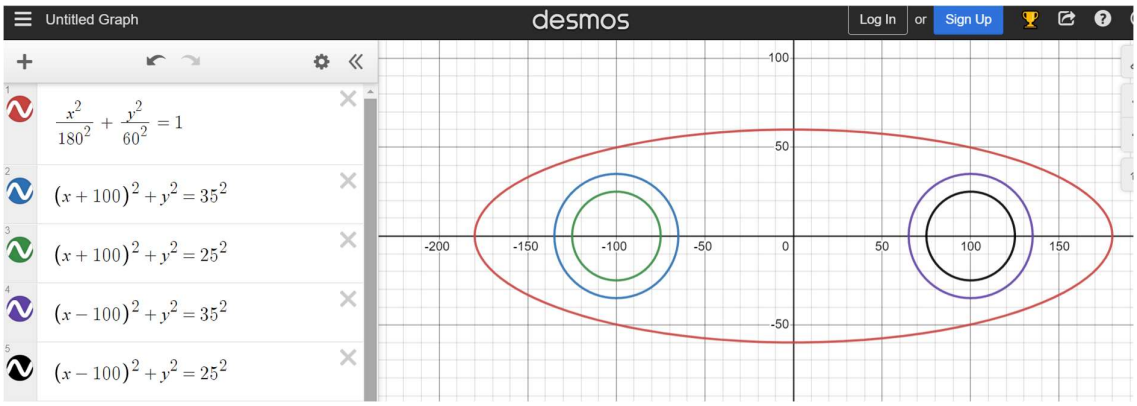
Assessment schedule: Mathematics and Statistics 91573 – Designer Tables

Evidence/Judgements for Achievement	Evidence/Judgements for Achievement with Merit	Evidence/Judgements for Achievement with Excellence
Apply the geometry of conic sections in solving problems **The student has demonstrated this by:** • selecting and using methods • demonstrating knowledge of concepts and terms • communicating using appropriate representations. *For example a student could:* Using the properties of conic sections, find **at least** two equations (of different types of conics) which model the circular base plates, hyperbolic pillar, parabolic and elliptic tabletop. The hyperbola can be an approximation that looks to be a good fit.	Apply the geometry of conic sections, using relational thinking, in solving problems **The student has demonstrated this by using one or more of:** • selecting and carrying out a logical sequence of steps • connecting different concepts or representations • demonstrating understanding of concepts • forming and using a model; AND • relating findings to a context, or communicating thinking using appropriate mathematical statements. *For example a student could:* Using the properties of conic sections, find **all the** equations which model the circular base plates, hyperbolic pillar, parabolic and elliptic tabletop. The hyperbola can be an approximation that looks to be a good fit.	Apply the geometry of conic sections, using extended abstract thinking, in solving problems. **The student has demonstrated this by:** • devising a strategy to investigate or solve a problem • identifying relevant concepts in context • developing a chain of logical reasoning, or proof • forming a generalisation; AND • using correct mathematical statements, or communicating mathematical insight. *For example a student could:* Using the properties of conic sections, find **all the** equations which model the circular base plates, hyperbolic pillar, parabolic and elliptic tabletop. AND Find the exact values for the equation of the hyperbola.

Final grades will be decided using professional judgement based on **a holistic examination of the evidence provided** against the criteria in the Achievement Standard.

Possible solutions to calculations (equations written using cm as units of measurement):

Elliptic table top:

