Name: _____

ULID: _____

Please write complete step by step solutions (whenever possible) to the problems below. Show your work

1. Find a polynomial of minimum degree that has the given zeros. Get rid of the imaginary i's in the expression.
   Zeros: $1, 3, 2 - i, 2 + i$.

2. Factor the following polynomial as a product of **linear** factors.
   $P(x) = (x^2 - 1)(x^4 - 16)$.

3. Solve the following quadratic equations. Find all solutions including complex zeros.

   (a) $x^2 + 3x + 5 = 0$

   (b) $(x + 5)^2 = -9$

   (c) $2x^2 + 7x + 4 = 0$

4. Find the domain of the following rational functions.

   (a) $\frac{2x+18}{4x^2-36}$

   (b) $\frac{x^3+x^2+1}{2(x^2-3x-4)}$.

   (c) $\frac{x^5+x^4+x^3+x^2+x+1}{x^2+1}$

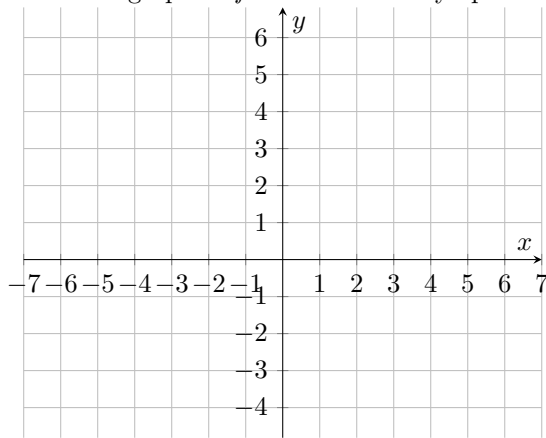5. For the rational function $f(x) = \frac{3x+6}{x-2}$, find:

   (a) Find any x-intercepts.

   (b) Find any y-intercepts.

   (c) Find the equation of the vertical asymptote.

   (d) Find the equation of the horizontal asymptote.

(e) Sketch the graph of f and label all asymptotes and intercepts.

6. Solve the given system of linear equations.

$$3x + 2y = 1$$
$$5x + 7y = 9$$

$$\frac{1}{2}x - \frac{1}{4}y = 2$$
$$4x - 3y = 10$$

$$2x + y = 3$$
$$4x + 2y = 4$$

$$x + 2y = 1$$
$$2x + 4y = 2$$

7. Write the augmented matrix if given the system of linear equations, and the system of equations if given the augment matrix.

(a)

$$4x + 2y - 3z = 0$$
$$2x + y + z = -9$$
$$x + y - 4z = 7$$

(b)

$$x + 2y - 3z = -1$$
$$y + z = 1$$
$$x - 4z = -2$$

(c)

$$3z + 11x + 2y = 0$$
$$44x + y + z = -6$$

(d)

$$\begin{pmatrix} 0 & 1 & 1 & -1 & \bigm| & 7 \\ 2 & 2 & 3 & 0 & \bigm| & 1 \\ 10 & 1 & 2 & 4 & \bigm| & -9 \end{pmatrix}$$

8. Solve the following system using Gauss-Jordan elimination with back substitution.

$$x + y - z = 0$$
$$2x + y + z = 1$$
$$2x - y + 3z = -1$$

BONUS PROBLEM

1. Two ferryboats start at the same instant from opposite sides of a river, travelling across the water on routs at right angles to the shores. Each travels at a constant speed, but one is faster than the other. They pass at a point 720 yars from the nearest shore. Both boats remain in their slips for 10 minutes before starting back. On the return trips they meet 400 yards from the other shore. How wide is the river?

2. You are presented with two fuses (lengths of string), each of which will burn for eactly 1 minute, but not uniformly along its length. Can you use them to measure 45 second?