

Appendix 1

Course Diagrams and Tables

Appendix 1 - Course Diagrams and Tables

1. Range and Bearing and the Reference Point	2
2. Size of the course circle	4
3. Size of the course circle	
4. Determining the reference position from the signal boat	6
5. Using Project location on the Garmin 76	7
6. Illustrating the course	8
7. Course Illustrations	
Trapezoid	9
Trapezoid with offset	10
Trapezoid with signal boat for start and finish	11
Trapezoid with beat to finish – separate finishing line	12
Trapezoid with beat to finish, offset mark and separate finishing line	13
Trapezoid with beat to finish – signal boat start and finish	14
Trapezoid with slalom finish	15
Windward leeward	16
Windward leeward with offset	17
Windward leeward with slalom finish	18
Windward leeward with offset and slalom finish	18
Windward Leeward with reaching finish	19
Windward Leeward with mark 1 gate and reaching finish	20
Trianglular	21
Trianglular with offset	22
Optimist	23
Match racing windward leeward	24
8. Course Tables	
Trapezoid 60°,120° Start finish together Reach = ½ Beat	25
Trapezoid 70°,110° Start finish together Reach = ½ Beat	27
Trapezoid 60°,120° Equal beats Reach = ½ Beat	29
Trapezoid 70°,110° Equal beats Reach = ½ Beat	31
Trapezoid 60°,120° Equal beats Reach = _ Beat	33
Trapezoid 70°,110° Equal beats Reach = _ Beat	35
Trapezoid 70°,110° Equal beats Reach = _ Beat Windward finish	37
Windward leeward	39
Windward leeward with offset	41
Triangle 45°, 90°, 45° Start finish 0.1 nm from marks 1 and 4	43
Triangle 45°, 90°, 45° Start finish 0.05 nm from marks 1 and 4	45
Optimist Course	47

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 called 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.

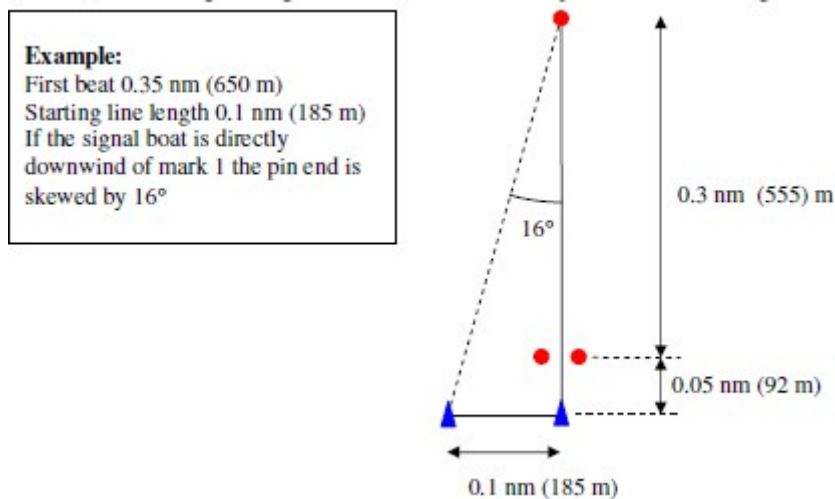
1.3 *Reference Point is the location of the signal boat*

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.



- (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

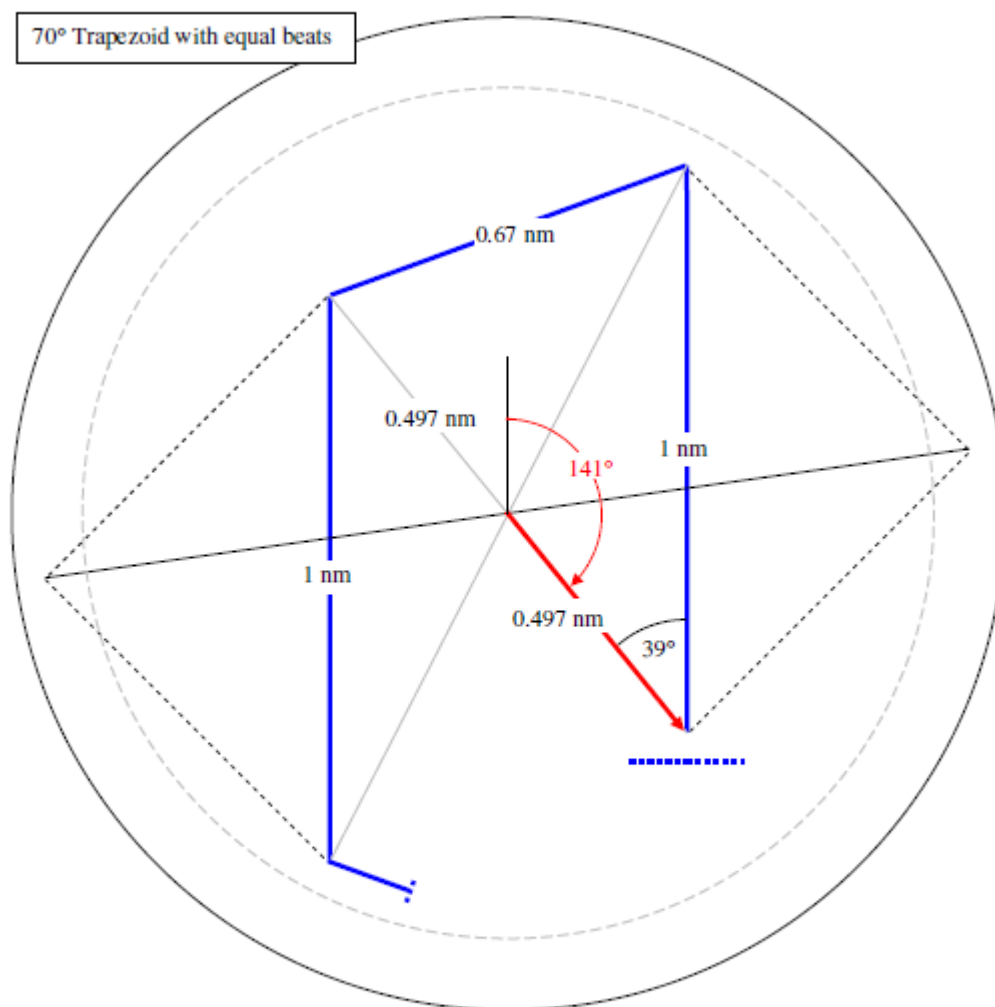
- (a) Ensures the course is as close as possible to the centre of a designated circle.
- (b) Useful as an initial point to calculate a reference point which centres the course on the course circle.

Cons

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

2. Size of Course Circle (70°110° trapezoid)

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



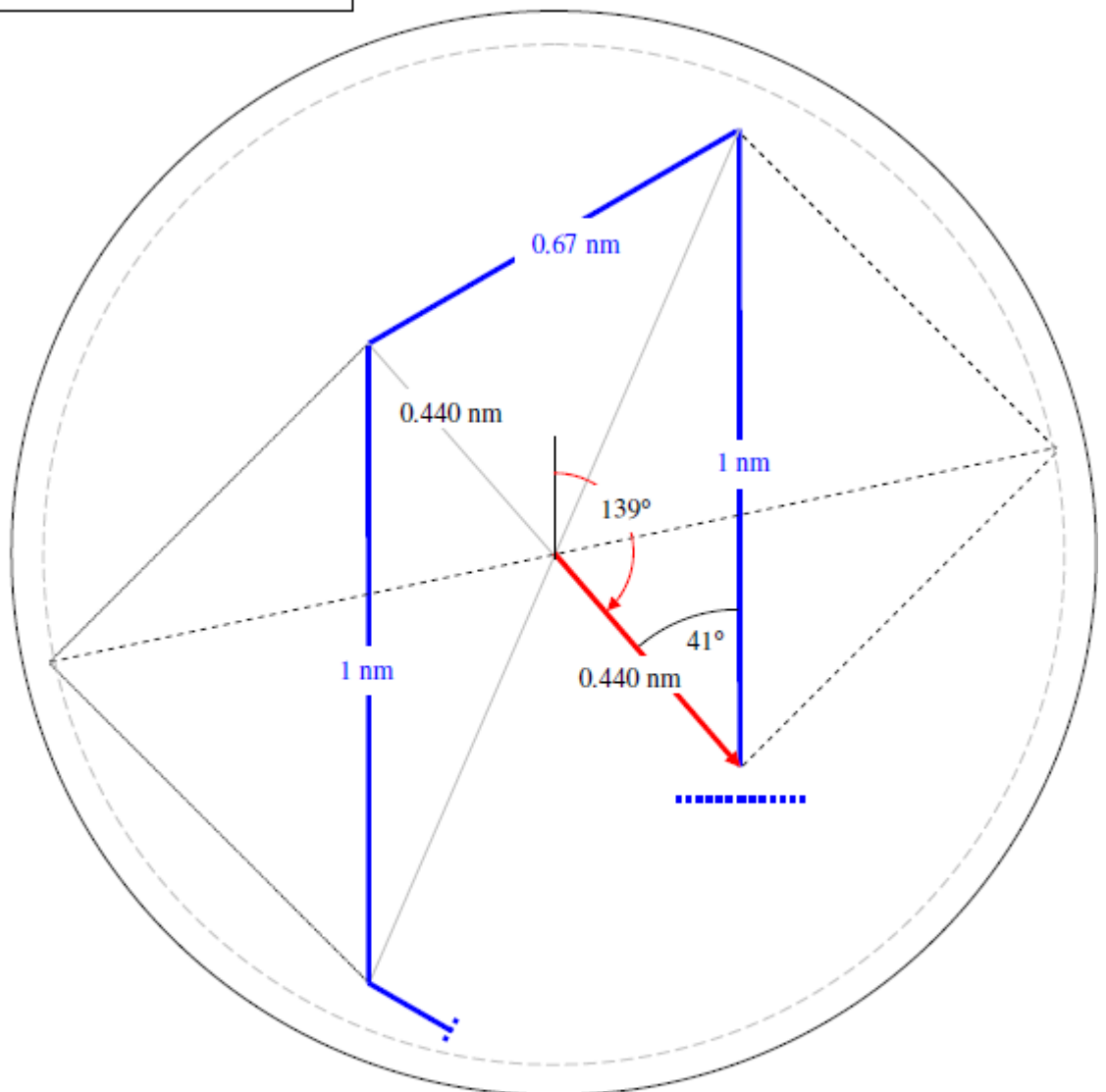
For a 1 nm beat the diameter of the circle is 1.5 nm if there is to be a 0.05 (90 m) room around marks 1 and 3, or 1.75 nm if there is to be 0.05 nm clearance around the extremities of the 4-1 and 3-2 beats.

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)

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

60° Trapezoid with equal beats

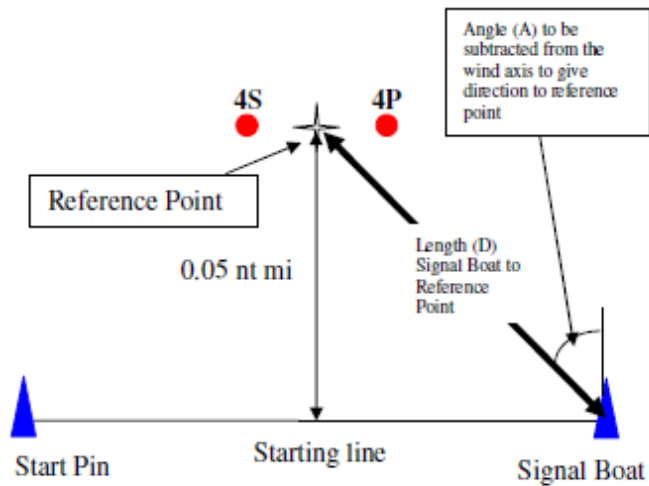


For a 1 nm beat the diameter of the circle is 1.6 nm if there is to be a 0.05 nm (90 m) room around mark 1 and the finish or 1.7 nm if there is to be 0.05 clearance around the extremities of the 4-1 and 3-2 beats.

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 from the signal boat**

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	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
T	Triangular with start finish in middle of the beat
TL	triangular with leeward finish
TW	triangular with windward finish
TR	triangular with reaching finish
IA, IWA, LA, WA, TLA, TWA, TRA	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).

