Math 111 - Final Exam Review Problems

None of these problems need a calculator! Remember, you will not be allowed to use a calculator on the test.

1. We proved three famous theorems in our class: the Pythagorean theorem, the infinitude of primes, and the fact that $\sqrt{2}$ is irrational. Be sure that you know what irrational means, what a prime number is, and that you understand at least one of the proofs of the Pythagorean theorem.

2. What is 10% of 300 million? What is 50 thousand times 4 million in scientific notation?

3. Which of the following numbers is prime?

   57 121 5795 349 764

4. It is a fact that $19 \times 26 = 494$. What does that mean about 494 mod 26? Use this information to help find 497 mod 26 without a calculator.

5. A crate can hold 2 tons of mulch. If the dimensions of the crate are all tripled, then how much mulch can the new crate hold?

6. The figure on the left contains about 150 dots. The figure on the right is scaled by a factor of 2. Estimate the number of dots in the larger figure.

7. List 5 integers that are equivalent to -7 modulo 100.

8. Compute the following moduli (without a calculator)
   (a) 476 mod 3
   (b) 9979 mod 11
   (c) 4660 mod 9
   (d) 297 mod 10

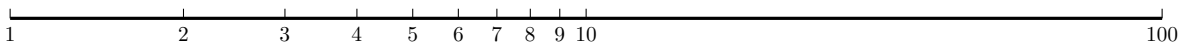
(e) 43 mod 2

9. If today is Friday, then what day of the week will it be 1403 days from now?

10. For the last 75 years, TV transmissions from the Earth have started spreading in a sphere around the solar system that is now 75 light years in radius. In another 75 years, the transmissions will have traveled twice as far. How many times more space will be able to detect TV signals from Earth 75 years from now?

11. Find the following without a calculator.
    (a) $4,000 * (2.0 \times 10^5)$
    (b) 8% of 0.3
    (c) $(1,000)^7$
    (d) 6 thousand divided by 0.01.

12. Indicate where the numbers 24, 75, and $\frac{7}{3}$ belong on the logarithmic scale below.



13. If your investments grow by 50%, why isn't that the same as multiplying by 0.50? Explain.

14. Convert the following growth factors into percentage changes. Be sure to indicate if it is a percentage increase or decrease.
    (a) Quintuple
    (b) 1.35
    (c) 0.48
    (d) 2.6

15. Suppose that you put $1000 in a savings account that pays 3% APR compounded monthly. Write down a formula for how much money you will have in that account after 10 years. You do not need to simplify your answer.

16. Suppose that my (high risk) investment portfolio grows 100% one year, and then declines 40% the next year. Calculate the total percentage change in my investments (without a calculator).

17. Use the following preference schedule to answer the questions below.

18. Suppose that a company needs to apportion a shipment of new 60 computers to its 4 different sites (A, B, C, and D). After adjusting the divisor in order to apportion the computers using Webster's method, they arrive at the following adjusted quotas:

Site	A	B	C	D
Adjusted Quota	5.53	17.61	23.79	13.07

Will these adjusted quotas give the correct apportionment using Websters method, or will we need to adjust the divisor again? If the apportionment is correct, how many computers will each site receive? If the apportionment is incorrect, will we need to increase or decrease the divisor?

19. Round the following percentages to whole numbers using Hamilton's method. Hint: *think of apportioning 100 seats to 6 states.*

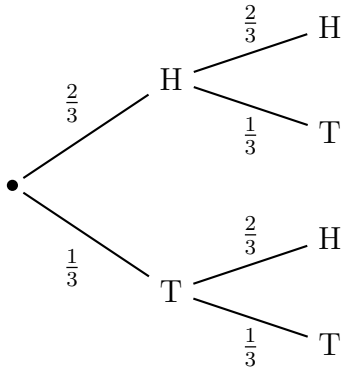
$$43.15\% + 12.59\% + 24.58\% + 3.57\% + 11.56\% + 4.55\% = 100\%$$

20. Suppose that Puerto Rico becomes the 51st state in the union. Suppose that the number of seats in the House of Representatives is increased by 6 to 441 in order to give Puerto Rico the six seats. If this addition caused one of the current 50 states to lose a seat, we would have an example of which paradox?

21. If I buy 4 sandwiches and 3 salads, then I have bought 7 things. Why is it ok to add 4 in 3 in this context, even though the multiplication rule says to multiply when you see numbers connected by the word "and"? When does the multiplication rule apply?

22. I want to select a group of representatives from a class to go to a conference. How many ways could I select a group of 3 students out of a class of 12?

23. Use the weighted tree diagram below to find the probability of each outcome: HH, HT, TH, and TT.



24. Find the following without a calculator.
    (a) ${}_8C_6$
    (b) ${}_8P_3$
    (c) ${}_{100}P_2$

25. If I flip a coin 6 times in a row, one event is that I get 5 or more heads. Describe the complimentary event in words.

You should also review the recent workshops about the normal distribution. I'll try to add a few more review problems next week.