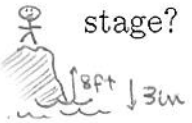
DATE: _____

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?



$y = 8 - \frac{1}{4}t$

"Slope" $3\text{in} = \frac{1}{4}\text{ft}$

→ find time when $y = 1$ ft

$1 = 8 - \frac{1}{4}t$

$-7 = -\frac{1}{4}t$

$28 = t$

28 hours

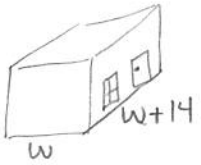
4. *Floor Space* The floor of a one-story building is 14 feet longer than it is wide. The building has 1632 square feet of floor space.

(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.

(a)



Length = width + 14

$l = w + 14$

$A = lw$ $\quad A = 1632\text{ft}^2$

(b) $1632 = (w+14)(w)$

(c) $1632 = w^2 + 14w$

$0 = w^2 + 14w - 1632$

$0 = (w+48)(w-34)$

$w = -48, \; w = 34$

can't have negative measurement

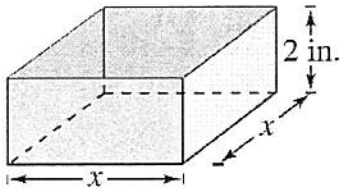
Width = 34ft

$l = 34 + 14$

$l = 48$

length = 48ft

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 $S = x^2 + 4xh$.)



Surface Area

bottom, 4 sides

$SA = x^2 + 4(2x)$

$84 = x^2 + 8x$

$0 = x^2 + 8x - 84$

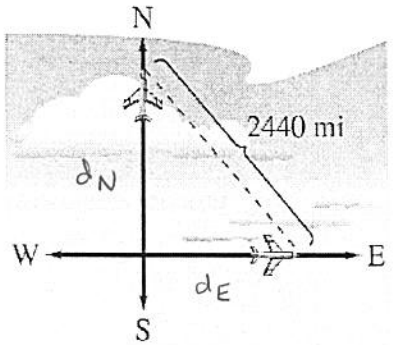
$0 = (x+14)(x-6)$

$x = -14$, $x = 6$

no negative measurements

Dimensions of box
6in × 6in × 2in

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.



$r_N = 50 + r_E$

r_E = rate of Eastbound plane

d_N = distance of Northbound plane

d_E = distance of Eastbound plane

$d = rt$ ∴ ☺

$(d_N)^2 + (d_E)^2 = 2440^2$

$(150 + 3r_E)^2 + (3r_E)^2 = 2440^2$

$(150 + 3r)^2 + (3r)^2 = 2440^2$

$d_N = (50 + r_E)(3)$
$= 150 + 3r_E$

$d_E = (r_E)(3)$
$= 3r_E$

$r_E = 549.570$ mile/hr

$r_N = 50 + 549.570$ mi/hr

Eastbound plane → 549.570 mph , Northbound plane → 599.570 mph