Name: ____ Class: ____________________

Honors Pre-Calculus Homework Packet: UNIT 2 Polynomial, Power, and Rational Functions

2.1

Determine if the function is a polynomial. If it is, state the degree and leading coefficient.

1. $f(x) = 9 - 2x$
2. $f(x) = 3x^{-5} + 17$
3. $f(x) = 2x^5 - \frac{1}{2}x + 9$

Write an equation for the linear function satisfying the given conditions.

4. $f(-3) = 5 \text{ and } f(6) = -2$
5. $f(1) = 2 \text{ and } f(5) = 7$

Write out the transformations of each quadratic function from $f(x) = x^2$. Then write the vertex and the axis of symmetry.

6. $f(x) = -3(x+2)^2 - 1$
7. $f(x) = 2\left(x - \sqrt{3}\right)^2 + 4$

Complete the square to find the transformations of each quadratic function from $f(x) = x^2$.

8. $f(x) = x^2 - 6x + 12$
9. $f(x) = 8 + 2x - x^2$
10. $f(x) = 5x^2 - 25x + 1$

Write an equation for a quadratic function whose graph contains the given vertex and point.

11. Vertex: (1, 3) Point (0, 5)
12. Vertex (-2, -5) Point (-4, -27)

2.2

Determine if the function is a power function. If it is, write the power and constant of variation.

1. $f(x) = 9x^{\frac{5}{3}}$
2. $f(x) = 13$
3. $K = \frac{1}{2}kv^5$
4. $V = \frac{4}{3}\pi r^3$

Write the statement as a power function. Use k for the constant of variation when it is not given.

5. The area A of an equilateral triangle varies directly as the square of the length s of its sides.

6. The volume V of a circular cylinder with fixed height h is directly proportional to the square of its radius r.

7. The current I in an electrical circuit is inversely proportional to the resistance R, with constant of variation V.

8. Charles' Law states the volume V of an enclosed ideal gas at a constant pressure P varies directly as the absolute temperature T.

9. The energy E produced in a nuclear reaction is directly proportional to the mass m, with the constant of variation being c^2, the square of the speed of light.

10. The speed, p of a free-falling object that has been dropped from rest varies directly as the square root of the distance traveled d, with a constant of variation $\boldsymbol{k = \sqrt{2g}}$

Find the equation of the power function by hand

11.

X	1	2	3	4	5
Y	-4	-32	-108	-256	-500

2.3

State the degree of each polynomial, then write out all of the zeroes and their multiplicities.

1. $f(x) = (x-1)(x+2)(x+3)$
2. $f(x) = -x^3(x+10)^2(2x-3)^4$
3. $f(x) = (2x+1)^3(x-1)$
4. $f(x) = -6(x+5)^3(x-4)^2(5x+3)$

Graph each polynomial function.

5. $f(x) = -(x+4)^2(x-1)(x-5)^3$
6. $f(x) = x(x+3)^5(x-2)^3$
7. $f(x) = (x-3)^4(x+2)(x+6)^2$
8. $f(x) = (x+3)^2(x-2)^2(x+6)^2(x-8)^2$

Write the polynomial function with the given zeroes in factored form and standard form.

9. Zeros: $-2, 3, -5$
10. Zeros: $4\ m. 2,\ 1+\sqrt{2},\ 1-\sqrt{2}$

2.4

Use long division to divide the polynomials.

1. $4x^3 - 8x^2 + 2x - 1 \ \div\ 2x+1$
2. $x^4 - 2x^3 + 3x^2 - 4x + 6 \ \div\ x^2 + 2x - 1$

Use synthetic division to divide the polynomials.

3. $2x^4 - 5x^3 + 7x^2 - 3x + 1 \ \div\ x - 3$
4. $3x^4 + x^3 - 4x^2 + 9x - 3 \ \div\ x + 5$

Use the Remainder Theorem to find the remainder after each polynomial is divided.

5. $x^3 - 3x + 4 \ \div\ x + 2$
6. $x^5 - 2x^4 + 3x^2 - 20x + 3 \ \div\ x + 1$

Use the Factor Theorem to determine whether to divisor is a factor of the polynomial.

