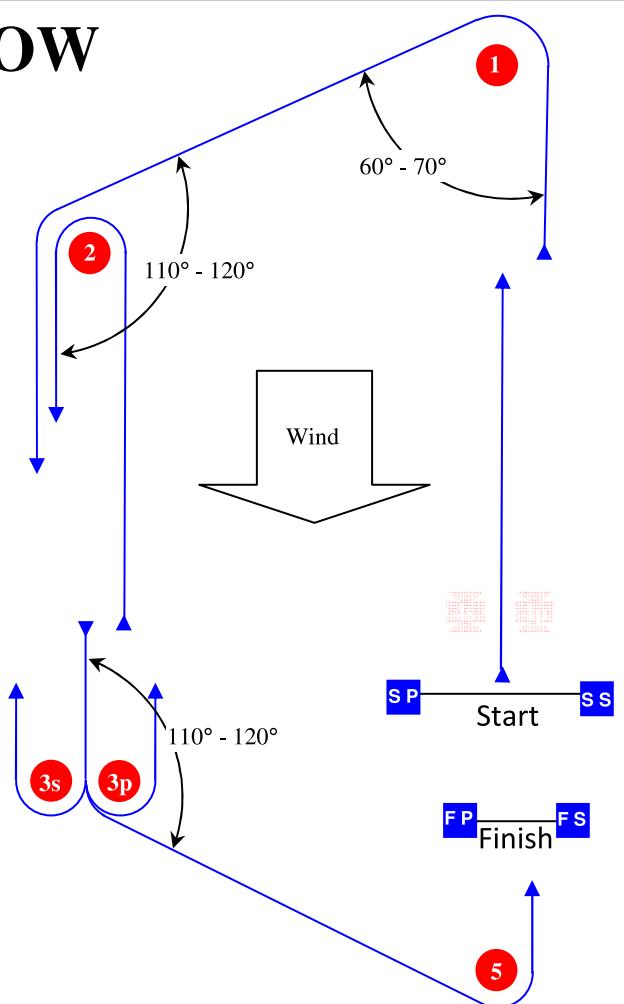
IW



Course: Inner Trapezoid with beat to finish

Signal	Mark Rounding Order
IW1	Start – 1 – 2 – 3p – 5 – Finish
IW2	Start – 1 – 4s/4p – 1 – 2 – 3p – 5 – Finish
IW3	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – 5 – Finish
IW4	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – 5 – Finish

OW



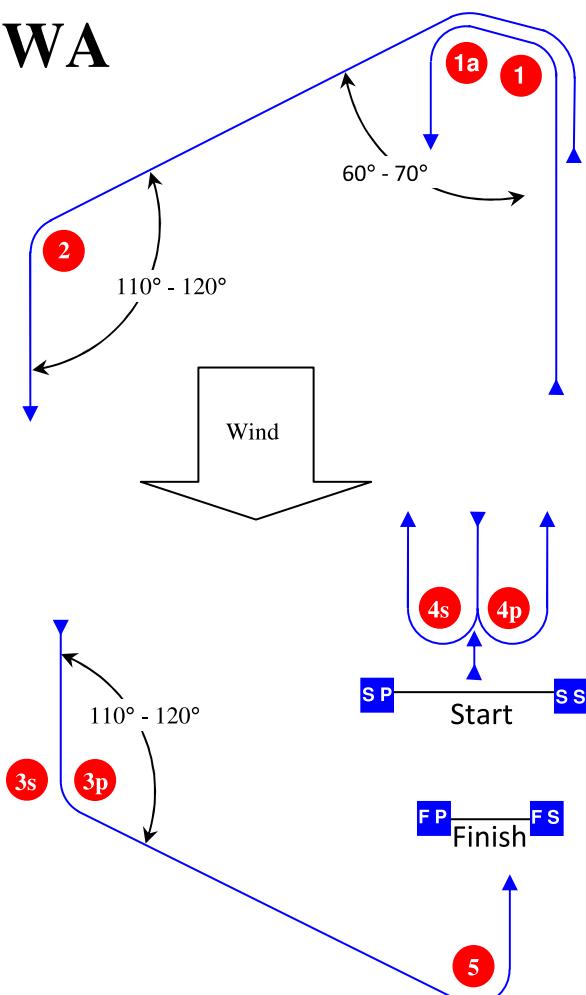
Course: Outer Trapezoid with beat to finish

Signal	Mark Rounding Order
OW2	Start – 1 – 2 – 3s/3p – 2 – 3p – 5 – Finish
OW3	Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – 5 – Finish
OW4	Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – 5 – Finish

Mark	Description
1 2	
3s 3p	
4s 4p	
5	
ss	Starting mark starboard end
sp	Starting mark port end
fs	Finishing mark starboard end
fp	Finishing mark port end

Course Illustration – Trapezoid with beat to finish, offset mark and separate finish

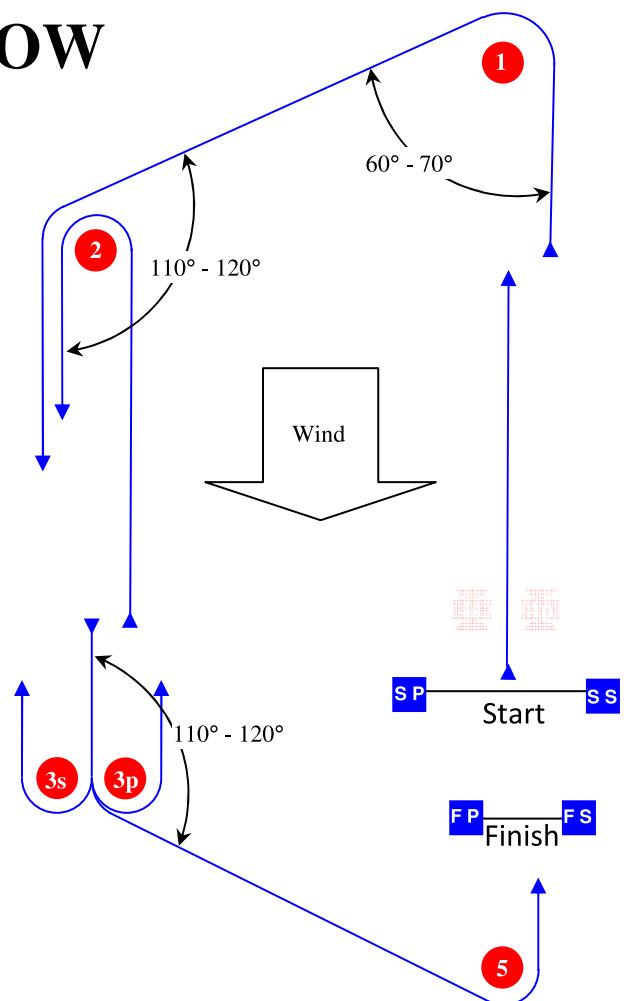
IWA



Course: Inner Trapezoid with beat to finish

Signal	Mark Rounding Order
IWA1	Start – 1 – 1a – 2 – 3p – 5 – Finish
IWA2	Start – 1 – 1a – 4s/4p – 1 – 1a – 2 – 3p – 5 – Finish
IWA3	Start – 1 – 1a – 4s/4p – 1 – 1a – 4s/4p – 1 – 1a – 2 – 3p – 5 – Finish
IWA4	Start – 1 – 1a – 4s/4p – 1 – 1a – 4s/4p – 1 – 1a – 4s/4p – 1 – 1a – 2 – 3p – 5 – Finish

OW



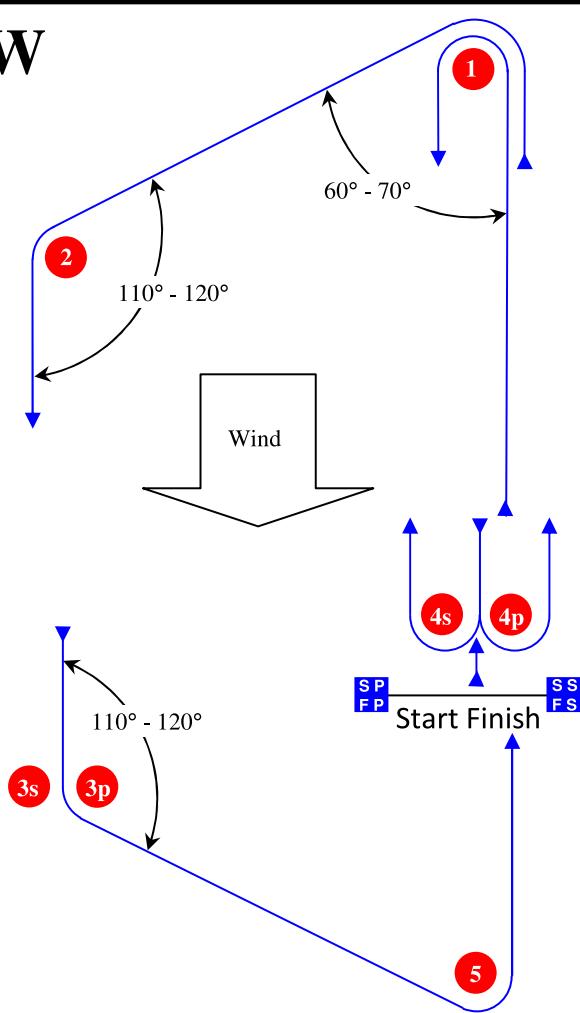
Course: Outer Trapezoid with beat to finish

Signal	Mark Rounding Order
OW2	Start – 1 – 2 – 3s/3p – 2 – 3p – 5 – Finish
OW3	Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – 5 – Finish
OW4	Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – 5 – Finish

Mark	Description
1 2	
1a	
3s 3p	
4s 4p	
5	
ss	Starting mark starboard end
sp	Starting mark port end
fs	Finishing mark starboard end
fp	Finishing mark port end

Course Illustration – Trapezoid with beat to finish - signal boat for start/finish

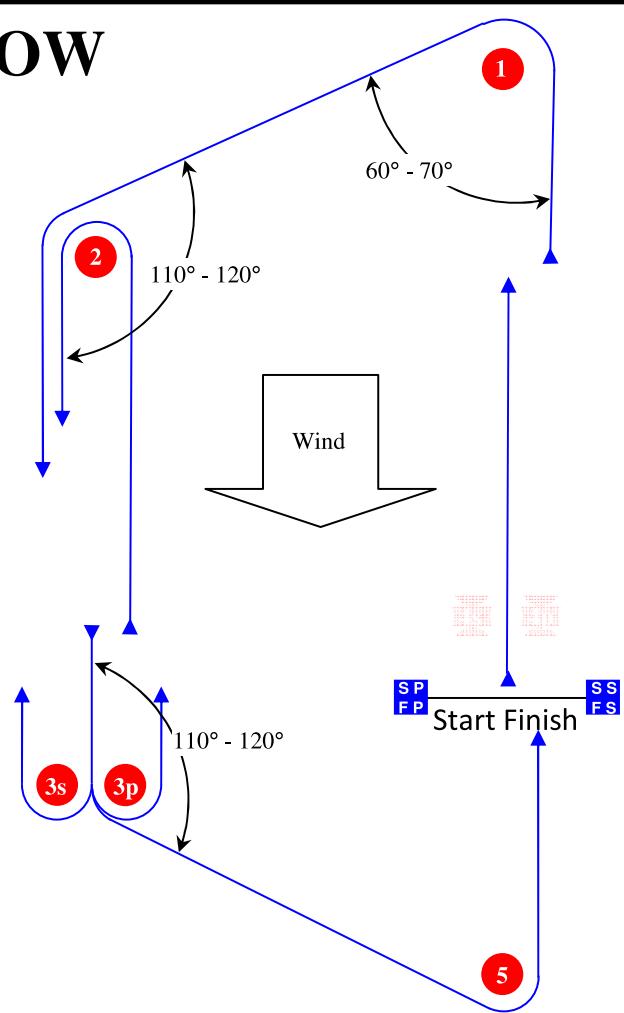
IW



Course: Inner Trapezoid with beat to finish

Signal	Mark Rounding Order
IW1	Start – 1 – 2 – 3p – 5 – Finish
IW2	Start – 1 – 4s/4p – 1 – 2 – 3p – 5 – Finish
IW3	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – 5 – Finish
IW4	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – 5 – Finish

OW



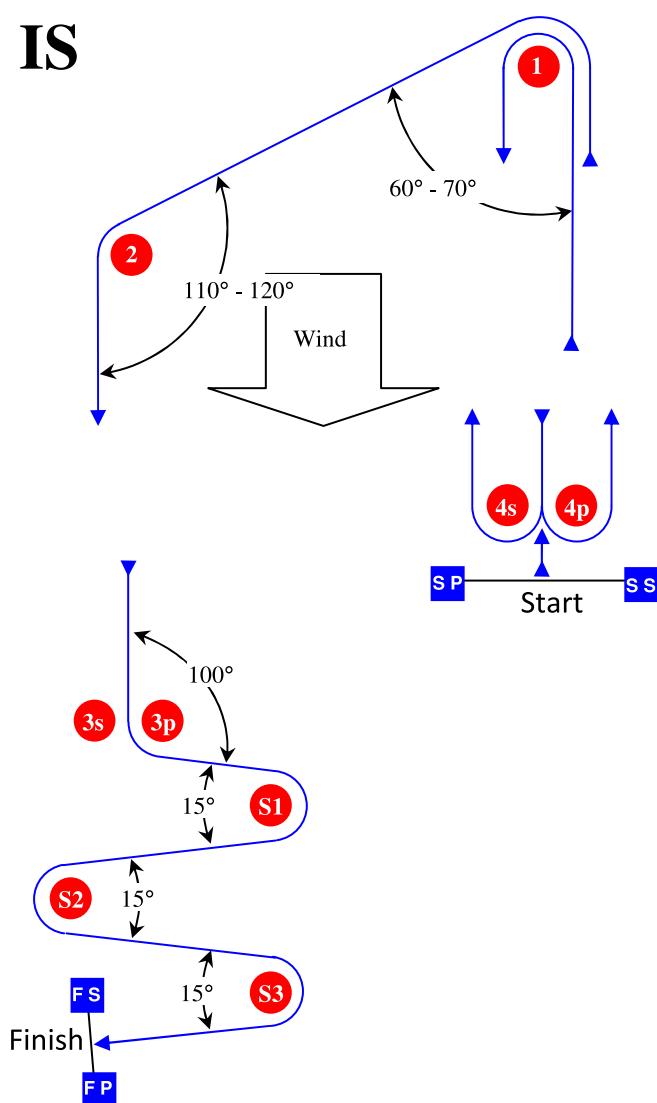
Course: Outer Trapezoid with beat to finish

Signal	Mark Rounding Order
OW2	Start – 1 – 2 – 3s/3p – 2 – 3p – 5 – Finish
OW3	Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – 5 – Finish
OW4	Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – 5 – Finish

Mark	Description
1 2	
3s 3p	
4s 4p	
5	
ss	Starting mark starboard end
sp	Starting mark port end
fs	Finishing mark starboard end
fp	Finishing mark port end

Course Illustration – Trapezoid with slalom finish

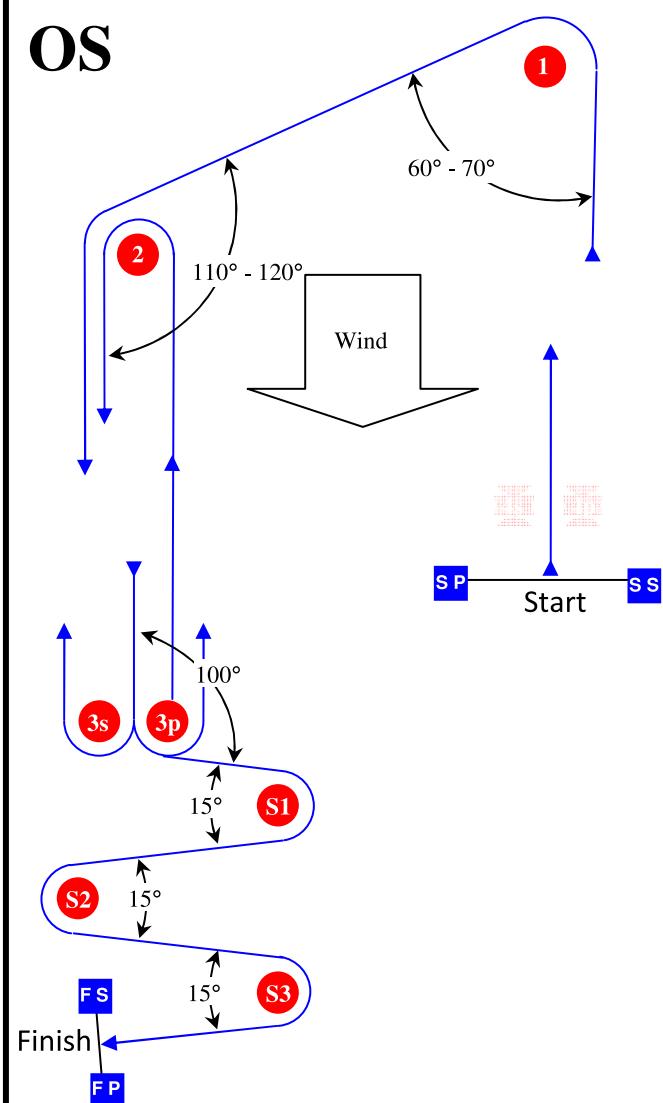
IS



Course: Inner trapezoid slalom finish

Signal	Mark Rounding Order
IS2	Start – 1 – 4s/4p – 1 – 2 – 3p – S1 – S2 – S3 – Finish
IS3	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – S1 – S2 – S3 – Finish
IS4	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – S1 – S2 – S3 – Finish