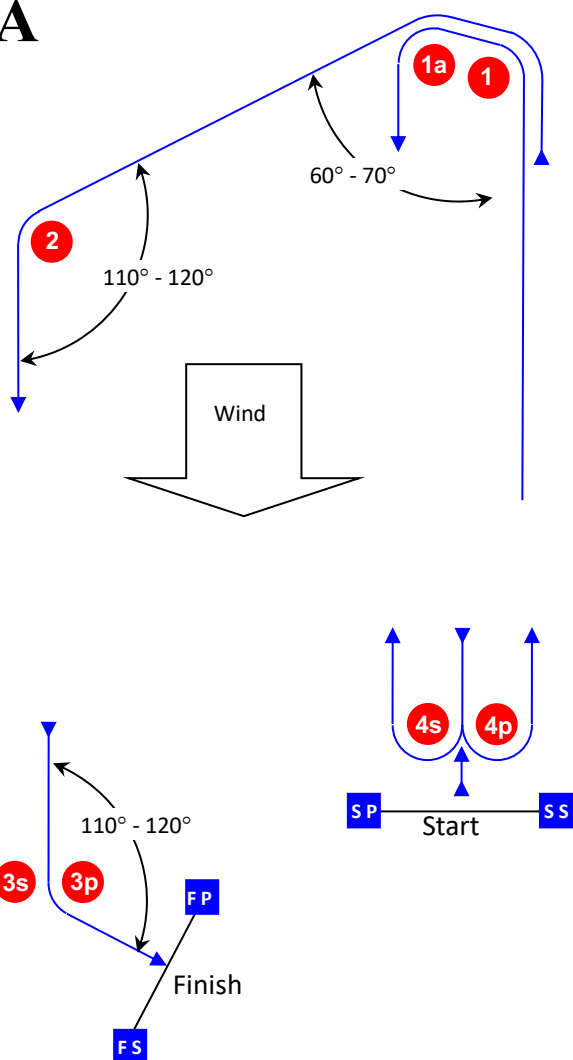
When a mark of a gate is used before a reaching leg, only the mark being rounded should be specified in the course description. E.g. the mark before the finish in an I or O course is 3p. The other mark (3s) is not a mark of the course even though it may still be laid.

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 with offset mark

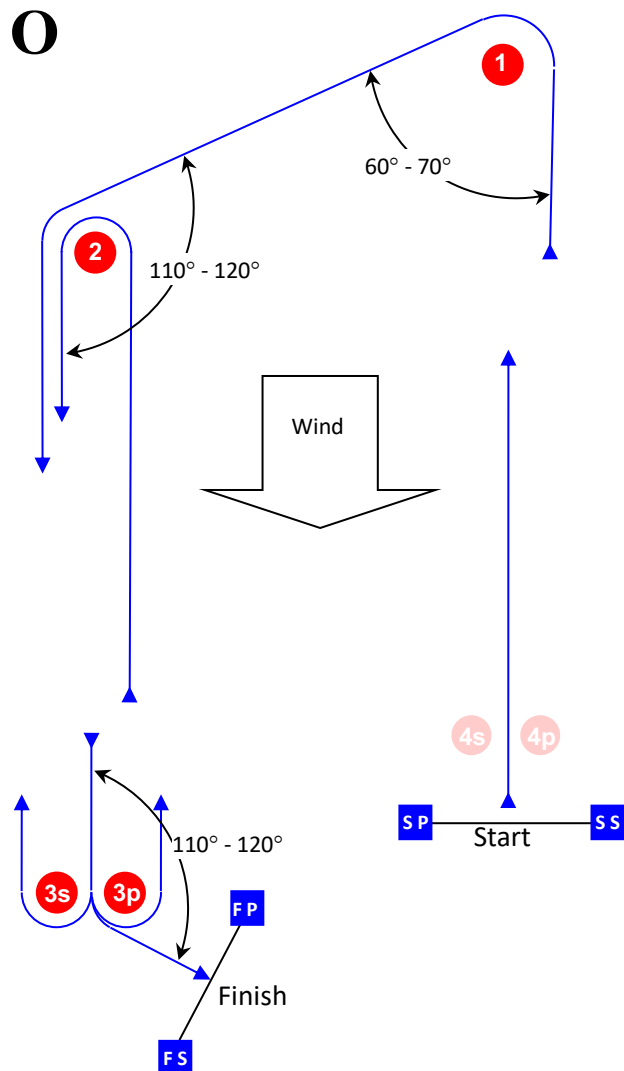
IA



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



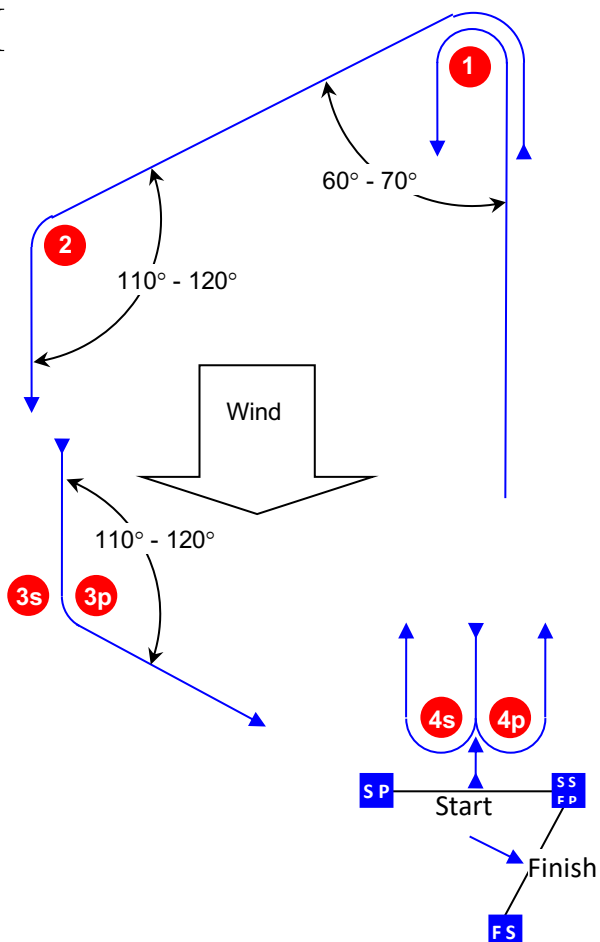
Course: Outer Trapezoid

Signal	Mark Rounding Order
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

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

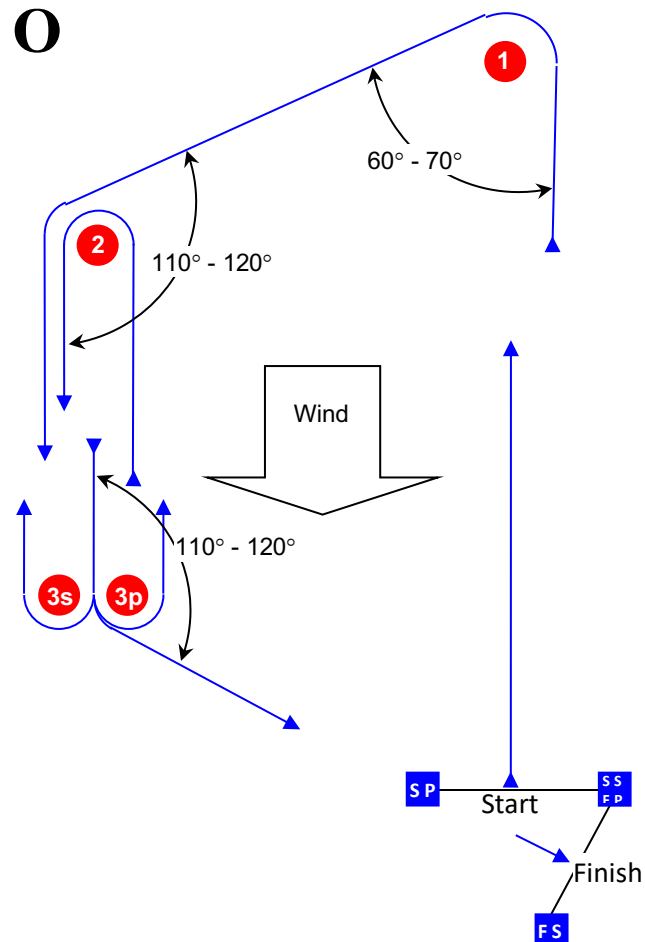
I



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



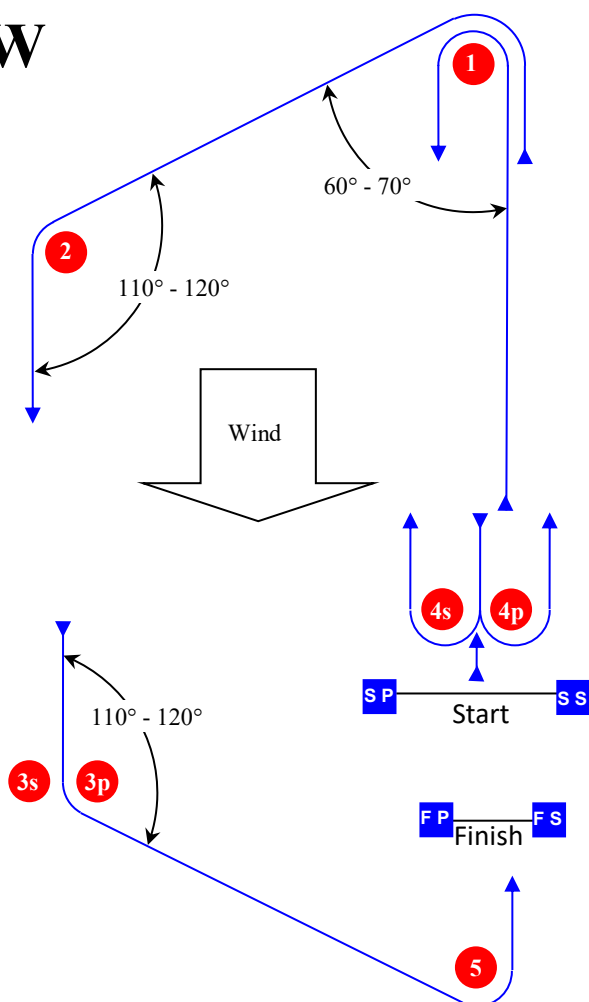
Course: Outer Trapezoid

Signal	Mark Rounding Order
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

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

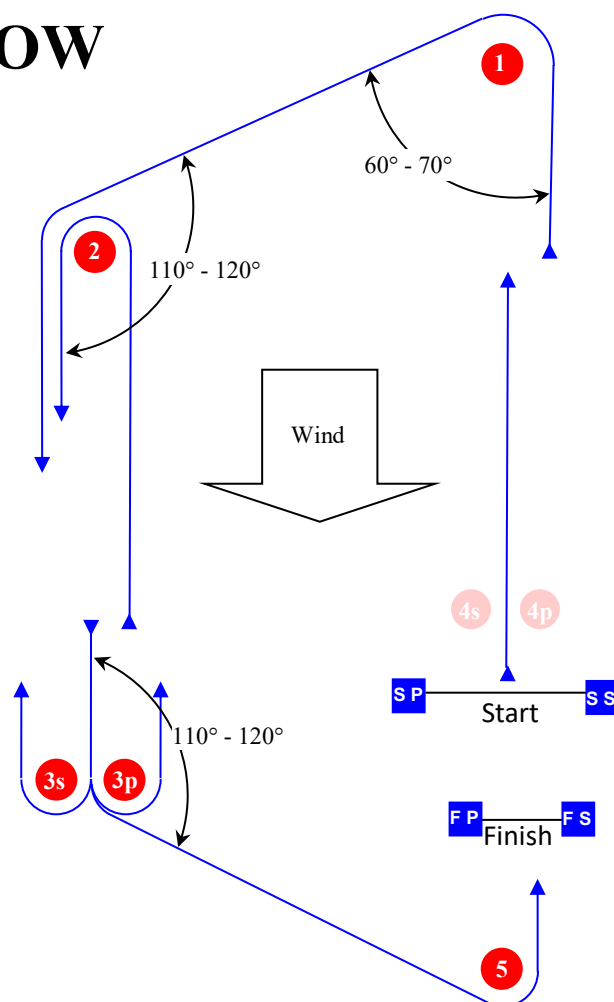
IW



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



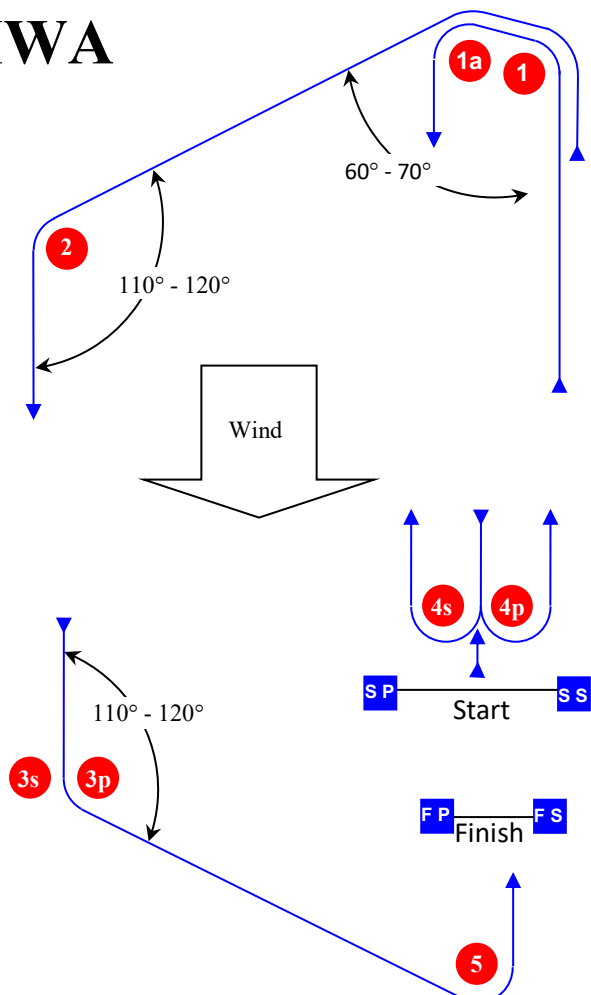
Course: Outer Trapezoid with beat to finish

