ALGEBRA 2 CHAPTER 6 NOTES
SECTION 6-1 POLYNOMIALS

Objectives:

Identify, evaluate, add, and subtract polynomials. CC.9-12.F.IF.7c; CC.9-12.A.APR.1

Classify and graph polynomials. CC.9-12.A.CED.2; CC.9-12.A.CED.2

A ____________________is a number or a product of numbers and variables with whole number exponents.

A _____________________ is a monomial or a sum or difference of monomials. Each monomial in a polynomial is a term.

Polynomials have no variables in____, no roots or absolute values of variables, and all variables have_________________________________.

Polynomials:

Not polynomials:

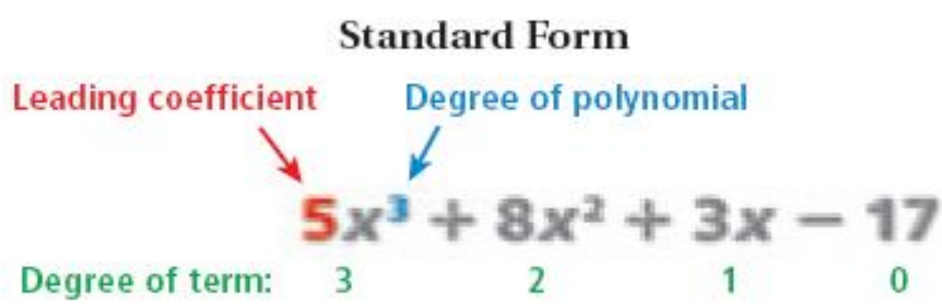
The ____________________________________is the sum of the exponents of the variables.

Identify the degree of each monomial.

A. z^6 **B. 5.6** **C.** $8xy^3$ **D.** a^2bc^3

An ______________________________________is given by the term with the greatest degree.

A____is the coefficient of the first term.



A polynomial with two terms is called a_________________________, and a polynomial with three terms is called a_________________________.

A polynomial can also be classified by its_____________________.

Classifying Polynomials by Degree		
Name	**Degree**	**Example**
Constant	0	-9
Linear	1	$x - 4$
Quadratic	2	$x^2 + 3x - 1$
Cubic	3	$x^3 + 2x^2 + x + 1$
Quartic	4	$2x^4 + x^3 + 3x^2 + 4x - 1$
Quintic	5	$7x^5 + x^4 - x^3 + 3x^2 + 2x - 1$

Rewrite each polynomial in standard form. Then identify the leading coefficient, degree, and number of terms. Name the polynomial.

A. $3 - 5x^2 + 4x$

B. $3x^2 - 4 + 8x^4$

Add or subtract. Write your answer in standard form.

A. $(2x^3 + 9 - x) + (5x^2 + 4 + 7x + x^3)$

B. $(3 - 2x^2) - (x^2 + 6 - x)$

Graph each polynomial function on a calculator. Describe the graph and identify the number of real zeros.

A. $f(x) = 2x^3 - 3x$

B. $f(x) = -\frac{1}{6}x^4 + 2x^2 - 2$

ALGEBRA 2 CHAPTER 6 NOTES
SECTION 6-2 MULTIPLYING POLYNOMIALS

Objectives:

Multiply polynomials.

Use binomial expansion to expand binomial expressions that are raised to positive integer powers. ***CC.9-12.A.APR.5; CC.9-12.A.APR.1; CC.9-12.A.APR.4***

Find each product.

A. $4y^2(y^2 + 3)$ **B.** $fg(f^4 + 2f^3g - 3f^2g^2 + fg^3)$ **C.** $3cd^2(4c^2d - 6cd + 14cd^2)$

Find the product. Using "rainbows"

$(a - 3)(2 - 5a + a^2)$

Find the product.

$(y^2 - 7y + 5)(y^2 - y - 3)$

Find the product.

$(x^2 - 4x + 1)(x^2 + 5x - 2)$

Pascal's triangle.

Binomial Theorem

Expand:

$(k - 5)^3$

$(3x + 1)^4$

ALGEBRA 2 CHAPTER 6 NOTES
SECTION 6-3 DIVIDING POLYNOMIALS

Objectives:

Use long division and synthetic division to divide polynomials. CC.9-12.A.APR.2; CC.9-12.A.APR.6

Divide using long division.