OS



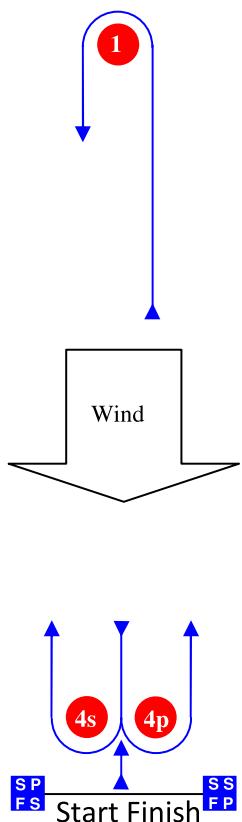
Course: Outer trapezoid slalom finish

Signal	Mark Rounding Order
OS2	Start – 1 – 2 – 3s/3p – 2 – 3p – S1 – S2 – S3 – Finish
OS3	Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – S1 – S2 – S3 – Finish
OS4	Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – S1 – S2 – S3 – Finish

Mark	Description
1 2	
3s 3p	
4s 4p	
S1 S2 S3	
ss	Starting mark starboard end
sp	Starting mark port end
fs	Finishing mark starboard end
fp	Finishing mark port end

Course Illustrations – Windward Leeward

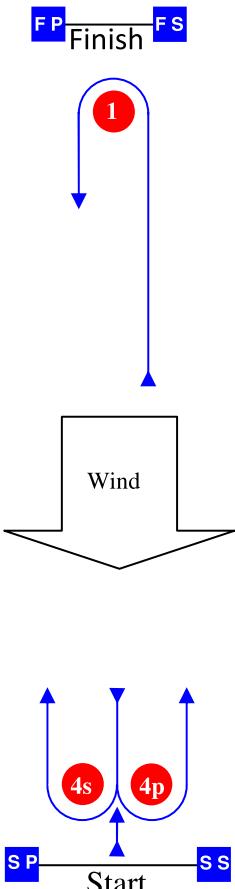
L



Course: Leeward finish

Signal	Mark Rounding Order
L2	Start – 1 – 4s/4p – 1 – Finish
L3	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – Finish
L4	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – 1 – Finish

W



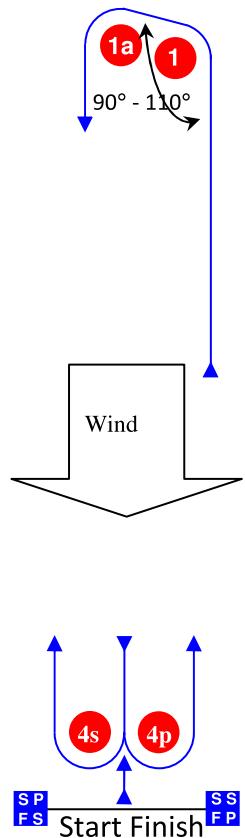
Course: Windward Finish

Signal	Mark Rounding Order
W2	Start – 1 – 4s/4p – Finish
W3	Start – 1 – 4s/4p – 1 – 4s/4p – Finish
W4	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – Finish

Mark	Description
1	
4s 4p	
ss	Starting mark starboard end
sp	Starting mark port end
fs	Finishing mark starboard end
fp	Finishing mark port end

Course Illustrations – Windward Leeward with offset

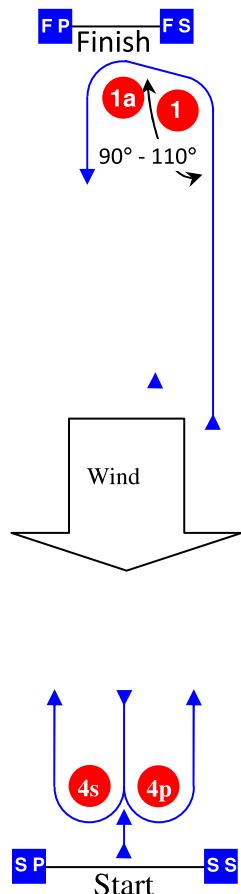
LA



Course: Leeward finish

Signal	Mark Rounding Order
LA2	Start – 1 – 1a – 4s/4p – 1 – 1a – Finish
LA3	Start – 1 – 1a – 4s/4p – 1 – 1a – 4s/4p – 1 – 1a – Finish
LA4	Start – 1 – 1a – 4s/4p – 1 – 1a – 4s/4p – 1 – 1a – 4s/4p – 1 – 1a – Finish

WA



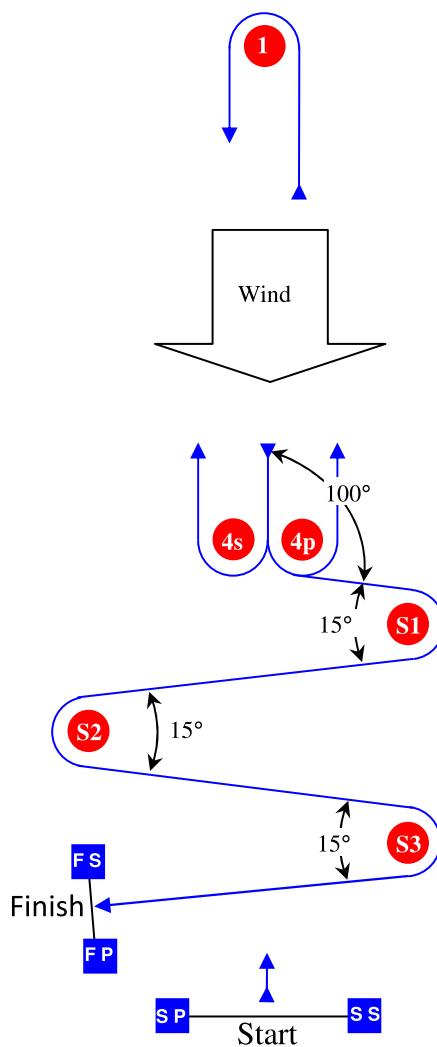
Course: Windward Finish

Signal	Mark Rounding Order
WA2	Start – 1 – 1a – 4s/4p – Finish
WA3	Start – 1 – 1a – 4s/4p – 1 – 1a – 4s/4p – 1 – 1a – Finish
WA4	Start – 1 – 1a – 4s/4p – 1 – 1a – 4s/4p – 1 – 1a – 4s/4p – 1 – 1a – Finish

Mark	Description
1	
1a	
4s 4p	
ss	Starting mark starboard end
sp	Starting mark port end
fp	
fs	
	LA
	WA

Course Illustration - Windward leeward with slalom finish

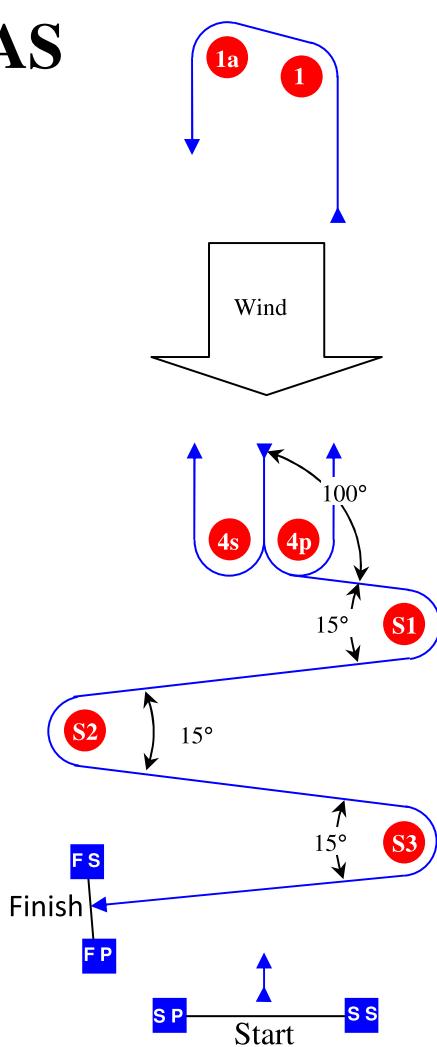
LS



Course: Windward Leeward slalom finish

Signal	Mark Rounding Order
LS2	Start – 1 – 4s/4p – 1 – 4p – S1 – S2 – S3 – Finish
LS3	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4p – S1 – S2 – S3 – Finish
LS4	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – 1 – 4p – S1 – S2 – S3 – Finish

LAS



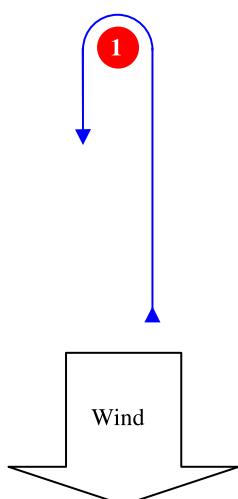
Course: Windward leeward with offset mark and slalom finish

Signal	Mark Rounding Order
LAS2	Start – 1 – 1a – 4s/4p – 1 – 4p – 1a – S1 – S2 – S3 – Finish
LAS3	Start – 1 – 1a – 4s/4p – 1 – 1a – 4s/4p – 1 – 4p – 1a – S1 – S2 – S3 – Finish
LAS4	Start – 1 – 1a – 4s/4p – 1 – 1a – 4s/4p – 1 – 1a – 4s/4p – 1 – 1a – S1 – S2 – S3 – Finish

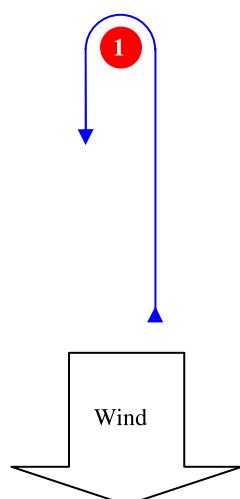
Mark	Description
1	
1a	
4s 4p	
S1 S2 S3	
SS	Starting mark starboard end
SP	Starting mark port end
FS	Finishing mark starboard end
FP	Finishing mark port end

Course Illustration – Windward Leeward with reaching finish

LR



LG



Course: Leeward finish

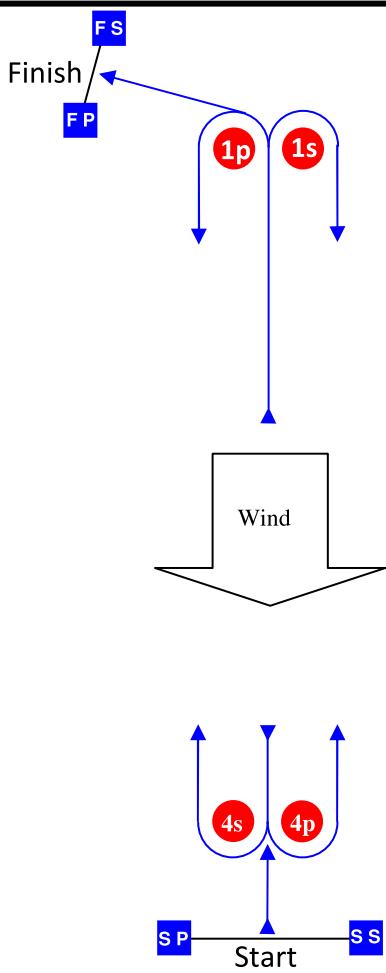
Signal	Mark Rounding Order
LR2	Start – 1 – 4s/4p – 1 – 4p – Finish
LR3	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4p – Finish
LR4	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – 1 – 4p – Finish

Course: Windward Finish

Signal	Mark Rounding Order
LG2	Start – 1 – 4s/4p – 1 – 4s – Finish
LG3	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s – Finish
LG4	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s – Finish

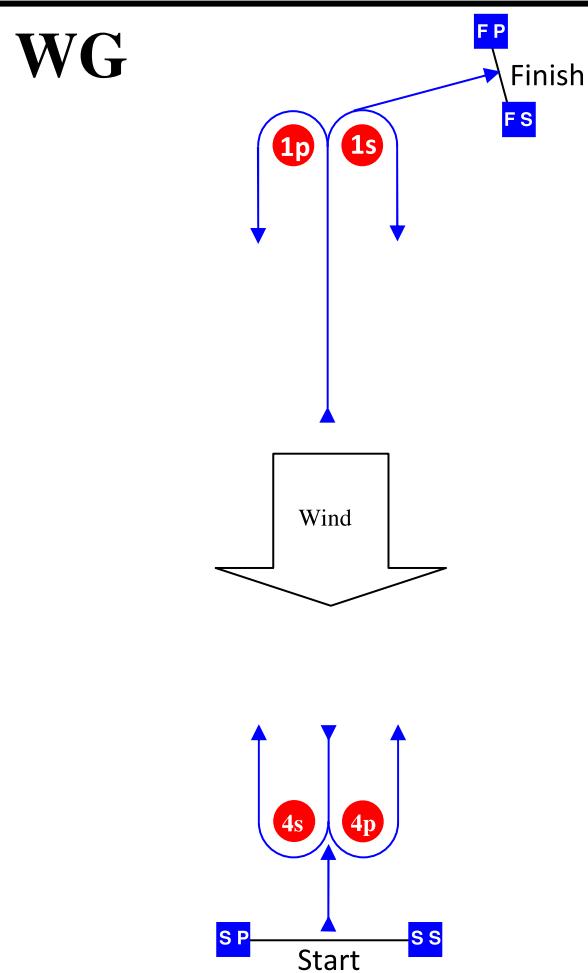
Mark	Description		
1			
4s 4p			
ss	Starting mark starboard end		
sp	Starting mark port end		
		LR	LG
fs	Finishing mark starboard end		
fp	Finishing mark port end		

Course Illustration – Windward Leeward with reaching finish (2)



Course: Leeward finish

Signal	Mark Rounding Order
WR2	Start – 1s/1p – 4s/4p – 1p – Finish
WR3	Start – 1s/1p – 4s/4p – 1s/1p – 4s/4p – 1p – Finish
WR4	Start – 1s/1p – 4s/4p – 1s/1p – 4s/4p – 1s/1p – 4s/4p – 1p – Finish



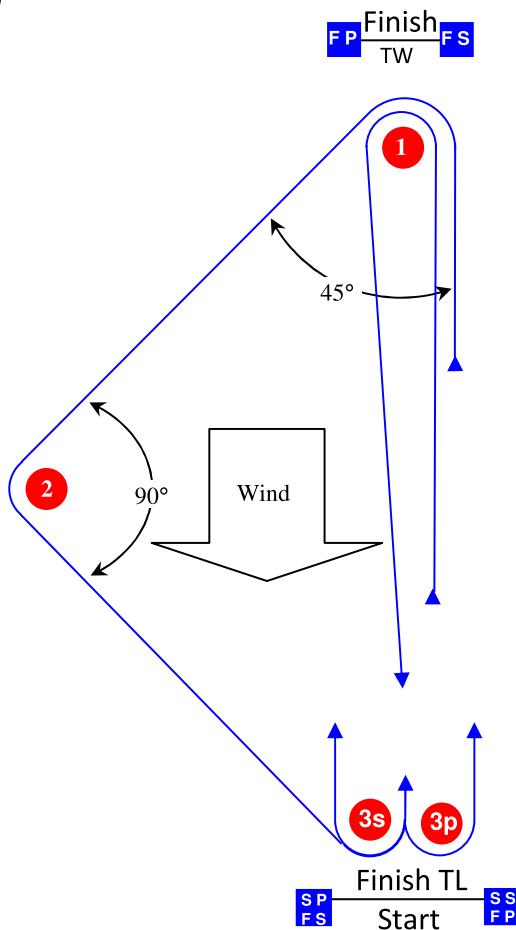
Course: Windward Finish

Signal	Mark Rounding Order
LG2	Start – 1s/1p – 4s/4p – 1s – Finish
LG3	Start – 1s/1p – 4s/4p – 1s/1p – 4s/4p – 1s – Finish
LG4	Start – 1s/1p – 4s/4p – 1s/1p – 4s/4p – 1s/1p – 4s/4p – 1s – Finish

Mark	Description		
1s 1p			
4s 4p			
ss	Starting mark starboard end		
sp	Starting mark port end		
		WR	WG
fs	Finishing mark starboard end		
fp	Finishing mark port end		

Course Illustration – Triangular course

TW / TL



Course: Triangular Upwind Finish

Signal	Mark Rounding Order
TW2	Start – 1 – 2 – 3s(port) – Finish
TW3	Start – 1 – 2 – 3s(port) – 1 – 3s/3p – Finish
TW4	Start – 1 – 2 – 3s(port) – 1 – 3s/3p – 1 – 2 – 3s(port) – Finish