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

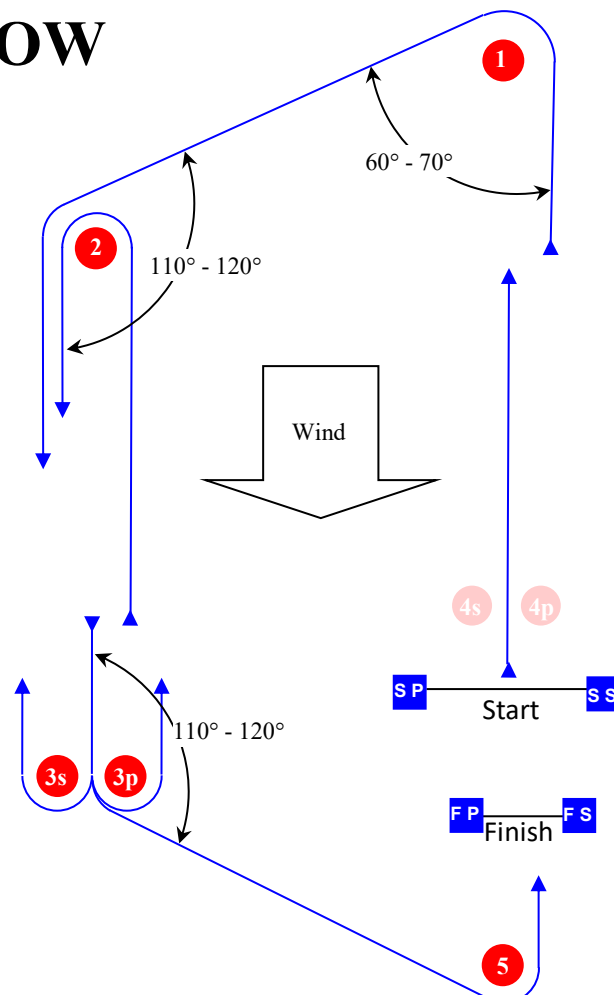
IWA



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 –

OW



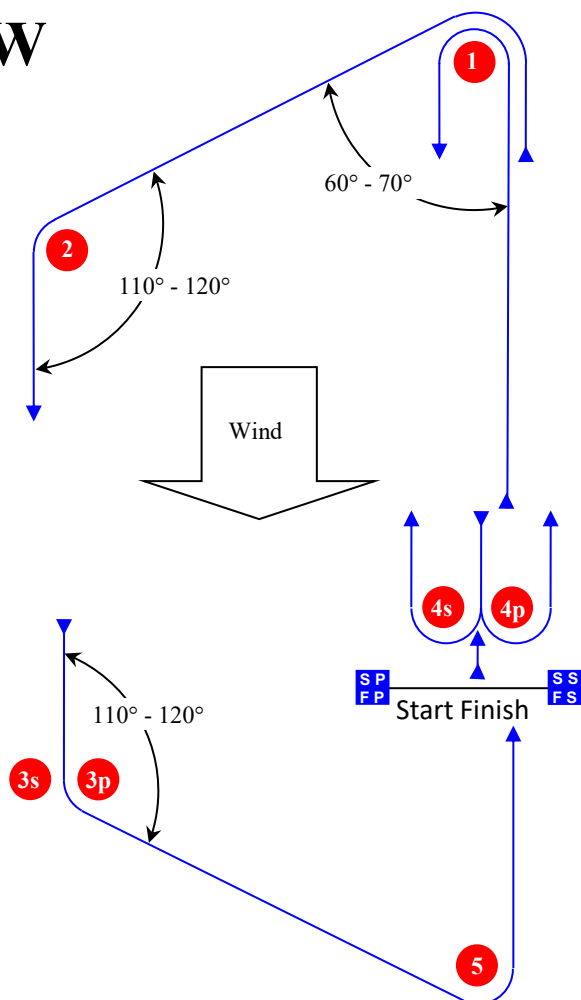
Course: Outer Trapezoid with beat to finish

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

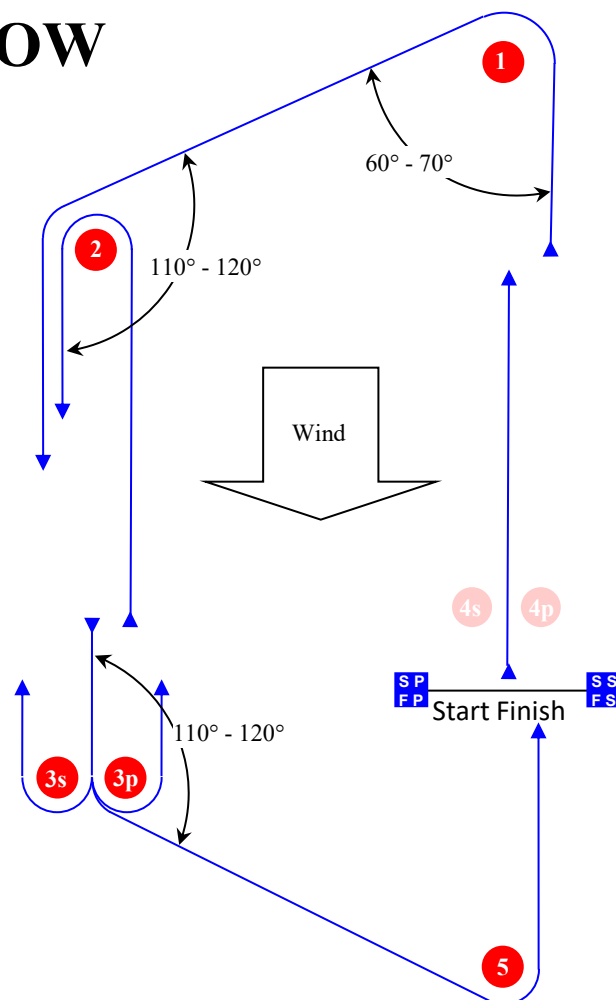
IW



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



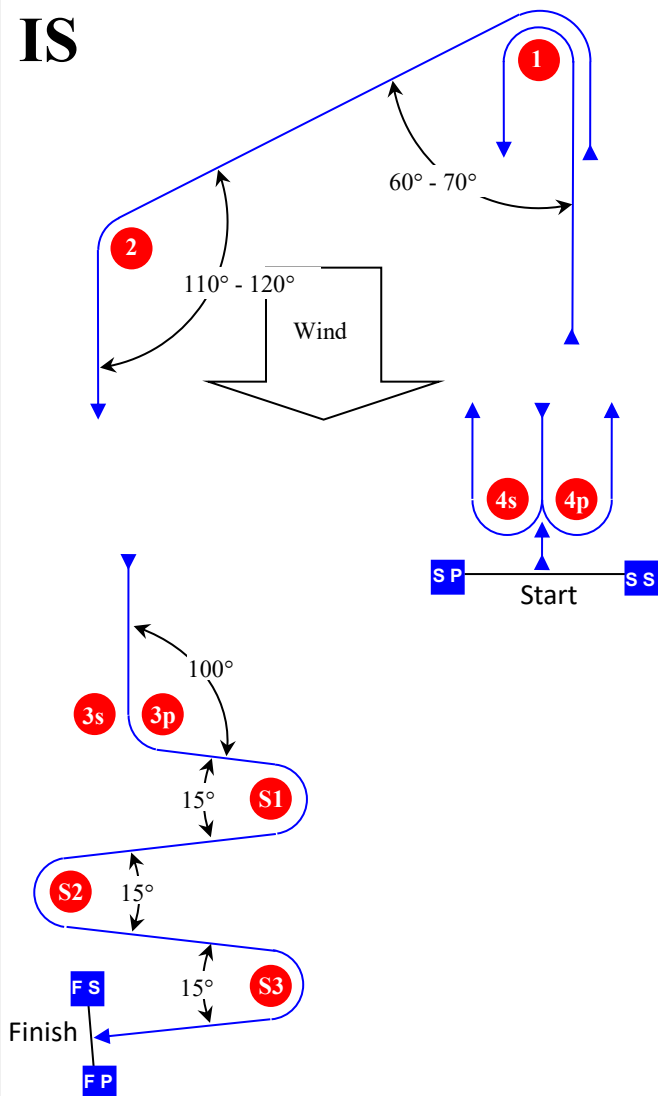
Course: Outer Trapezoid with beat to finish

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

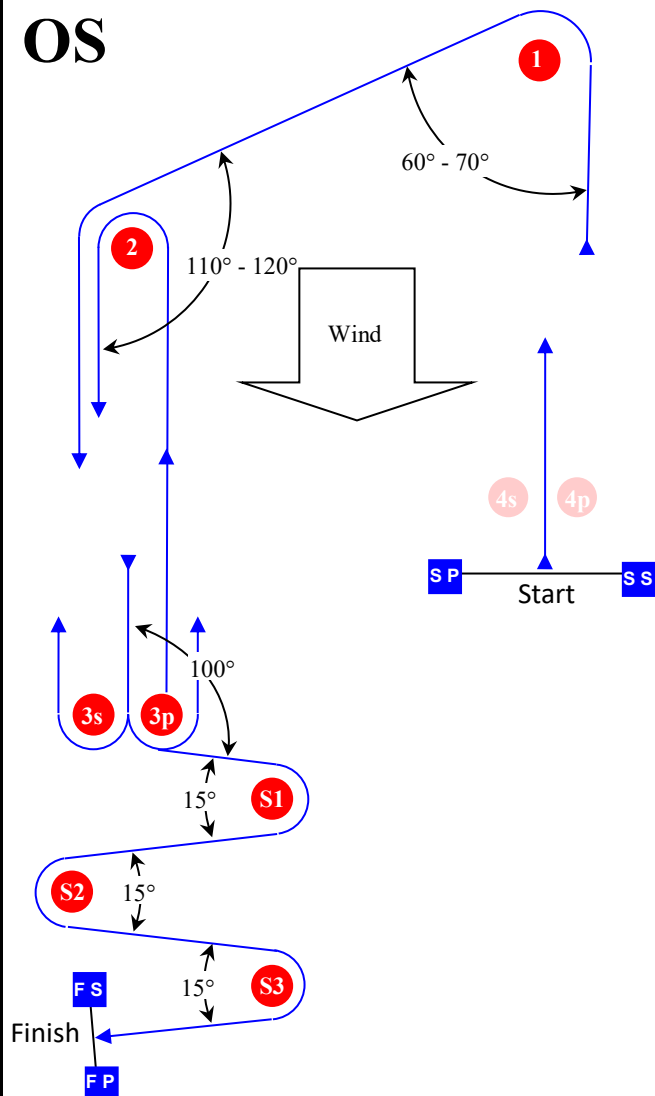
IS



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



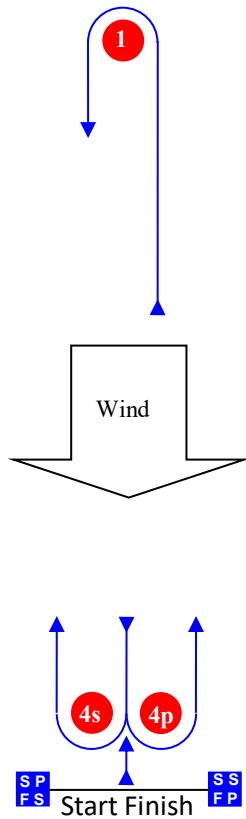
Course: Outer trapezoid slalom finish

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

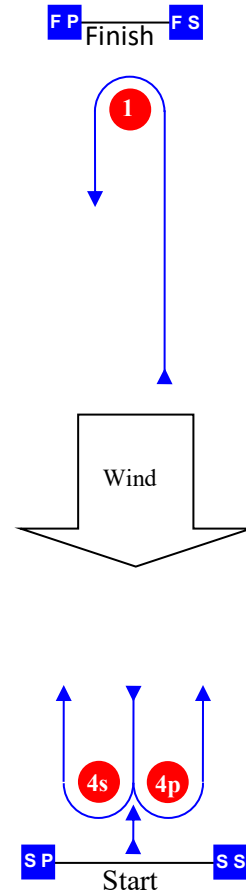
L



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



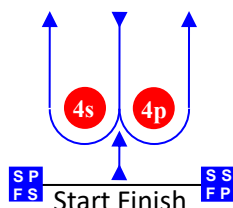
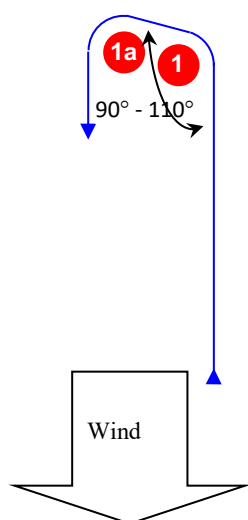
Course: Windward Finish

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	
	L	W
FS	Finishing mark starboard end	
FP	Finishing mark port end	

