# Math 223 — Hour Exam 1

October 6, 2016

**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 (75 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 6 questions (2 with two parts) on 6 pages.

**Question 1** (15 Points). Consider the helix

Show that the tangents to this curve when *t* is any integer multiple of π (i.e., when *t* = 0, ±π, ±2π, ±3π, etc.) are all parallel to each other.

**Question 2** (10 Points). Here are two lines in two dimensions:

L1:

L2:

Find the cosine of the angle at which the lines intersect.

**Question 3.** Suppose the parabola defined by the equations

in 3-dimensional space is rotated through a full circle around the *z* axis.

Part A (5 Points). What is the name of the resulting surface?

Part B (10 Points). Give an equation that describes the resulting surface, and explain in a sentence or two the thinking by which you found that equation.

**Question 4** (10 Points). A bird is traveling with velocity 4 miles per hour east, 4 miles per hour south, and 2 miles per hour downward, described by the vector . Find a unit vector that points in the direction the bird is moving.

**Question 5.** A certain plane has normal and contains points (1, 1, 1 ) and  
( 2, 3, 4 ). The vector is thus parallel to the plane.

Part A (10 Points). Find another vector, not parallel to that is also parallel to the plane.

Part B (5 Points). Give an equation for the plane.

**Question 6** (10 Points). Dr. Whowhatwherewhenwhyandhow’s all-in-one time machine and space ship is accelerating through space-time in such a manner that it’s velocity at time (as perceived by the occupants) *t* is

If the trip started at point (1,0,0,0) when *t* = 0, what point will the Doctor be at when *t* = 4?