First Homework Assignment for Math 151H
Due September 7

1. What is the Calculus about?
2. What do functions do?
3. What are the positive integers and why do we care?
4. What are the nonnegative integers and why do we care?
5. What are the rational numbers and why do we care?
6. What are the real numbers and why do we care?
7. What are the complex numbers and why do we care?
8. What is a prime number?
9. Why should one care about prime numbers?
10. What do x^2, $\frac{1}{x}$, and $\sqrt{x}$ mean?
11. Is $\frac{1}{2} = \frac{19}{38}$? Why?
12. π is a famous irrational number. Use this in a 1-line explanation that $\sqrt{\pi}$ is irrational.
13. Give a (short) proof/explanation that $\sqrt{3}$ is an irrational number.
14. Find a number x such that $x + y = y$ for all other numbers y.
15. Compute $\frac{3}{7} + \frac{6}{7}$.
16. Compute $\frac{3}{7} + \frac{2}{3}$.
17. Compute $\frac{3}{7} - \frac{4}{6}$.
18. Compute $\frac{1}{2} + \frac{3}{4}$.
19. Compute $\frac{1}{\frac{1}{2}+\frac{1}{3}}$.
20. Compute $\frac{\frac{1}{2}+\frac{1}{3}}{\frac{1}{5}+\frac{1}{7}}$.
21. Simplify $\frac{x-2}{\sqrt{x}-\sqrt{2}}$.
22. Compute $(2 - i) + (3 + 2i)$ and graph the result.
23. Compute $(2 - i) - (3 + 2i)$ and graph the result.
24. Compute $(2 + i)(1 - i)$ and graph the result.
25. Compute $(1 + i)^2$ and graph the result.
26. Compute $(1 + i)(1 - i)$.
27. Reconcile the previous computation with the fact that 2 is a prime number.
28. Compute $\frac{2-i}{1+i}$ and graph the result.
29. Compute $(2 - i)^3$ and graph the result.
30. Compute $\sqrt{2i}$ and graph the result.
31. Simplify $(x + 2)(3 - x)$.
32. Simplify $(1 + x)(x + 2)(3 - x)$.
33. Factor $x^2 - 9$.
34. Factor $3x^2 - 12$.
35. Factor $x^2 + 1$, completely.
36. Factor $x^2 + 3x + 2$.
37. Factor $x^2 + 5x + 6$.
38. Factor $x^2 - x - 6$.
39. Factor $2x^2 + 3x - 2$.
40. Factor $2x^2 + 3x + 1$.
41. Factor $2x^2 - 3x + 1$.
42. Factor $3x^2 + 2x - 8$.
43. Factor $x^2 + x + 1$.
44. Factor $x^2 - x - 1$.
45. Factor $x^2 + 4x - 1$.
46. Factor $x^3 + 2x^2 - x - 2$.
47. Factor $x^4 - 2x^2 + 1$.
48. Suppose $f(x) = x^2 + x + 41$. What do you notice about the values $f(x)$ for $x = 0, 1, \ldots, 10$?
49. Show that $a \cdot 0 = 0$, for any number a.
50. Show that $(-1) \cdot a = -a$.
51. Show that if $x \cdot a = a$ with $a \neq 0$ then $x = 1$.
52. What is $1 + 2 + \cdots + 50$?

Find all real numbers x for which

53. $4 - x < 3 - 2x$.
54. $5 - x^2 < 2$.
55. $(x - 1)(x - 3) > 0$.
56. $x^2 + x + 1 > 0$.
57. $(x - \pi)(x + 5)(x - 3) > 0$.
58. $\frac{x-1}{x+1} > 0$.

Express with at least one fewer pair of absolute value signs.

59. $|\sqrt{2} + \sqrt{3} + \sqrt{5} - \sqrt{7}|$.
60. $|(|a + b| - |a| - |b|)|$.
61. $|x^2 - 2xy + y^2|$.
62. $|(|\sqrt{2} + \sqrt{3}| - |\sqrt{5} - \sqrt{7}|)|$.

Find all real numbers x for which

63. $|x - 3| = 8$.
64. $|x + 4| < 2$.
65. $|x - 1| + |x - 2| > 1$.