DATE: ___________

1.6 Modeling with Functions (continued)

3. *Flood Control* A river has risen 8 feet above its flood stage. The water begins to recede at a rate of 3 inches per hour. Write a mathematical model that shows the number of feet above flood stage after t hours. If the water continually recedes at this rate, when will the river be 1 foot above its flood stage?

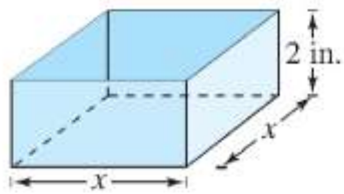
4. *Floor Space* The floor of a one-story building is 14 feet longer than it is wide. The building has 1632 square feet of floor space.

(a) Draw a diagram that gives a visual representation of the floor space. Represent the width as w and show the length in terms of w.

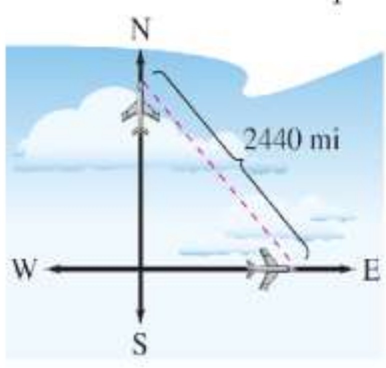
(b) Write a quadratic equation in terms of w.

(c) Find the length and width of the floor of the building.

5. *Packaging* An open box with a square base (see figure) is to be constructed from 84 square inches of material. The height of the box is 2 inches. What are the dimensions of the box? (*Hint*: The surface area is $S = x^2 + 4xh$.)



8. *Flying Speed* Two planes leave simultaneously from Chicago O'Hare Airport, one flying due north and the other due east (see figure). The northbound plane is flying 50 miles per hour faster than the eastbound plane. After 3 hours, the planes are 2440 miles apart. Find the speed of each plane.



Solutions:

3. $y = -0.25t + 8$
$1 = -0.25t + 8$
$0.25t = 7$
$t = 28$ hours

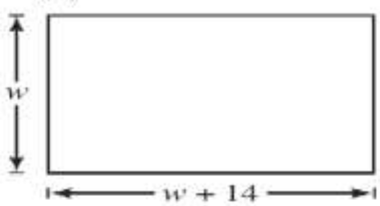
Source
Precalculus by Larson, Hostetler

4. $S = x^2 + 4xh$
$84 = x^2 + 4x(2)$
$0 = x^2 + 8x - 84$
$0 = (x + 14)(x - 6)$
$x = -14$ or $x = 6$

Since x must be positive, we have $x = 6$ inches. The dimensions of the box are 6 inches $\times 6$ inches $\times 2$ inches.

Source
Precalculus by Larson, Hostetler

5. (a)

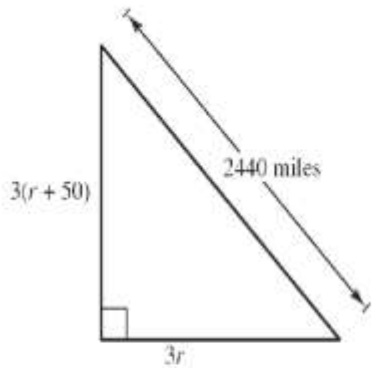


(b) $w(w + 14) = 1632$
(c) $w^2 + 14w - 1632 = 0$
$(w + 48)(w - 34) = 0$
$w = -48$ or $w = 34$

Since w must be greater than zero, we have $w = 34$ feet and the length is $w + 14 = 48$ feet.

Source
Precalculus by Larson, Hostetler

8.



$d_N = (3 \text{ hours})\,(r + 50 \text{ mph})$
$d_E = (3 \text{ hours})\,(r \text{ mph})$
$d_N^2 + d_E^2 = 2440^2$
$9\,(r + 50)^2 + 9r^2 = 2440^2$
$18r^2 + 900r - 5,931,100 = 0$
$r = \dfrac{-900 \pm \sqrt{900^2 - 4\,(18)\,(-5,931,100)}}{2\,(18)} = \dfrac{-900 \pm 60\sqrt{118,847}}{36}$

Using the positive value for r, we have one plane moving northbound at $r + 50 \approx 600$ miles per hour and one plane moving eastbound at $r \approx 550$ miles per hour

Source
Precalculus by Larson, Hostetler