Points

This sheet charts the shape of the shown reef. Some charts are copied to other sheets for illustrations, but all point calculations are confined to this sheet.

Secs

Subs

Details

Shown Reef
- **Unit exradius polygon**
- **Three View Chart**
- **Outer Frustum**
  - **Btm outer polygon**
  - **Top outer polygon**
  - **Outer lateral edges**
- **Inner Frustum**
  - **Top inner polygon**
  - **Btm inner polygon**
  - **Inner lateral edges**
- **Middle (Mean) Slice**
  - **inner middle polygon**
  - **outer middle polygon**
  - **Middle radial edges**

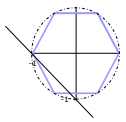
Triangle

Radial Slice
- **Relative Hole Data**
- **Trinion Geometry**
- **Points in Hole Chart**
- **Intersections**
- **Extended Lines**
- **Unused Points and Lines**

Shown Reef

$$e^{(x+dx)i} = e^{(x+dx)i} + e^{x\,i} * 2 \sin dx$$

Unit exradius polygon

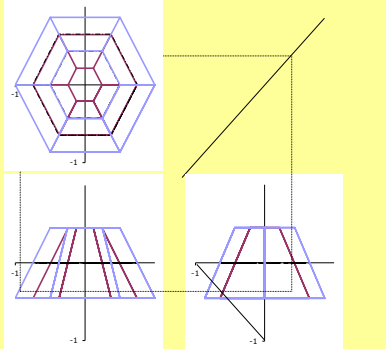


The sine and cosine values needed are calculated incrementally.

n =	6
ø =	0.524
dQ =	1.047
2 sin dQ =	1.732
one =	1.000 one

	w		sin	cos	
	1	0.000	-0.500	0.866	one
-1	1	0.000	0.500	0.866	one
1	1	0.000	1.000	0.000	one
3	1	0.000	0.500	-0.866	one
...	1	0.000	-0.500	-0.866	one
	1	0.000	-1.000	0.000	one
	1	0.000	-0.500	0.866	one
	1	0.000	0.500	0.866	one
	1	0.000	1.000	0.000	one
	l	**i**	**j**	**k**	

Three View Chart

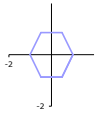


This is a copy of the three views in the Metrics worksheet. The aspect ratio should be 1::1 as shown by the \ diagonal, so that measurements on the screen should scale to calculated lengths elsewhere.

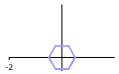
These are lists of quaterernions (4-D points) for rendering objects. They have nothing to go with the property calculations, but provide the points for rendering 2-D shapes to let us see what is happening.

Outer Frustum

Btm outer polygon



Top outer polygon



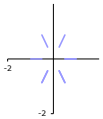
The units for display are either R or Δh so the plot area fits in a 2x2 square. The aspect ratio Δh/R should be measurable in the plots.

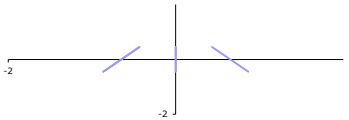
max radius:	mxR =	1.5	ft
vertical height:	Δh =	1.352	ft
aspect ratio:	Δh =	0.901	mxR
its inverse:	mxR =	1.109	Δh
display unit:	mxR	1.500	ft
	BeR =	1.000	m xR
	Δh =	0.901	m xR
	Δs =	1.000	m xR
	TeR =	0.500	m xR

Chart

	w	h	B	A	
-1	1	-0.451	-0.500	-0.866	m xR
1	1	-0.451	0.500	-0.866	m xR
3	1	-0.451	1.000	0.000	m xR
5	1	-0.451	0.500	0.866	m xR
7	1	-0.451	-0.500	0.866	m xR
9	1	-0.451	-1.000	0.000	m xR
11	1	-0.451	-0.500	-0.866	m xR
13	1	-0.451	0.500	-0.866	m xR
15	1	-0.451	1.000	0.000	m xR
-1	1	0.451	-0.250	-0.433	m xR
1	1	0.451	0.250	-0.433	m xR
3	1	0.451	0.500	0.000	m xR
5	1	0.451	0.250	0.433	m xR
7	1	0.451	-0.250	0.433	m xR

Outer lateral edges





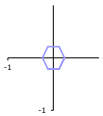
top 0.451 mXR
mdl 0.000 mXR
btm -0.451 mXR

9	1	0.451	-0.500	0.000	mXR
11	1	0.451	-0.250	-0.433	mXR
13	1	0.451	0.250	-0.433	mXR
15	1	0.451	0.500	0.000	mXR
-1	1	-0.451	-0.500	-0.866	mXR
	1	0.451	-0.250	-0.433	mXR
1	1	-0.451	0.500	-0.866	mXR
	1	0.451	0.250	-0.433	mXR
3	1	-0.451	1.000	0.000	mXR
	1	0.451	0.500	0.000	mXR
5	1	-0.451	0.500	0.866	mXR
	1	0.451	0.250	0.433	mXR
7	1	-0.451	-0.500	0.866	mXR
	1	0.451	-0.250	0.433	mXR
9	1	-0.451	-1.000	0.000	mXR
	1	0.451	-0.500	0.000	mXR
11	1	-0.451	-0.500	-0.866	mXR
	1	0.451	-0.250	-0.433	mXR
13	1	-0.451	0.500	-0.866	mXR
	1	0.451	0.250	-0.433	mXR
15	1	-0.451	1.000	0.000	mXR
	1	0.451	0.500	0.000	mXR

