1. (6 points) What is the Golden Rule of Algebra? (Circle one)
   a. Do unto one side as thou hast done unto the other.
   b. If I hath done it before I shalt do it again.
   c. Equation is opposition.
   d. Thou shalt do unto opposite sides opposite things.

2. (6 points) If I have 40 variables how many independent equations do I need to find values for all 40 variables? (Circle one)
   a. 20
   b. 39
   c. 40
   d. 42

3. (6 points) When can you divide by zero? (Circle one)
   a. Never
   b. When it cancels
   c. When it feel right
   d. Always

4. (10 points) \( y = 3x - 3 \) is a line with a y-intercept at \((0, -3)\) and slope \( \frac{3}{2} \).

5. (12 points) Divide \( \frac{x^2}{x-1} \) using any method you like.
6. (12 points) Solve the following. Be sure to include both answers in the simplest form.

\[
\frac{x - \frac{4}{5}}{\frac{2}{15} + \frac{1}{15}} = x^2
\]

\[
\frac{x - \frac{4}{5}}{\frac{3}{15}} = x
\]

\[
x = \frac{5}{3}
\]

\[
5x - 4 = x^2
\]

\[
x^2 - 5x + 4 = 0
\]

\[
(x - 1)(x - 4) = 0
\]

\[
x = 1, 4
\]

7. (8 points) Find the values of \(x\) for which the following inequality is true.

\[
6x - 7 > 3x + 2
\]

\[
3x - 7 > 2
\]

\[
x > \frac{9}{5}
\]

\[
x > 3
\]
8. (12 points) Solve the following story problems. Be sure to make it clear how you solved the problem. Write down exactly what you have done. Remember, you are trying to communicate to me that you understand how to do this.

a. (6 pts) You and a coworker together make $36.00 per hour. Your coworker earns 20% less than you do. What is your hourly wage?

\[ y = 0.2x \]
\[ x + y = 36 \]
\[ x + (0.2x) = 36 \]
\[ x + 0.2x = 36 \]
\[ 1.2x = 36 \]
\[ 1.2x = 36 \]
\[ x = 20 \]

b. (6 pts) After taking Math 1010 your productivity goes up. This increase in productivity has earned your company more money. So your boss has decided to give herself a raise. She used to make $40.00 per hour. Now she makes $44.00 per hour. This is a raise of what percent?

\[ 40 + 40x = 44 \]
\[ 40x = 4 \]
\[ 40x = 4 \]
\[ x = \frac{1}{10} \]

10%
9. (12 points) 
   a. (6 pts) What is the distance between (1, 3) and (−4, −1)? Be sure to simplify.
   
   \[ d = \sqrt{(1 + 4)^2 + (3 + 1)^2} = \sqrt{25 + 16} = \sqrt{41} \]

   b. (6 pts) What is the slope of the line that passes through (1, 3) and (−4, −1)?
   
   \[ m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-1 - 3}{-4 - 1} = \frac{-4}{-5} = \frac{4}{5} \]

10. (12 points) Graph the following.
   a. (6 pts) \( f(x) = -x - 1 \)

   b. (6 pts) \( f(x) = x^2 \)
11. (10 points) Find the equation of a line perpendicular to \( y = \frac{-x}{2} - 3 \) that passes through the point (1, 3).

\[
y = 2x + b
\]

\[
3 = 2(1) + b
\]

\[
3 = 2 + b
\]

\[
-2
\]

\[
b = 1
\]

12. (12 points) Let \( f(x) = \sqrt{-x} - 12 \).

a. (8 pts) What is the domain and range of \( f(x) \)?

\[
f(x) = \sqrt{-x} - 12
\]

\[
-x \geq 0
\]

\[
x \leq 0
\]

\[
x \geq 12
\]

\[
\frac{-x}{2} \geq -12
\]

b. (4 pts) What is \( f(1) \)?

\[
f(1) = \sqrt{1} - 12
\]

\[
= 1 - 12
\]

\[
f(1) = 1 - 12
\]
13. (10 points) Rewrite the following expressions using just one rational exponent or if possible write it as an integer.
   a. (5 pts) \( 81^{\frac{3}{4}} \) \( \frac{u^3 v^\frac{1}{2}}{u^\frac{5}{3}} \)

14. (12 points) Let the polynomial \( p \) be defined by \( p(x) = (3x - 4)(-2x + 1) \)
   a. (6 pts) Write \( p \) in standard form \( (p(x) = ax^2 + bx + c) \).

\[ p(x) = (3x - 4)(-2x + 1) \]
\[ = -6x^2 + 3x + 8x - 4 \]
\[ = -6x^2 + 11x - 4 \]

b. (6 pts) What is \( p(1/2) \)?

