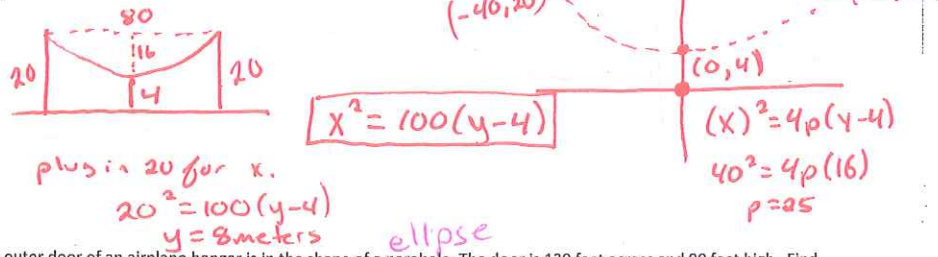


Friday, April 26th

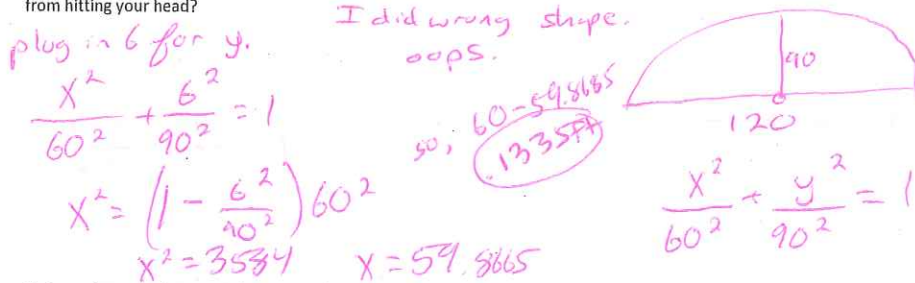
Parabola and Ellipse Word Problems

For each problem, draw a picture on a coordinate plane, clearly showing important points. Then, write an equation and use it to answer each question. SHOW ALL WORK.

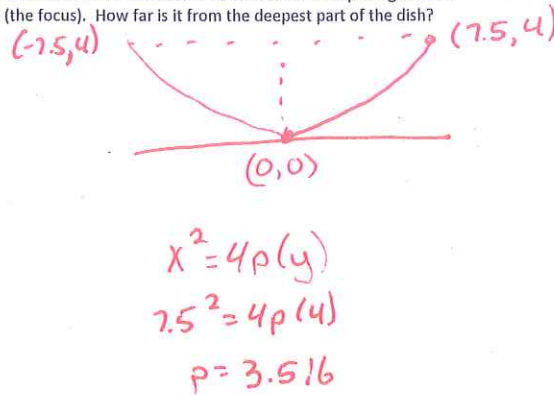
- 1) The main cables of a suspension bridge are 20 meters above the road at the towers and 4 meters above the road at the center. The road is 80 meters long. Vertical cables are spaced every 10 meters. The main cables hang in the shape of a parabola. Find the equation of the parabola. Then, determine how high the main cable is 20 meters from the center.



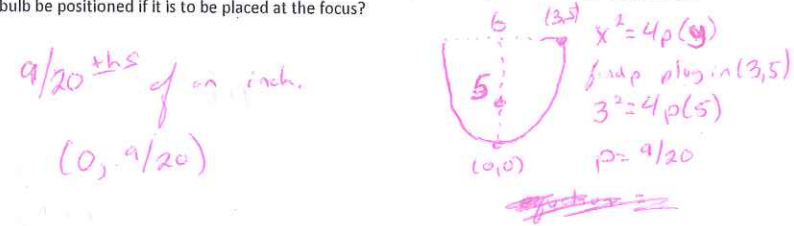
- 2) The outer door of an airplane hangar is in the shape of a parabola. The door is 120 feet across and 90 feet high. Find an equation describing the door's shape. If you are 6 feet tall, how far must you stand from the edge of the door to keep from hitting your head?