Inner Frustum

Top inner polygon

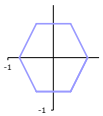
TIR = 0.243 mXR



-1	1	0.451	-0.122	-0.211	mXR
1	1	0.451	0.122	-0.211	mXR
3	1	0.451	0.243	0.000	mXR
5	1	0.451	0.122	0.211	mXR
7	1	0.451	-0.122	0.211	mXR
9	1	0.451	-0.243	0.000	mXR
11	1	0.451	-0.122	-0.211	mXR
13	1	0.451	0.122	-0.211	mXR
15	1	0.451	0.243	0.000	mXR

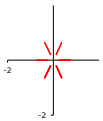
Btm inner polygon

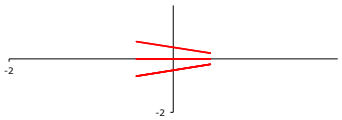
TeR = 0.743 mXR

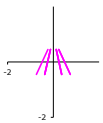


-1	1	-0.451	-0.372	-0.644	mXR
1	1	-0.451	0.372	-0.644	mXR
3	1	-0.451	0.743	0.000	mXR
5	1	-0.451	0.372	0.644	mXR
7	1	-0.451	-0.372	0.644	mXR
9	1	-0.451	-0.743	0.000	mXR
11	1	-0.451	-0.372	-0.644	mXR
13	1	-0.451	0.372	-0.644	mXR
15	1	-0.451	0.743	0.000	mXR

Inner lateral edges







-1	1	0.451	-0.122	-0.211	mXR
	1	-0.451	-0.372	-0.644	mXR
1	1	0.451	0.122	-0.211	mXR
	1	-0.451	0.372	-0.644	mXR
3	1	0.451	0.243	0.000	mXR
	1	-0.451	0.743	0.000	mXR
5	1	0.451	0.122	0.211	mXR
	1	-0.451	0.372	0.644	mXR
7	1	0.451	-0.122	0.211	mXR
	1	-0.451	-0.372	0.644	mXR
9	1	0.451	-0.243	0.000	mXR
	1	-0.451	-0.743	0.000	mXR
11	1	0.451	-0.122	-0.211	mXR
	1	-0.451	-0.372	-0.644	mXR
13	1	0.451	0.122	-0.211	mXR
	1	-0.451	0.372	-0.644	mXR
15	1	0.451	0.243	0.000	mXR
	1	-0.451	0.743	0.000	mXR

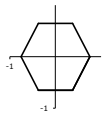
Middle (Mean) Slice

inner middle polygon

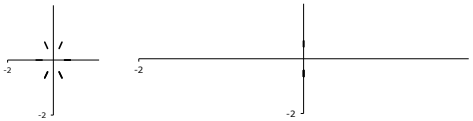
MIR = 0.493 ft

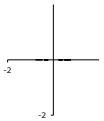
-1	1	0.000	-0.247	-0.427	mXR
1	1	0.000	0.247	-0.427	mXR
3	1	0.000	0.493	0.000	mXR
5	1	0.000	0.247	0.427	mXR
7	1	0.000	-0.247	0.427	mXR

outer middle polygon



Middle radial edges





MeR = 0.750 ft

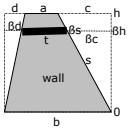
9	1	0.000	-0.493	0.000	m xR
11	1	0.000	-0.247	-0.427	m xR
13	1	0.000	0.247	-0.427	m xR
15	1	0.000	0.493	0.000	m xR
-1	1	0.000	-0.375	-0.650	m xR
1	1	0.000	0.375	-0.650	m xR
3	1	0.000	0.750	0.000	m xR
5	1	0.000	0.375	0.650	m xR
7	1	0.000	-0.375	0.650	m xR
9	1	0.000	-0.750	0.000	m xR
11	1	0.000	-0.375	-0.650	m xR
13	1	0.000	0.375	-0.650	m xR
15	1	0.000	0.750	0.000	m xR
-1	1	0.000	-0.247	-0.427	m xR
	1	0.000	-0.375	-0.650	m xR
1	1	0.000	0.247	-0.427	m xR
	1	0.000	0.375	-0.650	m xR
3	1	0.000	0.493	0.000	m xR
	1	0.000	0.750	0.000	m xR
5	1	0.000	0.247	0.427	m xR
	1	0.000	0.375	0.650	m xR
7	1	0.000	-0.247	0.427	m xR
	1	0.000	-0.375	0.650	m xR
9	1	0.000	-0.493	0.000	m xR
	1	0.000	-0.750	0.000	m xR
11	1	0.000	-0.247	-0.427	m xR
	1	0.000	-0.375	-0.650	m xR
13	1	0.000	0.247	-0.427	m xR
	1	0.000	0.375	-0.650	m xR
15	1	0.000	0.493	0.000	m xR
	1	0.000	0.750	0.000	m xR

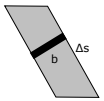
end middle

Triangle

This illustrative triangle is one section of the btm polygon.