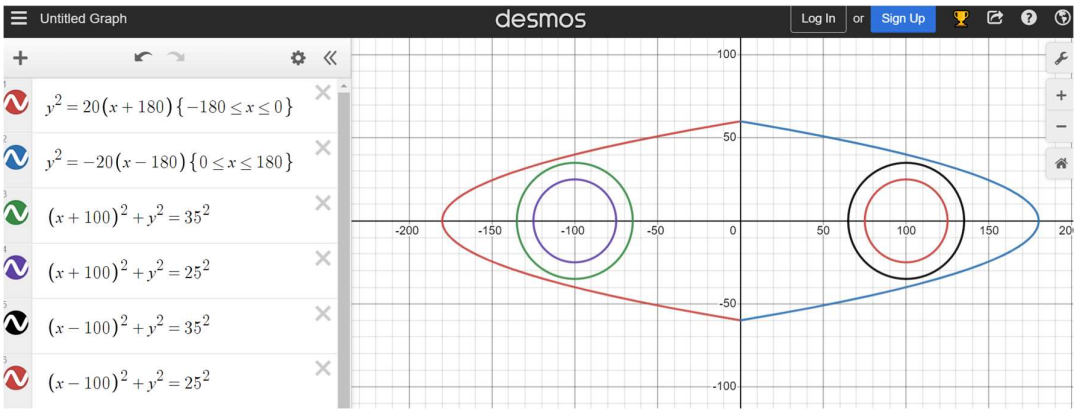


Elliptic table top $\frac{x^2}{180^2}+\frac{y^2}{60^2}=1$

Metal base plate outer edge – left $(x+100)^2+y^2=35^2$ right $(x-100)^2+y^2=35^2$

Metal base plate inner edge – left $(x+100)^2+y^2=25^2$ right $(x-100)^2+y^2=25^2$

Parabolic table top:



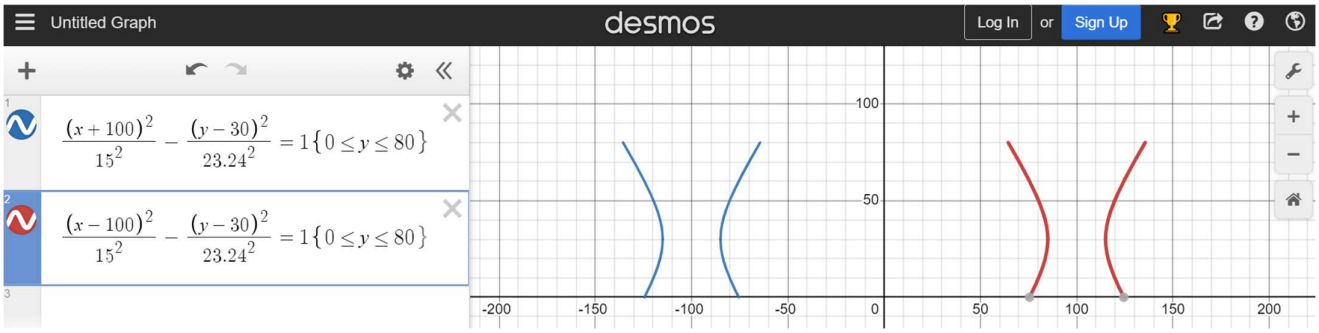
Parabolic table top:

- Left hand side $y^2=20(x+180), -180\le x\le 0$
- Right hand side $y^2=-20(x-180), 0\le x\le 180$

Metal base plate outer edge – left $(x+100)^2+y^2=35^2$ right $(x-100)^2+y^2=35^2$

Metal base plate inner edge – left $(x+100)^2+y^2=25^2$ right $(x-100)^2+y^2=25^2$

Hyperboloid structural pillars:



Exact values for the hyperbolic equation:

Left hand side pillar:

$\frac{(x+100)^2}{a^2} - \frac{(y-30)^2}{b^2} = 1$ passing through points (-75, 0) and (-65, 80):

Through (-75, 0)

$$\frac{625}{a^2} - \frac{900}{b^2} = 1$$
$$a^2 = \frac{625b^2}{b^2 + 900}$$

Through (-65, 80)

$$\frac{35^2}{a^2} - \frac{50^2}{b^2} = 1$$
$$\frac{1225}{a^2} - \frac{2500}{b^2} = 1$$

Substituting for a^2

$$\frac{1225(b^2 + 900)}{625b^2} - \frac{2500}{b^2} = 1$$
$$600b^2 - 460000 = 0$$
$$b^2 = \frac{2300}{3}$$
$$a^2 = \frac{575}{2}$$

Equations of hyperbolic pillars are

Left hand side $\frac{2(x+100)^2}{575} - \frac{3(y-30)^2}{2300} = 1$

Right hand side $\frac{2(x-100)^2}{575} - \frac{3(y-30)^2}{2300} = 1$