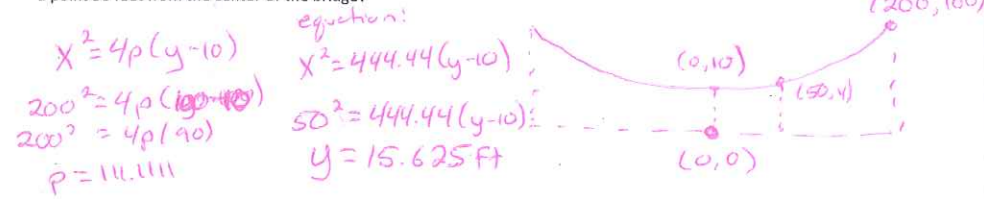
- 3) An engineer designs a satellite dish with a parabolic cross-section. The dish is 15 ft. wide at the opening and the depth is 4 feet. Find the position of the light source (the focus). How far is it from the deepest part of the dish?



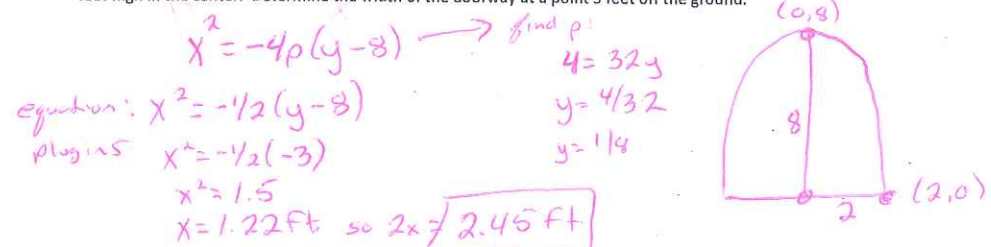
- 4) A car headlight mirror has a parabolic cross section with diameter of 6 in, and a depth of 5 in. How far from the vertex should the bulb be positioned if it is to be placed at the focus?



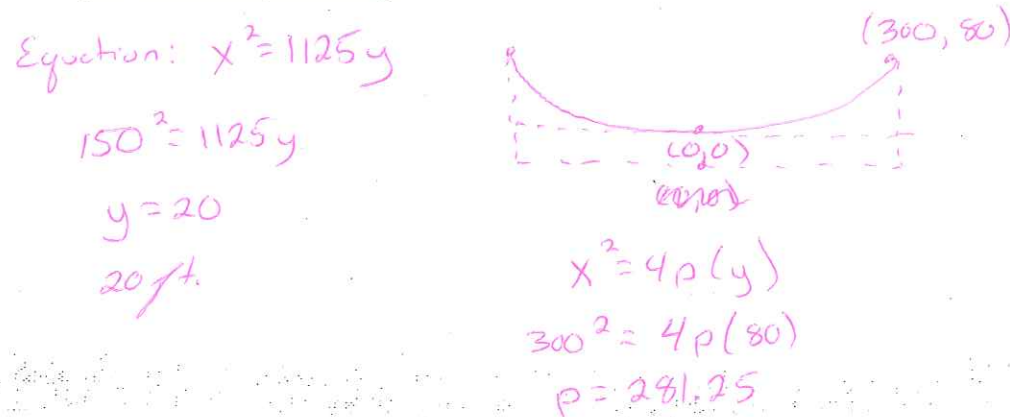
- 5) The cables of a suspension bridge are in the shape of a parabola. The towers supporting the cable are 400 feet apart and 100 feet high. If the cables are at a height of 10 feet midway between the towers, what is the height of the cable at a point 50 feet from the center of the bridge?



- 6) A doorway in a castle is shaped like a parabola. Find an equation describing the door given that it is 4 feet across and 8 feet high in the center. Determine the width of the doorway at a point 5 feet off the ground.



- 7) The cables of a suspension bridge are in the shape of a parabola. The towers supporting the cable are 600 feet apart and 80 feet high. If the cables touch the road surface midway between the towers, what is the height of the cable at a point 150 feet from the center of the bridge?



