

Quadric Surfaces

SUGGESTED REFERENCE MATERIAL:

As you work through the problems listed below, you should reference Chapter 11.7 of the recommended textbook (or the equivalent chapter in your alternative textbook/online resource) and your lecture notes.

EXPECTED SKILLS:

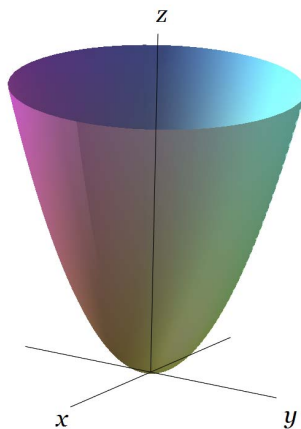
- Be able to compute & traces of quadric surfaces; in particular, be able to recognize the resulting conic sections in the given plane.
- Given an equation for a quadric surface, be able to recognize the type of surface (and, in particular, its graph).

PRACTICE PROBLEMS:

For problems 1-9, use traces to identify and sketch the given surface in 3-space.

1. $4x^2 + y^2 + z^2 = 4$
2. $-x^2 - y^2 + z^2 = 1$
3. $4x^2 + 9y^2 - 36z^2 = 36$
4. $z = 4x^2 + y^2$
5. $z^2 = x^2 + y^2$
6. $x^2 + y^2 - z^2 = 1$
7. $z = 4 - x^2 - y^2$
8. $3x^2 + 4y^2 + 6z^2 = 12$
9. $-4x^2 - 9y^2 + 36z^2 = 36$
10. Identify each of the following surfaces.
 - (a) $16x^2 + 4y^2 + 4z^2 - 64x + 8y + 16z = 0$
 - (b) $-4x^2 + y^2 + 16z^2 - 8x + 10y + 32z = 0$
11. Consider the paraboloid $z = x^2 + y^2$
 - (a) Compute equations for the traces in the $z = 0$, $z = 1$, $z = 2$, and $z = 3$ planes.

- (b) Sketch all the traces that you found in part (a) on the same coordinate axes.
- (c) Compute equations for the traces in the $y = 0$, $y = 1$, $y = 2$, and $y = 3$ planes.
- (d) Sketch all the traces that you found in part (c) on the same coordinate axes.
- (e) Below is the graph of $z = x^2 + y^2$. On the graph of the surface, sketch the traces that you found in parts (a) and (c).



For problems 12-13, find an equation of the trace of the surface in the indicated plane. Describe the graph of the trace.

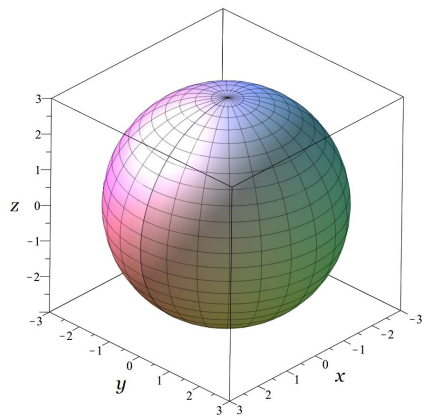
- 12. Surface: $8x^2 + y^2 + z^2 = 9$; Plane: $z = 1$
- 13. Surface: $-4x^2 - 4y^2 + 9z^2 = 35$; Plane $x = \frac{1}{2}$

For problems 14-15, sketch the indicated region.

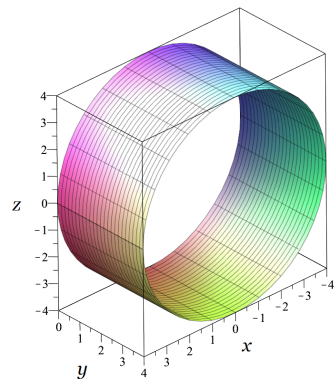
- 14. The region bounded below by $z = \sqrt{x^2 + y^2}$ and bounded above by $z = 2 - x^2 - y^2$.
- 15. The region bounded below by $2z = x^2 + y^2$ and bounded above by $z = y$.
- 16. Match each equation to an appropriate graph from the table below.

- (a) $x^2 - y + z^2 = 0$
- (b) $4x^2 - 9y^2 + 36z^2 = -36$
- (c) $4x^2 + 4y^2 + 4z^2 = 36$
- (d) $x^2 + z^2 = 16$
- (e) $x^2 + z - y^2 = 0$
- (f) $4x^2 - 36y^2 + 9z^2 = 36$

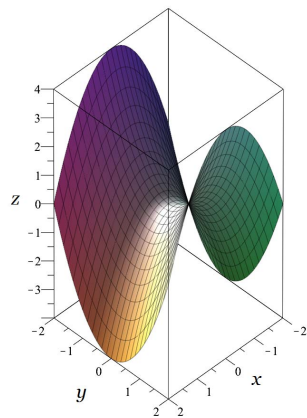
(I)



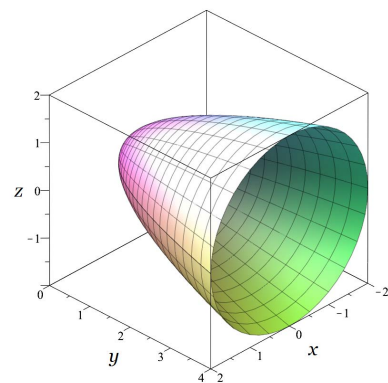
(IV)



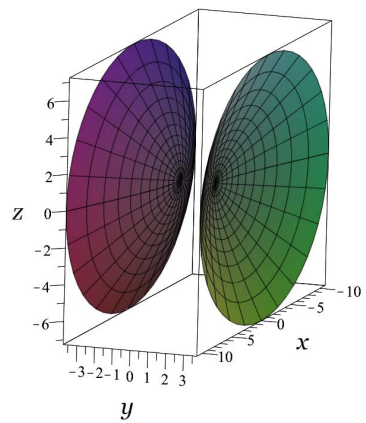
(II)



(V)



(III)



(VI)

