Lab on the Gutter Problem

1. Units relevant? (0.5 point)

Refer to lab pages 1 and 2. Notice that the figure at the top of "The Gutter Problem" page 1 is labeled in inches, but the Sketchpad figure on page 2 is calibrated in centimeters. How does the change in units affect the problem?

a. Since the figure in inches and the figure in centimeters are similar, the same angle will give the maximum area in either case.
b. The angle will have to be divided by 2.54
c. The angle will have to be multiplied by 2.54
d. Centimeters are useless because the gutter will be too small to hold water.

2. Area for 90 degrees (1 point)

Refer to lab page 2. What area does Sketchpad give for the angle size 90º? Report the number, without units.

a. Somewhere between 13.22 and 14.61
b. Somewhere between 14.03 and 14.78
c. Somewhere between 15.52 and 15.88
d. Somewhere between 15.92 and 16.13
e. Somewhere between 16.59 and 17.02

3. Area for 30 degrees (1 point)

Refer to lab page 2. What area does Sketchpad give for the angle size 30º?

a. $12.26 < area < 12.74$
b. $13.42 < area < 14.04$
c. $14.73 < area < 15.13$
d. $15.24 < area < 15.78$
e. $15.78 < area < 16.06$

4. Largest angle (0.5 point)

Refer to lab page 2. What is the largest that angle BOA can be before the model breaks down? (Hint: it is impossible for the gutter material to pass through itself.) Report the number of degrees.

5. Area for 30 exactly (1 point)

What is the cross sectional area of the gutter exactly if the angle x is 30º?

a. $4\sqrt{3}+8$ b. $8\sqrt{3}+4$ c. $7\sqrt{5}$ d. $7\sqrt{2}+5$ e. $5\sqrt{2}+7$

6. Area for 45 exactly (1 point)

What is the cross sectional area exactly if the the angle x is 45º?

a. $8\sqrt{2}+4$ b. $8\sqrt{2}+8$ c. $9\sqrt{3}+6$ d. 16   e. $6\sqrt{3}+9$
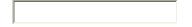
7. General formula (1 point)

Develop a formula that uses trigonometric functions to give the cross sectional area as a function of the angle x.

a. 16*sin (x)*cos(x) + 16*cos(x)
b. 16*sin(x)*cos(x) + 16*sin(x)
c. 16*sin (x)*cos(x) + 8*cos(x)
d. 16*sin(x)*cos(x) + 8*sin(x)
e. 8*sin(x)*cos(x) + 16*cos(x)
f. 8*sin(x)*cos(x) + 16*sin(x)

8. Graphing Utility max (1 point)

Refer to lab page 3. Use the graphing utility to plot the function you found in the previous question. What value of the angle x makes the area a maximum according to the graph of the function you found?
(Hint: Look for the smallest positive angle. The grapher reports the answer in radians, not degrees, so give your answer in radians.)

[ ]

9. Maximum area (1 point)

What is the maximum cross sectional area of the gutter in square inches? Report the number to three decimal places, without units (Use the grapher on page 3: the number reported by Sketchpad is not accurate enough to answer this question. You will need to zoom in to get the necessary accuracy.)

[ ]

10. Limitations (2 points)

Write a few sentences about limitations of this model for gutter design. Think of some factors the model does not take into account that could influence the design of the gutter, or some assumptions the model makes that are unnecessary or wrong-headed. (My grader or I will read your response to this question on WebCT "in person"--points will not show on your Lab score report today.)

[text area]

Paragraph