$(2y^2 + 2y^3 + 25) \div (y - 3)$

$$y - 3 \overline{\smash{)}\, 2y^3 - y^2 + 0y + 25}$$

$(15x^2 + 8x - 12) \div (3x + 1)$

$$3x + 1 \overline{\smash{)}\, 15x^2 + 8x - 12}$$

____is a shorthand method of dividing a polynomial by a linear binomial by using only the coefficients.

$(3x^4 - x^3 + 5x - 1) \div (x + 2)$

You can use synthetic division to evaluate polynomials. This process is called ____.

$P(x) = 2x^3 + 5x^2 - x + 7$ for $x = 2$

$P(x) = x^3 + 3x^2 + 4$ for $x = -3$

ALGEBRA 2 CHAPTER 6 NOTES

SECTION 6-4 FACTORING POLYNOMIALS

Objectives:

Use the Factor Theorem to determine factors of a polynomial.

CC.9-12.A.APR.2; CC.9-12.A.APR.3;

Factor the sum and difference of two cubes. CC.9-12.A.APR.4; CC.9-12.A.SSE.2

The ____states that if a polynomial is divided by ($x - a$), the remainder will be a ________________________.

The______________________________: if the remainder is 0, then (x – a) is a _______________.

Determine whether the given binomial is a factor of the polynomial $P(x)$.

A. $(x + 1)$; $(x^2 - 3x + 1)$

B. $(x + 2)$; $(3x^4 + 6x^3 - 5x - 10)$

Factor by grouping:

$x^3 - x^2 - 25x + 25$.

$2x^3 + x^2 + 8x + 4$

Factoring the Sum and the Difference of Two Cubes

METHOD	ALGEBRA
Sum of two cubes	$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$
Difference of two cubes	$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

$4x^4 + 108x$

$125d^3 - 8$

ALGEBRA 2 CHAPTER 6 NOTES
SECTION 6-5 FINDING REAL ROOTS
Objectives:
Identify the multiplicity of roots.
CC.9-12.A.APR.3
Use the Rational Root Theorem and the irrational Root Theorem to solve polynomial equations. CC.9-12.A.REI.11; CC.9-12.A.CED.1

Solve the polynomial equation by factoring.

$4x^5 + 4x^4 - 24x^3 = 0$

$x^4 + 25 = 26x^2$

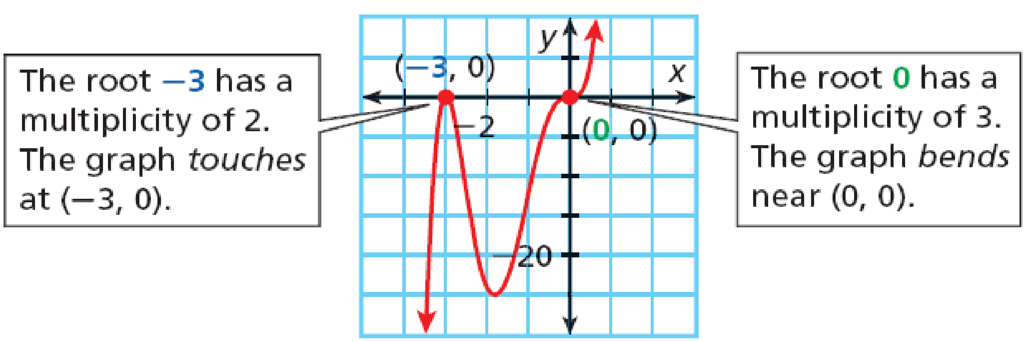
Sometimes a polynomial equation has a factor that appears more than once. This creates a ___________________________________

The ____of root *r* is the number of times that *x* – *r* is a factor of *P*(*x*).

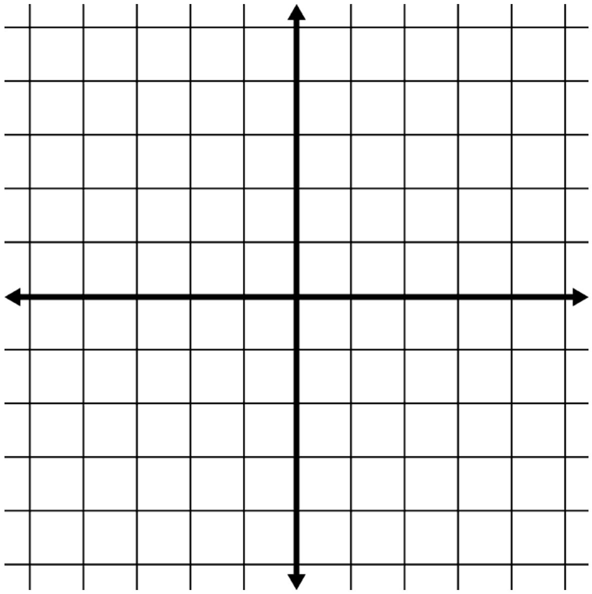
When a real root has a multiplicity of one, the graph of y = P(x) will __________ the x-axis cleanly.

