State the degree and leading coefficient of the following polynomials? Then determine the end behaviors. (3pts each)

1. $f\left(x\right)=9x^{3}+6x^{4}-x^{2}+1$
	1. $Degree-$
	2. $Leading Coefficient-$
	3. As x → $-\infty $ then y → \_\_\_\_\_; As x → $\infty $ then y → \_\_\_\_\_

Determine the number of complex roots of the following polynomials (2pts each).

1. $g\left(x\right)= x^{3}-x^{2}+1$
2. $q\left(x\right)= 6x^{5}+51x^{3}+x$

Determine the complex roots of the following polynomials by factoring (3pts each).

1. $x^{4}+x^{2}-12=0$
2. $x^{4}-10x^{2}=-9$

Write a polynomial of least degree that has the following roots. (Yes, you MUST foil this out). (4pts)

1. $x=4, x=-1, and x=5i$

Determine the value of c that completes the square (2pts each)

1. $x^{2}-22x+c$
2. $x^{2}+9x+c$

Determine the roots of the function by completing the square (3pts each).

1. $x^{2}-6x+1=-4 $
2. $x^{2}=16x+20 $
3. $5x^{2}=60-10x $

Express the following equation in vertex form by completing the square (4pts each).

1. $y=3x^{2}-12x+11$
2. $y=x^{2}+6x+1$

Expand the following using Pascal’s Triangle (4pts each).

1. $\left(x+2\right)^{3}$
2. $\left(2x-3\right)^{4}$

What is the coefficient of the $x^{3}$ term in the expansion below (3pts)?

1. $\left(3x+2\right)^{6}$

Use the Remainder Theorem with synthetic division to find the remainder from division. State whether the binomial is a factor of the function? (4pts each)

1. $\frac{x^{3}+4x^{2}-3x+5}{x+3}$
2. $\frac{x^{3}+3x^{2}-8x-24}{x+3}$

Express each polynomial as a product of linear factors using synthetic division. (4pts each)

1. $f\left(x\right)=x^{3}-2x^{2}-4x+8$ given the factor ($x-2)$
2. $f\left(x\right)=x^{4}+3x^{3}-13x^{2}-15x$ given the factor ($x-3)$
3. Use the data in the table below to answer the following questions: (8 points total).

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| x | -1 | -.5 | 0 | .5 | 1 | 1.5 | 2 | 2.5 | 3 | 3.5 | 4 |
| f(x) | -10 | -6.4 | -5 | -5.1 | -6 | -6.9 | -7 | -5.6 | -2 | 4.6 | 15 |

1. What quadratic polynomial function models the data?
2. What cubic polynomial function models the data?
3. What model do you think is more appropriate? Explain with correct mathematical reasoning.

Decompose each expression into partial fractions (3pts each).

1. $\frac{4x}{x^{2}+x-2}$
2. $\frac{6}{x^{2}-2x}$