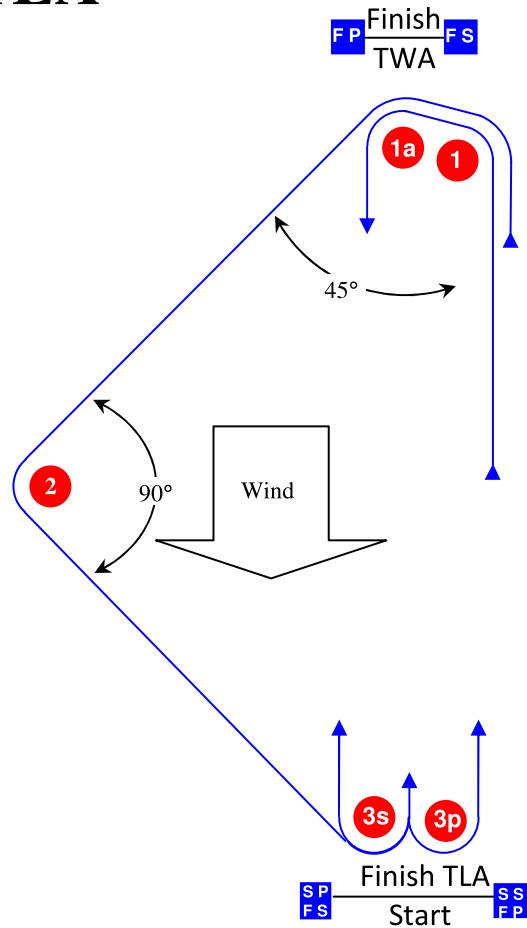
Course: Triangular Downwind Finish

Signal	Mark Rounding Order
TL2	Start – 1 – 2 – 3s(port) – 1 – Finish
TL3	Start – 1 – 2 – 3s(port) – 1 – 3s/3p – 1 – Finish
TL4	Start – 1 – 2 – 3s(port) – 1 – 3s/3p – 1 – 2 – 3s(port) – 1 – Finish

Mark	Description
1	
2	
3s 3p	
ss	Starting mark starboard end
sp	Starting mark port end
	TW
fs	Finishing mark starboard end
fp	Finishing mark port end

Course Illustration – Triangular course with offset

TWA / TLA



Course: Triangular Upwind Finish

Signal	Mark Rounding Order
TWA2	Start – 1 – 1a – 2 – 3s(port) – Finish
TWA3	Start – 1 – 1a – 2 – 3s(port) – 1 – 1a – 3s/3p – Finish
TWA4	Start – 1 – 1a – 2 – 3s(port) – 1 – 1a – 3s/3p – 1 – 1a – 2 – 3s(port) – Finish

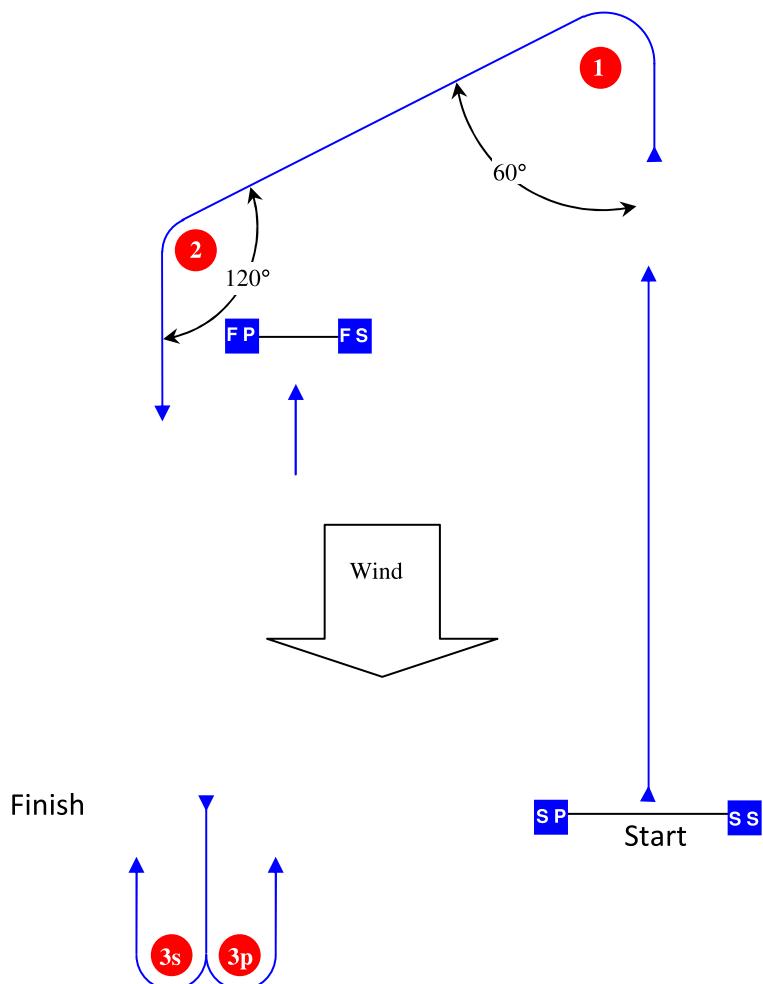
Course: Triangular Downwind Finish

Signal	Mark Rounding Order
TLA2	Start – 1 – 1a – 2 – 3s(port) – 1 – 1a – Finish
TLA3	Start – 1 – 1a – 2 – 3s(port) – 1 – 1a – 3s/3p – 1 – 1a – Finish
TLA4	Start – 1 – 1a – 2 – 3s(port) – 1 – 1a – 3s/3p – 1 – 1a – 2 – 3s(port) – 1 – 1a – Finish

Mark	Description
1	
1a	
2	
3s 3p	
ss	Starting mark starboard end
sp	Starting mark port end
fs	Finishing mark starboard end
fp	Finishing mark port end
	TWA
	TLA

Course Illustration – Optimist course

IOD

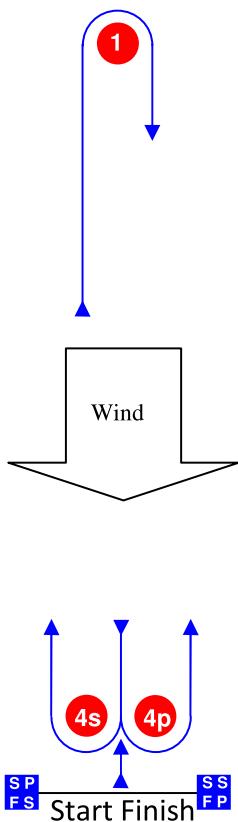


Signal	Mark Rounding Order
IOD	Start 1 – 2 – 3s/3p – Finish

Mark	Description
1	
2	
3s 3p	
ss	Starting mark starboard end
sp	Starting mark port end
fs	Finishing mark starboard end
fp	Finishing mark port end

Course Illustration – Match Racing

M



Course: Leeward finish

Signal	Mark Rounding Order
M2	Start – 1 – 4s/4p – 1 – Finish
M3	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – Finish
M4	Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – 1 – Finish

Mark	Description
1	
4s 4p	
SS	Starting mark starboard end
SP	Starting mark port end
FS	Finishing mark starboard end
FP	Finishing mark port end

Trapezoid 60°, 120°, 120°, 60° interior angles Start Finish together. Reach = half beat length

Course Axis	Angles in Degrees								
	4 - 1 3 - 2	1 - 4 2 - 3	4 - 2	2 - 4	1 - 2	2 - 1	4 - 3	3 - 4	Start Line
000	180	330	150	240	060	300	120	270	
005	185	335	155	245	065	305	125	275	
010	190	340	160	250	070	310	130	280	
015	195	345	165	255	075	315	135	285	
020	200	350	170	260	080	320	140	290	
025	205	355	175	265	085	325	145	295	
030	210	000	180	270	090	330	150	300	
035	215	005	185	275	095	335	155	305	
040	220	010	190	280	100	340	160	310	
045	225	015	195	285	105	345	165	315	
050	230	020	200	290	110	350	170	320	
055	235	025	205	295	115	355	175	325	
060	240	030	210	300	120	000	180	330	
065	245	035	215	305	125	005	185	335	
070	250	040	220	310	130	010	190	340	
075	255	045	225	315	135	015	195	345	
080	260	050	230	320	140	020	200	350	
085	265	055	235	325	145	025	205	355	
090	270	060	240	330	150	030	210	000	
095	275	065	245	335	155	035	215	005	
100	280	070	250	340	160	040	220	010	
105	285	075	255	345	165	045	225	015	
110	290	080	260	350	170	050	230	020	
115	295	085	265	355	175	055	235	025	
120	300	090	270	000	180	060	240	030	
125	305	095	275	005	185	065	245	035	
130	310	100	280	010	190	070	250	040	
135	315	105	285	015	195	075	255	045	
140	320	110	290	020	200	080	260	050	
145	325	115	295	025	205	085	265	055	
150	330	120	300	030	210	090	270	060	
155	335	125	305	035	215	095	275	065	
160	340	130	310	040	220	100	280	070	
165	345	135	315	045	225	105	285	075	
170	350	140	320	050	230	110	290	080	
175	355	145	325	055	235	115	295	085	

Course Axis	Angles in Degrees								
	4 - 1 3 - 2	1 - 4 2 - 3	4 - 2	2 - 4	1 - 2	2 - 1	4 - 3	3 - 4	Start Line
180	000	150	330	060	240	120	300	090	
185	005	155	335	065	245	125	305	095	
190	010	160	340	070	250	130	310	100	
195	015	165	345	075	255	135	315	105	
200	020	170	350	080	260	140	320	110	
205	025	175	355	085	265	145	325	115	
210	030	180	000	090	270	150	330	120	
215	035	185	005	095	275	155	335	125	
220	040	190	010	100	280	160	340	130	
225	045	195	015	105	285	165	345	135	
230	050	200	020	110	290	170	350	140	
235	055	205	025	115	295	175	355	145	
240	060	210	030	120	300	180	000	150	
245	065	215	035	125	305	185	005	155	
250	070	220	040	130	310	190	010	160	
255	075	225	045	135	315	195	015	165	
260	080	230	050	140	320	200	020	170	
265	085	235	055	145	325	205	025	175	
270	090	240	060	150	330	210	030	180	
275	095	245	065	155	335	215	035	185	
280	100	250	070	160	340	220	040	190	
285	105	255	075	165	345	225	045	195	
290	110	260	080	170	350	230	050	200	
295	115	265	085	175	355	235	055	205	
300	120	270	090	180	000	240	060	210	
305	125	275	095	185	005	245	065	215	
310	130	280	100	190	010	250	070	220	
315	135	285	105	195	015	255	075	225	
320	140	290	110	200	020	260	080	230	
325	145	295	115	205	025	265	085	235	
330	150	300	120	210	030	270	090	240	
335	155	305	125	215	035	275	095	245	
340	160	310	130	220	040	280	100	250	
345	165	315	135	225	045	285	105	255	
350	170	320	140	230	050	290	110	260	
355	175	325	145	235	055	295	115	265	

Trapezoid 60°, 120°, 120°, 60° interior angles Start Finish together. Reach = half beat length

Lengths in Nautical Miles				
4-1	4-2	4-3	1-2	2-3
1-4	2-4	3-4	2-1	3-2
0.2	0.17	0.1	0.1	0.1
0.3	0.26	0.15	0.15	0.15
0.4	0.35	0.2	0.2	0.2
0.5	0.43	0.25	0.25	0.25
0.6	0.52	0.3	0.3	0.3
0.7	0.61	0.35	0.35	0.35
0.8	0.69	0.4	0.4	0.4
0.9	0.78	0.45	0.45	0.45
1	0.87	0.5	0.5	0.5
1.1	0.95	0.55	0.55	0.55
1.2	1.04	0.6	0.6	0.6
1.3	1.13	0.65	0.65	0.65
1.4	1.21	0.7	0.7	0.7
1.5	1.3	0.75	0.75	0.75
1.6	1.39	0.8	0.8	0.8
1.7	1.47	0.85	0.85	0.85
1.8	1.56	0.9	0.9	0.9
1.9	1.65	0.95	0.95	0.95
2	1.73	1	1	1
2.1	1.82	1.05	1.05	1.05
2.2	1.91	1.1	1.1	1.1
2.3	1.99	1.15	1.15	1.15
2.4	2.08	1.2	1.2	1.2
2.5	2.17	1.25	1.25	1.25
2.6	2.25	1.3	1.3	1.3
2.7	2.34	1.35	1.35	1.35
2.8	2.42	1.4	1.4	1.4
2.9	2.51	1.45	1.45	1.45
3	2.6	1.5	1.5	1.5

I2 Start – 1 – 4s/4p – 1 – 2 – 3p – Finish

I3 Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – Finish

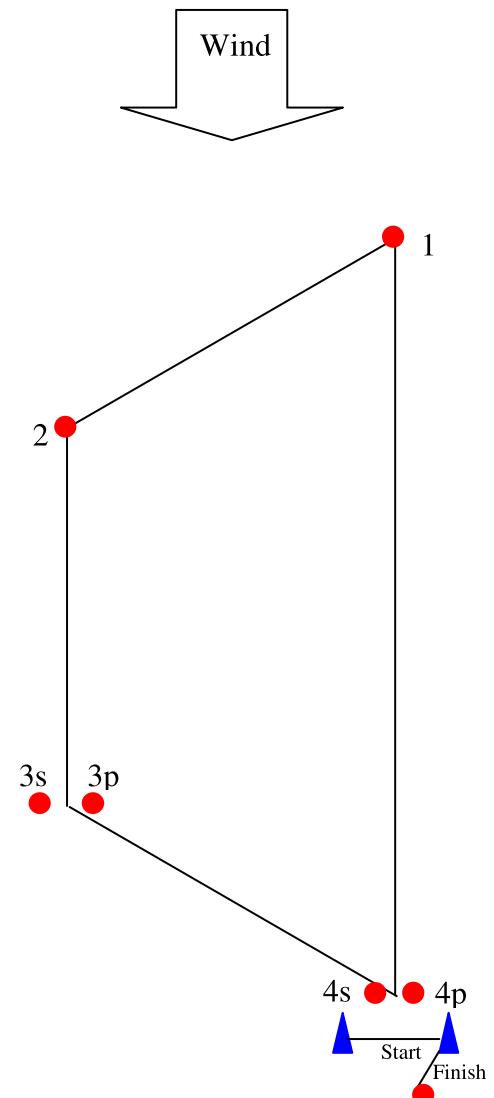
I4 Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – Finish

O2 Start – 1 – 2 – 3s/3p – 2 – 3p – Finish

O3 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – Finish

O4 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – Finish

Total Course Length in Nautical Miles					
I2	I3	I4	O2	O3	O4
0.95	1.35	1.75	0.75	0.95	1.15
1.4	2	2.6	1.1	1.4	1.7
1.85	2.65	3.45	1.45	1.85	2.25
2.3	3.3	4.3	1.8	2.3	2.8
2.75	3.95	5.15	2.15	2.75	3.35
3.2	4.6	6	2.5	3.2	3.9
3.65	5.25	6.85	2.85	3.65	4.45
4.1	5.9	7.7	3.2	4.1	5
4.55	6.55	8.55	3.55	4.55	5.55
5	7.2	9.4	3.9	5	6.1
5.45	7.85	10.25	4.25	5.45	6.65
5.9	8.5	11.1	4.6	5.9	7.2
6.35	9.15	11.95	4.95	6.35	7.75
6.8	9.8	12.8	5.3	6.8	8.3
7.25	10.45	13.65	5.65	7.25	8.85
7.7	11.1	14.5	6	7.7	9.4
8.15	11.75	15.35	6.35	8.15	9.95
8.6	12.4	16.2	6.7	8.6	10.5
9.05	13.05	17.05	7.05	9.05	11.05
9.5	13.7	17.9	7.4	9.5	11.6
9.95	14.35	18.75	7.75	9.95	12.15
10.4	15	19.6	8.1	10.4	12.7
10.85	15.65	20.45	8.45	10.85	13.25
11.3	16.3	21.3	8.8	11.3	13.8
11.75	16.95	22.15	9.15	11.75	14.35
12.2	17.6	23	9.5	12.2	14.9
12.65	18.25	23.85	9.85	12.65	15.45
13.1	18.9	24.7	10.2	13.1	16
13.55	19.55	25.55	10.55	13.55	16.55



Trapezoid 70°, 110°, 110°, 70° interior angles Start finish together. Reach = half beat length