7. $x^3 - x^2 - x - 15 \ \div\ x - 3$

Use the Rational Zeroes Theorem to write a list of all the potential rational zeros. Then determine which ones are actual zeroes.

8. $f(x) = 2x^3 - x^2 - 9x + 9$

Use Synthetic Division to prove that the number k is an upper bound for the real zeros of the function.

9. $k = 3, f(x) = 4x^4 - 6x^3 - 7x^2 + 9x + 2$

Use Synthetic Division to prove that the number k is a lower bound for the real zeros of the function.

10. $k = -4, f(x) = 3x^3 - x^2 - 5x - 3$

2.5 and 2.6

Write the polynomial in standard form.

1. $f(x) = (x+2)\left(x - \sqrt{3}i\right)(x + \sqrt{3}i)$
2. $f(x) = x(x+1)(x-1-i)(x-1+i)$

(CONTINUED ON NEXT PAGE)

Write the polynomial function with the given zeros in factored form and standard form.

3. Zeros: $1-2i$ *and* $1+2i$

4. Zeros: $-1, 2,$ *and* $1-i$

5. Zeros: $3+4i,$ *and* $2-7i$

Given one zero of the polynomial, find the rest of the zeros of the polynomial.

6. $4i$ *is a zero of* $f(x) = x^4 + 13x^2 - 487$. 7. 2 *is a zero of* $f(x) = x^3 - 6x^2 + 13x - 10$

8. $1+3i$ *is a zero of* $f(x) = x^4 - 2x^3 + 5x^2 + 10x - 50$

2.7

Describe how the graph of the given function can be obtained from the reciprocal function.

1. $f(x) = -\frac{2}{x+5}$

2. $f(x) = \frac{3x-2}{x-1}$

3. $f(x) = \frac{4-3x}{x-5}$

Find the x intercepts, y intercept, horizontal asymptote/slant asymptote and vertical asymptotes of each function.

4. $f(x) = \frac{3x^2}{x^2+1}$

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

6. $f(x) = \frac{3}{x^3-4x}$

7. $f(x) = \frac{-3x^2+x+12}{x^2-4}$

8. $f(x) = \frac{x+1}{x^2-3x-10}$

9. $f(x) = \frac{x^2-x-2}{x^2-2x-8}$

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

2.8

Solve each equation algebraically. Check for extraneous solutions.

1. $x+2 = \frac{15}{x}$

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

3. $\frac{3}{x-1} + \frac{2}{x} = 8$

4. $\frac{4x}{x+4} + \frac{3}{x-1} = \frac{15}{x^2+3x-4}$

5. $\frac{x+2}{x} - \frac{4}{x-1} + \frac{2}{x^2-x} = 0$

6. $\frac{x+3}{x} - \frac{2}{x+3} = \frac{6}{x^2+3x}$

7. $\frac{3x}{x+2} + \frac{2}{x-1} = \frac{5}{x^2+x-2}$

8. $2 - \frac{3}{x+4} = \frac{12}{x^2+4x}$

2.9

Determine where the function is (a) < 0, (b) ≤ 0, (c) > 0, and (d) ≥ 0

1. $f(x) = (x-7)(3x+1)(x+4)$

2. $f(x) = (5x+3)(x+6)^2(x-1)$

3. $f(x) = (x+2)^3(4x+1)(x-9)^4$

4. $f(x) = (2x+5)(x-8)^2(x+1)^3$

Solve the inequality.

5. $(2x+1)(x-2)(3x-4) \leq 0$

6. $(2x-7)\sqrt{x+4} > 0$

7. $\frac{(x+3)}{|x-8|} \geq 0$

Determine where the function is (a) < 0, (b) ≤ 0, (c) > 0, and (d) ≥ 0

8. $f(x) = \frac{(2x-7)(x+1)}{x+5}$

9. $f(x) = \frac{\sqrt{x+5}}{(2x+1)(x-1)}$

10. $f(x) = \frac{3x-1}{(x+3)\sqrt{x-5}}$

11. $f(x) = \frac{(x-5)|x-2|}{\sqrt{2x-3}}$

12. $f(x) = \frac{x^2(x-4)^3}{\sqrt{x+1}}$