# EXAM 3

THIS EXAM CONSISTS OF 5 PROBLEMS AND ONE BONUS PROBLEM. IN ORDER TO RECEIVE FULL CREDIT ON EACH PROBLEM, **SHOW ALL OF YOUR WORK!**.

Problem 1. (10 pts total) Alex has 800 feet of fencing to enclose a rectangular garden and then divide it into 3 pens with fencing parallel to one side of the rectangle (please see the figure below).

(a) (3 pts) Find a formula for the perimeter of the garden. Solve for the variable y in terms of x.

(b) (4 pts) Find a function that model the area A of the corral in terms of the width x of the coral (there should only be one variable in your function).

(c) (3 pts) Find the largest possible total area of the four pens. (Don't forget the units!)
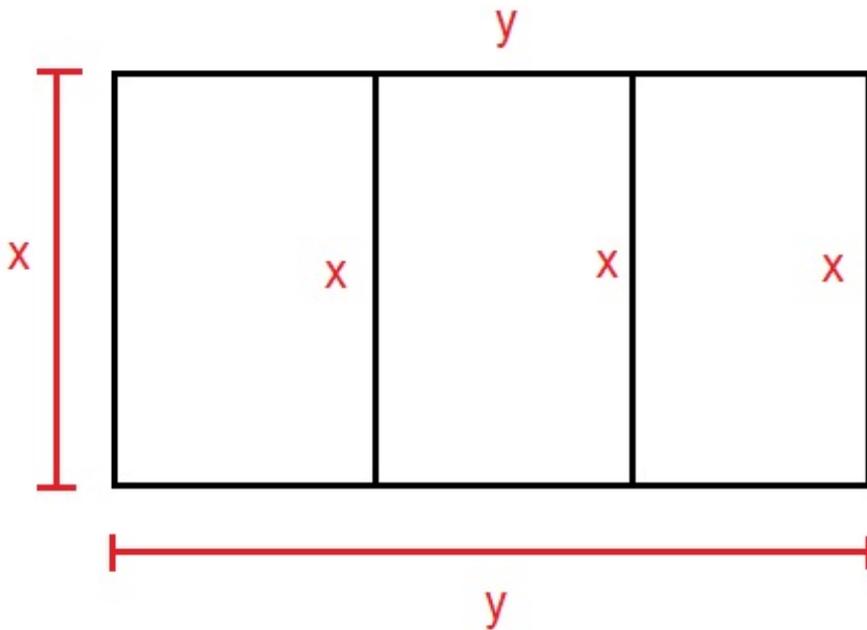
Problem 2. (18 pts total) Consider the following rational function

$$r(x) = \frac{3x^2 + 2x}{x^2 - x}.$$

(a) (3 pts) Does $r(x)$ have a hole? If so, what are its coordinates?

(b) (2 pts) Find the x-intercepts of $r(x)$.

(c) (2 pts) Find the y-intercepts of $r(x)$.

(d) (6 pts) Let

$$g(x) = \frac{3x + 2}{x - 1}.$$

Use polynomial division to show that $g(x)$ is a transformation of $f(x) = 1/x$. List all of the transformations.

(e) (5 pts) Use the transformations of $g(x)$ you found in (c) to graph $r(x)$. Plot the intercepts and the hole (if there is one) of $r(x)$.

HINT: The graph of $r(x)$ looks exactly like the graph of $g(x)$, but there is one difference!

Problem 3. (9 pts) An irrigation system uses a straight sprinkler pipe $r = 200$ feet long that pivots around a central point, as shown below. Because of an obstacle the pipe is allowed to pivot through $\theta = 250°$ only. Find the area irrigated by this system.

Round your answer to the nearest whole number (no decimals) and don't forget the units!
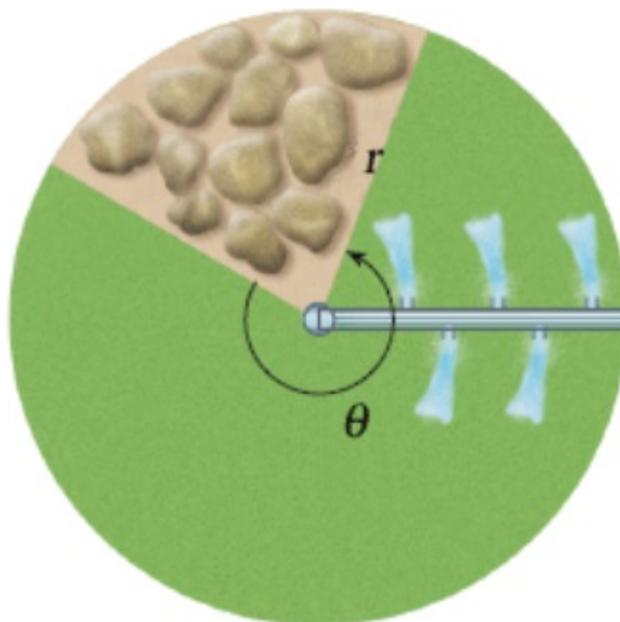
Problem 4. (10 pts total) Answer the following questions in order to find the value of $\cos\left(\frac{7\pi}{6}\right)$ **without a calculator**.