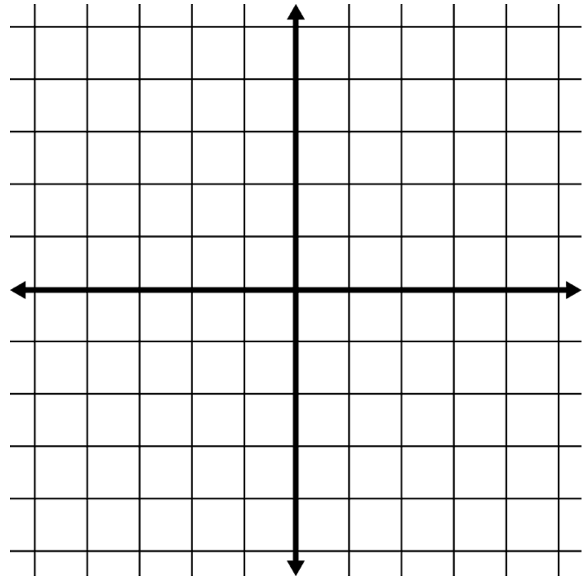
When a real root has ___________multiplicity, the graph of *y* = *P*(*x*) ____________________the *x*-axis but ________________________________.

When a real root has ___________multiplicity greater than 1, the graph _____________ or "swooshes" as it crosses the *x*-axis.



Looking at the multiplicities of the previous equations, sketch a rough graph:





____**can help you find all possible rational roots of a polynomial equation.**

Rational Root Theorem

If the polynomial $P(x)$ has integer coefficients, then every rational root of the polynomial equation $P(x) = 0$ can be written in the form $\frac{p}{q}$, where p is a factor of the constant term of $P(x)$ and q is a factor of the leading coefficient of $P(x)$.

The ____say that irrational roots come in____. For example, if you know that 1 +   is a root of $x^3 - x^2 - 3x - 1 = 0$, then you know that 1 –   is also a root.

Identify all the real roots of
$2x^3 - 3x^2 - 10x - 4 = 0$.

$3x^4 - 7x^2 + 6x - 12 = 0$

ALGEBRA 2 CHAPTER 6 NOTES
SECTION 6-6 FUNDAMENTAL THEOREM OF ALGEBRA

Objectives:

Use the Fundamental Theorem of Algebra and its corollary to write a polynomial equation of least degree with given roots. (CC.9-12.N.CN7,CN8,CN90

Identify all of the roots of a polynomial equation.(CC.9-12.A.APR.2)

Also (CC.9-12.A.CED1, CC.9-12.A.REI.11)

3 other names for a root:

Write the simplest polynomial with roots –1, 2/3 , and 4.

Write the simplest function with zeros 2 + *i*, , and 1.

THE FUNDAMENTAL THEOREM OF ALGEBRA

Solve $x^4 - 3x^3 + 5x^2 - 27x - 36 = 0$ by finding all roots.

Solve $x^4 + 4x^3 - x^2 + 16x - 20 = 0$ by finding all roots.

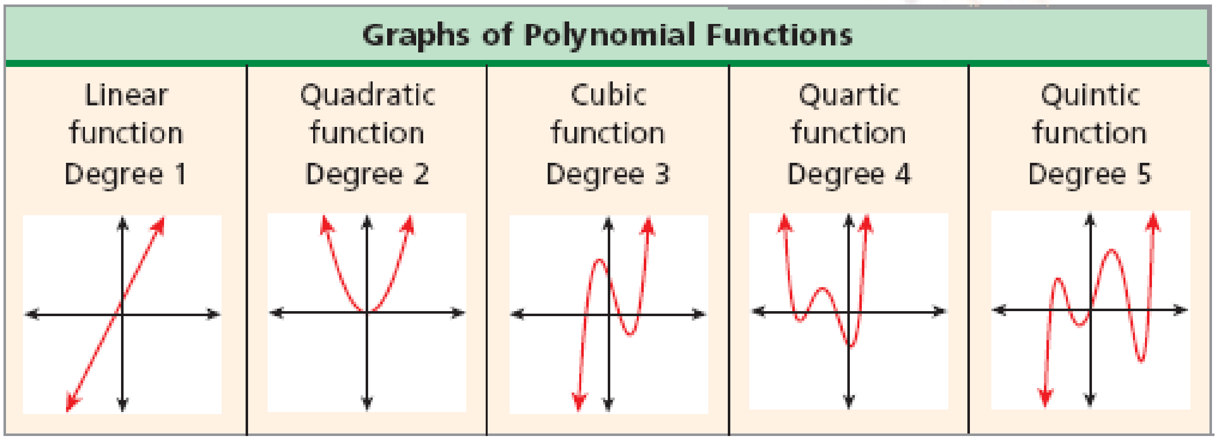
Write the simplest function with zeros 2*i*, , and 3.