Course Illustrations – Windward Leeward with offset

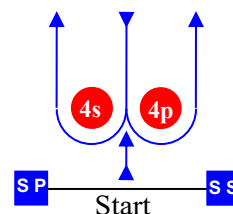
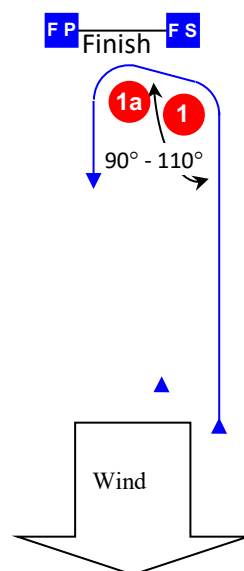
LA



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



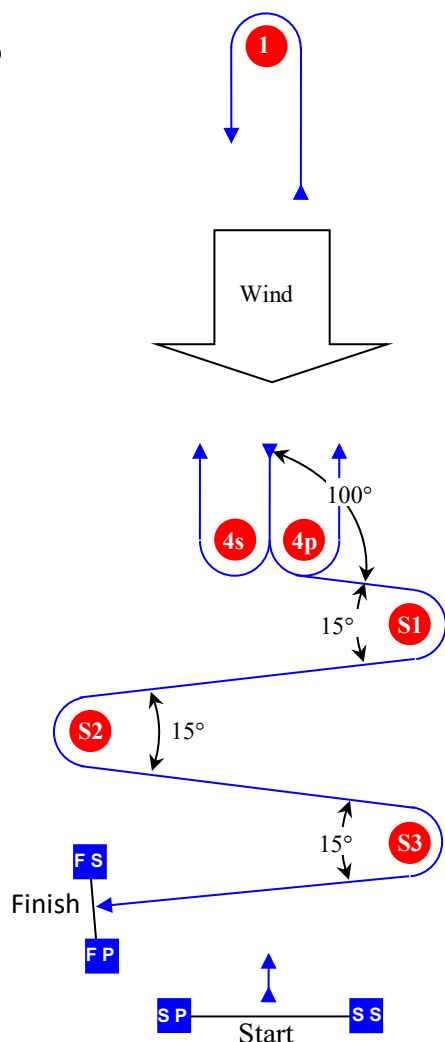
Course: Windward Finish

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

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

Course Illustration - Windward leeward with slalom finish

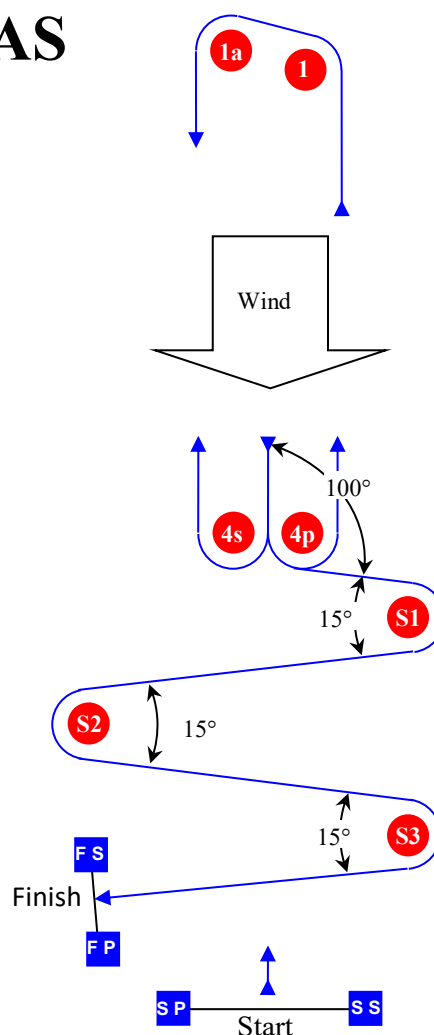
LS



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



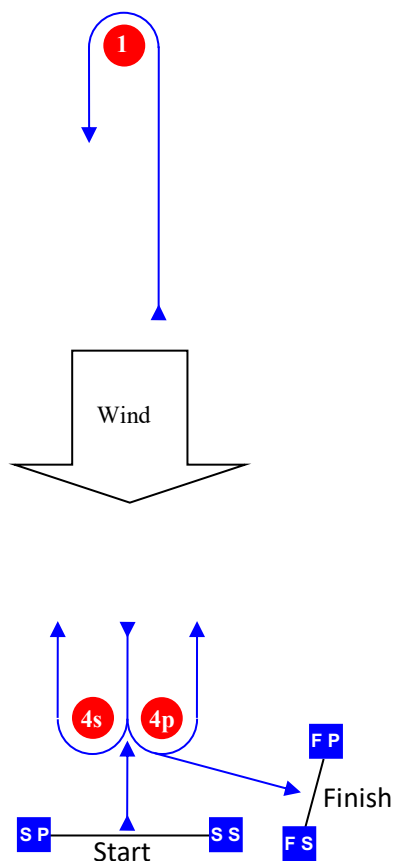
Course: Windward leeward with offset mark and slalom finish

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 – 4p – 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

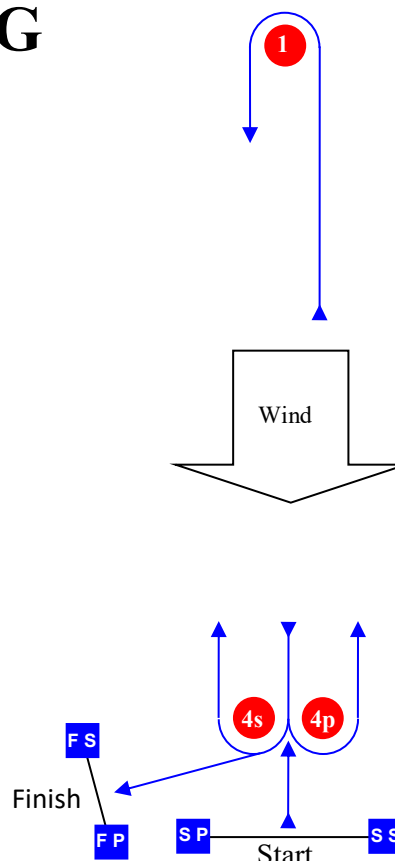
LR



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

LG



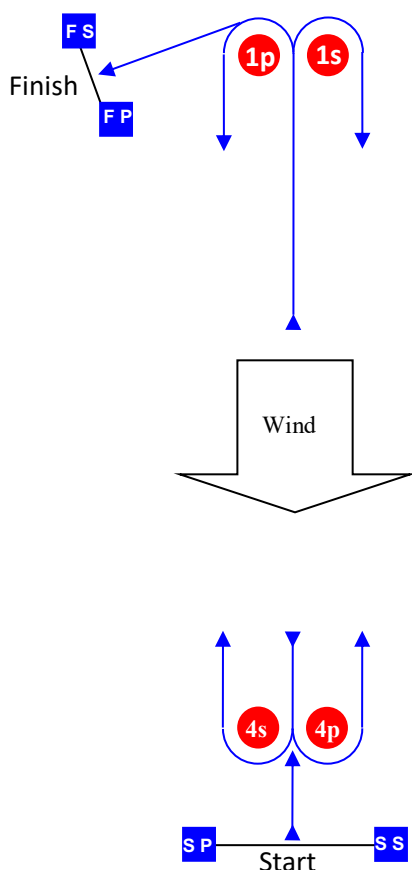
Course: Leeward Finish

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)

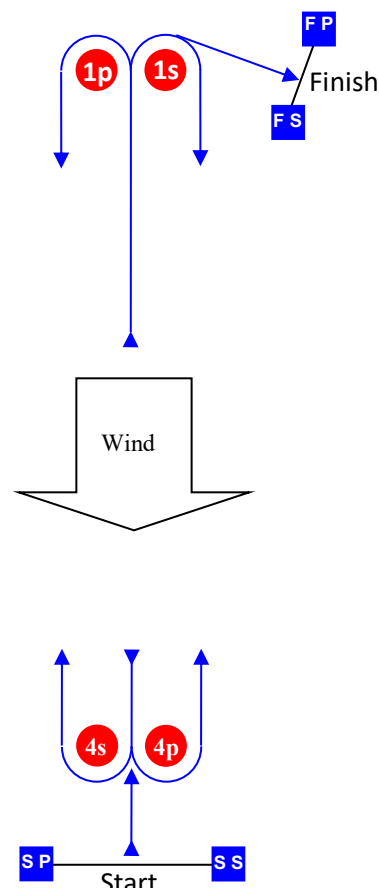
WR



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

WG



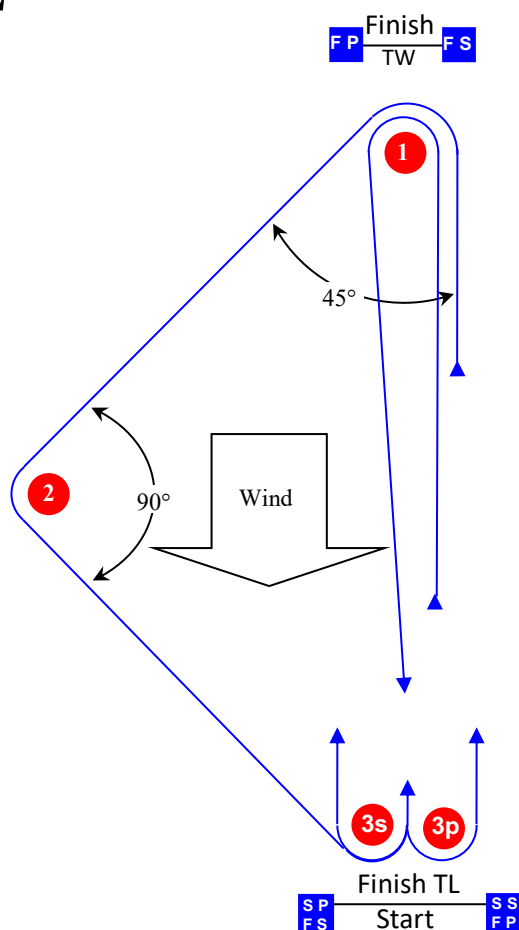
Course: Windward Finish

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

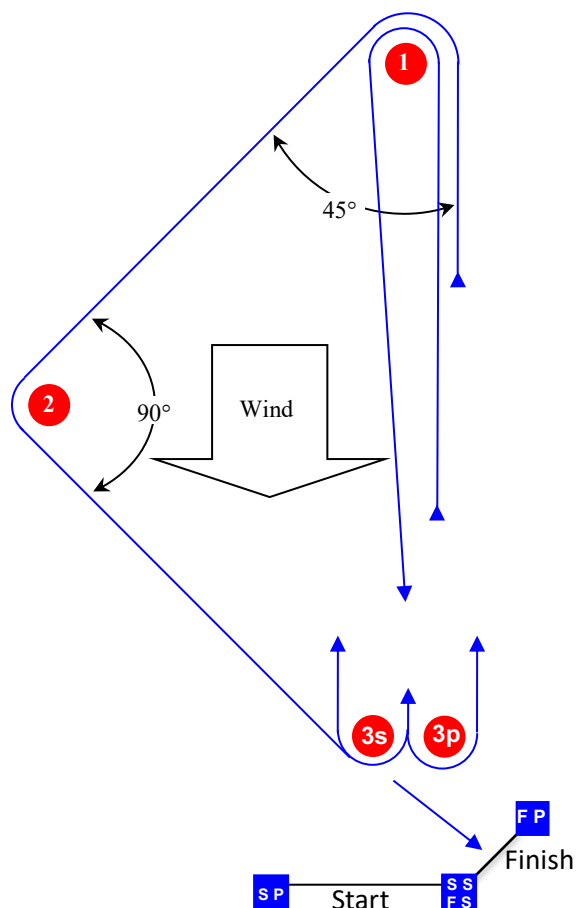
Course: Triangular Downwind Finish

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	TL
FS	Finishing mark starboard end	
FP	Finishing mark port end	

Course Illustration – Triangular course reaching finish

TR



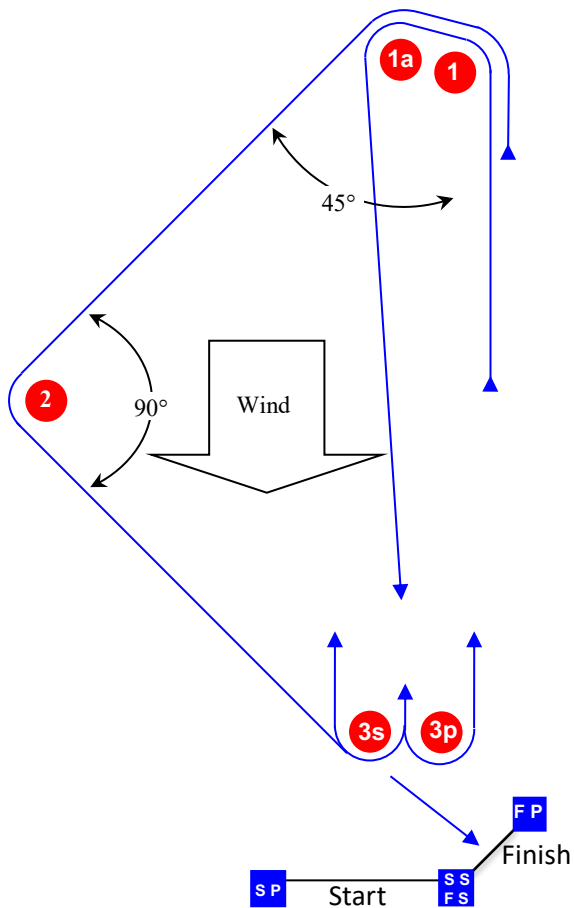
Course: Triangular Reaching Finish

Signal	Mark Rounding Order
TR1	Start – 1 – 2 – Finish
TR2	Start – 1 – 3s/3p – 1 – 2 – Finish
TR3	Start – 1 – 3s/3p – 1 – 3s/3p – 1 – 2 – 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 – Triangular course with offset reaching finish