0	0.000	0.000
A	-0.500	-0.866
B	0.500	-0.866
0	0.000	0.000

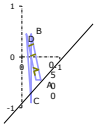




Radial Slice

The theory behind these 2D calculations is that of trinions, a homogeneous extension of 2D points into 3D. Any nonzero multiple of a trinion represents the same 2D point or line. Familiar operations on **i,j,k** vectors support required operations on 2D points and lines. See **Trinion Geometry** below. The notion extends to 3D points and planes, which is more than enough for now.

This is a side view of one panel showing the axes of horizontal or normal holes through its thickness. The relative widths are hole diameters measured horizontally. The vertical widths can be inferred.



Relative Hole Data

		normal?	TRUE	ß *el widths*		
1.000	m xR	Δs				
0.042	m xR	md		5/8	1/12	Δs
0.069	m xR	tp		7/8	5/36	Δs
0.069	m xR	bt		2/8	5/36	Δs

Trinion Geometry

distance from point to line:	d	D • N				0.5313	units
normal to AB through D:	N|D	N – d **k**	- 17/32	- 585/649	1/4		
check that N|D goes thru D:	√	(N|D)•D				3E-17	units
fence halfway between A and B:	A|B	A'–B'	- 3/32	- 585/649	1/4		parallel to N
intersection of two lines:	NxAB	N x AB					
extended line through A and B:	AB	A x B	- 24/71	1/4	585/649		
intersection AB at N	ABx\	AB x N	7/8	6/71	39/128		

Points in Hole Chart

	P	N•*P*	*P*• **k**	*P*• **i**=*P'*•**i**	*P*• **j**=*P'*•**j**	*P'*• ***k***	**Fence Logic**
	A	0.531	1	-0.451	0.500	-0.227	|P-X| < |Q-X|
	B	-0.344	1	0.451	0.250	-0.133	(P-X)•(P-X) – (Q-X)•(Q-X) < 0
|A-B| =	N	A – B	0	- 585/649	1/4		= fence A | B normal to AxB
ray normal to AB thru O:	C	-0.376	1	0.451	0.122	-0.109	P•P-2P•X – (Q•Q-2Q•X) < 0
	D	0.499	1	-0.451	0.372	-0.171	(P•P-Q•Q)/2 – (P-Q)•X < 0
	A		1	-0.451	0.500	-0.227	((P-P•P/2)–(Q-Q•Q/2))•(X+1) > 0
							(P'–Q')•(X+**k**) > 0
	tpo	-0.149	1	0.250	0.306	-0.047	

	tpi	-0.149	1	0.217	0.186	-0.041		
	mdo	0.045	1	0.050	0.361	-0.066	= A+ß(B-A)	
	mdi	0.045	1	0.017	0.242	-0.029	= CD x md | D+ß(C-D)	
	bti+	0.267	1	-0.212	0.305	-0.069		
	bto	0.337	1	-0.250	0.444	-0.099		
	bti	0.337	1	-0.283	0.325	-0.093		
	bti–	0.406	1	-0.355	0.345	-0.123		

Intersections

	apex	-0.305	1/4	24/71	0		= AB x axis	
inner centers:	cmdr	-0.039	- 7/8	- 11/738	- 65/307		= CD x md	
	ctpn	0.131	- 7/8	- 120/631	- 23/141		= CD x tp	
	cbtn	-0.295	- 7/8	31/125	- 76/267		= CD x bt	
	cbtn-	-0.234	- 7/8	94/507	- 58/217		= CD x bt	
	cbtn-	-0.355	- 7/8	214/689	- 286/947		= CD x bt	

Extended Lines

inner face:	CD	C x D	165/742	- 1/4	- 585/649		= C x D
	md		- 13/288	- 585/649	1/4		= same fence maybe shifted
	tp		43/288	- 585/649	1/4		= fence shifted up
	bt		- 97/288	- 585/649	1/4		= fence shifted dn
	bt+r		- 77/288	- 585/649	1/4		top of hole
	bt–r		- 13/32	- 585/649	1/4		bottom of hole
	axis		0	0	1		

Unused Points and Lines

Y intercept:	cYo	-0.041	- 585/649	13/288	0		= axis x md
plottable Y intercept:	Yo		1	- 32/639	0	-0.001	
the origin:	O	0	1	0	0	0	
top thickness:	BC		-0.057824	0.1283001	0		= B x C
btm thickness:	DA		-0.057824	-0.1283	0		= D x A