

Important to know...

Answers

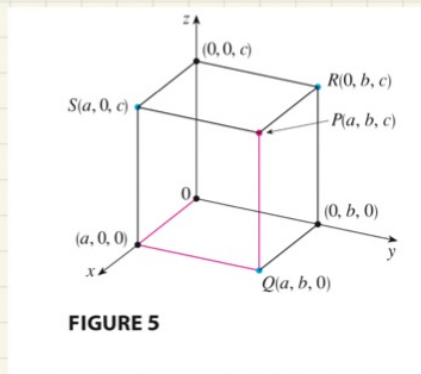


FIGURE 5

① The distance from  $P(x_1, y_1, z_1)$  to  $P(x_2, y_2, z_2)$  is

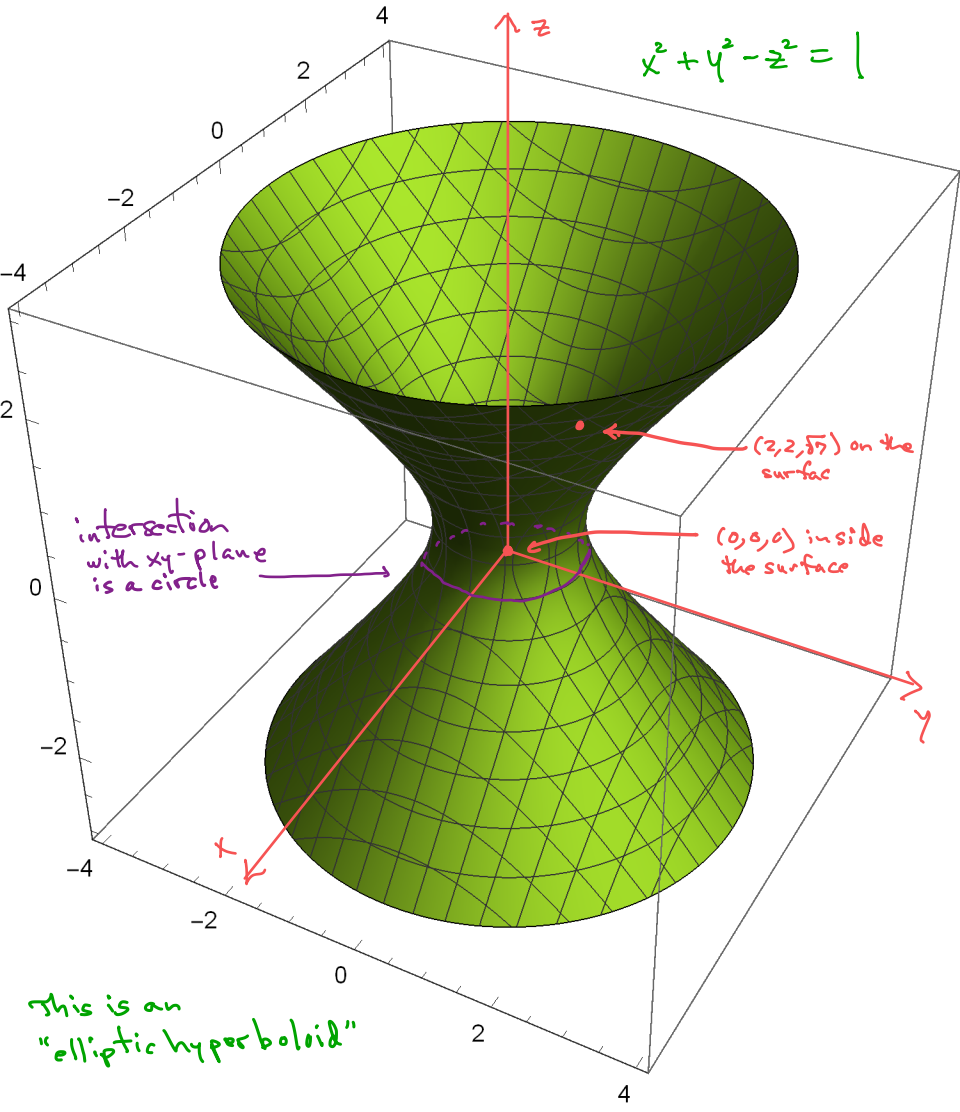
$$\text{dist}(P, Q) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

observe:  $\text{dist}(P, Q) = \text{dist}(Q, P)$  (can you show it?)

⑤ The graph in  $xyz$ -space of an equation in  $F(x, y, z) = 0$  with variables  $x, y, z$  consists of all points  $(x, y, z)$  which satisfy the equation.

Example Consider the equation  $x^2 + y^2 - z^2 = 1$  (which may also be written as  $x^2 + y^2 - z^2 - 1 = 0$ ),

- its graph does not go thru  $(0, 0, 0)$  because  $0^2 + 0^2 - 0^2 \neq 1$
  - its graph does go thru  $(2, 2, \sqrt{7})$  b/c  $2^2 + 2^2 - (\sqrt{7})^2 = 1$ .
  - its graph contains all points  $(x, y, 0)$  where  $x^2 + y^2 = 1$ .
- The full graph is pictured on the next page (but it will be a few chapters down the road before we can explain this).



answers continued...

(2) The coordinate planes are:

$xy$ -plane: contains  $x$  and  $y$  axes, and is the graph of  $z=0$

$xz$ -plane: contains  $x$  and  $z$  axes, and is the graph of  $y=0$

$yz$ -plane: contains  $y$  and  $z$  axes, and is the graph of  $x=0$

(3) The  $x$ -axis consists of all points  $(x, y, z)$  where both  $y=0$  and  $z=0$ . These equations describe the  $x$ -axis as the intersection of the  $xy$ -plane ( $z=0$ ) and the  $xz$ -plane ( $y=0$ ). Similarly

$y$ -axis :  $x=0$  and  $z=0$

$z$ -axis :  $x=0$  and  $y=0$

(4) The octants are determined by specifying the  $\pm$  signs for the  $x$ -coordinate of a point, the  $y$ -coordinate and the  $z$ -coordinate

first octant would be all points  $(x, y, z)$  where  $x \geq 0$ ,  $y \geq 0$  and  $z \geq 0$ .

another octant would consist of points  $(x, y, z)$  where  $x \leq 0$ ,  $y \geq 0$  and  $z \leq 0$ .

(There are 8 possibilities.)