

## Problem 1

Two sides of a triangle have fixed lengths  $a$  and  $b$ , and the angle between them is  $\theta$ . What value of  $\theta$  maximizes the area of the triangle? Hint:  $A = \frac{1}{2}ab\sin(\theta)$ .

## Problem 2

Suppose that the US postal Service will only accept a box (with length  $l$ , height  $h$ , and width  $w$ ) for domestic shipping if the length + the **girth**, (here, girth is a kind of perimeter measure:  $2h + 2w$ ) does not exceed 144 inches. What are the dimensions of the largest (volume wise) square end box one can send in the mail? Hint: square end means that  $h = w$ .

### Problem 3

Jane is 3 miles offshore on a party boat. She decides that the REAL party is goin' down at club located 10 miles down a straight shoreline from the closest point on the beach to her boat. If the boat can only go 3 mi/h, and she can run 5 mi/h. where should she tell the captain to land the boat so that she can get to the club in the least amount of time? How far does Jane have to run? Hint:  $\frac{\sqrt{109}}{3} \approx 3.48$ , so you don't need a calculator.