TRA



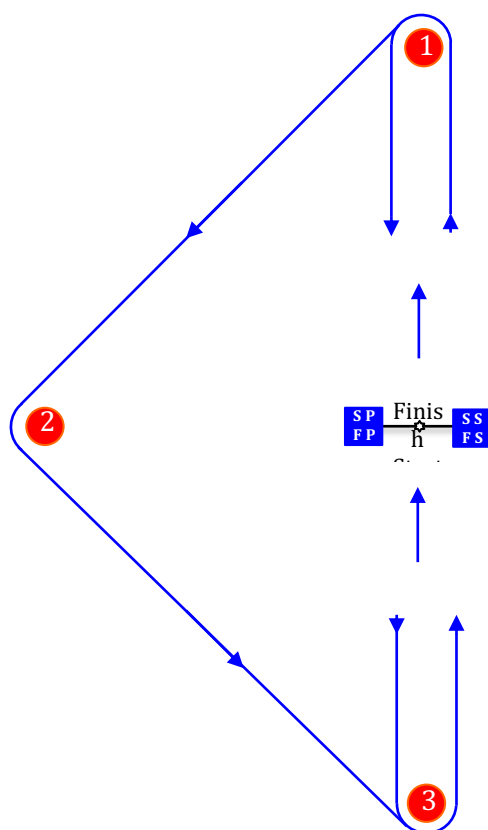
Course: Triangular with offset Reaching Finish

Signal	Mark Rounding Order
TRA1	Start – 1 – 1a – 2 – Finish
TRA2	Start – 1 – 1a – 3s/3p – 1 – 1a – 2 – Finish
TRA3	Start – 1 – 1a – 3s/3p – 1 – 1a – 3s/3p – 1 – 1a – 2 – 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	

Course Illustration – Triangular course start finish middle of beat

T



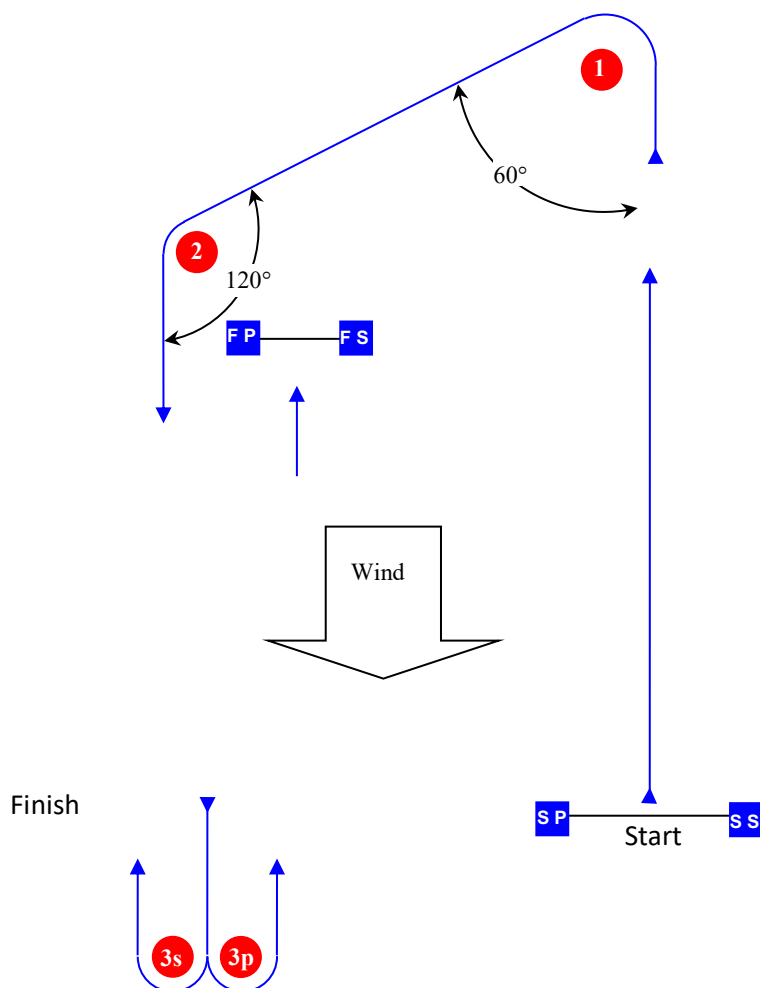
Course: Triangular with offset Reaching Finish

Signal	Mark Rounding Order
T1	Start – 1 – 2 – 3 – Finish
T2	Start – 1 – 2 – 3 – 1 – 3 – Finish
T3	Start – 1 – 2 – 3 – 1 – 3 – 1 – 2 – 3 – Finish

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

Course Illustration – Optimist course

IOD

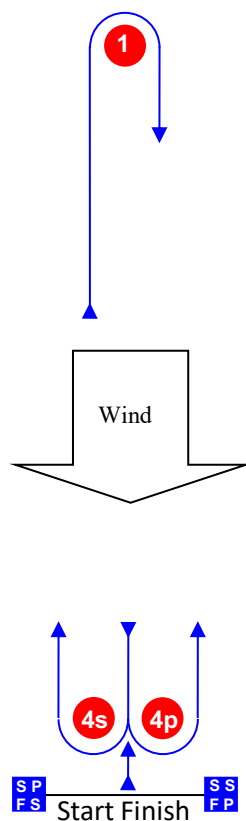


Signal	Mark Rounding Order
IOD	Start 1 – 2 – 3s/3p – Finish

Mark	Description
1	
2	
3s 3p	
S S	Starting mark starboard end
S P	Starting mark port end
F S	Finishing mark starboard end
F P	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	

Course Tables

The tables in the following pages are to help with laying the course.

Copying and laminating the appropriate course is advisable to enable its use in a wet environment.

Where there is a mark or gate immediately to windward of the starting line the reference point is set from this mark or gate.

For triangular course with the start finish in the middle of the beat and the optimist course the reference point is the middle of the starting line.

Refer to pages 2-3 for information about the reference point.

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

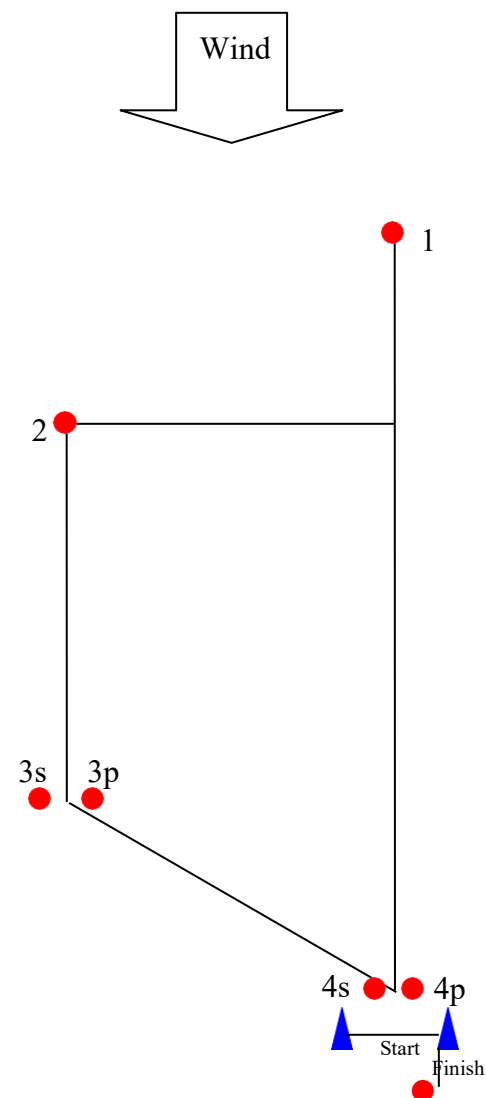
Course Axis	Angles in Degrees							
4 - 1 3 - 2	1 - 4 2 - 3	4 - 2	2 - 4	1 - 2	2 - 1	4 - 3	3 - 4	Start Line
180	000	150	330	060	240	120	300	090
185	005	155	335	065	245	125	305	095
190	010	160	340	070	250	130	310	100
195	015	165	345	075	255	135	315	105
200	020	170	350	080	260	140	320	110
205	025	175	355	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 1-4	4-2 2-4	4-3 3-4	1-2 2-1	2-3 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

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

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



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

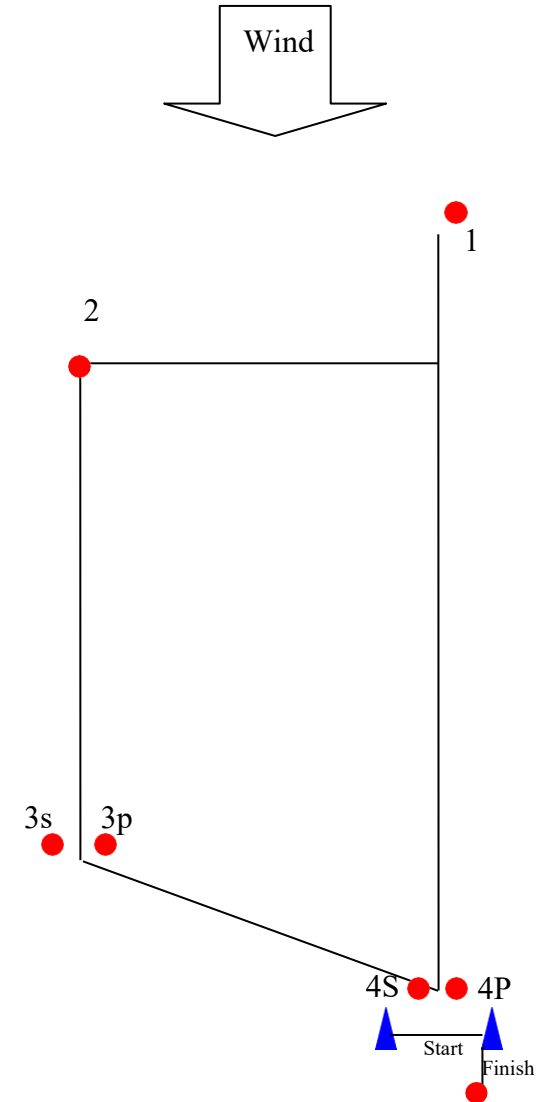
Course Axis	Angle in degrees							
4 - 1 3 - 2	1 - 4 2 - 3	4 - 2	2 - 4	1 - 2	2 - 1	4 - 3	3 - 4	Start Line
180	000	150	330	070	250	110	290	090
185	005	155	335	075	255	115	295	095
190	010	160	340	080	260	120	300	100
195	015	165	345	085	265	125	305	105
200	020	170	350	090	270	130	310	110
205	025	175	355	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	170	350	150
245	065	215	035	135	315	175	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	000	220	040	200
295	115	265	085	185	005	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 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

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

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



Trapezoid 60°, 120°, 120°, 60° 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	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

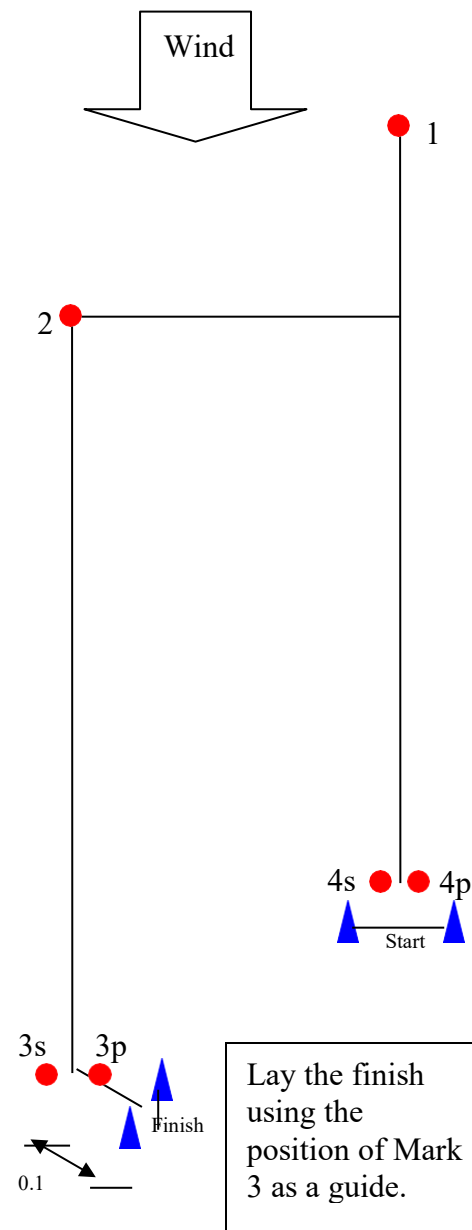
Course Axis	Angles in degrees							
4 - 1 3 - 2	1 - 4 2 - 3	4 - 2	2 - 4	4 - 3 1 - 2	3 - 4 2 - 1	F - 3	3 - F	Start Line
180	000	150	330	060	240	120	300	090
185	005	155	335	065	245	125	305	095
190	010	160	340	070	250	130	310	100
195	015	165	345	075	255	135	315	105
200	020	170	350	080	260	140	320	110
205	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 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

