MATH 2120 Lab 1

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1. (a) $E_{abs} = |3.141592 - 3.14| = 0.001592$
   $E_{rel} = |3.141592 - 3.14|/|3.141592| = 0.00050674944$

   (b) $E_{abs} = |1,000,000 - 999,996| = 4$
   $E_{rel} = |1,000,000 - 999,996|/|1,000,000| = 0.000004$

   (c) $E_{abs} = |0.000012 - 0.000009| = 0.000003$
   $E_{rel} = |0.000012 - 0.000009|/|0.000012| = 0.25$

2. (a) $f(2.73) = 20.3 - 5(7.45) + 16.3 + 0.55 = -0.05$
   $\delta = |0.011917 - (-0.05)|/|0.011917| * 100 = 519.5\%$

   (b) $f(2.73) = 0.0320$
   $\delta = |0.011917 - 0.0320|/|0.011917| * 100 = 168.5\%$

   (c) The error in (b) is significantly lower than in (a). This is expected, since we've avoided subtracting similar small numbers.

3. Done in double precision, this calculation results in 0.
   A better representation would be:
$$\frac{1}{x(x+1)}$$

4. $x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 1.30769$
   $x_2 = x_1 - \frac{f(x_1)}{f'(x_1)} =$

5. (a) This sort of depends on your definition of 'near'. It converges to a value on the same order of magnitude (8.4667).

Table 1: 5a

n	x_n
0	2
1	6
2	8.66667
3	8.84024
4	8.4645
5	8.4666
6	8.4667
7	8.4667

(b) This converges to 1.2440, but it takes many more iterations than last time.

Table 2: 5b

n	x_n	n	x_n	n	x_n
0	2	20	1.2300	41	1.2442
1	0.8571	21	1.2556	42	1.2434
2	1.7193	22	1.2341	43	1.2441
3	0.9586	23	1.2521	44	1.2436
4	1.5567	24	1.2369	45	1.2440
5	1.0357	25	1.2497	46	1.2437
6	1.4548	26	1.2390	47	1.2440
7	1.0932	27	1.2480	48	1.2437
8	1.3883	28	1.2404	49	1.2440
9	1.1356	29	1.2468	50	1.2440
10	1.3437	30	1.2414		
11	1.1665	31	1.2459		
12	1.3133	32	1.2421		
13	1.1887	33	1.2453		
14	1.2923	34	1.2426		
14	1.2047	35	1.2449		
15	1.2778	36	1.2430		
16	1.2161	37	1.2446		
17	1.2677	38	1.2433		
18	1.2242	39	1.2444		
19	1.2606	40	1.2434		

(c) This one is back to a reasonable number of iterations, and converges to 1.2439.

Table 3: 5c

n	x_n
0	2
1	1.3093
2	1.2491
3	1.2443
4	1.2439
5	1.2439

6.

7.