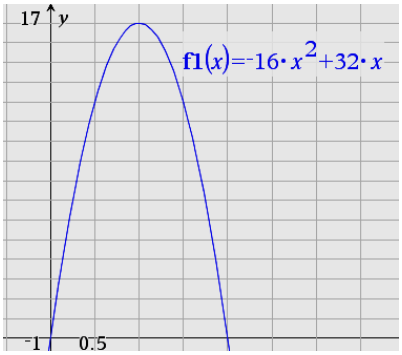
2C-3: Polynomial Applications

In this lesson, we will explore a couple ways to apply polynomial functions.

Quadratic Inequalities

Over their heads

Suppose a soccer player kicks a soccer ball in the air at a low parabolic arc. If the height of the ball is modeled by the function $h(t) = -16t^2 + 32t$, find the times when the ball will be lower than 6 feet so players can reach it.



Solving Quadratic Inequalities

The solutions to a quadratic inequality are the intervals of $(-\infty, \infty)$ *that satisfy the inequality*

Step 1: Change the inequality to an equation and find the zeros.

Step 2: Plot these zeros on a number line.

Step 3: Use the inequality to test one value in each of the intervals that are made by the zeros.

Each interval that contains a value that satisfies the inequality is a solution.

Try It Solve the inequalities:

a) $x^2 + 9x \leq 10$

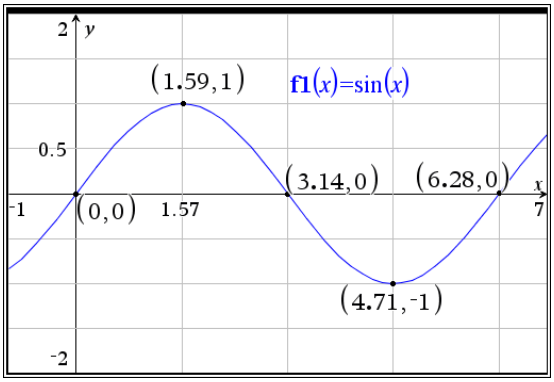
b) $x^2 + 9x \geq 10$

Polynomial Regression

In previous lessons, we have used our graphing calculators to find linear and quadratic regression models, but sometimes we can use higher degree regressions to better model a situation.

Modeling Waves with Polynomials

Many patterns in nature form waves that are often modeled using trigonometry functions like sine and cosine. However, these trigonometric functions can be difficult to work with in some situations, so we would like to find a polynomial function that models a wave for a small amount of time.



Try It: To the right is the graph of a sine wave. Enter the given points into two lists in your calculator, then find a cubic regression model to approximate the values of sin (x) on the interval [0,6.28].

a) Record your cubic regression equation and R^2 value here.

b) Graph $y = \sin(x)$ and your cubic function in the same window. How do they compare?

c) Now, find a *quartic* (4^{th} degree) regression model and write it's equation and R^2 value.

d) Graph $y = \sin(x)$ and your quartic function in the same window. How do they compare?

Pre-Calculus Name: Date: Period:

Assignment 3B-2

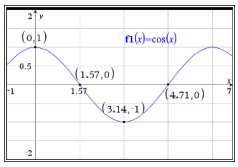
Solve these quadratic Inequalities

1. $x^2 + 4x < 12$

2. $x^2 + 4x \geq 12$

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

4. Use the points in the graph to the right to find a *cubic* regression model for $y = \cos(x)$ on the interval [0,6.28].



   a. State the function and the R^2 value.

   b. Use your cubic function to approximate $\cos\left(\frac{\pi}{4}\right)$. That is, find $f\left(\frac{\pi}{4}\right)$.

   c. How does (b) compare to the real value of $\cos\left(\frac{\pi}{4}\right) \approx .7071$?

5. Add the point (6.28,1) to your list, then use the points in the graph to the right to find a *quartic* regression model for $y = \cos(x)$ on the interval [0,6.28].

   a. State the function and the R^2 value.

   b. Use your quartic function to approximate $\cos\left(\frac{\pi}{4}\right)$. That is, find $f\left(\frac{\pi}{4}\right)$.

   c. How does (b) compare to the real value of $\cos\left(\frac{\pi}{4}\right) \approx .7071$?