(a) (3 pts) Identify the quadrant in which the angle with measure $\frac{7\pi}{6}$ is located. Is cosine positive or negative in this quadrant?

(b) (4 pts) Find the measure of the reference angle $\bar{\theta}$ of the angle of measure $\frac{7\pi}{6}$.
HINT: The measure of $\bar{\theta}$ is between 0 and 2π.

(c) (3 pts) Use the value of $\cos\left(\bar{\theta}\right)$ and part (a) to find the value of $\cos\left(\frac{7\pi}{6}\right)$.


Problem 5. (9 pts total) **Make sure that your scientific calculator is in "degrees" mode to complete this problem.**

Consider the figure below. The height of the triangle is 6, the length of its base is C, the lengths of the bases of the two right triangles within the larger triangle are A and B.

(a) Use a trigonometric function to find A. (Round answer to 2 decimal places.)

(b) Use a trigonometric function to find B. (Round answer to 2 decimal places.)

(c) Use your answers from parts (a) and (b) to find C. (Round answer to 2 decimal places.)
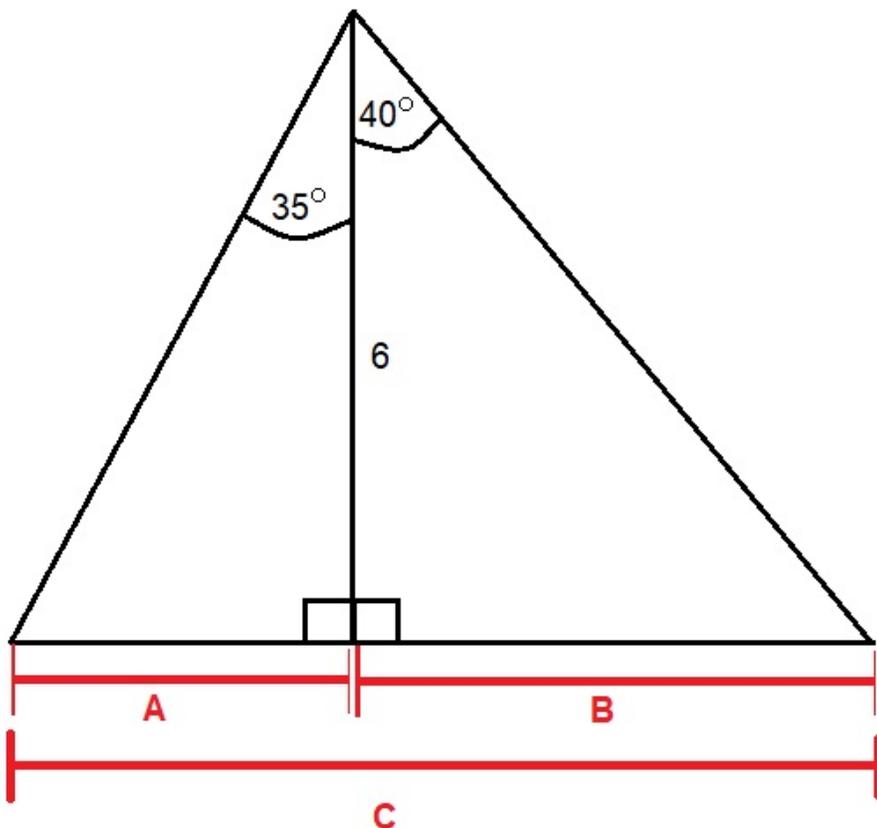
BONUS PROBLEM. (This is for extra credit.) (5 pts total) Consider the function

$$g(x) = 3\sin(2x - \pi).$$

(a) (1 pt) What is the period of $f(x)$?

(b) (1 pt) What is the amplitude of $f(x)$?

(c) (3 pts) Draw **one period** of the graph of $f(x)$ starting at $x = \frac{\pi}{2}$ on the x-axis.