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

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



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

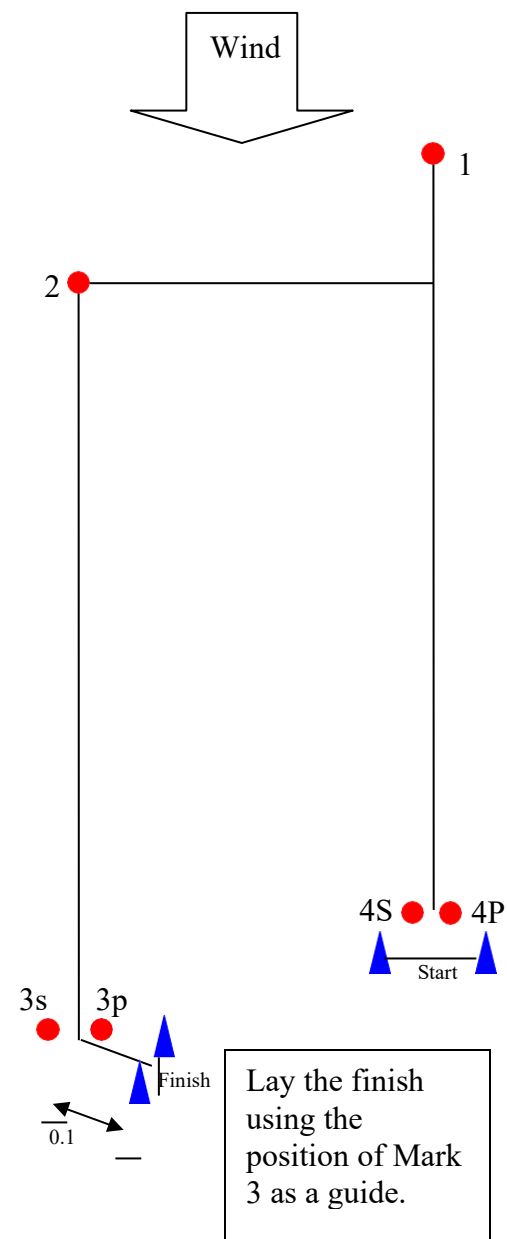
Course Axis	Angles in degrees							
4-1 3-2	1-4 2-3	4-2	2-4	4-3 1-2	3-4 2-1	F-3	3-F	Start Line
000	180	330	150	250	070	290	110	270
005	185	335	155	255	075	295	115	275
010	190	340	160	260	080	300	120	280
015	195	345	165	265	085	305	125	285
020	200	350	170	270	090	310	130	290
025	205	355	175	275	095	315	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

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

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

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



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

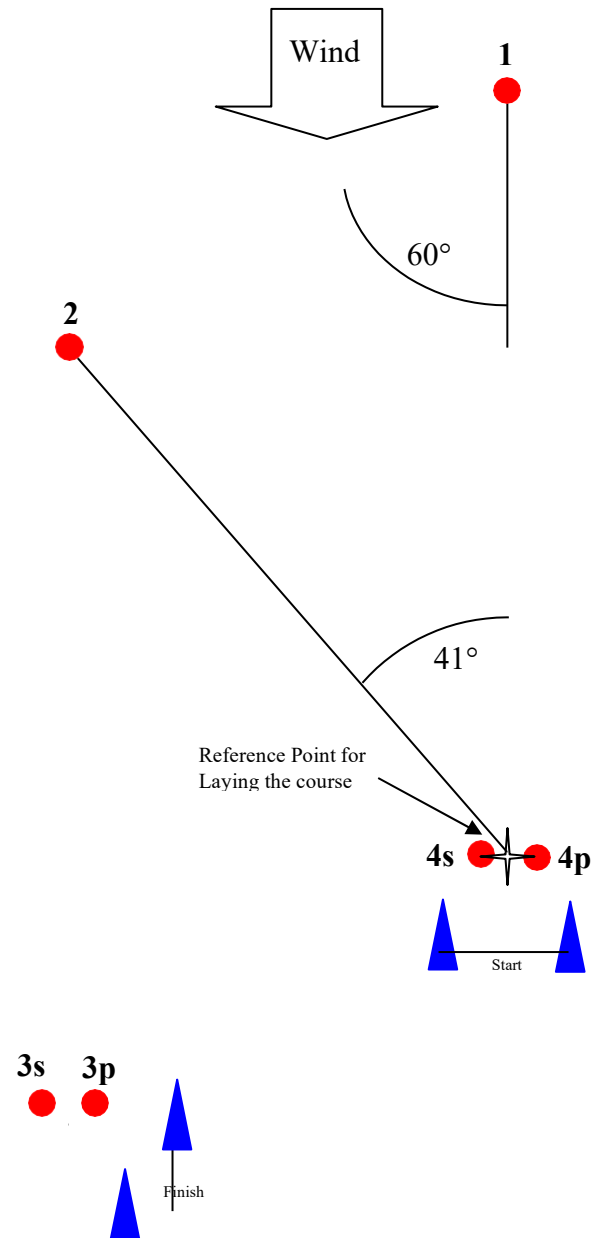
Course Axis	Angles in Degrees								
4 - 1	1 - 4	4 - 2	2 - 4	4 - 3	3 - 4	Signal	Pin -	3 -	Finish
3 - 2	2 - 3			1 - 2	2 - 1	- Pin	Signal	Finish	- 3
180	000	139	319	060	240	090	270	300	120
185	005	144	324	065	245	095	275	305	125
190	010	149	329	070	250	100	280	310	130
195	015	154	334	075	255	105	285	315	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	000	210	030	060	240
305	125	264	084	185	005	215	035	065	245
310	130	269	089	190	010	220	040	070	250
315	135	274	094	195	015	225	045	075	255
320	140	279	099	200	020	230	050	080	260
325	145	284	104	205	025	235	055	085	265
330	150	289	109	210	030	240	060	090	270
335	155	294	114	215	035	245	065	095	275
340	160	299	119	220	040	250	070	100	280
345	165	304	124	225	045	255	075	105	285
350	170	309	129	230	050	260	080	110	290
355	175	314	134	235	055	265	085	115	295

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

Leg lengths		
4 - 1 & 1 - 4 2 - 3 & 3 - 2	4 - 2 & 2 - 4	1 - 2 & 2 - 1 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 – 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



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

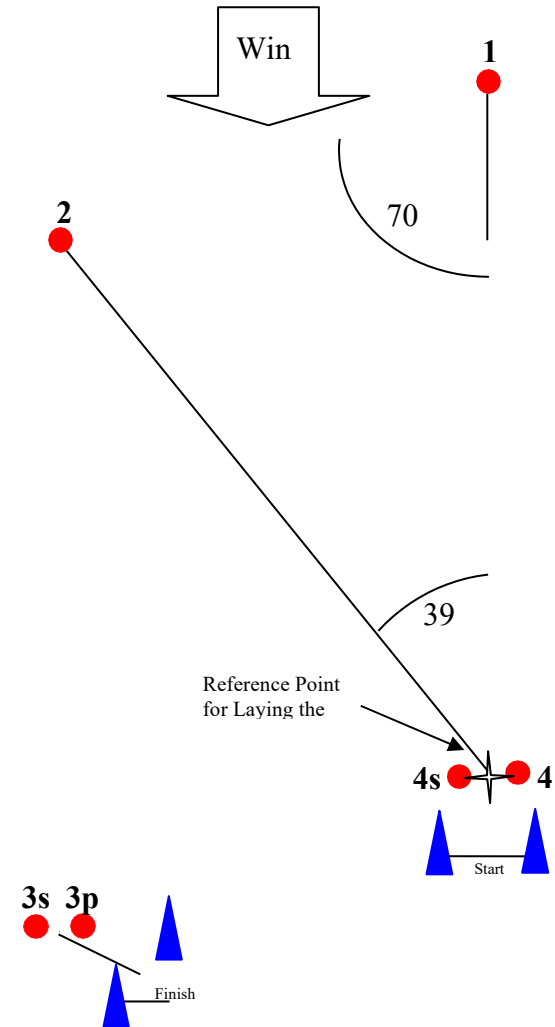
Course Axis	Angles in Degrees								
4 - 1	1 - 4	4 - 2	2 - 4	4 - 3	3 - 4	Signal	Pin -	3 -	Finish
3 - 2	2 - 3			1 - 2	2 - 1	- Pin	Signal	Finish	- 3
180	360	141	321	070	250	090	270	290	110
185	005	146	326	075	255	095	275	295	115
190	010	151	331	080	260	100	280	300	120
195	015	156	336	085	265	105	285	305	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 - 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 – 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



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

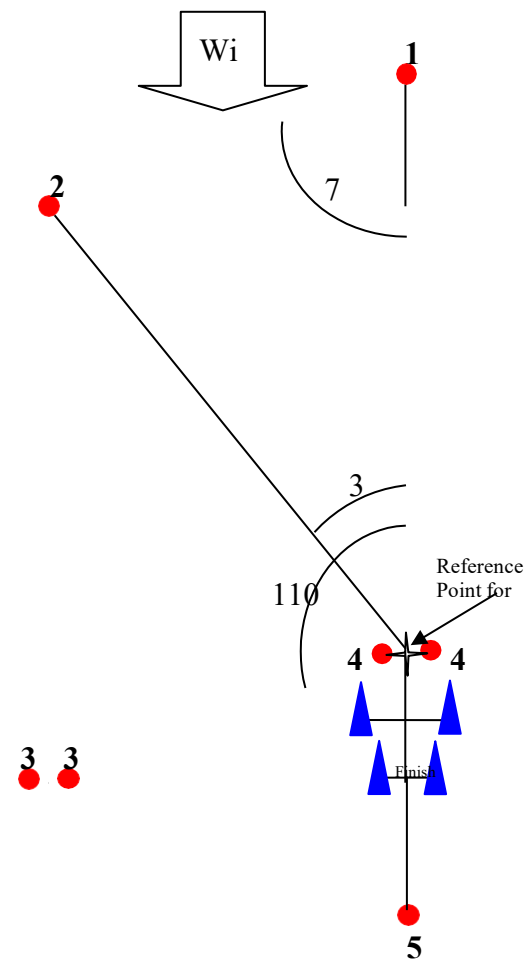
Course Axis	Trapezoid Course 70, 110 interior angles								
4 - 1 3 - 2 5 - F	1 - 4 2 - 3 F - 5	4 - 2	2 - 4	4 - 3 1 - 2	3 - 4 2 - 1	3 - 5	5 - 3	Signal - Pin	Pin - Signal
000	180	321	141	250	070	110	290	270	090
005	185	326	146	255	075	115	295	275	095
010	190	331	151	260	080	120	300	280	100
015	195	336	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 5 - F	1 - 4 2 - 3 F - 5	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

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

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

Trapezoid Course with windward finish 60°, 120° interior angles

Course Axis	Trapezoid Course 60, 120 interior angles								
4 - 1 3 - 2 5 - F	1 - 4 2 - 3 F - 5	4 - 2	2 - 4	4 - 3 1 - 2	3 - 4 2 - 1	3 - 5	5 - 3	Signal - Pin	Pin - Signal
000	180	319	139	240	060	120	300	270	090
005	185	324	144	245	065	125	305	275	095
010	190	329	149	250	070	130	310	280	100
015	195	334	154	255	075	135	315	285	105
020	200	339	159	260	080	140	320	290	110
025	205	344	164	265	085	145	325	295	115
030	210	349	169	270	090	150	330	300	120
035	215	354	174	275	095	155	335	305	125
040	220	359	179	280	100	160	340	310	130
045	225	004	184	285	105	165	345	315	135
050	230	009	189	290	110	170	350	320	140
055	235	014	194	295	115	175	355	325	145
060	240	019	199	300	120	180	000	330	150
065	245	024	204	305	125	185	005	335	155
070	250	029	209	310	130	190	010	340	160
075	255	034	214	315	135	195	015	345	165
080	260	039	219	320	140	200	020	350	170
085	265	044	224	325	145	205	025	355	175
090	270	049	229	330	150	210	030	000	180
095	275	054	234	335	155	215	035	005	185
100	280	059	239	340	160	220	040	010	190
105	285	064	244	345	165	225	045	015	195
110	290	069	249	350	170	230	050	020	200
115	295	074	254	355	175	235	055	025	205
120	300	079	259	000	180	240	060	030	210
125	305	084	264	005	185	245	065	035	215
130	310	089	269	010	190	250	070	040	220
135	315	094	274	015	195	255	075	045	225
140	320	099	279	020	200	260	080	050	230
145	325	104	284	025	205	265	085	055	235
150	330	109	289	030	210	270	090	060	240
155	335	114	294	35	215	275	095	065	245
160	340	119	299	40	220	280	100	070	250
165	345	124	304	45	225	285	105	075	255
170	350	129	309	50	230	290	110	080	260
175	355	134	314	55	235	295	115	085	265

