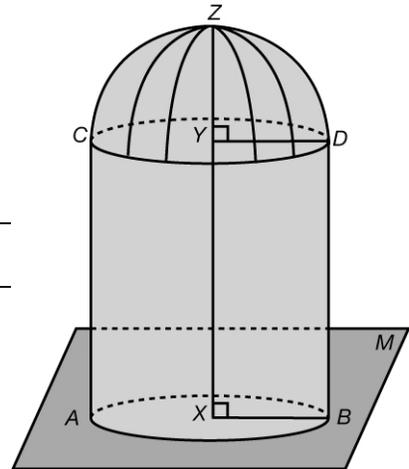


### Storage: Silos and Spherical Tanks

Grain producers often store grain in silos. A typical silo is a right circular cylinder with a spherical cap. Sometimes the cap is a hemisphere. Gasoline and other liquids are sometimes stored in spherical storage tanks.

1. This diagram shows a silo whose cap is a hemisphere with center  $Y$ .



- a. Write an algebraic expression for the total volume of the silo. Include both the cylinder and the cap.

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- b. Explain why the radius of the hemisphere is the same as the radius of the circular base.

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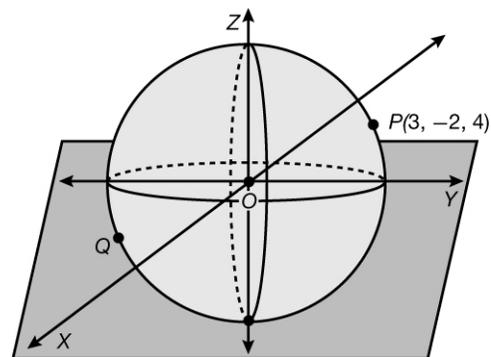
- c. A silo has base radius 12 feet and cylinder height 24 feet. Write a numerical expression for total volume. Do not simplify.

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2. This diagram shows a spherical storage tank for gasoline. The sphere has center  $O(0, 0, 0)$ . Points  $P$  and  $Q$  are on the sphere.



- a. Point  $O$  is the midpoint of  $\overline{PQ}$ . Use midpoint equations to find the coordinates of  $Q$ . Show your work.

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- b. Find  $PQ$  in simplest radical form. Show your work.

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3. The spherical top of this silo is a hemisphere. The cylindrical base is a right circular cylinder. There is an overhang as shown.

a. In words, as best as you can, describe symmetry in the silo using a plane as the basis of symmetry.

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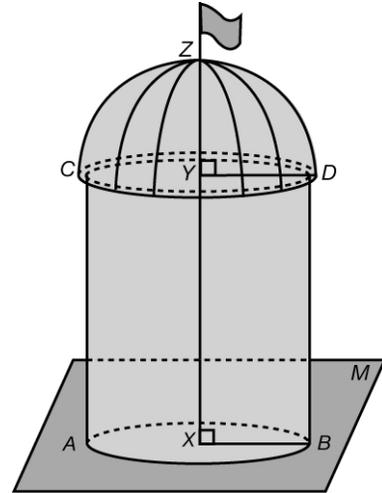
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b. Is the silo symmetric about the plane containing  $A$ ,  $Y$ , and  $D$ ? Explain your response.

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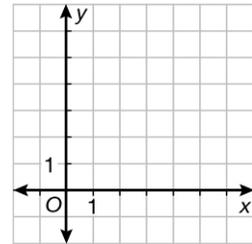


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4. This silo's circular base is a circle inscribed in the square bounded by  $2 \leq x \leq 6$  and  $2 \leq y \leq 6$ .

a. On this grid, sketch the solution region for this system of inequalities. Describe the solution region.




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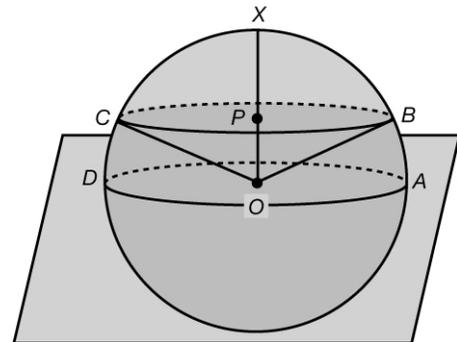
b. Find the radius and area of the circular base for the silo. Show your work.

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5. This diagram shows a spherical storage tank. The level of the liquid in the tank is shown by the cross section that is the circle with center  $P$  and diameter  $\overline{CB}$ . Consider the vertical cross section that is the circle with center  $O$  and radius  $OA$ . The radius,  $OA$ , of the tank is 12 ft and  $PB$  is 75% of  $OA$ . To the nearest tenth, find the area of the cross section bounded by  $\overline{BC}$  and  $\widehat{BC}$ . Show your work.




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