1. (16 pts) For each of the below either give an example or state that there exist no such examples:

(a) A relation, described as a set of ordered pairs \((x, y)\), that does not define \(y\) as a function of \(x\).

(b) A trinomial in \(x\) that is prime.

(c) A polynomial with greatest common factor \(-2a\).

(d) A number \(x\) so that \(x^0 = 0\).

(e) A system of linear equations with no solution.

(f) A system of linear equations with exactly two solutions.

(g) A system of linear equations with an infinite number of solutions.

(h) A trinomial with the following factors: 2, \(x + 4\), \(x - 4\).
2. (15 pts) Do one of the following two problems. If you do both problems, I will give you credit for the better of the two.

(a) A car and a bus set out at 2pm towards Ogallala on I-80. The average speed of the car is 30mph slower than twice the speed of the bus. At 4pm, both the car and the bus are pulled over by state troopers, but the car is 100 miles farther than the bus. What is the average speed of the car?

(b) You are working in a chemistry lab that is stocked with 10% acid solution and 30% acid solution. However, you need 10 liters of 15% acid solution. How much of each solution must you mix in order to get the solution you need?
3. (5 pts) Let’s say that \( x \) is related to \( y \) if \( y = 2x + 1 \). Does this relation define \( y \) as a function of \( x \)? Justify your answer.

Identify the dependent and independent variables:

4. (15 pts) Multiply:
   
   (a) \((2m - 5)(3m^2 + 4m - 5)\)

   (b) \((2k + q)^2\)

   (c) \((6x + y)(6x - y)\)
5. (11 pts) Let \( f(x) = -2x^2 + 5x - 6 \) and let \( g(x) = 7x - 3 \). Evaluate each of the following:
   (a) \((f + g)(x)\)

   (b) \((f - g)(x)\)

   (c) \((f + g)(-2)\)

6. (10 pts) Fully simplify each expression, writing each with no negative exponents:
   (a) \((-2x^4y^{-3})^0 (-4x^{-3}y^{-8})^2\)
7. (20 pts) Factor:

(a) \( ak^3 + 2ak^2 - 9ak - 18a \)

(b) \( 18k^2 - 200j^2 \)

(c) \( a^3u^3 + c^3 \) (Remember that, in general, \( x^3 + y^3 = (x + y)(x^2 - xy + y^2) \).)
(d) $4p^2 + 3p - 1$

(e) $2(1 - x)^4 + 2(1 - x)^3 - (1 - x)^2$

8. (8 pts) Replace $x$ with $-1$ and $y$ with 2 to give an example showing that $(x + y)^2$ does not equal $x^2 + y^2$.

While it is not true in general that $(x + y)^2 = x^2 + y^2$, the equation is true for certain values of $x$ and $y$. Give an example of choices for $x$ and $y$ that make the equality true: $(x+y)^2 = x^2+y^2$.

9. Bonus (2 pts) Describe all choices of $x$ and $y$ that make the equation true: $(x + y)^2 = x^2 + y^2$.

Bonus (2 pts) Prove that you have in fact described all such choices (that is, give an argument to convince me that you haven’t forgotten any).