ALGEBRA 2 CHAPTER 6 NOTES
SECTION 6-7 GRAPHS OF POLYNOMIALS

Objectives:

Use properties of end behavior to analyze, describe, and graph polynomial functions. CC.9-12.A.APR.3; CC.9-12.F.IF.7c

Identify and use maxima and minima of polynomial functions to solve problems. CC.9-12.A.CED.2; CC.9-12.A.CED.3



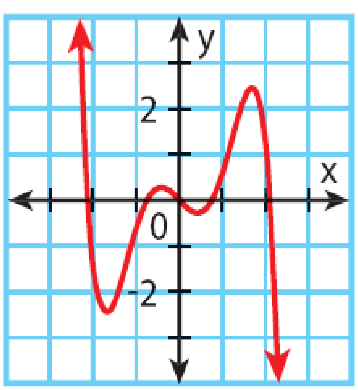
____________________________________is a description of the values of the function as *x* approaches infinity _________or negative infinity __________.

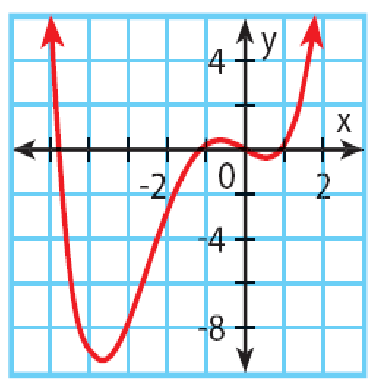
The _______________________________________coefficient of a polynomial function determine its end behavior.

Identify the leading coefficient, degree, and end behavior.

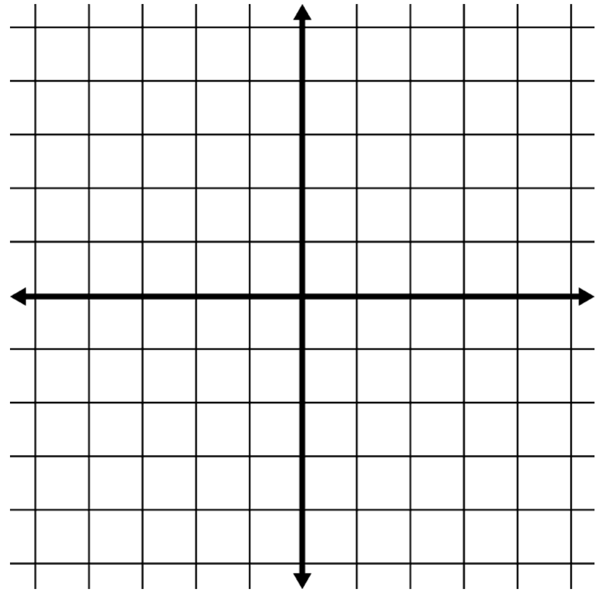
A. $Q(x) = -x^4 + 6x^3 - x + 9$ **B.** $P(x) = 2x^5 + 6x^4 - x + 4$

Determine a possible equation given the graph.





Graph the function. $f(x) = x^3 + 4x^2 + x - 6$.



A _____________________________________ is where a graph changes from ____

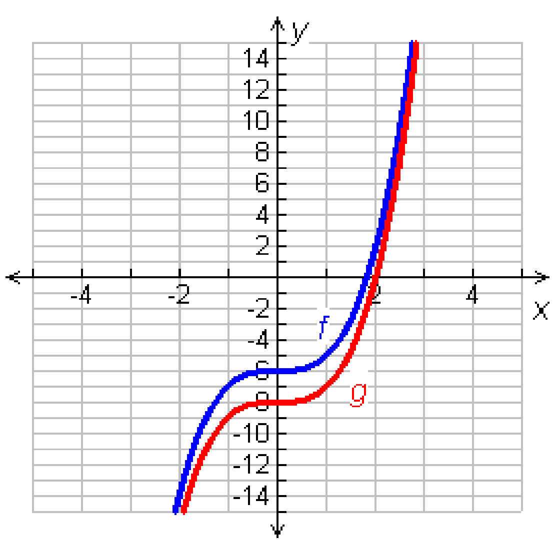
A turning point corresponds to a *local*_______________________________.

