

Name: \_\_\_\_\_

**MATH 113 – EXAM 4**  
**23 November 2005**

**Directions:** Answer every question. Show all work and justify your answers. Each question is worth five points.

1. Name the Platonic Solids described by each statement.
  - (a) The Platonic Solid with the most faces.
  - (b) The Platonic Solid that is its own dual.
  - (c) The Platonic Solid whose faces are pentagons.
  - (d) The Platonic Solids with 12 edges (two answers).
  - (e) The Platonic Solid on display in front of the room.
  
2. At Let's Make A Deal University instead of taking math tests the students choose grades that are hidden behind doors. There are three doors. Behind one door is an A and behind the other two doors are Fs. Monty Hall is ready to pick his math grade. He chooses door #1. The math professor (who knows which grades are behind which door) opens door #2 and shows Monty an F. The professor says to Monty, "Do you want to stick with door #1 or do you want to switch to door #3?" What advice do you give Monty? Why?
  
3.
  - (a) What is the equation for the Euler Characteristic?
  
  - (b) Draw a planar graph and demonstrate that this equation is true for your graph.

4. (a) What is the difference between a *polyhedron* and a *polygon*?
- (b) How many Platonic Solids are possible?
- (c) How many regular polygons are possible?
5. The probability of winning Cash 3 Lotto from the Tennessee Lottery is 1 in 1000.
- (a) If you buy a ticket, what is the chance of not winning?
- (b) If you play Cash 3 Lotto every day for a year, what is your chance of not winning?
- (c) It costs \$1 to play Cash 3 Lotto, and if you win, you get \$500. Do you think it's wise to play this game?
6. We learned in Chapter 2 that the decimal expansion for  $\sqrt{2}$  never ends and never repeats. What do you think is the chance that your social security number appears somewhere in the decimal expansion of  $\sqrt{2}$ ?
7. State the Law of Large Numbers.

8. The Information Technology department of a company has determined that of every 10,000 email messages received by the company that 8000 are legitimate and 2000 of them are spam. The IT department has suggested implementing a spam filter. Unfortunately, the filter is not perfect. It will correctly identify 90% of spam as spam and prevent it from reaching the users; the other 10% of spam gets by the filter. For legitimate email, this filter will mistakenly think that 1% of it is spam. The other 99% of real email makes its way past the filter just fine. If this filter believes that an email message is spam, what is the probability that it really is spam?

9. Rooms in buildings on the campus of the University of Tennessee can be either too cold, too hot, or just right. Explain how you would determine the probability that a room chosen at random was too hot.

10. Name a real-life item that is shaped like a Platonic Solid.

11. Arrange the following in order from least to most likely:

- Someone else at UT has the same birthday as you.
- A UT freshman chosen at random is *not* from Tennessee.
- You flip a fair coin and get heads.

12. You roll two fair, standard dice.

(a) What is the probability that you roll a four and a five?

(b) What is the probability that you roll doubles?

(c) What is the probability that you don't roll doubles?