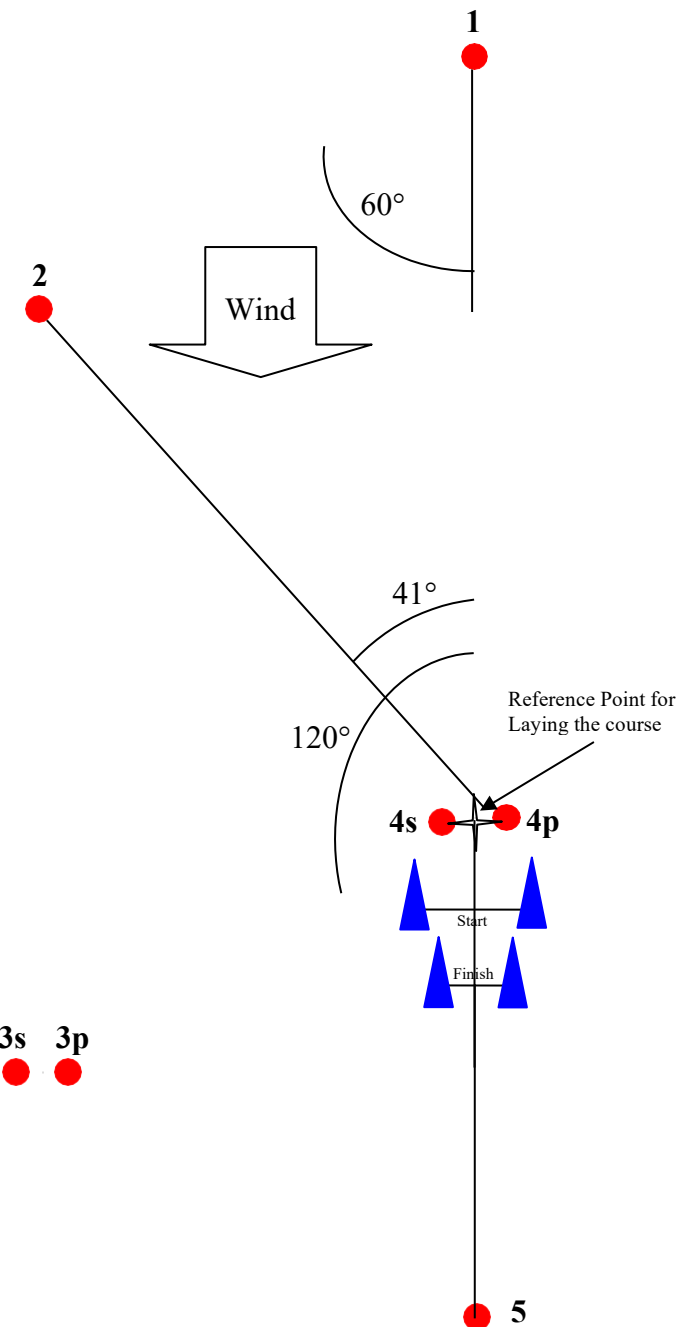
Course Axis									
4 - 1 3 - 2 5 - F	1 - 4 2 - 3 F - 5	4 - 2	2 - 4	4 - 3 1 - 2	3 - 4 2 - 1	3 - 5	5 - 3	Signal - Pin	Pin - Signal
180	000	139	319	060	240	300	120	090	270
185	005	144	324	065	245	305	125	095	275
190	010	149	329	070	250	310	130	100	280
195	015	154	334	075	255	315	135	105	285
200	020	159	339	080	260	320	140	110	290
205	025	164	344	085	265	325	145	115	295
210	030	169	349	090	270	330	150	120	300
215	035	174	354	095	275	335	155	125	305
220	040	179	359	100	280	340	160	130	310
225	045	184	004	105	285	345	165	135	315
230	050	189	009	110	290	350	170	140	320
235	055	194	014	115	295	355	175	145	325
240	060	199	019	120	300	000	180	150	330
245	065	204	024	125	305	005	185	155	335
250	070	209	029	130	310	010	190	160	340
255	075	214	034	135	315	015	195	165	345
260	080	219	039	140	320	020	200	170	350
265	085	224	044	145	325	025	205	175	355
270	090	229	049	150	330	030	210	180	000
275	095	234	054	155	335	035	215	185	005
280	100	239	059	160	340	040	220	190	010
285	105	244	064	165	345	045	225	195	015
290	110	249	069	170	350	050	230	200	020
295	115	254	074	175	355	055	235	205	025
300	120	259	079	180	000	060	240	210	030
305	125	264	084	185	005	065	245	215	035
310	130	269	089	190	010	070	250	220	040
315	135	274	094	195	015	075	255	225	045
320	140	279	099	200	020	080	260	230	050
325	145	284	104	205	025	085	265	235	055
330	150	289	109	210	030	090	270	240	060
335	155	294	114	215	035	095	275	245	065
340	160	299	119	220	040	100	280	250	070
345	165	304	124	225	045	105	285	255	075
350	170	309	129	230	050	110	290	260	080
355	175	314	134	235	055	115	295	265	085

60° Trapezoid with windward finish Course Lengths to Marks and Course Lengths – Equal beats, Reaches (1-2 and 3-5) two thirds of beat length

Start 0.05 NM downwind of 4S/4P(4) Finish 0.1 NM below the starting line

4 - 1 & 1 - 4	4 - 2 & 2 - 4	1 - 2 & 2 - 1	4 - 5	5 - F		IW2	IW3	IW4
2 - 3 & 3 - 2		4 - 3 & 3 - 4	5 - 4	F - 5		OW2	OW3	OW4
0.40	0.35	0.27	0.27	0.12		2.31	4.31	6.31
0.45	0.40	0.30	0.30	0.15		2.6	4.6	6.6
0.50	0.44	0.33	0.33	0.18		2.89	4.89	6.89
0.55	0.48	0.37	0.37	0.22		3.21	5.21	7.21
0.60	0.53	0.40	0.40	0.25		3.5	5.5	7.5
0.65	0.57	0.43	0.43	0.28		3.79	5.79	7.79
0.70	0.62	0.47	0.47	0.32		4.11	6.11	8.11
0.75	0.66	0.50	0.50	0.35		4.4	6.4	8.4
0.80	0.70	0.53	0.53	0.38		4.69	6.69	8.69
0.85	0.75	0.57	0.57	0.42		5.01	7.01	9.01
0.90	0.79	0.60	0.60	0.45		5.3	7.3	9.3
0.95	0.84	0.63	0.63	0.48		5.59	7.59	9.59
1.00	0.88	0.67	0.67	0.52		5.91	7.91	9.91
1.10	0.97	0.73	0.73	0.12		6.49	8.49	10.49
1.20	1.06	0.80	0.80	0.15		7.1	9.1	11.1
1.30	1.14	0.87	0.87	0.18		7.71	9.71	11.71
1.40	1.23	0.93	0.93	0.22		8.29	10.29	12.29
1.50	1.32	1.00	1.00	0.25		8.9	10.9	12.9
1.60	1.41	1.07	1.07	0.28		9.51	11.51	13.51
1.70	1.50	1.13	1.13	0.32		10.09	12.09	14.09
1.80	1.58	1.20	1.20	0.35		10.7	12.7	14.7
1.90	1.67	1.27	1.27	0.38		11.31	13.31	15.31
2.00	1.76	1.33	1.33	0.42		11.89	13.89	15.89

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



Windward-leeward courses

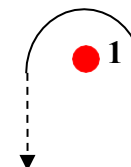
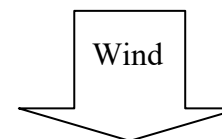
Course Axis				Course Axis			
4 – 1	1 - 4	Signal - Pin	Pin - Signal	4 – 1	1 - 4	Signal - Pin	Pin - Signal
000	180	270	090	180	000	090	270
005	185	275	095	185	005	095	275
010	190	280	100	190	010	100	280
015	195	285	105	195	015	105	285
020	200	290	110	200	020	110	290
025	205	295	115	205	025	115	295
030	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

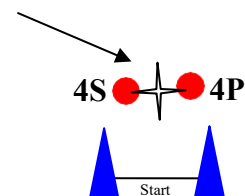
Start/Finish 0.05 nt mi downwind of mark 4S/4P (4)

Leg Length	Course Distances			
4 - 1	L1	L2	L3	L4
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



Reference Point for laying the course



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

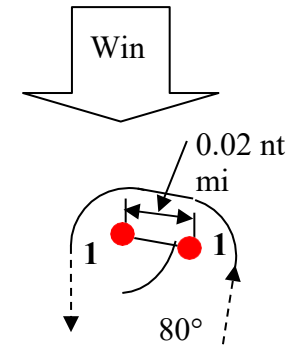
Course Distances			
L1	L2	L3	L4
1.12	2.14	3.16	4.18
1.32	2.54	3.76	4.98
1.52	2.94	4.36	5.78
1.72	3.34	4.96	6.58
1.92	3.74	5.56	7.38
2.12	4.14	6.16	8.18
2.32	4.54	6.76	8.98
2.52	4.94	7.36	9.78
2.72	5.34	7.96	10.58
2.92	5.74	8.56	11.38
3.12	6.14	9.16	12.18
3.32	6.54	9.76	12.98
3.52	6.94	10.36	13.78
3.72	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

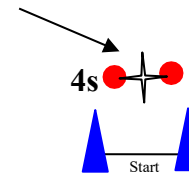
L2 Start – 1 – 4s/4p – 1 – Finish

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

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



Reference Point
for Laying the



45°, 90°, 45° Triangular course with start finish in the middle of the beat.

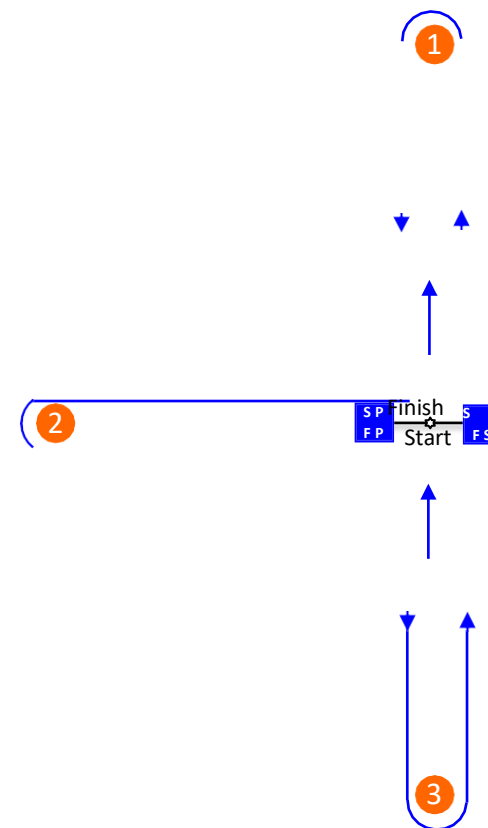
R - 1 3 - R	1 - R R - 3	R - 2 S - Pin	2 - R Pin - S		R - 1 3 - R	1 - R R - 3	R - 2 S - Pin	2 - R Pin - S
000	180	270	090		180	000	090	270
005	185	275	095		185	005	095	275
010	190	280	100		190	010	100	280
015	195	285	105		195	015	105	285
020	200	290	110		200	020	110	290
025	205	295	115		205	025	115	295
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

45°, 90°, 45° Triangular course with start finish in the middle of the beat.