Course Axis	Angle in degrees								
4 - 1 3 - 2	1 - 4 2 - 3	4 - 2	2 - 4	1 - 2	2 - 1	4 - 3	3 - 4	Start Line	
000	180	330	150	250	070	290	110	270	
005	185	335	155	255	075	295	115	275	
010	190	340	160	260	080	300	120	280	
015	195	345	165	265	085	305	125	285	
020	200	350	170	270	090	310	130	290	
025	205	355	175	275	095	315	135	295	
030	210	000	180	280	100	320	140	300	
035	215	005	185	285	105	325	145	305	
040	220	010	190	290	110	330	150	310	
045	225	015	195	295	115	335	155	315	
050	230	020	200	300	120	340	160	320	
055	235	025	205	305	125	345	165	325	
060	240	030	210	310	130	350	170	330	
065	245	035	215	315	135	355	175	335	
070	250	040	220	320	140	000	180	340	
075	255	045	225	325	145	005	185	345	
080	260	050	230	330	150	010	190	350	
085	265	055	235	335	155	015	195	355	
090	270	060	240	340	160	020	200	000	
095	275	065	245	345	165	025	205	005	
100	280	070	250	350	170	030	210	010	
105	285	075	255	355	175	035	215	015	
110	290	080	260	000	180	040	220	020	
115	295	085	265	005	185	045	225	025	
120	300	090	270	010	190	050	230	030	
125	305	095	275	015	195	055	235	035	
130	310	100	280	020	200	060	240	040	
135	315	105	285	025	205	065	245	045	
140	320	110	290	030	210	070	250	050	
145	325	115	295	035	215	075	255	055	
150	330	120	300	040	220	080	260	060	
155	335	125	305	045	225	085	265	065	
160	340	130	310	050	230	090	270	070	
165	345	135	315	055	235	095	275	075	
170	350	140	320	060	240	100	280	080	
175	355	145	325	065	245	105	285	085	

Course Axis	Angle in degrees								
4 - 1 3 - 2	1 - 4 2 - 3	4 - 2	2 - 4	1 - 2	2 - 1	4 - 3	3 - 4	Start Line	
180	180	150	330	070	250	110	290	090	
185	185	155	335	075	255	115	295	095	
190	190	160	340	080	260	120	300	100	
195	195	165	345	085	265	125	305	105	
200	200	170	350	090	270	130	310	110	
205	205	175	355	095	275	135	315	115	
210	210	180	000	100	280	140	320	120	
215	215	185	005	105	285	145	325	125	
220	220	190	010	110	290	150	330	130	
225	225	195	015	115	295	155	335	135	
230	230	200	020	120	300	160	340	140	
235	235	205	025	125	305	165	345	145	
240	240	210	030	130	310	170	350	150	
245	245	215	035	135	315	175	355	155	
250	250	220	040	140	320	180	000	160	
255	255	225	045	145	325	185	005	165	
260	260	230	050	150	330	190	010	170	
265	265	235	055	155	335	195	015	175	
270	270	240	060	160	340	200	020	180	
275	275	245	065	165	345	205	025	185	
280	280	250	070	170	350	210	030	190	
285	285	255	075	175	355	215	035	195	
290	290	260	080	180	000	220	040	200	
295	295	265	085	185	005	225	045	205	
300	300	270	090	190	010	230	050	210	
305	305	275	095	195	015	235	055	215	
310	310	280	100	200	020	240	060	220	
315	315	285	105	205	025	245	065	225	
320	320	290	110	210	030	250	070	230	
325	325	295	115	215	035	255	075	235	
330	330	300	120	220	040	260	080	240	
335	335	305	125	225	045	265	085	245	
340	340	310	130	230	050	270	090	250	
345	345	315	135	235	055	275	095	255	
350	350	320	140	240	060	280	100	260	
355	355	325	145	245	065	285	105	265	

Trapezoid 70°, 110°, 110°, 70° interior angles Start finish together. Reach = half beat length

Lengths in Nautical Miles				
4-1	4-2	4-3	1-2	2-3
1-4	2-4	3-4	2-1	3-2
0.2	0.19	0.1	0.1	0.13
0.3	0.29	0.15	0.15	0.2
0.4	0.38	0.2	0.2	0.26
0.5	0.48	0.25	0.25	0.33
0.6	0.57	0.3	0.3	0.39
0.7	0.67	0.35	0.35	0.46
0.8	0.76	0.4	0.4	0.53
0.9	0.86	0.45	0.45	0.59
1	0.95	0.5	0.5	0.66
1.1	1.05	0.55	0.55	0.72
1.2	1.14	0.6	0.6	0.79
1.3	1.24	0.65	0.65	0.86
1.4	1.33	0.7	0.7	0.92
1.5	1.43	0.75	0.75	0.99
1.6	1.52	0.8	0.8	1.05
1.7	1.62	0.85	0.85	1.12
1.8	1.72	0.9	0.9	1.18
1.9	1.81	0.95	0.95	1.25
2	1.91	1	1	1.32
2.1	2	1.05	1.05	1.38
2.2	2.1	1.1	1.1	1.45
2.3	2.19	1.15	1.15	1.51
2.4	2.29	1.2	1.2	1.58
2.5	2.38	1.25	1.25	1.64
2.6	2.48	1.3	1.3	1.71
2.7	2.57	1.35	1.35	1.78
2.8	2.67	1.4	1.4	1.84
2.9	2.76	1.45	1.45	1.91
3	2.86	1.5	1.5	1.97

I2 Start – 1 – 4s/4p – 1 – 2 – 3p – Finish

I3 Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – Finish

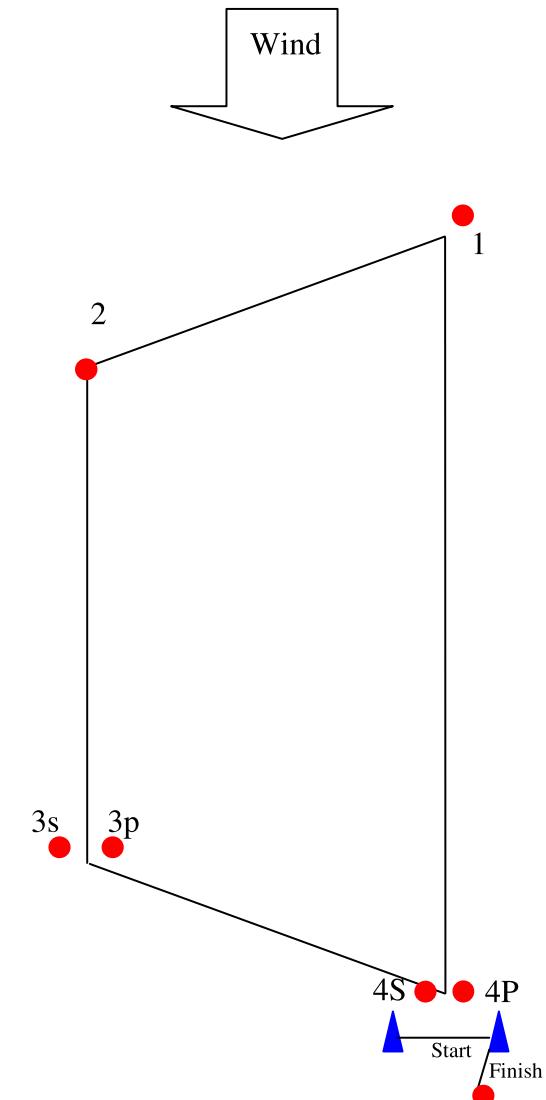
I4 Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – Finish

O2 Start – 1 – 2 – 3s/3p – 2 – 3p – Finish

O3 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – Finish

O4 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – Finish

Total Course Length in Nautical Miles					
I2	I3	I4	O2	O3	O4
0.98	1.38	1.78	0.84	1.1	1.36
1.45	2.05	2.65	1.25	1.65	2.05
1.91	2.71	3.51	1.63	2.15	2.67
2.38	3.38	4.38	2.04	2.7	3.36
2.84	4.04	5.24	2.42	3.2	3.98
3.31	4.71	6.11	2.83	3.75	4.67
3.78	5.38	6.98	3.24	4.3	5.36
4.24	6.04	7.84	3.62	4.8	5.98
4.71	6.71	8.71	4.03	5.35	6.67
5.17	7.37	9.57	4.41	5.85	7.29
5.64	8.04	10.44	4.82	6.4	7.98
6.11	8.71	11.31	5.23	6.95	8.67
6.57	9.37	12.17	5.61	7.45	9.29
7.04	10.04	13.04	6.02	8	9.98
7.5	10.7	13.9	6.4	8.5	10.6
7.97	11.37	14.77	6.81	9.05	11.29
8.43	12.03	15.63	7.19	9.55	11.91
8.9	12.7	16.5	7.6	10.1	12.6
9.37	13.37	17.37	8.01	10.65	13.29
9.83	14.03	18.23	8.39	11.15	13.91
10.3	14.7	19.1	8.8	11.7	14.6
10.76	15.36	19.96	9.18	12.2	15.22
11.23	16.03	20.83	9.59	12.75	15.91
11.69	16.69	21.69	9.97	13.25	16.53
12.16	17.36	22.56	10.38	13.8	17.22
12.63	18.03	23.43	10.79	14.35	17.91
13.09	18.69	24.29	11.17	14.85	18.53
13.56	19.36	25.16	11.58	15.4	19.22
14.02	20.02	26.02	11.96	15.9	19.84



Trapezoid 60°, 120°, 120°, 60° interior angles equal beats. Reach = half beat length

Course Axis	Angles in degrees								
4 - 1	1 - 4	4 - 2	2 - 4	4 - 3	3 - 4	F - 3	3 - F	Start Line	
3 - 2	2 - 3			1 - 2	2 - 1				
000	180	330	150	240	060	300	120	270	
005	185	335	155	245	065	305	125	275	
010	190	340	160	250	070	310	130	280	
015	195	345	165	255	075	315	135	285	
020	200	350	170	260	080	320	140	290	
025	205	355	175	265	085	325	145	295	
030	210	000	180	270	090	330	150	300	
035	215	005	185	275	095	335	155	305	
040	220	010	190	280	100	340	160	310	
045	225	015	195	285	105	345	165	315	
050	230	020	200	290	110	350	170	320	
055	235	025	205	295	115	355	175	325	
060	240	030	210	300	120	000	180	330	
065	245	035	215	305	125	005	185	335	
070	250	040	220	310	130	010	190	340	
075	255	045	225	315	135	015	195	345	
080	260	050	230	320	140	020	200	350	
085	265	055	235	325	145	025	205	355	
090	270	060	240	330	150	030	210	000	
095	275	065	245	335	155	035	215	005	
100	280	070	250	340	160	040	220	010	
105	285	075	255	345	165	045	225	015	
110	290	080	260	350	170	050	230	020	
115	295	085	265	355	175	055	235	025	
120	300	090	270	000	180	060	240	030	
125	305	095	275	005	185	065	245	035	
130	310	100	280	010	190	070	250	040	
135	315	105	285	015	195	075	255	045	
140	320	110	290	020	200	080	260	050	
145	325	115	295	025	205	085	265	055	
150	330	120	300	030	210	090	270	060	
155	335	125	305	035	215	095	275	065	
160	340	130	310	040	220	100	280	070	
165	345	135	315	045	225	105	285	075	
170	350	140	320	050	230	110	290	080	
175	355	145	325	055	235	115	295	085	

Course Axis	Angles in degrees								
4 - 1	1 - 4	4 - 2	2 - 4	4 - 3	3 - 4	F - 3	3 - F	Start Line	
3 - 2	2 - 3			1 - 2	2 - 1				
180	000	150	330	060	240	120	300	090	
185	005	155	335	065	245	125	305	095	
190	010	160	340	070	250	130	310	100	
195	015	165	345	075	255	135	315	105	
200	020	170	350	080	260	140	320	110	
205	025	175	355	085	265	145	325	115	
210	030	180	000	090	270	150	330	120	
215	035	185	005	095	275	155	335	125	
220	040	190	010	100	280	160	340	130	
225	045	195	015	105	285	165	345	135	
230	050	200	020	110	290	170	350	140	
235	055	205	025	115	295	175	355	145	
240	060	210	030	120	300	180	000	150	
245	065	215	035	125	305	185	005	155	
250	070	220	040	130	310	190	010	160	
255	075	225	045	135	315	195	015	165	
260	080	230	050	140	320	200	020	170	
265	085	235	055	145	325	205	025	175	
270	090	240	060	150	330	210	030	180	
275	095	245	065	155	335	215	035	185	
280	100	250	070	160	340	220	040	190	
285	105	255	075	165	345	225	045	195	
290	110	260	080	170	350	230	050	200	
295	115	265	085	175	355	235	055	205	
300	120	270	090	180	000	240	060	210	
305	125	275	095	185	005	245	065	215	
310	130	280	100	190	010	250	070	220	
315	135	285	105	195	015	255	075	225	
320	140	290	110	200	020	260	080	230	
325	145	295	115	205	025	265	085	235	
330	150	300	120	210	030	270	090	240	
335	155	305	125	215	035	275	095	245	
340	160	310	130	220	040	280	100	250	
345	165	315	135	225	045	285	105	255	
350	170	320	140	230	050	290	110	260	
355	175	325	145	235	055	295	115	265	

Trapezoid 60°, 120°, 120°, 60° interior angles equal beats. Reach = half beat length

Lengths in Nautical Miles		
4 - 1	4 - 2	4 - 3
1 - 4	2 - 4	3 - 4
2 - 3		1 - 2
3 - 2		2 - 1
0.3	0.26	0.15
0.4	0.35	0.2
0.5	0.43	0.25
0.6	0.52	0.3
0.7	0.61	0.35
0.8	0.69	0.4
0.9	0.78	0.45
1	0.87	0.5
1.1	0.95	0.55
1.2	1.04	0.6
1.3	1.13	0.65
1.4	1.21	0.7
1.5	1.3	0.75
1.6	1.39	0.8
1.7	1.47	0.85
1.8	1.56	0.9
1.9	1.65	0.95
2	1.73	1
2.1	1.82	1.05
2.2	1.91	1.1
2.3	1.99	1.15
2.4	2.08	1.2
2.5	2.17	1.25
2.6	2.25	1.3
2.7	2.34	1.35
2.8	2.42	1.4
2.9	2.51	1.45
3	2.6	1.5

I2 Start – 1 – 4s/4p – 1 – 2 – 3p – Finish

I3 Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – Finish

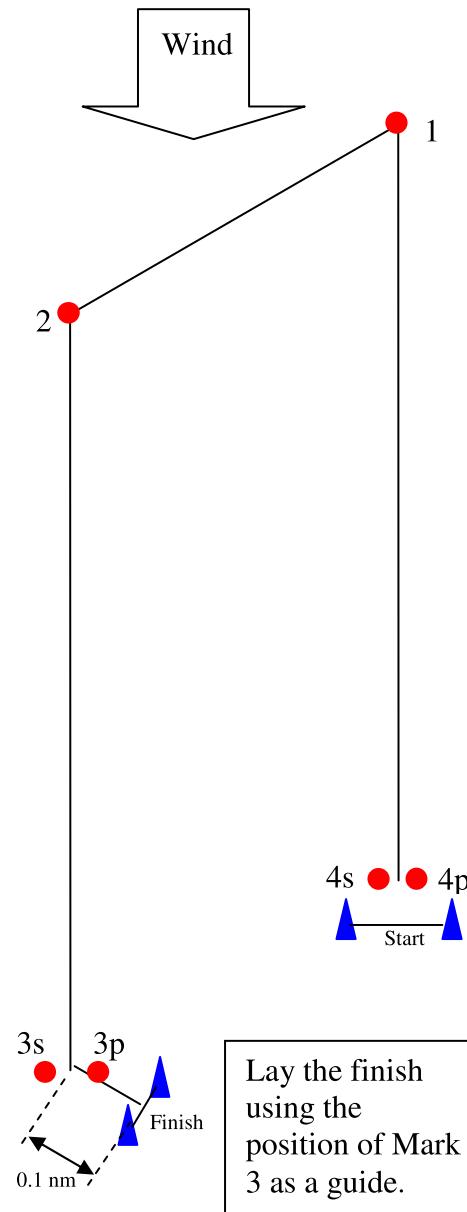
I4 Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – Finish

O2 Start – 1 – 2 – 3s/3p – 2 – 3p – Finish

O3 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – Finish

O4 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – Finish

Total Course Length in Nautical Miles					
I2	I3	I4	O2	O3	O4
1.50	2.10	2.70	1.50	2.10	2.70
1.95	2.75	3.55	1.95	2.75	3.55
2.40	3.40	4.40	2.40	3.40	4.40
2.85	4.05	5.25	2.85	4.05	5.25
3.30	4.70	6.10	3.30	4.70	6.10
3.75	5.35	6.95	3.75	5.35	6.95
4.20	6.00	7.80	4.20	6.00	7.80
4.65	6.65	8.65	4.65	6.65	8.65
5.10	7.30	9.50	5.10	7.30	9.50
5.55	7.95	10.35	5.55	7.95	10.35
6.00	8.60	11.20	6.00	8.60	11.20
6.45	9.25	12.05	6.45	9.25	12.05
6.90	9.90	12.90	6.90	9.90	12.90
7.35	10.55	13.75	7.35	10.55	13.75
7.80	11.20	14.60	7.80	11.20	14.60
8.25	11.85	15.45	8.25	11.85	15.45
8.70	12.50	16.30	8.70	12.50	16.30
9.15	13.15	17.15	9.15	13.15	17.15
9.60	13.80	18.00	9.60	13.80	18.00
10.05	14.45	18.85	10.05	14.45	18.85
10.50	15.10	19.70	10.50	15.10	19.70
10.95	15.75	20.55	10.95	15.75	20.55
11.40	16.40	21.40	11.40	16.40	21.40
11.85	17.05	22.25	11.85	17.05	22.25
12.30	17.70	23.10	12.30	17.70	23.10
12.75	18.35	23.95	12.75	18.35	23.95
13.20	19.00	24.80	13.20	19.00	24.80
13.65	19.65	25.65	13.65	19.65	25.65



