

# Math 113: Exam 2

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

Wednesday, February 18, 2009

**Directions:** Answer every question. Show appropriate work and justify your answers.

1. Give an example of each of the following:

(a) A fraction whose decimal expansion terminates.

(b) A fraction whose decimal expansion repeats.

2. What mathematical problem is hard for computers to do, leading to the security of information protected by the RSA code?

3. Decide if the following equation is true or false and explain your answer:

$$\frac{665857}{470832} = \sqrt{2}$$

4. Use modular arithmetic to calculate each of the following:

(a)  $(7 + 8) \times 2 \pmod{7}$

(b)  $11^{97378} + 1000000000000 + 3 \pmod{10}$

5. If  $e = 3$  and  $n = 55$ , use RSA to encrypt the number 5.

6. Determine if each number is rational or irrational. You do not need to justify your answers.

(a)  $\frac{1}{97}$

(b)  $\sqrt{2}$

(c)  $\sqrt{9}$

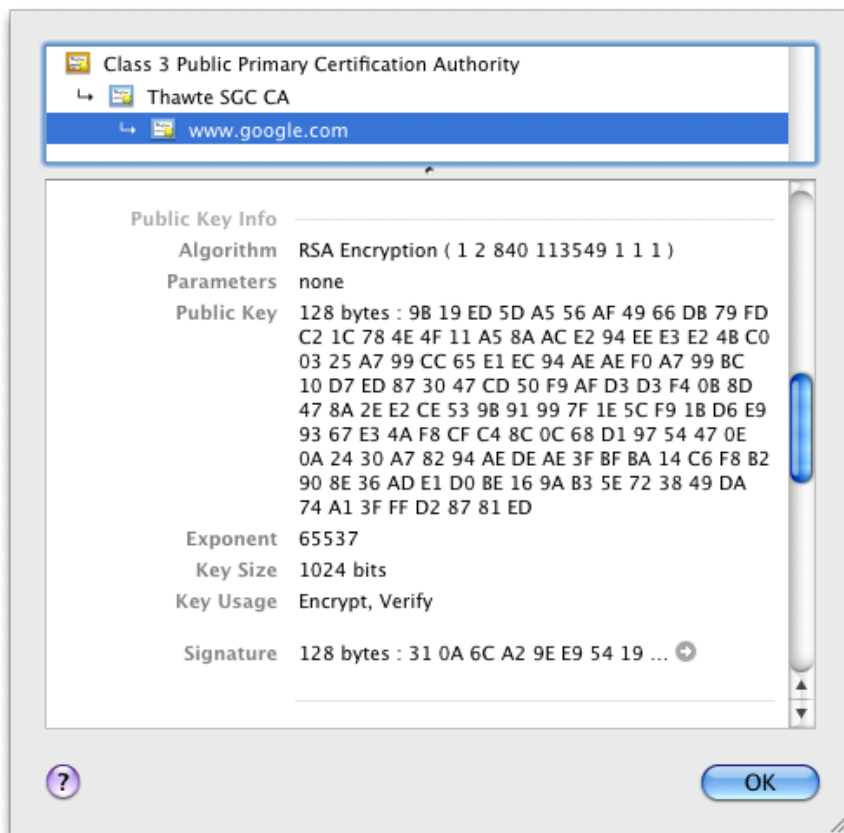
(d) 3.14159265358979

(e) 0.2468101214161820222426283032 ...

7. Using the method that we learned in class (not the Ans $\blacktriangleright$ Frac button on your calculator), write the number 0.4787878787878787878 ... as a fraction.

8. Suppose I have two rational numbers,  $\frac{a}{b}$  and  $\frac{c}{d}$ , where  $a, b, c, d$  are whole numbers and  $b$  and  $d$  are not equal to zero. Is the product of these two number a rational number? Why or why not?

9. Here is the web security certificate for Gmail. When we learned about RSA, we talked about five numbers:  $e$ ,  $d$ ,  $n$ ,  $p$ , and  $q$ . Which of those numbers appear on this certificate? Clearly label them on the picture.



10. The UPC code for Xerox brand lilac colored printer paper begins: 0 95205 11230. Calculate the value of the check digit.

11. The barcode reader at the post office scans a piece of mail and reads 2050000027. Explain why you know that a mistake has been made.

12. Prove that  $\sqrt{5}$  is an irrational number.