Math 230 — Hour Exam 2

April 20, 2015

General Directions. This is an open-book, open-notes, open-computer test. However, you may not communicate with any person, except me, during the test. You have the full class period (50 minutes) in which to do the test. Put your answer to each question in the space provided (use the backs of pages if you need more space). Be sure to **show your work**! I give partial credit for incorrect answers if you show correct steps leading up to them; conversely, I do not give full credit even for correct answers if it is not clear that you understand where those answers come from. Good luck.

This test contains 4 questions (one with 2 parts) on 4 pages.

Question 1 (15 Points). Triangles can be classified as equilateral, isosceles, or neither according to how many of their sides are equal in length. The following Matlab code reads *a*, *b*, and *c*, the lengths of the sides of a triangle, from its user. Add statements that will print "equilateral" if *a*, *b*, and *c* are all equal, "isosceles" if any 2 of *a*, *b*, and *c* (but not all 3) are equal, and "neither" in all other cases.

```
a = input( 'Length of first side: ' );
b = input( 'Length of second side: ' );
c = input( 'Length of third side: ' );
```

Question 2. Define the "Math 230 Series" as the infinite sum

$$\sum_{n=1}^{\infty} \frac{\sin\left(\frac{n\pi}{2}\right)}{n^2}$$

Written out, the first few terms of this series are

$$\frac{\sin\frac{\pi}{2}}{1} + \frac{\sin\frac{2\pi}{2}}{2^2} + \frac{\sin\frac{3\pi}{2}}{3^2} + \cdots$$

Part A (10 Points). Here is the beginning of a Matlab function that is supposed to compute the sum of the first *k* terms in the Math 230 Series. Fill in the function's body, using a `for` loop and no vectorized computations.

```
function [ s ] = math230SeriesLoop( k )
```

Part B (10 Points). Here is the beginning of another Matlab function that is supposed to compute the sum of the first *k* terms in the Math 230 Series. Fill in this function's body using only vector/array computations and no loops.

```
function [ s ] = math230SeriesVectorize( k )
```

Question 3 (10 Points). One of the properties of definite integrals is that

$$\int_a^b f(x)dx = -\int_b^a f(x)dx$$

Does the trapezoid rule respect this property, i.e., if you use the trapezoid rule to integrate some function from *a* to *b* will you get the negative of what you would get by asking it to integrate the same function from *b* to *a*? Why or why not?

Use the following pseudocode as the definition of "the trapezoid rule" for answering this question:

```
function R = trapezoid( f, a, b, n )
   % Integrate f between a and b using n trapezoids
   deltaX = (b – a) / n
   R = 0
   for i = 1 to n
      x = a + (i-1) * deltaX
      R = R + deltaX * ( f(x) + f(x+deltaX) ) / 2
   end
end
```

Question 4 (5 Points). Write a Matlab expression that is the logical complement of

```
x < 23 && y == -3
```

(the complement of a logical expression is another expression that is true exactly when the first expression is false and false exactly when the first expression is true.)