Trapezoid 70°, 110°, 110°, 70° interior angles equal beats. Reach = half beat length

Course Axis	Angles in degrees								
	4-1 3-2	1-4 2-3	4-2	2-4	4-3 1-2	3-4 2-1	F-3	3-F	Start Line
000	180	330	150	250	070	290	110	270	
005	185	335	155	255	075	295	115	275	
010	190	340	160	260	080	300	120	280	
015	195	345	165	265	085	305	125	285	
020	200	350	170	270	090	310	130	290	
025	205	355	175	275	095	315	135	295	
030	210	000	180	280	100	320	140	300	
035	215	005	185	285	105	325	145	305	
040	220	010	190	290	110	330	150	310	
045	225	015	195	295	115	335	155	315	
050	230	020	200	300	120	340	160	320	
055	235	025	205	305	125	345	165	325	
060	240	030	210	310	130	350	170	330	
065	245	035	215	315	135	355	175	335	
070	250	040	220	320	140	000	180	340	
075	255	045	225	325	145	005	185	345	
080	260	050	230	330	150	010	190	350	
085	265	055	235	335	155	015	195	355	
090	270	060	240	340	160	020	200	000	
095	275	065	245	345	165	025	205	005	
100	280	070	250	350	170	030	210	010	
105	285	075	255	355	175	035	215	015	
110	290	080	260	000	180	040	220	020	
115	295	085	265	005	185	045	225	025	
120	300	090	270	010	190	050	230	030	
125	305	095	275	015	195	055	235	035	
130	310	100	280	020	200	060	240	040	
135	315	105	285	025	205	065	245	045	
140	320	110	290	030	210	070	250	050	
145	325	115	295	035	215	075	255	055	
150	330	120	300	040	220	080	260	060	
155	335	125	305	045	225	085	265	065	
160	340	130	310	050	230	090	270	070	
165	345	135	315	055	235	095	275	075	
170	350	140	320	060	240	100	280	080	
175	355	145	325	065	245	105	285	085	

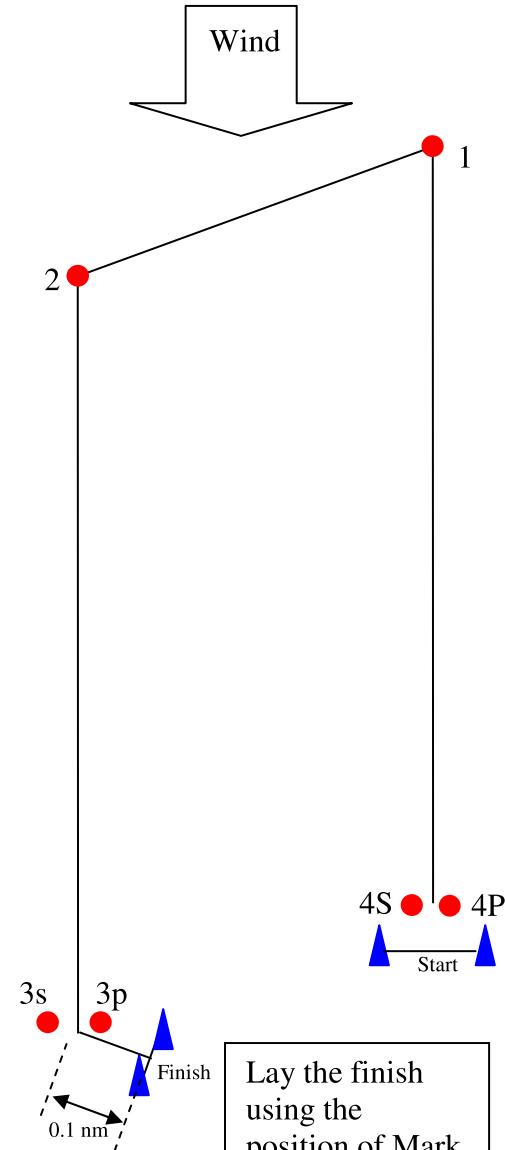
Course Axis	Angles in degrees								
	4-1 3-2	1-4 2-3	4-2	2-4	4-3 1-2	3-4 2-1	F-3	3-F	Start Line
180	000	150	330	070	250	110	290	090	
185	005	155	335	075	255	115	295	095	
190	010	160	340	080	260	120	300	100	
195	015	165	345	085	265	125	305	105	
200	020	170	350	090	270	130	310	110	
205	025	175	355	095	275	135	315	115	
210	030	180	000	100	280	140	320	120	
215	035	185	005	105	285	145	325	125	
220	040	190	010	110	290	150	330	130	
225	045	195	015	115	295	155	335	135	
230	050	200	020	120	300	160	340	140	
235	055	205	025	125	305	165	345	145	
240	060	210	030	130	310	530	350	150	
245	065	215	035	135	315	535	355	155	
250	070	220	040	140	320	180	000	160	
255	075	225	045	145	325	185	005	165	
260	080	230	050	150	330	190	010	170	
265	085	235	055	155	335	195	015	175	
270	090	240	060	160	340	200	020	180	
275	095	245	065	165	345	205	025	185	
280	100	250	070	170	350	210	030	190	
285	105	255	075	175	355	215	035	195	
290	110	260	080	180	360	220	040	200	
295	115	265	085	185	365	225	045	205	
300	120	270	090	190	010	230	050	210	
305	125	275	095	195	015	235	055	215	
310	130	280	100	200	020	240	060	220	
315	135	285	105	205	025	245	065	225	
320	140	290	110	210	030	250	070	230	
325	145	295	115	215	035	255	075	235	
330	150	300	120	220	040	260	080	240	
335	155	305	125	225	045	265	085	245	
340	160	310	130	230	050	270	090	250	
345	165	315	135	235	055	275	095	255	
350	170	320	140	240	060	280	100	260	
355	175	325	145	245	065	285	105	265	

Trapezoid 70°, 110°, 110°, 70° interior angles equal beats. Reach = half beat length

Lengths in Nautical Miles		
4-1	4-2	4-3
1-4	2-4	3-4
2-3		1-2
3-2		2-1
0.3	0.29	0.15
0.4	0.38	0.2
0.5	0.48	0.25
0.6	0.57	0.3
0.7	0.67	0.35
0.8	0.76	0.4
0.9	0.86	0.45
1	0.95	0.5
1.1	1.05	0.55
1.2	1.14	0.6
1.3	1.24	0.65
1.4	1.33	0.7
1.5	1.43	0.75
1.6	1.52	0.8
1.7	1.62	0.85
1.8	1.72	0.9
1.9	1.81	0.95
2	1.91	1
2.1	2	1.05
2.2	2.1	1.1
2.3	2.19	1.15
2.4	2.29	1.2
2.5	2.38	1.25
2.6	2.48	1.3
2.7	2.57	1.35
2.8	2.67	1.4
2.9	2.76	1.45
3	2.86	1.5

I2 Start – 1 – 4s/4p – 1 – 2 – 3p – Finish
I3 Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – Finish
I4 Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – Finish
O2 Start – 1 – 2 – 3s/3p – 2 – 3p – Finish
O3 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – Finish
O4 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – Finish

Total Course Length in Nautical Miles					
I2	I3	I4	O2	O3	O4
1.50	2.10	2.70	1.50	2.10	2.70
1.95	2.75	3.55	1.95	2.75	3.55
2.40	3.40	4.40	2.40	3.40	4.40
2.85	4.05	5.25	2.85	4.05	5.25
3.30	4.70	6.10	3.30	4.70	6.10
3.75	5.35	6.95	3.75	5.35	6.95
4.20	6.00	7.80	4.20	6.00	7.80
4.65	6.65	8.65	4.65	6.65	8.65
5.10	7.30	9.50	5.10	7.30	9.50
5.55	7.95	10.35	5.55	7.95	10.35
6.00	8.60	11.20	6.00	8.60	11.20
6.45	9.25	12.05	6.45	9.25	12.05
6.90	9.90	12.90	6.90	9.90	12.90
7.35	10.55	13.75	7.35	10.55	13.75
7.80	11.20	14.60	7.80	11.20	14.60
8.25	11.85	15.45	8.25	11.85	15.45
8.70	12.50	16.30	8.70	12.50	16.30
9.15	13.15	17.15	9.15	13.15	17.15
9.60	13.80	18.00	9.60	13.80	18.00
10.05	14.45	18.85	10.05	14.45	18.85
10.50	15.10	19.70	10.50	15.10	19.70
10.95	15.75	20.55	10.95	15.75	20.55
11.40	16.40	21.40	11.40	16.40	21.40
11.85	17.05	22.25	11.85	17.05	22.25
12.30	17.70	23.10	12.30	17.70	23.10
12.75	18.35	23.95	12.75	18.35	23.95
13.20	19.00	24.80	13.20	19.00	24.80
13.65	19.65	25.65	13.65	19.65	25.65



Lay the finish using the position of Mark 3 as a guide.

Trapezoid Course 60°, 120° interior angles equal beats. Reach = 2/3 beat length

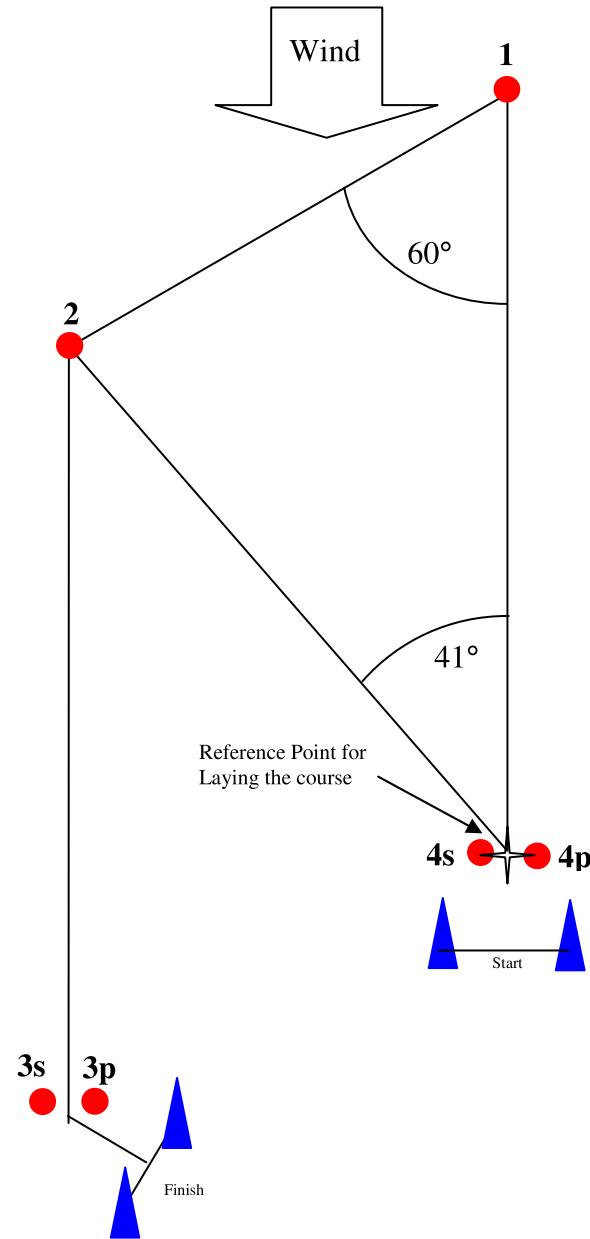
Course Axis	Angles in Degrees									
	4 - 1	1 - 4	4 - 2	2 - 4	4 - 3	3 - 4	Signal	Pin -	3 -	Finish
3 - 2	2 - 3	1 - 2			2 - 1	- Pin	Signal	Finish	- 3	
000	180	319	139	240	060	270	090	120	300	
005	185	324	144	245	065	275	095	125	305	
010	190	329	149	250	070	280	100	130	310	
015	195	334	154	255	075	285	105	135	315	
020	200	339	159	260	080	290	110	140	320	
025	205	344	164	265	085	295	115	145	325	
030	210	349	169	270	090	300	120	150	330	
035	215	354	174	275	095	305	125	155	335	
040	220	359	179	280	100	310	130	160	340	
045	225	004	184	285	105	315	135	165	345	
050	230	009	189	290	110	320	140	170	350	
055	235	014	194	295	115	325	145	175	355	
060	240	019	199	300	120	330	150	180	000	
065	245	024	204	305	125	335	155	185	005	
070	250	029	209	310	130	340	160	190	010	
075	255	034	214	315	135	345	165	195	015	
080	260	039	219	320	140	350	170	200	020	
085	265	044	224	325	145	355	175	205	025	
090	270	049	229	330	150	000	180	210	030	
095	275	054	234	335	155	005	185	215	035	
100	280	059	239	340	160	010	190	220	040	
105	285	064	244	345	165	015	195	225	045	
110	290	069	249	350	170	020	200	230	050	
115	295	074	254	355	175	025	205	235	055	
120	300	079	259	000	180	030	210	240	060	
125	305	084	264	005	185	035	215	245	065	
130	310	089	269	010	190	040	220	250	070	
135	315	094	274	015	195	045	225	255	075	
140	320	099	279	020	200	050	230	260	080	
145	325	104	284	025	205	055	235	265	085	
150	330	109	289	030	210	060	240	270	090	
155	335	114	294	035	215	065	245	275	095	
160	340	119	299	040	220	070	250	280	100	
165	345	124	304	045	225	075	255	285	105	
170	350	129	309	050	230	080	260	290	110	
175	355	134	314	055	235	085	265	295	115	

Course Axis	Angles in Degrees									
	4 - 1	1 - 4	4 - 2	2 - 4	4 - 3	3 - 4	Signal	Pin -	3 -	Finish
3 - 2	2 - 3	1 - 2			2 - 1	- Pin	Signal	Finish	- 3	
180	000	139	319	060	240	090	270	300	120	
185	005	144	324	065	245	095	275	305	125	
190	010	149	329	070	250	100	280	310	130	
195	015	154	334	075	255	105	285	315	135	
200	020	159	339	080	260	110	290	320	140	
205	025	164	344	085	265	115	295	325	145	
210	030	169	349	090	270	120	300	330	150	
215	035	174	354	095	275	125	305	335	155	
220	040	179	359	100	280	130	310	340	160	
225	045	184	004	105	285	135	315	345	165	
230	050	189	009	110	290	140	320	350	170	
235	055	194	014	115	295	145	325	355	175	
240	060	199	019	120	300	150	330	000	180	
245	065	204	024	125	305	155	335	005	185	
250	070	209	029	130	310	160	340	010	190	
255	075	214	034	135	315	165	345	015	195	
260	080	219	039	140	320	170	350	020	200	
265	085	224	044	145	325	175	355	025	205	
270	090	229	049	150	330	180	000	030	210	
275	095	234	054	155	335	185	005	035	215	
280	100	239	059	160	340	190	010	040	220	
285	105	244	064	165	345	195	015	045	225	
290	110	249	069	170	350	200	020	050	230	
295	115	254	074	175	355	205	025	055	235	
300	120	259	079	180	360	210	030	060	240	
305	125	264	084	185	365	215	035	065	245	
310	130	269	089	190	370	220	040	070	250	
315	135	274	094	195	375	225	045	075	255	
320	140	279	099	200	380	230	050	080	260	
325	145	284	104	205	385	235	055	085	265	
330	150	289	109	210	390	240	060	090	270	
335	155	294	114	215	395	245	065	095	275	
340	160	299	119	220	400	250	070	100	280	
345	165	304	124	225	405	255	075	105	285	
350	170	309	129	230	410	260	080	110	290	
355	175	314	134	235	415	265	085	115	295	

Trapezoid Course 60°, 120° interior angles equal beats. Reach = 2/3 beat length

Leg lengths		
4 - 1 & 1 - 4	4 - 2	1 - 2 & 2 - 1
2 - 3 & 3 - 2	& 2 - 4	4 - 3 & 3 - 4
0.20	0.18	0.13
0.25	0.22	0.17
0.30	0.26	0.20
0.35	0.31	0.23
0.40	0.35	0.27
0.45	0.40	0.30
0.50	0.44	0.33
0.55	0.48	0.37
0.60	0.53	0.40
0.65	0.57	0.43
0.70	0.62	0.47
0.75	0.66	0.50
0.80	0.70	0.53
0.85	0.75	0.57
0.90	0.79	0.60
0.95	0.84	0.63
1.00	0.88	0.67
1.10	0.97	0.73
1.20	1.06	0.80
1.30	1.14	0.87
1.40	1.23	0.93
1.50	1.32	1.00
1.60	1.41	1.07
1.70	1.50	1.13
1.80	1.58	1.20
1.90	1.67	1.27
2.00	1.76	1.33

