Major issues from Semester Final

1. For his New Year's Resolution, Mr. Sacco is going to change from drinking coffee to drinking tea. He climbs to the top of the Centennial Bridge and throws his giant container of Maxwell House into the Mississippi. Use the quadratic equation that models projectile motion to answer the following questions, where x represents the time in seconds and $f(x)$ represents the height of the can in feet.

$$f(x) = -16x^2 + 92x + 170$$

a. What is the height of the Centennial Bridge?

b. What will the height of the coffee container be after 6.5 seconds?

c. What is the maximum height of the coffee container?

d. At what time(s) will the coffee container be at a height of 250 feet?

e. How long does it take for the coffee container to hit the water?

2. Use the given equation and factors to answer the questions below:

$$f(x) = x^4 + x^3 + 13x^2 + 25x - 300; (x - 3) \text{ and } (x + 4)$$

a. How many total solutions? _____

b. Find all of the solutions.

3. Given the following polynomial, answer the questions below:
$$f(x) = x^4 + 11x^3 + 47x^2 + 103x + 90$$

   a. How many total solutions? _____

   b. Find all of the solutions.

4. Solve the equation. Be sure to list restrictions and check for any extraneous solutions.

$$\frac{4}{x+6} - \frac{2}{x+4} = \frac{5x+16}{x^2+10x+24}$$

5. Given $f(x) = -3x^5 + 4x^2 - 7x - 11$, name the following:

   a. Degree: _____

   b. Leading coefficient: _____

   c. End behaviors   Left: _____   Right: _____

6. Simplify
   a. i^{24} b. i^{47} c. i^{77}

7. Simplify. Express your answer in standard form. $(3x - 4)(x^2 - 2x + 1)$

8. Decide if the following are polynomials in one variable. If they are, classify them by their number of terms (monomial, binomial, trinomial, polynomial). If they are not, explain why.

   a. $4x^2 - 5y$

   b. $\frac{2}{5}x + 4x^4$

   c. 5

   d. $2x^5 - \frac{7}{x} + 1$
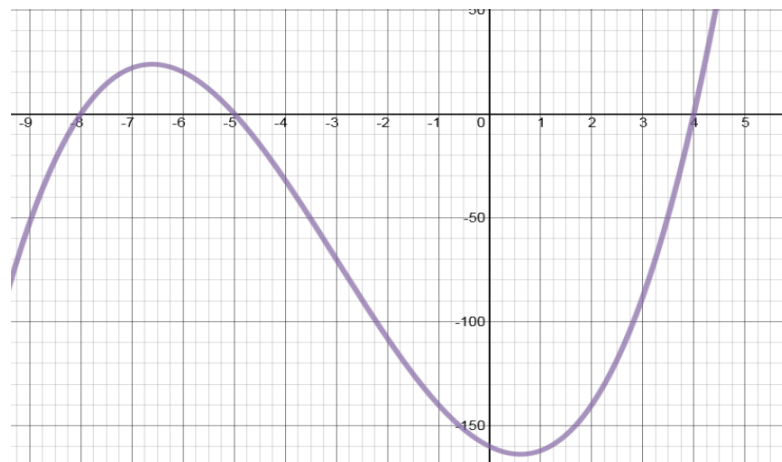
   e. $4 + x^{\frac{1}{2}} + x$

9. Match the picture to the right with its equation.
   a. $f(x) = -(x - 8)(x - 5)(x + 4)$
   b. $f(x) = (x + 8)(x + 5)(x - 4)$
   c. $f(x) = (x - 8)(x - 5)(x + 4)$
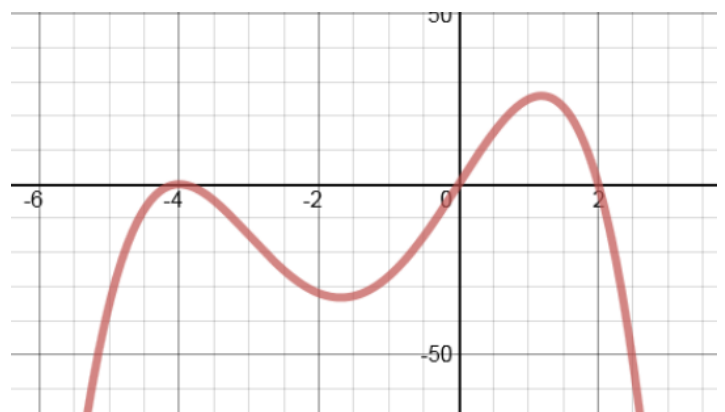   d. $f(x) = -(x + 8)(x + 5)(x - 4)$

10. Match the picture to the right with its equation.
    a. $f(x) = -x(x - 2)(x + 4)$
    b. $f(x) = x(x + 4)(x - 2)$
    c. $f(x) = -x(x + 4)(x - 2)(x + 4)$
    d. $f(x) = x(x + 4)(x + 4)(x - 2)$

11. Sara invests her $18,000 for 10 years at 4%, compounded continuously, while Joe invests his $18,000 for 10 years at 4%, compounded quarterly.

    a. How much will Sara have at the end of 10 years?

    b. When will she have $45,000?

    c. How much will Joe have at the end of 10 years?

    d. When will he have $45,000?

12. Divide. $\dfrac{4x^3+6x^2-5}{2x-3}$

13. Determine the number and type of solutions for the following equations. Justify your answer both graphically and algebraically.

    a. $f(x) = x^2 - 6x + 45$

        a. 1 real and 1 imaginary solution
        b. 2 different real solutions
        c. 1 real solution (double root)
        d. No real solutions

    b. $f(x) = 9x^2 + 42x + 49$

        a. 1 real and 1 imaginary solution
        b. 2 different real solutions
        c. 1 real solution (double root)
        d. No real solutions

14. Given the following graph of a polynomial,

    a. What is the degree? _____

    b. How many real roots? _____

    c. Name the real roots. _____

    d. How many imaginary roots? _____