Typical ways to evaluate limits of fractions analytically when direct substitution fails:

1. $\lim_{x \to 5} (3x+2)$ Translates to "The Limit as x goes to 5 of 3x + 2)"

   This means that as x gets closer to 5 from below and above, find what (3x + 2) is approaching.
   Consider the table:

x	4.6	4.7	4.8	4.9	5.1	5.2	5.3	5.4
3x + 2	15.8	16.1	16.4	16.7	17.3	17.6	17.9	18.2

   Notice as x gets closer to 5 from either side right or left, 3x + 2 gets closer to 17.

2. Therefore $\lim_{x \to 5}$ (3x + 2) = 17
3. If you simply plug in 5 for x, you will get 17, this is called **Direct Substitution**
4. The problem is that Direct Substitution does not always work.
5. Consider $\lim_{x \to 0} \frac{\sin x}{x}$. Direct Substitution will lead to $\frac{0}{0}$, but that is NOT the answer.
6. Consider the table:

x	-0.5	-0.4	-0.3	-0.2	-0.1	0.1	0.2	0.3	0.4	0.5
(sin x) / x	0.95885	0.97355	0.98507	0.99335	0.99833	0.99833	0.99355	0.99507	0.97355	0.958885

   Notice that as x get closer to 0 from either side right or left, $\frac{\sin x}{x}$ gets closer to 1

7. Therefore $\lim_{x \to 0} \frac{\sin x}{x} = 1$
8. We now see a scenario where there is a consideration of a $\frac{0}{0}$ situation that leads to a definite answer.
9. Consider $\lim_{x \to 2} \frac{x^2+x-6}{2x^2-5x+2}$. Again Direct substitution will not work.
10. Factoring can lead to an answer: $\lim_{x \to 2} \frac{x^2+x-6}{2x^2-5x+2} = \lim_{x \to 2} \frac{(x+3)(x-2)}{(2x-1)(x-2)} = \lim_{x \to 2} \frac{x+3}{2x-1} = \frac{5}{3}$

Pre-Calc 2 Assignment 248 Wednesday, May 20, 2015 Hour Name ______________________

SHOW YOUR WORK

1. $\lim_{x \to 6} \dfrac{x-6}{x^2-36} =$

2. $\lim_{x \to 9} \dfrac{9-x}{x^2-81} =$

3. $\lim_{x \to -1} \dfrac{1-2x-3x^2}{1+x} =$

4. $\lim_{x \to -4} \dfrac{2x^2+7x-4}{x+4} =$

5. $\lim_{x \to 2} \dfrac{x^3-8}{x-2} =$

6. $\lim_{x \to -1} \dfrac{x^3+2x^2-x-2}{x^3+4x^2-x-4} =$