Course Distances		
I2	I3	I4
O2	O3	O4
1.13	1.53	1.93
1.37	1.87	2.37
1.06	2.20	2.80
1.83	2.53	3.23
2.07	2.87	3.67
2.30	3.20	4.10
2.53	3.53	4.53
2.77	3.87	4.97
3.00	4.20	5.40
3.23	4.53	5.83
3.47	4.87	6.27
3.70	5.20	6.70
3.93	5.53	7.13
4.17	5.87	7.57
4.40	6.20	8.00
4.63	6.53	8.43
4.87	6.87	8.87
5.33	7.53	9.73
5.80	8.2	10.60
6.27	8.87	11.47
6.73	9.53	12.33
7.20	10.20	13.20
7.67	10.87	14.07
8.13	11.53	14.93
8.60	12.20	15.80
9.07	12.87	16.67
9.53	13.53	17.53



I2 Start – 1 – 4s/4p – 1 – 2 – 3p – Finish

I3 Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – Finish

I4 Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – Finish

O2 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – Finish

O3 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3s/3p – Finish

O4 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3s/3p – 2 – 3s/3p – Finish

Trapezoid Course 70°, 110° interior angles. Reach = 2/3 beat length

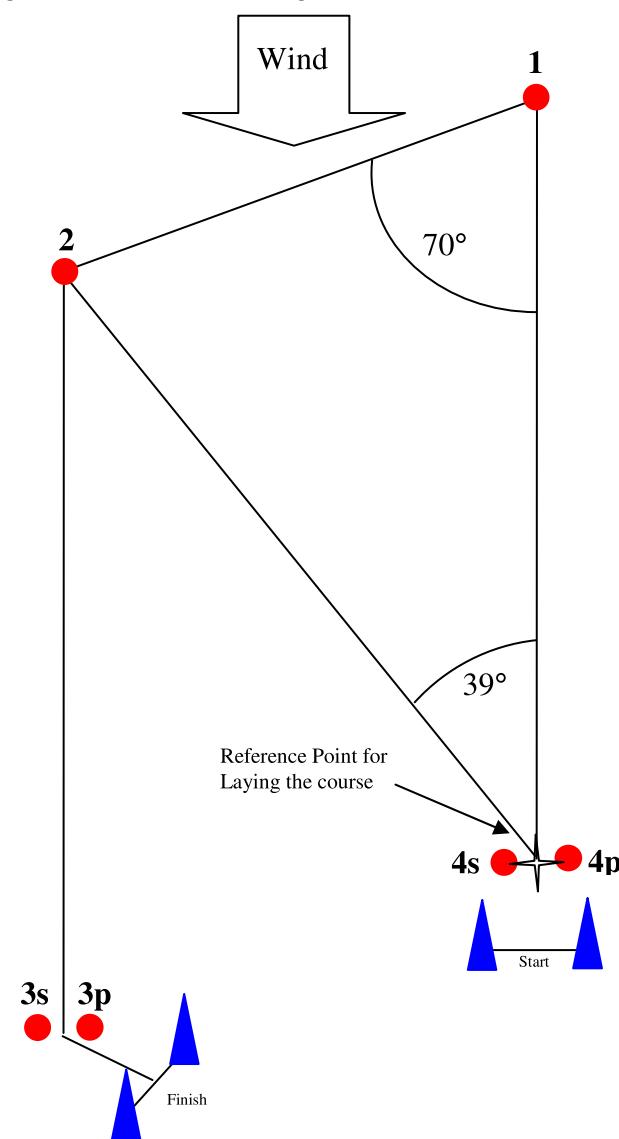
Course Axis	Angles in Degrees									
	4 - 1	1 - 4	4 - 2	2 - 4	4 - 3	3 - 4	Signal	Pin -	3 -	Finish
3 - 2	2 - 3	1 - 2			2 - 1	- Pin	Signal	Finish	- 3	
000	180	321	141	250	070	270	090	110	290	
005	185	326	146	255	075	275	095	115	295	
010	190	331	151	260	080	280	100	120	300	
015	195	336	156	265	085	285	105	125	305	
020	200	341	161	270	090	290	110	130	310	
025	205	346	166	275	095	295	115	135	315	
030	210	351	171	280	100	300	120	140	320	
035	215	356	176	285	105	305	125	145	325	
040	220	001	181	290	110	310	130	150	330	
045	225	006	186	295	115	315	135	155	335	
050	230	011	191	300	120	320	140	160	340	
055	235	016	196	305	125	325	145	165	345	
060	240	021	201	310	130	330	150	170	350	
065	245	026	206	315	135	335	155	175	355	
070	250	031	211	320	140	340	160	180	000	
075	255	036	216	325	145	345	165	185	005	
080	260	041	221	330	150	350	170	190	010	
085	265	046	226	335	155	355	175	195	015	
090	270	051	231	340	160	000	180	200	020	
095	275	056	236	345	165	005	185	205	025	
100	280	061	241	350	170	010	190	210	030	
105	285	066	246	355	175	015	195	215	035	
110	290	071	251	000	180	020	200	220	040	
115	295	076	256	005	185	025	205	225	045	
120	300	081	261	010	190	030	210	230	050	
125	305	086	266	015	195	035	215	235	055	
130	310	091	271	020	200	040	220	240	060	
135	315	096	276	025	205	045	225	245	065	
140	320	101	281	030	210	050	230	250	070	
145	325	106	286	035	215	055	235	255	075	
150	330	111	291	040	220	060	240	260	080	
155	335	116	296	045	225	065	245	265	085	
160	340	121	301	050	230	070	250	270	090	
165	345	126	306	055	235	075	255	275	095	
170	350	131	311	060	240	080	260	280	100	
175	355	136	316	065	245	085	265	285	105	

Course Axis	Angles in Degrees									
	4 - 1	1 - 4	4 - 2	2 - 4	4 - 3	3 - 4	Signal	Pin -	3 -	Finish
3 - 2	2 - 3	1 - 2			2 - 1	- Pin	Signal	Finish	- 3	
180	360	141	321	070	250	090	270	290	110	
185	005	146	326	075	255	095	275	295	115	
190	010	151	331	080	260	100	280	300	120	
195	015	156	336	085	265	105	285	305	125	
200	020	161	341	090	270	110	290	310	130	
205	025	166	346	095	275	115	295	315	135	
210	030	171	351	100	280	120	300	320	140	
215	035	176	356	105	285	125	305	325	145	
220	040	181	001	110	290	130	310	330	150	
225	045	186	006	115	295	135	315	335	155	
230	050	191	011	120	300	140	320	340	160	
235	055	196	016	125	305	145	325	345	165	
240	060	201	021	130	310	150	330	350	170	
245	065	206	026	135	315	155	335	355	175	
250	070	211	031	140	320	160	340	000	180	
255	075	216	036	145	325	165	345	005	185	
260	080	221	041	150	330	170	350	010	190	
265	085	226	046	155	335	175	355	015	195	
270	090	231	051	160	340	180	000	020	200	
275	095	236	056	165	345	185	005	025	205	
280	100	241	061	170	350	190	010	030	210	
285	105	246	066	175	355	195	015	035	215	
290	110	251	071	180	000	200	020	040	220	
295	115	256	076	185	005	205	025	045	225	
300	120	261	081	190	010	210	030	050	230	
305	125	266	086	195	015	215	035	055	235	
310	130	271	091	200	020	220	040	060	240	
315	135	276	096	205	025	225	045	065	245	
320	140	281	101	210	030	230	050	070	250	
325	145	286	106	215	035	235	055	075	255	
330	150	291	111	220	040	240	060	080	260	
335	155	296	116	225	045	245	065	085	265	
340	160	301	121	230	050	250	070	090	270	
345	165	306	126	235	055	255	075	095	275	
350	170	311	131	240	060	260	080	100	280	
355	175	316	136	245	065	265	085	105	285	

Trapezoid Course 70°, 110° interior angles. Reach = 2/3 beat length

Leg lengths		
4 - 1 & 1 - 4	4 - 2 & 2 - 4	1 - 2 & 2 - 1
2 - 3 & 3 - 2	4 - 2 & 2 - 4	4 - 3 & 3 - 4
0.20	0.20	0.13
0.25	0.25	0.17
0.30	0.30	0.20
0.35	0.35	0.23
0.40	0.40	0.27
0.45	0.45	0.30
0.50	0.50	0.33
0.55	0.55	0.37
0.60	0.60	0.40
0.65	0.65	0.43
0.70	0.70	0.47
0.75	0.75	0.50
0.80	0.80	0.53
0.85	0.85	0.57
0.90	0.89	0.60
0.95	0.94	0.63
1.00	0.99	0.67
1.10	1.09	0.73
1.20	1.19	0.80
1.30	1.29	0.87
1.40	1.39	0.93
1.50	1.49	1.00
1.60	1.59	1.07
1.70	1.69	1.13
1.80	1.79	1.20
1.90	1.89	1.27
2.00	1.99	1.33

Course Distances		
I2	I3	I4
O2	O3	O4
1.13	1.53	1.93
1.37	1.87	2.37
1.60	2.20	2.80
1.83	2.53	3.23
2.07	2.87	3.67
2.30	3.20	4.10
2.53	3.53	4.53
2.77	3.87	4.97
3.00	4.20	5.40
3.23	4.53	5.83
3.47	4.87	6.27
3.70	5.20	6.70
3.93	5.53	7.13
4.17	5.87	7.57
4.40	6.20	8.00
4.63	6.53	8.43
4.87	6.87	8.87
5.33	7.53	9.73
5.80	8.20	10.60
6.27	8.87	11.47
6.73	9.53	12.33
7.20	10.20	13.20
7.67	10.87	14.07
8.13	11.53	14.93
8.60	12.20	15.80
9.07	12.87	16.67
9.53	13.53	17.53



- I2 Start – 1 – 4s/4p – 1 – 2 – 3p – Finish
- I3 Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – Finish
- I4 Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – Finish
- O2 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – Finish
- O3 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – Finish
- O4 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – Finish

Laser and Laser Radial Trapezoid Course 70°, 110° interior angles

Course Axis	<i>Trapezoid Course 70, 110 interior angles</i>									
4 - 1 3 - 2	1 - 4 2 - 3	4 - 2	2 - 4	4 - 3 1 - 2	3 - 4 2 - 1	3 - 5	5 - 3	Signal - Pin	Pin - Signal	
000	180	321	141	250	070	110	290	270	090	
005	185	326	146	255	075	115	295	275	095	
010	190	331	151	260	080	120	300	280	100	
015	195	336	156	265	085	125	305	285	105	
020	200	341	161	270	090	130	310	290	110	
025	205	346	166	275	095	135	315	295	115	
030	210	351	171	280	100	140	320	300	120	
035	215	356	176	285	105	145	325	305	125	
040	220	001	181	290	110	150	330	310	130	
045	225	006	186	295	115	155	335	315	135	
050	230	011	191	300	120	160	340	320	140	
055	235	016	196	305	125	165	345	325	145	
060	240	021	201	310	130	170	350	330	150	
065	245	026	206	315	135	175	355	335	155	
070	250	031	211	320	140	180	000	340	160	
075	255	036	216	325	145	185	005	345	165	
080	260	041	221	330	150	190	010	350	170	
085	265	046	226	335	155	195	015	355	175	
090	270	051	231	340	160	200	020	000	180	
095	275	056	236	345	165	205	025	005	185	
100	280	061	241	350	170	210	030	010	190	
105	285	066	246	355	175	215	035	015	195	
110	290	071	251	000	180	220	040	020	200	
115	295	076	256	005	185	225	045	025	205	
120	300	081	261	010	190	230	050	030	210	
125	305	086	266	015	195	235	055	035	215	
130	310	091	271	020	200	240	060	040	220	
135	315	096	276	025	205	245	065	045	225	
140	320	101	281	030	210	250	070	050	230	
145	325	106	286	035	215	255	075	055	235	
150	330	111	291	040	220	260	080	060	240	
155	335	116	296	045	225	265	085	065	245	
160	340	121	301	050	230	270	090	070	250	
165	345	126	306	055	235	275	095	075	255	
170	350	131	311	060	240	280	100	080	260	
175	355	136	316	065	245	285	105	085	265	

Course Axis										
4 - 1 3 - 2	1 - 4 2 - 3	4 - 2	2 - 4	4 - 3 1 - 2	3 - 4 2 - 1	3 - 5	5 - 3	Signal - Pin	Pin - Signal	
180	360	141	321	070	250	290	110	090	270	
185	005	146	326	075	255	295	115	095	275	
190	010	151	331	080	260	300	120	100	280	
195	015	156	336	085	265	305	125	105	285	
200	020	161	341	090	270	310	130	110	290	
205	025	166	346	095	275	315	135	115	295	
210	030	171	351	100	280	320	140	120	300	
215	035	176	356	105	285	325	145	125	305	
220	040	181	001	110	290	330	150	130	310	
225	045	186	006	115	295	335	155	135	315	
230	050	191	011	120	300	340	160	140	320	
235	055	196	016	125	305	345	165	145	325	
240	060	201	021	130	310	350	170	150	330	
245	065	206	026	135	315	355	175	155	335	
250	070	211	031	140	320	000	180	160	340	
255	075	216	036	145	325	005	185	165	345	
260	080	221	041	150	330	010	190	170	350	
265	085	226	046	155	335	015	195	175	355	
270	090	231	051	160	340	020	200	180	000	
275	095	236	056	165	345	025	205	185	005	
280	100	241	061	170	350	030	210	190	010	
285	105	246	066	175	355	035	215	195	015	
290	110	251	071	180	000	040	220	200	020	
295	115	256	076	185	005	045	225	205	025	
300	120	261	081	190	010	050	230	210	030	
305	125	266	086	195	015	055	235	215	035	
310	130	271	091	200	020	060	240	220	040	
315	135	276	096	205	025	065	245	225	045	
320	140	281	101	210	030	070	250	230	050	
325	145	286	106	215	035	075	255	235	055	
330	150	291	111	220	040	080	260	240	060	
335	155	296	116	225	045	085	265	245	065	
340	160	301	121	230	050	090	270	250	070	
345	165	306	126	235	055	095	275	255	075	
350	170	311	131	240	060	100	280	260	080	
355	175	316	136	245	065	105	285	265	085	

Laser and Laser Radial 70° Trapezoid Course Lengths to Marks and Course Lengths – Equal beats, Reaches (1-2 and 3-5) two thirds of beat length

4 - 1 & 1 - 4	4 - 2 & 2 - 4	1 - 2 & 2 - 1	4 - 5	5 - F	IW2	IW3
2 - 3 & 3 - 2		4 - 3 & 3 - 4	5 - 4	F - 5	OW2	OW3
0.20	0.20	0.13	0.10	0.10	1.21	1.61
0.25	0.25	0.17	0.11	0.10	1.49	1.99
0.30	0.30	0.20	0.14	0.10	1.75	2.35
0.35	0.35	0.23	0.16	0.10	2.01	2.71
0.40	0.40	0.27	0.18	0.10	2.29	3.09
0.45	0.45	0.30	0.21	0.10	2.55	3.45
0.50	0.50	0.33	0.23	0.10	2.81	3.81
0.55	0.55	0.37	0.25	0.10	3.09	4.19
0.60	0.60	0.40	0.27	0.12	3.37	4.57
0.65	0.65	0.43	0.3	0.15	3.66	4.96
0.70	0.70	0.47	0.32	0.17	3.96	5.36
0.75	0.75	0.50	0.34	0.19	4.24	5.74
0.80	0.80	0.53	0.36	0.21	4.52	6.12
0.85	0.85	0.57	0.39	0.24	4.83	6.53
0.90	0.89	0.60	0.41	0.26	5.11	6.91
0.95	0.94	0.63	0.43	0.28	5.39	7.29
1.00	0.99	0.67	0.46	0.31	5.7	7.7
1.10	1.09	0.73	0.5	0.35	6.26	8.46
1.20	1.19	0.80	0.55	0.4	6.85	9.25
1.30	1.29	0.87	0.59	0.44	7.43	10.03
1.40	1.39	0.93	0.64	0.49	8	10.8
1.50	1.49	1.00	0.68	0.53	8.58	11.58
1.60	1.59	1.07	0.73	0.58	9.17	12.37
1.70	1.69	1.13	0.78	0.63	9.74	13.14
1.80	1.79	1.20	0.82	0.67	10.32	13.92
1.90	1.89	1.27	0.87	0.72	10.91	14.71
2.00	1.99	1.33	0.91	0.76	11.47	15.47