\[ p(\frac{1}{2}) = \left( 3 \cdot \frac{1}{2} - 4 \right) \left( -2 \cdot \frac{1}{2} + 1 \right) \]
\[ = \left( \frac{3}{2} - 4 \right) \left( -1 \right) \]
\[ = 0 \]
15. \( (10 \text{ points}) \) Add and simplify
\[
\frac{1}{x + 6} + \frac{11}{x^2 + x - 30}
\]
\[
\frac{(x - 5)}{(x - 5)(x + 6)} + \frac{11}{(x + 6)(x - 5)}
\]
\[
\frac{x - 5 + 11}{(x + 6)(x - 5)} = \frac{x + 6}{x + 6}(x - 5)
\]
\[
\frac{1}{x - 5}
\]

16. \( (10 \text{ points}) \) Divide and simplify
\[
\frac{1}{x^2 + x - 30} \div \frac{1}{x - 5}
\]
\[
\frac{1}{(x + 6)(x - 5)} = \frac{(x - 5)}{(x + 6)(x - 5)}
\]
\[
\frac{1}{x + 6}
\]

\(10\)

\(20\)
17. (8 points) Solve the following equation.
\[
\sqrt{-3x - 2} = x^2
\]

\[-3x - 2 = x^2\]
\[x^2 + 3x + 2 = 0\]
\[(x + 2)(x + 1)\]
\[
\begin{align*}
  x &= -2 \\
  x &= -1
\end{align*}
\]

18. (8 points) Solve the linear system
\[
\begin{align*}
  2x + 6y &= 6 \\
  -x + 4y &= -5 + 4y
\end{align*}
\]
\[
\begin{align*}
  2x + 6y &= 6 \\
  2(5 - 4y) + 6y &= 6
\end{align*}
\]
\[
\begin{align*}
  2x + 12 &= 6 \\
  -12 &= -12
\end{align*}
\]
\[
\begin{align*}
  2x &= -6 \\
  x &= -3
\end{align*}
\]
\[
\begin{align*}
  10 - 8y + 6y &= 6 \\
  10 - 2y &= 6 \\
  -10 &= -10
\end{align*}
\]
\[
\begin{align*}
  -2y &= 4 \\
  y &= 2
\end{align*}
\]
\[
\begin{align*}
  y &= 2 \\
  x &= -3
\end{align*}
\]
19. (10 points)
   a. (5 pts) Multiply $(3 + i) \times (1 + 6i)$.

   \[
   (3 + i)(1 + 6i) \\
   3 + 18i + i + 6i^2 \\
   3 + 19i - 6 \\
   19i - 3
   \]

   b. (5 pts) Subtract $(-2 - 6i) - (7 + 5i)$

   \[
   -2 - 6i - 7 - 5i \\
   -9 - 11i
   \]
20. (14 points) You have been commissioned to do a painting. The client is paying $450.00 for a painting that will be 1 foot wide and 2 feet high. The client has decided that they want a larger painting. Now they want it to be 2 feet long and 4 feet high. The client offers you $900.00 for this larger painting.

a. (5 pts) Before you accept you calculate ratio of the area of the large painting to the area of the small painting. The area of a rectangle is $A = l \times w$.

\[
\begin{align*}
\text{Ratio of large to small:} & \quad \frac{8}{2} \quad \frac{4}{1} \\
A_{\text{large}} & = 8 \times 4 = 32 \\
A_{\text{small}} & = 1 \times 2 = 2
\end{align*}
\]

b. (5 pts) How much money should you ask for? Why?

\[
\begin{align*}
\frac{4}{1} \cdot \frac{x}{450} = \frac{450}{4} \quad \frac{1800}{4} = 450
\end{align*}
\]

\$1800.

Because the ratio of painting area would be equal to the ratio of money.

c. (4 pts) You client would still like to get a larger painting but the 2ft by 4ft. painting is out of their budget. He would like the painting to still be a rectangle that is twice as high as it is wide. Your client wants to know what are the dimensions of the largest painting he could get for $900.00? (This answer will involve radicals. Don’t panic! Just write the answer in simplest form.)

\[
\begin{align*}
\sqrt{2} \times 2\sqrt{2} & \quad 4
\end{align*}
\]
Bonus Question (3pts) Find the area of the circle

The diagonal of the square is \( d^2 = r^2 \) by the Pythagorean theorem.

\[ c^2 = 2 = 2 \Rightarrow c = \sqrt{2} \]

Half of that is the radius

\[ r = \frac{\sqrt{2}}{2} \]

The area of a circle is

\[ A = \pi r^2 \]

\[ = \pi \left( \frac{\sqrt{2}}{2} \right)^2 = \pi \frac{1 \times 2}{2} = \pi \frac{\sqrt{2}}{2} \]

\[ = \pi \frac{2}{4} = \frac{\pi}{2} \]