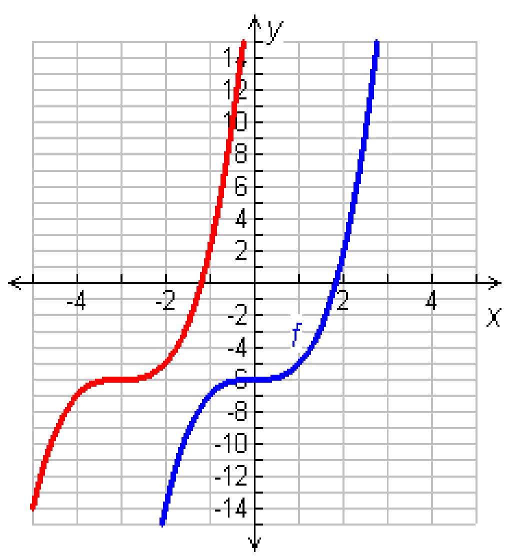
ALGEBRA 2 CHAPTER 6 NOTES
SECTION 6-8 TRANSFORMING POLYNOMIALS

Objectives:
Transform polynomial functions.
CC.9-12.F.IF.7c; CC.9-12.F.BF.3;
CC.9-12.A.CED.3

Transformations of $f(x)$		
Transformation	**$f(x)$ Notation**	**Examples**
Vertical translation	$f(x) + k$	$g(x) = x^3 + 3$ 3 units up $g(x) = x^3 - 4$ 4 units down
Horizontal translation	$f(x - h)$	$g(x) = (x - 2)^3$ 2 units right $g(x) = (x + 1)^3$ 1 unit left
Vertical stretch/ compression	$af(x)$	$g(x) = 6x^3$ stretch by 6 $g(x) = \frac{1}{2}x^3$ compression by $\frac{1}{2}$
Horizontal stretch/ compression	$f\left(\frac{1}{b}x\right)$	$g(x) = \left(\frac{1}{5}x\right)^3$ stretch by 5 $g(x) = (3x)^3$ compression by $\frac{1}{3}$
Reflection	$-f(x)$ $f(-x)$	$g(x) = -x^3$ across x-axis $g(x) = (-x)^3$ across y-axis

For $f(x) = x^3 - 6$, write the rule for each function and sketch its graph.



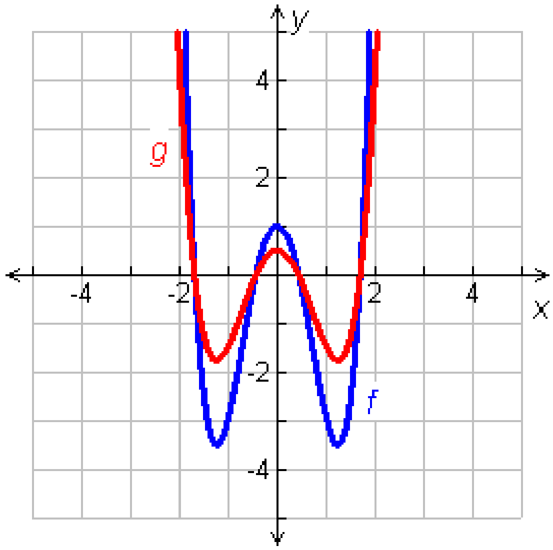


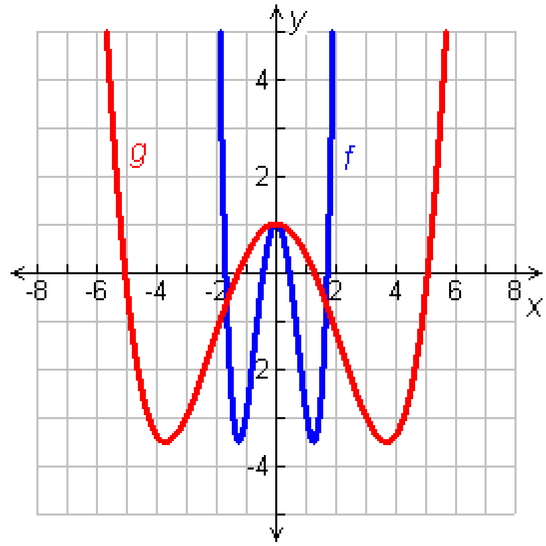
Let $f(x) = x^3 + 5x^2 - 8x + 1$. Write a function g that performs each transformation.

