

Key Concepts:

1. Synthetic Division	2. Rational Zeros Theorem
3. Analyze Rational Functions	4. Limit Notation
5. Solving Inequalities	6. Graphing Polynomials with Multiplicity
7. Polynomial Long Division	8. Write Polynomials using the given Information

1. Synthetic Division

- a. Use synthetic division to reduce the rational function: $g(x) = \frac{2x^4 + x^3 - 11x^2 + 5x - 6}{x - 2}$

- b. Completely factor $f(x)$, $x = -\frac{1}{2}$ is a zero.
 $f(x) = 4x^3 + 4x^2 - 11x - 6$

2. Rational Zeros Theorem

- a. Explain why the Rational Zeros Theorem is helpful.

- b. What are the possible rational zeros of $f(x)$?

$$f(x) = 4x^5 - 17x^3 + 12x^2 - 8x - 16$$

- c. Use synthetic division to completely factor $g(x)$.

$$g(x) = -x^5 - 5x^4 + 5x^3 + 25x^2 - 4x - 20$$

- d. Use synthetic division to completely factor $f(x)$.

$$f(x) = -4x^4 + 12x^3 + 3x^2 - 8x - 3$$

3. Analyze Rational Functions

a. Use the function $f(x) = \frac{2x^2 - x - 28}{x^2 - 1}$ to find the following:

x-intercepts	Vertical Asymptotes
y-intercept	Horizontal Asymptote

b. Use the function $y = \frac{4x^2 + 4x}{x^2 + 4x + 3}$ to find the following:

x-intercepts	Vertical Asymptotes
y-intercept	Horizontal Asymptote

4. Limit Notation

Use limit notation to describe the end behavior of the following functions.

a. $f(x) = 8x^3 - 2x^2 - 17x - 5$	b. $g(x) = -16x^7 + 2x^6 - x^4 + 2x$
c. $h(x) = -x^2 + 6x + 5$	d. $f(w) = 2w^4 + w^3 - 4w - 6$

Use limit notation to describe all vertical and horizontal asymptotes.

e. $f(x) = \frac{x-3}{x^2-2x}$	f. $g(x) = \frac{4x^2+4x}{x^2+4x+3}$
--------------------------------	--------------------------------------

5. Solving Inequalities (Hint: May need to use Sign Analysis Chart)

a. Solve for x :

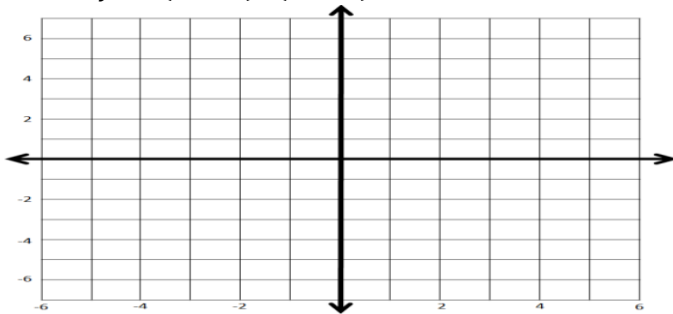
$$3x^4 + x^3 - 36x^2 + 36x + 16 \geq 0$$

b. Solve for t :

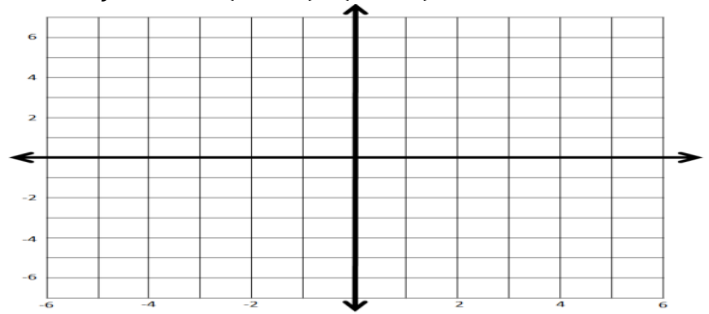
$$\frac{t^2 + 3t - 10}{t^2 - 6t + 9} < 0$$

6. Graphing Polynomials with Multiplicity: Graph the following polynomials and label x-intercepts:

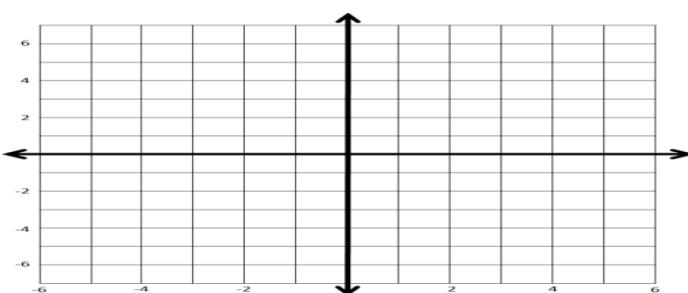
a. $y = (x + 2)^3(x - 1)^2$



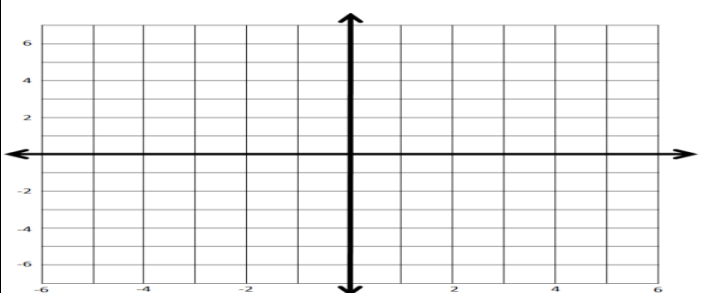
b. $y = -2x(x - 3)^3(x + 2)^4$



c. $y = 3x^2(2x - 1)^2(x - 4)^3(x + 3)^5$



d. $y = 5x^3(x + 1)(x - 4)^3(x + 3)^4$



7. Polynomial Long Division

a. Find the quotient of $f(x)$ and $g(x)$:

$$f(x) = x^5 + 4x^4 - 3x^3 - 2x^2 + 2x - 6$$

$$g(x) = x^2 - 2$$

b. Reduce the rational function to a polynomial:

$$g(x) = \frac{x^7 - 3x^6 + 2x^5 + x^3 - 7x^2 + 14x - 8}{x^2 - 3x + 2}$$

8. Write Polynomials using the given Information:

a. Degree = 3
Leading coefficient = 2
Zeros at $x = -4, \sqrt{3}$

b. Degree = 3
Constant = -80
x-intercepts at $-2, 2, 5$

c. Degree = 4
Zeros at $x = 1, 2 - i$