IW2 Start – 1 – 4s/4p – 1 – 2 – 3p – 5 – Finish

IW3 Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – 5 – Finish

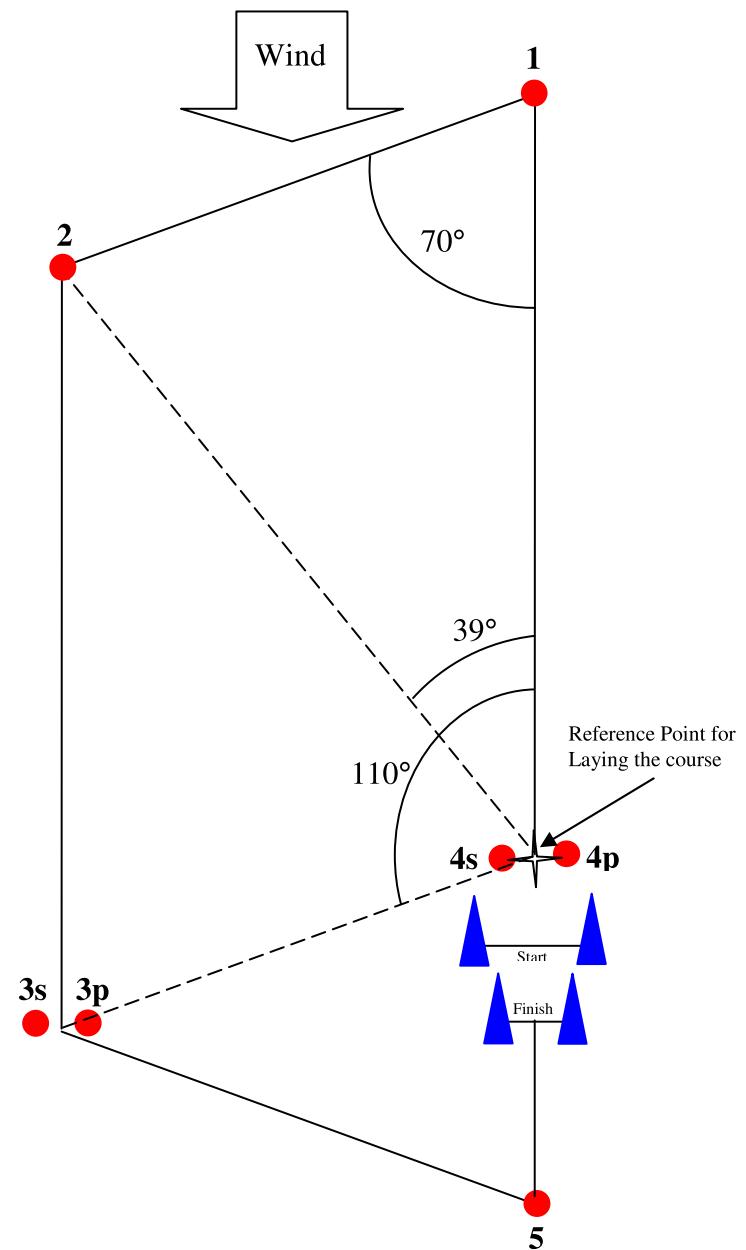
IW4 Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – 1 – 2 – 3p – 5 – Finish

OW2 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 5 – Finish

OW3 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – 5 – Finish

OW4 Start – 1 – 2 – 3s/3p – 2 – 3s/3p – 2 – 3s/3p – 2 – 3p – 5 – Finish

Start 0.05 nt mi downwind of 4S/4P(4)



Windward-leeward courses

Course Axis				Course Axis			
4 - 1	1 - 4	Signal - Pin	Pin - Signal	4 - 1	1 - 4	Signal - Pin	Pin - Signal
000	180	270	090	180	000	090	270
005	185	275	095	185	005	095	275
010	190	280	100	190	010	100	280
015	195	285	105	195	015	105	285
020	200	290	110	200	020	110	290
025	205	295	115	205	025	115	295
030	210	300	120	210	030	120	300
035	215	305	125	215	035	125	305
040	220	310	130	220	040	130	310
045	225	315	135	225	045	135	315
050	230	320	140	230	050	140	320
055	235	325	145	235	055	145	325
060	240	330	150	240	060	150	330
065	245	335	155	245	065	155	335
070	250	340	160	250	070	160	340
075	255	345	165	255	075	165	345
080	260	350	170	260	080	170	350
085	265	355	175	265	085	175	355
090	270	000	180	270	090	180	000
095	275	005	185	275	095	185	005
100	280	010	190	280	100	190	010
105	285	015	195	285	105	195	015
110	290	020	200	290	110	200	020
115	295	025	205	295	115	205	025
120	300	030	210	300	120	210	030
125	305	035	215	305	125	215	035
130	310	040	220	310	130	220	040
135	315	045	225	315	135	225	045
140	320	050	230	320	140	230	050
145	325	055	235	325	145	235	055
150	330	060	240	330	150	240	060
155	335	065	245	335	155	245	065
160	340	070	250	340	160	250	070
165	345	075	255	345	165	255	075
170	350	080	260	350	170	260	080
175	355	085	265	355	175	265	085

Windward-leeward Course Lengths to Marks and Course Lengths
Start/Finish 0.05 nt mi downwind of mark 4S/4P (4)

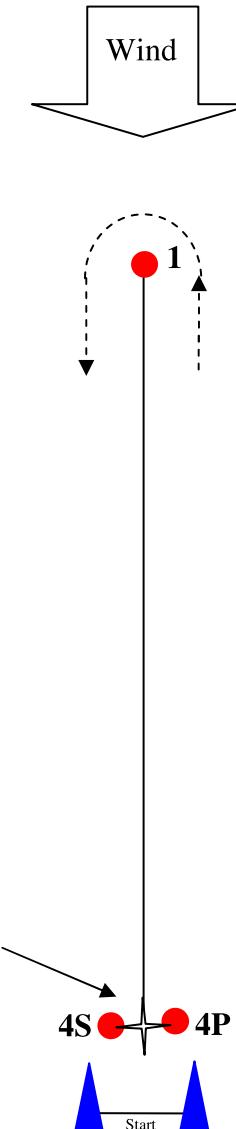
Leg Length	Course Distances			
	L1	L2	L3	L4
4 - 1				
1 - 4				
0.50	1.10	2.10	3.10	4.10
0.60	1.30	2.50	3.70	4.90
0.70	1.50	2.90	4.30	5.70
0.80	1.70	3.30	4.90	6.50
0.90	1.90	3.70	5.50	7.30
1.00	2.10	4.10	6.10	8.10
1.10	2.30	4.50	6.70	8.90
1.20	2.50	4.90	7.30	9.70
1.30	2.70	5.30	7.90	10.50
1.40	2.90	5.70	8.50	11.30
1.50	3.10	6.10	9.10	12.10
1.60	3.30	6.50	9.70	13.90
1.70	3.50	6.90	10.30	13.70
1.80	3.70	7.30	10.90	14.50
1.90	3.90	7.70	11.50	15.30
2.00	4.10	8.10	12.10	16.10
2.10	4.30	8.50	12.70	16.90
2.20	4.50	8.90	13.30	17.70
2.30	4.70	9.30	13.90	18.50
2.40	4.90	9.70	14.50	19.30
2.50	5.10	10.10	15.10	20.10
2.60	5.30	10.50	15.70	20.90
2.70	5.50	10.90	16.30	21.70
2.80	5.70	11.30	16.90	22.50
2.90	5.90	11.70	17.50	23.30
3.00	6.10	12.10	18.10	24.10

L1 Start – 1 – Finish

L2 Start – 1 – 4S/4P – 1 – Finish

L3 Start – 1 – 4S/4P – 1 – 4S/4P – 1 – Finish

L4 Start – 1 – 4S/4P – 1 – 4S/4P – 1 – 4S/4P – 1 – Finish



Windward-leeward courses with 80° offset mark 1A

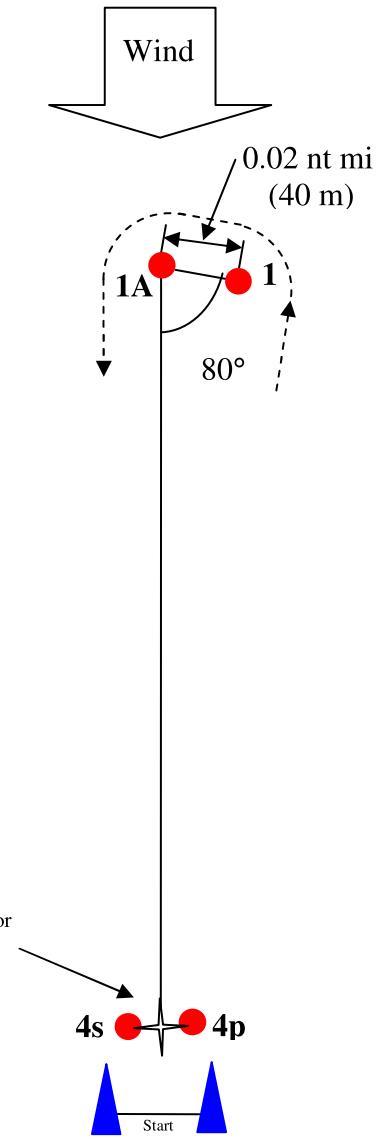
Course Axis	4 - 1A	1A - 4	1 - 1A	1A - 1	Signal - Pin	Pin - Signal
000	180	280	100	270	090	
005	185	285	105	275	095	
010	190	290	110	280	100	
015	195	295	115	285	105	
020	200	300	120	290	110	
025	205	305	125	295	115	
030	210	310	130	300	120	
035	215	315	135	305	125	
040	220	320	140	310	130	
045	225	325	145	315	135	
050	230	330	150	320	140	
055	235	335	155	325	145	
060	240	340	160	330	150	
065	245	345	165	335	155	
070	250	350	170	340	160	
075	255	355	175	345	165	
080	260	000	180	350	170	
085	265	005	185	355	175	
090	270	010	190	000	180	
095	275	015	195	005	185	
100	280	020	200	010	190	
105	285	025	205	015	195	
110	290	030	210	020	200	
115	295	035	215	025	205	
120	300	040	220	030	210	
125	305	045	225	035	215	
130	310	050	230	040	220	
135	315	055	235	045	225	
140	320	060	240	050	230	
145	325	065	245	055	235	
150	330	070	250	060	240	
155	335	075	255	065	245	
160	340	080	260	070	250	
165	345	085	265	075	255	
170	350	090	270	080	260	
175	355	095	275	085	265	

Course Axis	4 - 1A	1A - 4	1 - 1A	1A - 1	Signal - Pin	Pin - Signal
180	000	100	280	090	270	
185	005	105	285	095	275	
190	010	110	290	100	280	
195	015	115	295	105	285	
200	020	120	300	110	290	
205	025	125	305	115	295	
210	030	130	310	120	300	
215	035	135	315	125	305	
220	040	140	320	130	310	
225	045	145	325	135	315	
230	050	150	330	140	320	
235	055	155	335	145	325	
240	060	160	340	150	330	
245	065	165	345	155	335	
250	070	170	350	160	340	
255	075	175	355	165	345	
260	080	180	000	170	350	
265	085	185	005	175	355	
270	090	190	010	180	000	
275	095	195	015	185	005	
280	100	200	020	190	010	
285	105	205	025	195	015	
290	110	210	030	200	020	
295	115	215	035	205	025	
300	120	220	040	210	030	
305	125	225	045	215	035	
310	130	230	050	220	040	
315	135	235	055	225	045	
320	140	240	060	230	050	
325	145	245	065	235	055	
330	150	250	070	240	060	
335	155	255	075	245	065	
340	160	260	080	250	070	
345	165	265	085	255	075	
350	170	270	090	260	080	
355	175	275	095	265	085	

Windward-leeward courses with 80° offset mark 1A

Leg lengths	
4 - 1	1 - 1A
1 - 4	1A - 1
0.50	0.02
0.60	0.02
0.70	0.02
0.80	0.02
0.90	0.02
1.00	0.02
1.10	0.02
1.20	0.02
1.30	0.02
1.40	0.02
1.50	0.02
1.60	0.02
1.70	0.02
1.80	0.02
1.90	0.02
2.00	0.02
2.10	0.02
2.20	0.02
2.30	0.02
2.40	0.02
2.50	0.02
2.60	0.02
2.70	0.02
2.80	0.02
2.90	0.02
3.00	0.02

Course Distances			
L1	L2	L3	L4
1.12	2.14	3.16	4.18
1.32	2.54	3.76	4.98
1.52	2.94	4.36	5.78
1.72	3.34	4.96	6.58
1.92	3.74	5.56	7.38
2.12	4.14	6.16	8.18
2.32	4.54	6.76	8.98
2.52	4.94	7.36	9.78
2.72	5.34	7.96	10.58
2.92	5.74	8.56	11.38
3.12	6.14	9.16	12.18
3.32	6.54	9.76	12.98
3.52	6.94	10.36	13.78
3.72	7.34	10.96	14.58
3.92	7.74	11.56	15.38
4.12	8.14	12.16	16.18
4.32	8.54	12.76	16.98
4.52	8.94	13.36	17.78
4.72	9.34	13.96	18.58
4.92	9.74	14.56	19.38
5.12	10.14	15.16	20.18
5.32	10.54	15.76	20.98
5.52	10.94	16.36	21.78
5.72	11.34	16.96	22.58
5.92	11.74	17.56	23.38
6.12	12.14	18.16	24.18



L1 Start – 1 – Finish

L2 Start – 1 – 4s/4p – 1 – Finish

L3 Start – 1 – 4s/4p – 1 – 4s/4p – 1 – Finish

L4 Start – 1 – 4s/4p – 1 – 4s/4p – 1 – 4s/4p – 1 – Finish

45°, 90°, 45° Triangular Course Used for OK Worlds 2010

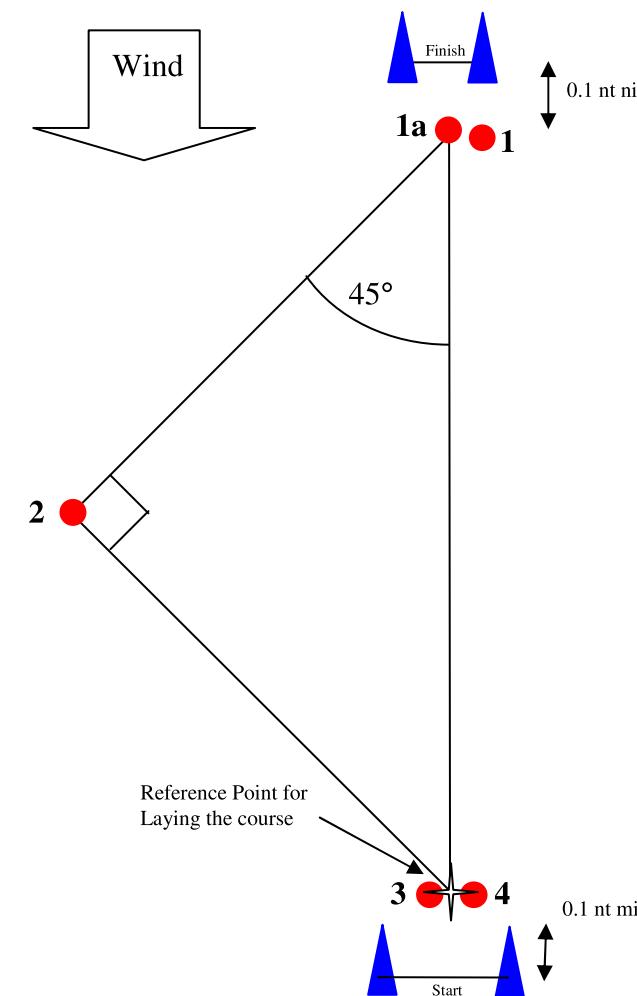
Start 0.1 nm downwind of mark 3/4 and Finish 0.1 nm above Mark 1

Course Axis	Angles in Degrees							Course Axis	Angle in Degrees							
	Start to 1	1 to 3	3 to 2	2 to 3	1 to 2	2 to 1	Start (Finish) to Pin (FP)	Pin (FP)	Start to 1	1 to 3	3 to 2	2 to 3	1 to 2	2 to 1	Start (Finish) to Pin (FP)	Pin (FP)
Start to 1									Start to 1							
3 / 4 to 1									3 / 4 to 1							
3 / 4 to Finish									3 / 4 to Finish							
000	180	315	135	225	045	270	090	180	000	135	315	045	225	090	270	
005	185	320	140	230	050	275	095	185	005	140	320	050	230	095	275	
010	190	325	145	235	055	280	100	190	010	145	325	055	235	100	280	
015	195	330	150	240	060	285	105	195	015	150	330	060	240	105	285	
020	200	335	155	245	065	290	110	200	020	155	335	065	245	110	290	
025	205	340	160	250	070	295	115	205	025	160	340	070	250	115	295	
030	210	345	165	255	075	300	120	210	030	165	345	075	255	120	300	
035	215	350	170	260	080	305	125	215	035	170	350	080	260	125	305	
040	220	355	175	265	085	310	130	220	040	175	355	085	265	130	310	
045	225	000	180	270	090	315	135	225	045	180	000	090	270	135	315	
050	230	005	185	275	095	320	140	230	050	185	005	095	275	140	320	
055	235	010	190	280	100	325	145	235	055	190	010	100	280	145	325	
060	240	015	195	285	105	330	150	240	060	195	015	105	285	150	330	
065	245	020	200	290	110	335	155	250	070	205	025	115	295	155	335	
070	250	025	205	295	115	340	160	255	075	210	030	120	300	165	345	
075	255	030	210	300	120	345	165	260	080	215	035	125	305	170	350	
080	260	035	215	305	125	350	170	265	085	220	040	130	310	175	355	
085	265	040	220	310	130	355	175	270	090	225	045	135	315	180	000	
090	270	045	225	315	135	000	180	275	095	230	050	140	320	185	005	
095	275	050	230	320	140	005	185	280	100	235	055	145	325	190	010	
100	280	055	235	325	145	010	190	285	105	240	060	150	330	195	015	
105	285	060	240	330	150	015	195	290	110	245	065	155	335	200	020	
110	290	065	245	335	155	020	200	295	115	250	070	160	340	205	025	
115	295	070	250	340	160	025	205	300	120	255	075	165	345	210	030	
120	300	075	255	345	165	030	210	305	125	260	080	170	350	215	035	
125	305	080	260	350	170	035	215	310	130	265	085	175	355	220	040	
130	310	085	265	355	175	040	220	315	135	270	090	180	000	225	045	
135	315	090	270	000	180	045	225	320	140	275	095	185	005	230	050	
140	320	095	275	005	185	050	230	325	145	280	100	190	010	235	055	
145	325	100	280	010	190	055	235	330	150	285	105	195	015	240	060	
150	330	105	285	015	195	060	240	335	155	290	110	200	020	245	065	
155	335	110	290	020	200	065	245	340	160	295	115	205	025	250	070	
160	340	115	295	025	205	070	250	345	165	300	120	210	030	255	075	
165	345	120	300	030	210	075	255	350	170	305	125	215	035	260	080	
170	350	125	305	035	215	080	260	355	175	310	130	220	040	265	085	
175	355	130	310	040	220	085	265	360	180	315	135	225	045	270	090	