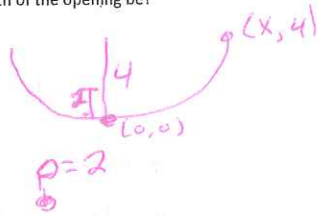
8) A searchlight is shaped like a parabola of revolution. If the light source is located 2 feet from the base along the axis of symmetry and the depth of the searchlight is 4 feet, what should the width of the opening be?

$$x^2 = 4p(y)$$

$$x^2 = 8(4)$$

$$x^2 = 32$$

$$x = 4\sqrt{2} \quad \text{width} = 8\sqrt{2}$$



9) According to Kepler's Laws, planets have elliptical orbits, with the sun at one of the foci. The farthest Pluto gets from the sun is 7.4 billion kilometers. The closest it gets to the sun is 4.4 billion kilometers. Find the equation of Pluto's orbit assuming a center at (0,0).

Farthest = $a+c$

$$\frac{x^2}{5.9^2} + \frac{y^2}{5.7^2} = 1$$

Closest = $a-c$

$$7.4 = a+c$$

$$4.4 = a-c$$

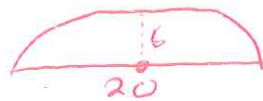
$$11.8 = 2a$$

$$a = 5.9, \therefore c = 1.5, \text{ so } c^2 = a^2 - b^2, 1.5^2 = 5.9^2 - b^2, b^2 = 32.56, b = 5.7$$



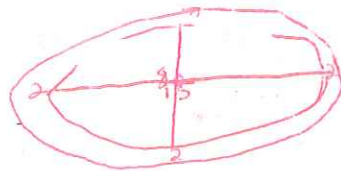
10) An arch in the shape of the upper half of an ellipse is used to support a bridge that is to span a river 20 meters wide. The center of the arch is 6 meters above the center of the river. Write an equation for the ellipse if the x-axis coincides with the water level and the y-axis passes through the center of the arch.

$$\frac{(x)^2}{100} + \frac{y^2}{36} = 1$$



11) An elliptically shaped garden is surrounded by a wood walkway. The garden is 15 meters long and 8 meters wide. The walkway is 2 meters wide. Find the equation describing the ellipse that includes both the garden and the walkway.

$$\frac{(x)^2}{(9.5)^2} + \frac{y^2}{6^2} = 1$$

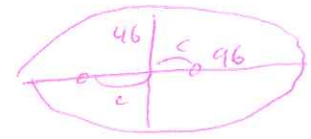


major = 19
minor = 12

12) The Statuary Hall in the United States Capitol is elliptical. It measures 46 feet wide and 96 feet long. If a person is standing at one focus, her whisper can be heard by a person standing at the other focus. How far apart are the two people?

$$\frac{x^2}{48^2} + \frac{y^2}{23^2} = 1$$

$$\text{distance} = 84.26$$

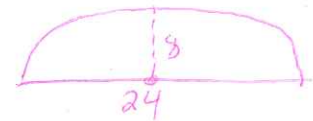


$$c^2 = 48^2 - 23^2$$

$$c = 42.13$$

13) A narrow arch supporting a stone bridge is in the shape of half an ellipse and is 24 meters long and 8 meters high. A person standing at one focus of the ellipse throws a rubber ball against the arch. No matter what direction the ball is thrown, it always bounces off the arch once and strikes the same point on the ground (the other focus). How far apart are the person throwing the ball and the point on the ground at which the ball strikes?

① distance between both foci is $8\sqrt{5}$



$$a = 12, b = 8$$

$$c^2 = 12^2 - 8^2$$

$$c = 4\sqrt{5}$$

14) An arch of a bridge over a highway is semi-elliptical in shape and 42 ft. across. The highest point of the arch is 14 feet above the highway. What is the maximum height, to the nearest inch, of a truck 8 ft. wide that can fit under the arch? (assume the highway is one lane)

2. plug 4 in for x

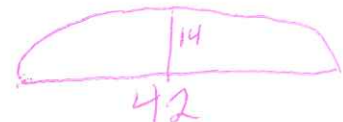
$$\frac{4^2}{21^2} + \frac{y^2}{14^2} = 1$$

$$\frac{y^2}{14^2} = \left(1 - \frac{4^2}{21^2}\right) \cdot 14^2$$

$$y^2 = 1700/9$$

$$y = \pm 13.74$$

$$x \approx \pm 13.74 \text{ ft.}$$



find equation

$$1. \frac{x^2}{21^2} + \frac{y^2}{14^2} = 1$$

max height = 13 ft. 9 inches