Reflect $f(x)$ across the x-axis.

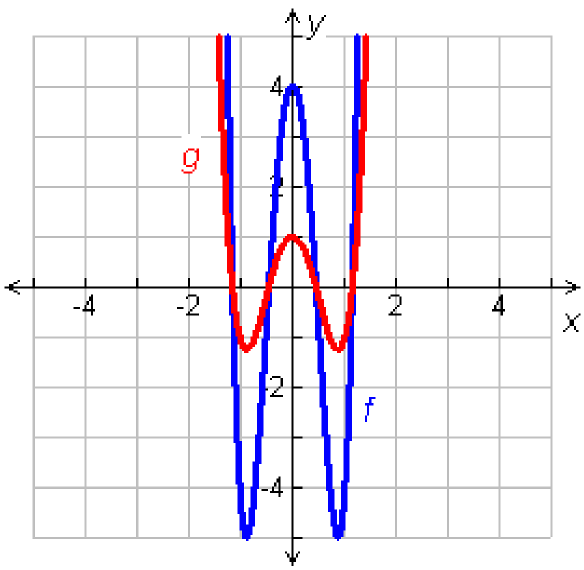
Reflect $f(x)$ across the y-axis.

Let $f(x) = 2x^4 - 6x^2 + 1$. Graph f and g on the same coordinate plane. Describe g as a transformation of f.





Let $f(x) = 16x^4 - 24x^2 + 4$. Graph f and g on the same coordinate plane. Describe g as a transformation of f.



Write a function that transforms $f(x) = 6x^3 - 3$ in each of the following ways.

Compress vertically by a factor of 1/3 , and shift 2 units right.

Reflect across the y-axis and shift 2 units down.

Write a function that transforms $f(x) = 8x^3 - 2$ in each of the following ways.

Compress vertically by a factor of 1/2, and move the x-intercept 3 units right.

ALGEBRA 2 CHAPTER 6 NOTES
SECTION 6-9 CURVE FITTING

Objectives:

Use finite differences to determine the degree of a polynomial that will fit a given set of data. CC.9-12.F.IF.7c; CC.9-12.A.CED.3; CC.9-12.A.CED.2

Use technology to find polynomial models for a given set of data.

Finite Differences of Polynomials		
Function Type	**Degree**	**Constant Finite Differences**
Linear	1	First
Quadratic	2	Second
Cubic	3	Third
Quartic	4	Fourth
Quintic	5	Fifth

Use finite differences to determine the degree of the polynomial that best describes the data.

x	**–6**	**–3**	**0**	**3**	**6**	**9**
y	**–9**	**16**	**26**	**41**	**78**	**151**

x	**12**	**15**	**18**	**21**	**24**	**27**
y	**3**	**23**	**29**	**29**	**31**	**43**

The table below shows the population of a city from 1960 to 2000. Write a polynomial function for the data.

Year	**1960**	**1970**	**1980**	**1990**	**2000**
R Population (Thousands)	**4,267**	**5,185**	**6,166**	**7,830**	**10,812**

The table below shows the gas consumption of a compact car driven a constant distance at various speed. Write a polynomial function for the data

Speed	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**
Gas (gal)	**23.8**	**25**	**25.2**	**25**	**25.4**	**27**	**30.6**	**37**

Often, real-world data can be too__________________________ for you to use finite differences or find a polynomial function that fits perfectly. In these situations, you can use the regression feature of your graphing calculator. Remember that the closer the R^2-value is to ___, the____.

The table below shows the opening value of a stock index on the first day of trading in various years. Use a polynomial model to estimate the value on the first day of trading in 2000

Year	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Price ($)	**683**	**652**	**948**	**1306**	**863**	**901**

The table below shows the opening value of a stock index on the first day of trading in various years. Use a polynomial model to estimate the value on the first day of trading in 1999.

Year	**1994**	**1995**	**1996**	**2000**	**2003**	**2004**
Price ($)	**3754**	**3835**	**5117**	**11,497**	**8342**	**10,454**