45°, 90°, 45° Triangular Course Used for OK Worlds 2010

Start 0.1 nm downwind of mark 3/4 and Finish 0.1 nm above Mark 1

Leg lengths				Total Course Distance
3 to 1 1 to 3	3 to 2 2 to 3	1 to 2 2 to 1	Finish to 3	
0.4	0.28	0.28	0.5	2.36
0.45	0.32	0.32	0.55	2.64
0.5	0.35	0.35	0.6	2.9
0.55	0.39	0.39	0.65	3.18
0.6	0.42	0.42	0.7	3.44
0.65	0.46	0.46	0.75	3.72
0.7	0.49	0.49	0.8	3.98
0.75	0.53	0.53	0.85	4.26
0.8	0.57	0.57	0.9	4.54
0.85	0.6	0.6	0.95	4.8
0.9	0.64	0.64	1	5.08
0.95	0.67	0.67	1.05	5.34
1	0.71	0.71	1.1	5.62
1.05	0.74	0.74	1.15	5.88
1.1	0.78	0.78	1.2	6.16
1.15	0.81	0.81	1.25	6.42
1.2	0.85	0.85	1.3	6.7
1.25	0.88	0.88	1.35	6.96
1.3	0.92	0.92	1.4	7.24
1.35	0.95	0.95	1.45	7.5
1.4	0.99	0.99	1.5	7.78
1.45	1.03	1.03	1.55	8.06
1.5	1.06	1.06	1.6	8.32
1.55	1.1	1.1	1.65	8.6
1.6	1.13	1.13	1.7	8.86
1.65	1.17	1.17	1.75	9.14
1.7	1.2	1.2	1.8	9.4
1.75	1.24	1.24	1.85	9.68
1.8	1.27	1.27	1.9	9.94
1.85	1.31	1.31	1.95	10.22
1.9	1.34	1.34	2	10.48
1.95	1.38	1.38	2.05	10.76
2	1.41	1.41	2.1	11.02



Course

Start – 1 – 1a – 2 – 3 – 1 – 1a – 3/4 – Finish

45°, 90°, 45° Triangular Course

Start/Finish 0.05 nt mi downwind of mark 3 or Finish 0.05 nt mi upwind of Mark 1

Course Axis	Angles in degrees								
	1	3	2	1	2	Start	Pin	3	Finish
Start to 1	to	to	to	to	to	to	to	to	to
3 (3S/3P) to 1	3	2	3	2	1	Pin	Start	Finish	3
000	180	315	135	225	045	270	090	252	072
005	185	320	140	230	050	275	095	257	077
010	190	325	145	235	055	280	100	262	082
015	195	330	150	240	060	285	105	267	087
020	200	335	155	245	065	290	110	272	092
025	205	340	160	250	070	295	115	277	097
030	210	345	165	255	075	300	120	282	102
035	215	350	170	260	080	305	125	287	107
040	220	355	175	265	085	310	130	292	112
045	225	000	180	270	090	315	135	297	117
050	230	005	185	275	095	320	140	302	122
055	235	010	190	280	100	325	145	307	127
060	240	015	195	285	105	330	150	312	132
065	245	020	200	290	110	335	155	317	137
070	250	025	205	295	115	340	160	322	142
075	255	030	210	300	120	345	165	327	147
080	260	035	215	305	125	350	170	332	152
085	265	040	220	310	130	355	175	337	157
090	270	045	225	315	135	000	180	342	162
095	275	050	230	320	140	005	185	347	167
100	280	055	235	325	145	010	190	352	172
105	285	060	240	330	150	015	195	357	177
110	290	065	245	335	155	020	200	002	182
115	295	070	250	340	160	025	205	007	187
120	300	075	255	345	165	030	210	012	192
125	305	080	260	350	170	035	215	017	197
130	310	085	265	355	175	040	220	022	202
135	315	090	270	000	180	045	225	027	207
140	320	095	275	005	185	050	230	032	212
145	325	100	280	010	190	055	235	037	217
150	330	105	285	015	195	060	240	042	222
155	335	110	290	020	200	065	245	047	227
160	340	115	295	025	205	070	250	052	232
165	345	120	300	030	210	075	255	057	237
170	350	125	305	035	215	080	260	062	242
175	355	130	310	040	220	085	265	067	247

Course Axis	Angles in degrees								
	1	3	2	1	2	Start	Pin	3	Finish
Start to 1	to	to	to	to	to	to	to	to	to
3 (3S/3P) to 1	3	2	3	2	1	Pin	Start	Finish	3
180	000	135	315	045	225	090	270	072	252
185	005	140	320	050	230	095	275	077	257
190	010	145	325	055	235	100	280	082	262
195	015	150	330	060	240	105	285	087	267
200	020	155	335	065	245	110	290	092	272
205	025	160	340	070	250	115	295	097	277
210	030	165	345	075	255	120	300	102	282
215	035	170	350	080	260	125	305	107	287
220	040	175	355	085	265	130	310	112	292
225	045	180	000	090	270	135	315	117	297
230	050	185	005	095	275	140	320	122	302
235	055	190	010	100	280	145	325	127	307
240	060	195	015	105	285	150	330	132	312
245	065	200	020	110	290	155	335	137	317
250	070	205	025	115	295	160	340	142	322
255	075	210	030	120	300	165	345	147	327
260	080	215	035	125	305	170	350	152	332
265	085	220	040	130	310	175	355	157	337
270	090	225	045	135	315	180	000	162	342
275	095	230	050	140	320	185	005	167	347
280	100	235	055	145	325	190	010	172	352
285	105	240	060	150	330	195	015	177	357
290	110	245	065	155	335	200	020	182	002
295	115	250	070	160	340	205	025	187	007
300	120	255	075	165	345	210	030	192	012
305	125	260	080	170	350	215	035	197	017
310	130	265	085	175	355	220	040	202	022
315	135	270	090	180	000	225	045	207	027
320	140	275	095	185	005	230	050	212	032
325	145	280	100	190	010	235	055	217	037
330	150	285	105	195	015	240	060	222	042
335	155	290	110	200	020	245	065	227	047
340	160	295	115	205	025	250	070	232	052
345	165	300	120	210	030	255	075	237	057
350	170	305	125	215	035	260	080	242	062
355	175	310	130	220	040	265	085	247	067

45°, 90°, 45° Triangular Course

Start/Finish (TL) 0.05 nt mi downwind of mark 3s/3p or Finish (TW) 0.05 nt mi upwind of Mark 1

Leg lengths		
3 to 1	3 to 2	1 to 2
1 to 3	2 to 3	2 to 1
0.50	0.35	0.35
0.60	0.42	0.42
0.70	0.49	0.49
0.80	0.57	0.57
0.90	0.64	0.64
1.00	0.71	0.71
1.10	0.78	0.78
1.20	0.85	0.85
1.30	0.92	0.92
1.40	0.99	0.99
1.50	1.06	1.06
1.60	1.13	1.13
1.70	1.20	1.20
1.80	1.27	1.27
1.90	1.34	1.34
2.00	1.41	1.41
2.10	1.48	1.48
2.20	1.56	1.56
2.30	1.63	1.63
2.40	1.70	1.70
2.50	1.77	1.77
2.60	1.84	1.84
2.70	1.91	1.91
2.80	1.98	1.98
2.90	2.05	2.05
3.00	2.12	2.12

Course Distances					
TL1	TL2	TL3	TW1	TW2	TW3
1.81	2.81	4.01	2.31	3.31	4.51
2.15	3.35	4.80	2.75	3.95	5.40
2.49	3.89	5.58	3.19	4.59	6.28
2.83	4.43	6.36	3.63	5.23	7.16
3.17	4.97	7.15	4.07	5.87	8.05
3.51	5.51	7.93	4.51	6.51	8.93
3.86	6.06	8.71	4.96	7.16	9.81
4.20	6.60	9.49	5.40	7.80	10.69
4.54	7.14	10.28	5.84	8.44	11.58
4.88	7.68	11.06	6.28	9.08	12.46
5.22	8.22	11.84	6.72	9.72	13.34
5.56	8.76	12.63	7.16	10.36	14.23
5.90	9.30	13.41	7.60	11.00	15.11
6.25	9.85	14.19	8.05	11.65	15.99
6.59	10.39	14.97	8.49	12.29	16.87
6.93	10.93	15.76	8.93	12.93	17.76
7.27	11.47	16.54	9.37	13.57	18.64
7.61	12.01	17.32	9.81	14.21	19.52
7.95	12.55	18.11	10.25	14.85	20.41
8.29	13.09	18.89	10.69	15.49	21.29
8.64	13.64	19.67	11.14	16.14	22.17
8.98	14.18	20.45	11.58	16.78	23.05
9.32	14.72	21.24	12.02	17.42	23.94
9.66	15.26	22.02	12.46	18.06	24.82
10.00	15.80	22.80	12.90	18.70	25.70
10.34	16.34	23.59	13.34	19.34	26.59

TL2 Start – 1 – 2 – 3s – Finish (Downwind)

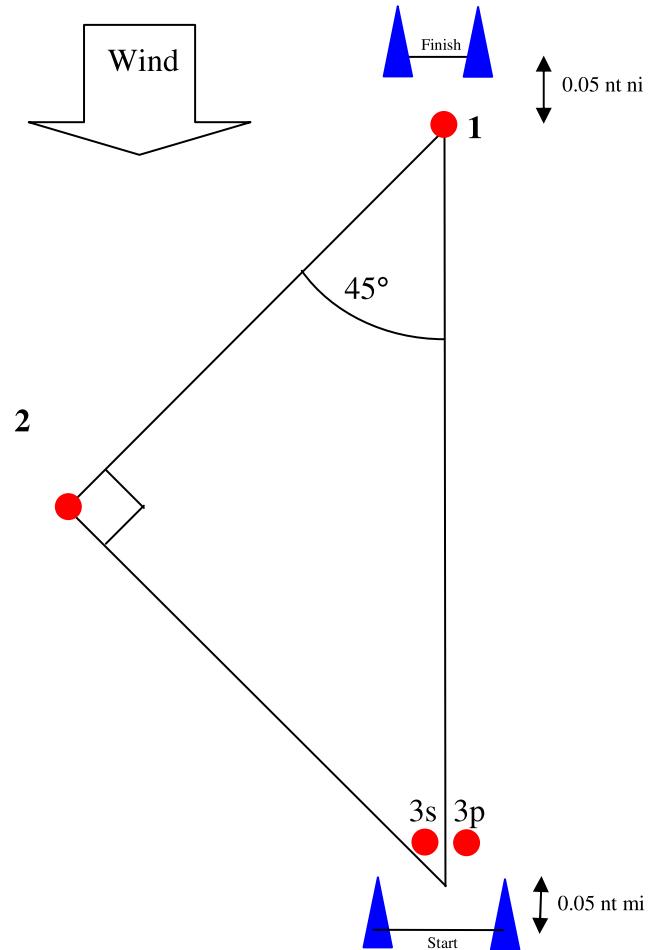
TL3 Start – 1 – 2 – 3s – 1 – 3s/3p – Finish (Downwind)

TL4 Start – 1 – 2 – 3s – 1 – 3s/3p – 1 – 2 – 3s – 1 – Finish (Downwind)

TL2 Start – 1 – 2 – 3s – 1 – Finish (Downwind)

TL3 Start – 1 – 2 – 3s – 1 – 3s/3p – 1 – Finish (Downwind)

TL4 Start – 1 – 2 – 3s – 1 – 3s/3p – 1 – 2 – 3s – 1 – Finish (Downwind)



Reference Point for laying the course
is the middle of the Mark 3s/3p gate

Optimist Course 60 °, 120 °interior angles - Finish laid 50 m from Mark 2 on the inside of the course.

Course Axis	1 - Reference	2 - Reference	1 - 2	2 - 1	3 - Reference	Signal - Pin	Pin - Signal	Course Axis	1 - Reference	2 - Reference	1 - 2	2 - 1	3 - Reference	Signal - Pin	Pin - Signal
000	180	120	240	060	060	270	090	180	000	300	060	240	240	090	270
005	185	125	245	065	065	275	095	185	005	305	065	245	245	095	275
010	190	130	250	070	070	280	100	190	010	310	070	250	250	100	280
015	195	135	255	075	075	285	105	195	015	315	075	255	255	105	285
020	200	140	260	080	080	290	110	200	020	320	080	260	260	110	290
025	205	145	265	085	085	295	115	205	025	325	085	265	265	115	295
030	210	150	270	090	090	300	120	210	030	330	090	270	270	120	300
035	215	155	275	095	095	305	125	215	035	335	095	275	275	125	305
040	220	160	280	100	100	310	130	220	040	340	100	280	280	130	310
045	225	165	285	105	105	315	135	225	045	345	105	285	285	135	315
050	230	170	290	110	110	320	140	230	050	350	110	290	290	140	320
055	235	175	295	115	115	325	145	235	055	355	115	295	295	145	325
060	240	180	300	120	120	330	150	240	060	0	120	300	300	150	330
065	245	185	305	125	125	335	155	245	065	5	125	305	305	155	335
070	250	190	310	130	130	340	160	250	070	10	130	310	310	160	340
075	255	195	315	135	135	345	165	255	075	15	135	315	315	165	345
080	260	200	320	140	140	350	170	260	080	20	140	320	320	170	350
085	265	205	325	145	145	355	175	265	085	25	145	325	325	175	355
090	270	210	330	150	150	000	180	270	090	30	150	330	330	180	000
095	275	215	335	155	155	005	185	275	095	35	155	335	335	185	005
100	280	220	340	160	160	010	190	280	100	40	160	340	340	190	010
105	285	225	345	165	165	015	195	285	105	45	165	345	345	195	015
110	290	230	350	170	170	020	200	290	110	50	170	350	350	200	020
115	295	235	355	175	175	025	205	295	115	55	175	355	355	205	025
120	300	240	000	180	180	030	210	300	120	60	180	000	000	210	030
125	305	245	005	185	185	035	215	305	125	65	185	005	005	215	035
130	310	250	010	190	190	040	220	310	130	70	190	010	010	220	040
135	315	255	015	195	195	045	225	315	135	75	195	015	015	225	045
140	320	260	020	200	200	050	230	320	140	80	200	020	020	230	050
145	325	265	025	205	205	055	235	325	145	85	205	025	025	235	055
150	330	270	030	210	210	060	240	330	150	90	210	030	030	240	060
155	335	275	035	215	215	065	245	335	155	95	215	035	035	245	065
160	340	280	040	220	220	070	250	340	160	100	220	040	040	250	070
165	345	285	045	225	225	075	255	345	165	105	225	045	045	255	075
170	350	290	050	230	230	080	260	350	170	110	230	050	050	260	080
175	355	295	055	235	235	085	265	355	175	115	235	055	055	265	085

Optimist Course 60°, 120°Interior Angles. Equal Leg lengths

Leg Lengths					Course Distance
Reference - 1	Reference - 2	Reference - 3	1 – 2 2 – 3	3 - Finish	
0.2	0.2	0.2	0.2	0.17	0.77
0.25	0.25	0.25	0.25	0.22	0.97
0.3	0.3	0.3	0.3	0.27	1.17
0.35	0.35	0.35	0.35	0.32	1.37
0.4	0.4	0.4	0.4	0.37	1.57
0.45	0.45	0.45	0.45	0.42	1.77
0.5	0.5	0.5	0.5	0.47	1.97
0.55	0.55	0.55	0.55	0.52	2.17
0.6	0.6	0.6	0.6	0.57	2.37
0.65	0.65	0.65	0.65	0.62	2.57
0.7	0.7	0.7	0.7	0.67	2.77
0.75	0.75	0.75	0.75	0.72	2.97
0.8	0.8	0.8	0.8	0.77	3.17
0.85	0.85	0.85	0.85	0.82	3.37
0.9	0.9	0.9	0.9	0.87	3.57
0.95	0.95	0.95	0.95	0.92	3.77
1	1	1	1	0.97	3.97

Course IOD
Start – 1 – 2 – 3s/3p – Finish

