

MATH 330 – Discrete Mathematics – Spring 2025

Turn In Homework Assignment 4

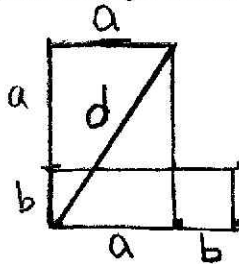
100 Points

Due: Thursday March 20, 2025

Your turn in write up will be graded on neatness, clarity of exposition (notation and definitions) and cleverness, but MOSTLY correctness. There are 5 problems. Each problem is worth 20 points. You may ask me questions if you do not understand the problem. You may discuss the problems with others in class but the write up you turn in must be your OWN work. You may use the spread sheets we built in class or your own spread sheets, class notes or Chapters 1 – 4 from our textbook and Desmos but your conclusions from these MUST be in your write up in your OWN words. You can include tables from spread sheets and graphs from Desmos in your write up. Your write up must be turned in class and be stapled in the left corner if it is more than one page.

1. Let  $r_1, r_2$  be the two solutions to  $r = 1 + \frac{1}{r}$  and suppose  $r = \frac{a}{b}$ . Give the following

(a)  $r_1 r_2$  (b)  $r_1 + r_2$  (c)  $r_1 - r_2$  (d)  $\frac{r_2}{r_1}$  (e)  $\frac{r_1}{r_2}$  (f)  $a$  if  $b = 10$  (g)  $b$  if  $a = 10$  (h) The length of the diagonal and the area of each of the four rectangles in the picture in simplified form. (i) How is the area of the largest rectangle related to the three smaller rectangles?



2. Consider  $f(x) = x^3 - x - 1$ . (a) Give the real roots and the fixed points of  $f$ . (b) How does the root equation for  $f$  differ from the golden ratio equation? Hint: We learned algorithms to find roots and fixed points. Use: desmos to help you.

3. Give the following sums and the average of the numbers making up the sum assuming the patterns.

(a)  $\sum_{k=0}^{10} 11^k$

(b)  $5+10+15+20+25+ \dots +1000$  (c)  $\frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \dots + \frac{1}{1048576}$  (d)  $1+3+9+11+17+19+25+27+ \dots + 201+203$

4. You are investing money into an investment fund that pays a 5% yearly interest rate each month. How much money will you have after 10 years if (a) you initially invest \$1000 and then no more investments by you? (b) you invest \$50 each month? (c) Give the functions that you iterate on to get your solution for both (a) and (b).

5. Let  $y = e^{-x^2}$  for  $-1 \leq x \leq 1$ . Give the average value of  $y$  approximated by  $n$  equally spaced values.

(a)  $n = 3$  (b)  $n = 5$  (c)  $n = 7$  (d)  $n = 9$ . (e) Using these values what is the best approximation to  $\int_{-1}^1 e^{-x^2} dx$ ?