R - 1 1 - R R - 3 3 - R	R - 2 2 - R	1 - 2 2 - 1 3 - 2 2 - 3
0.20	0.20	0.28
0.25	0.25	0.35
0.30	0.30	0.42
0.35	0.35	0.49
0.40	0.40	0.57
0.45	0.45	0.64
0.50	0.50	0.71
0.55	0.55	0.78
0.60	0.60	0.85
0.65	0.65	0.92
0.70	0.70	0.99
0.75	0.75	1.06
0.80	0.80	1.13
0.85	0.85	1.20
0.90	0.90	1.27
0.95	0.95	1.34
1.00	1.00	1.41
1.05	1.05	1.48
1.10	1.10	1.56
1.15	1.15	1.63
1.20	1.20	1.70
1.25	1.25	1.77
1.30	1.30	1.84
1.35	1.35	1.91
1.40	1.40	1.98
1.45	1.45	2.05
1.50	1.50	2.12

T1	T2	T3
0.96	1.76	2.72
1.20	2.20	3.40
1.44	2.64	4.08
1.68	3.08	4.76
1.94	3.54	5.48
2.18	3.98	6.16
2.42	4.42	6.84
2.66	4.86	7.52
2.90	5.30	8.20
3.14	5.74	8.88
3.38	6.18	9.56
3.62	6.62	10.24
3.86	7.06	10.92
4.10	7.50	11.60
4.34	7.94	12.28
4.58	8.38	12.96
4.82	8.82	13.64
5.06	9.26	14.32
5.32	9.72	15.04
5.56	10.16	15.72
5.80	10.60	16.40
6.04	11.04	17.08
6.28	11.48	17.76
6.52	11.92	18.44
6.76	12.36	19.12
7.00	12.80	19.80
7.24	13.24	20.48

R, the reference point,
is the middle of the starting line.
For projecting its location use
wind axis minus 90° and half starting line
length



T1	Start – 1 – 2 – 3 – Finish
T2	Start – 1 – 2 – 3 – 1 - 3 - Finish
T3	Start – 1 – 2 – 3 – 1 – 3 – 1 – 2 - 3 Finish

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

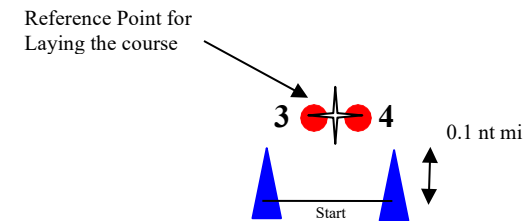
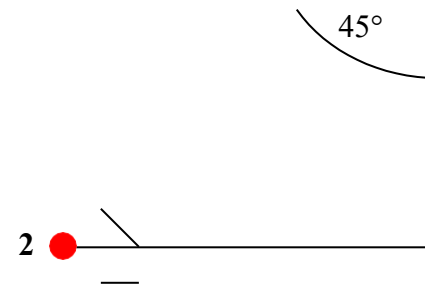
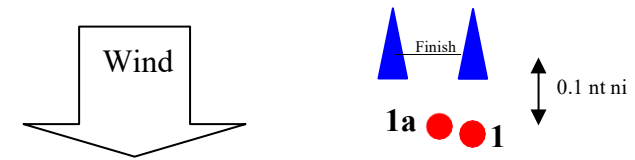
Start 0.1 NM downwind of mark 3/4 and Finish 0.1 NM above Mark 1

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

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 NM downwind of mark 3 or Finish 0.05 NM upwind of Mark 1

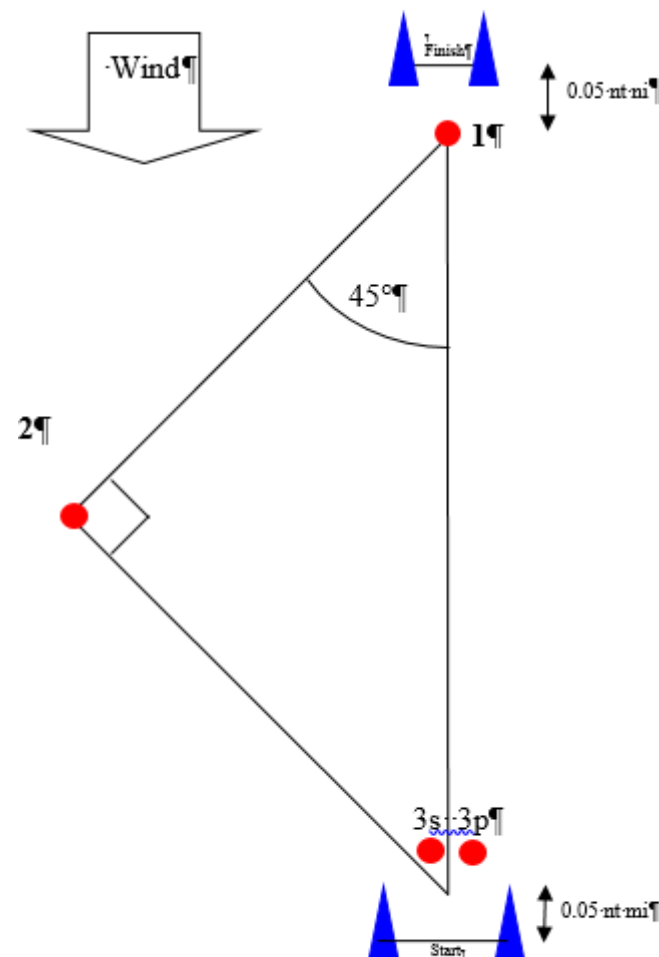
Course Axis	Angles ind degrees							Course Axis	Angles ind degrees						
3 to 1	1 to 3	3 to 2	2 to 3	1 to 2	2 to 1	Signal to Pin	Pin to Signal	3 to 1	1 to 3	3 to 2	2 to 3	1 to 2	2 to 1	Signal to Pin	Pin to Signal
000	180	315	135	225	045	270	090	180	000	135	315	045	225	090	270
005	185	320	140	230	050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

45°, 90°, 45° Triangular Course

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

Leg lengths		
3 to 1	3 to 2	1 to 2
1 to 3	2 to 3	2 to 1
0.30	0.21	0.21
0.35	0.25	0.25
0.40	0.28	0.28
0.45	0.32	0.32
0.50	0.35	0.35
0.55	0.39	0.39
0.60	0.42	0.42
0.65	0.46	0.46
0.70	0.49	0.49
0.75	0.53	0.53
0.80	0.57	0.57
0.85	0.60	0.60
0.90	0.64	0.64
0.95	0.67	0.67
1.00	0.71	0.71
1.05	0.74	0.74
1.10	0.78	0.78
1.15	0.81	0.81
1.20	0.85	0.85
1.25	0.88	0.88
1.30	0.92	0.92
1.35	0.95	0.95
1.40	0.99	0.99
1.45	1.03	1.03
1.50	1.06	1.06

Course Distances					
TL2	TL3	TL4	TW2	TW3	TW4
1.42	2.02	2.74	1.12	1.72	2.44
1.65	2.35	3.20	1.30	2.00	2.85
1.86	2.66	3.62	1.46	2.26	3.22
2.09	2.99	4.08	1.64	2.54	3.63
2.30	3.30	4.50	1.80	2.80	4.00
2.53	3.63	4.96	1.98	3.08	4.41
2.74	3.94	5.38	2.14	3.34	4.78
2.97	4.27	5.84	2.32	3.62	5.19
3.18	4.58	6.26	2.48	3.88	5.56
3.41	4.91	6.72	2.66	4.16	5.97
3.64	5.24	7.18	2.84	4.44	6.38
3.85	5.55	7.60	3.00	4.70	6.75
4.08	5.88	8.06	3.18	4.98	7.16
4.29	6.19	8.48	3.34	5.24	7.53
4.52	6.52	8.94	3.52	5.52	7.94
4.73	6.83	9.36	3.68	5.78	8.31
4.96	7.16	9.82	3.86	6.06	8.72
5.17	7.47	10.24	4.02	6.32	9.09
5.40	7.80	10.70	4.20	6.60	9.50
5.61	8.11	11.12	4.36	6.86	9.87
5.84	8.44	11.58	4.54	7.14	10.28
6.05	8.75	12.00	4.70	7.40	10.65
6.28	9.08	12.46	4.88	7.68	11.06
6.51	9.41	12.92	5.06	7.96	11.47
6.72	9.72	13.34	5.22	8.22	11.84



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

TW2 Start – 1 – 2 – 3s – Finish (Upwind)
TW3 Start – 1 – 2 – 3s – 1 – 3s/3p – Finish (Upwind)
TW4 Start – 1 – 2 – 3s – 1 – 3s/3p – 1 – 2 – 3s – Finish (Upwind)
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)

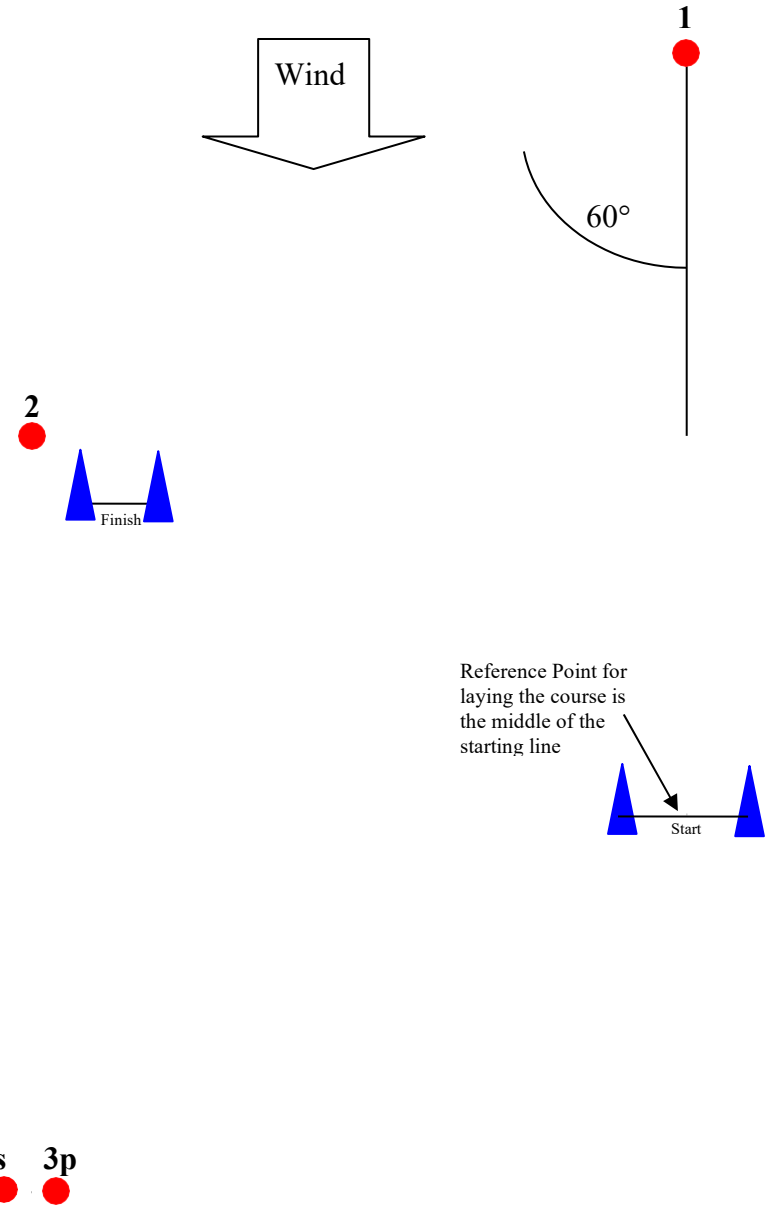
Optimist Course 60°, 120° interior angles - Finish laid 50 m from Mark 2 on the inside of the course.

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

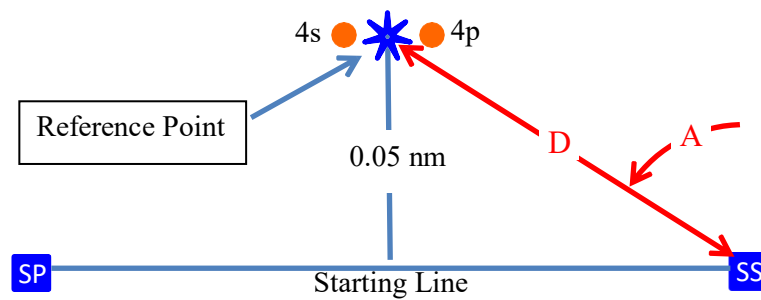
Course Axis	1 - Reference	2 - Reference	1 - 2	2 - 1	3 - Reference	Reference - 3	Signal - Pin	Pin - Signal
180	000	300	060	240	240	060	090	270
185	005	305	065	245	245	065	095	275
190	010	310	070	250	250	070	100	280
195	015	315	075	255	255	075	105	285
200	020	320	080	260	260	080	110	290
205	025	325	085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



2.5 Determining the Reference Position



Starting Line		Length (D) Signal Boat to Reference	Angle(A) to subtract from
Length	Length (Nt mi)		
80	0.04	0.05	23
90	0.05	0.06	26
100	0.05	0.06	28
110	0.06	0.06	31
120	0.06	0.06	33
130	0.07	0.06	35
140	0.08	0.06	37
150	0.08	0.06	39
160	0.09	0.07	41
170	0.09	0.07	43
180	0.1	0.07	44
190	0.1	0.07	46
200	0.11	0.07	47
210	0.11	0.08	49
220	0.12	0.08	50
230	0.12	0.08	51
240	0.13	0.08	52
250	0.13	0.08	53
260	0.14	0.09	55
270	0.15	0.09	56
280	0.15	0.09	57
290	0.16	0.09	57
300	0.16	0.1	58
310	0.17	0.1	59
320	0.17	0.1	60
330	0.18	0.1	61
340	0.18	0.1	61
350	0.19	0.11	62
360	0.19	0.11	63
370	0.2	0.11	63
380	0.21	0.11	64
390	0.21	0.12	65
400	0.22	0.12	65
410	0.22	0.12	66
420	0.23	0.12	66
430	0.23	0.13	67
440	0.24	0.13	67
450	0.24	0.13	68
460	0.25	0.13	68
470	0.25	0.14	68
480	0.26	0.14	69
490	0.26	0.14	69
500	0.27	0.14	70

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