

Objectives for Polynomial Activity

- Create power functions
- Find and interpret intercepts
- Find intervals of increasing and decreasing function values
- Identify end behavior
- Find and interpret extrema
- Identify and interpret concavity
- Find and interpret inflection points
- Find polynomial functions given intercepts
- Polynomial regression

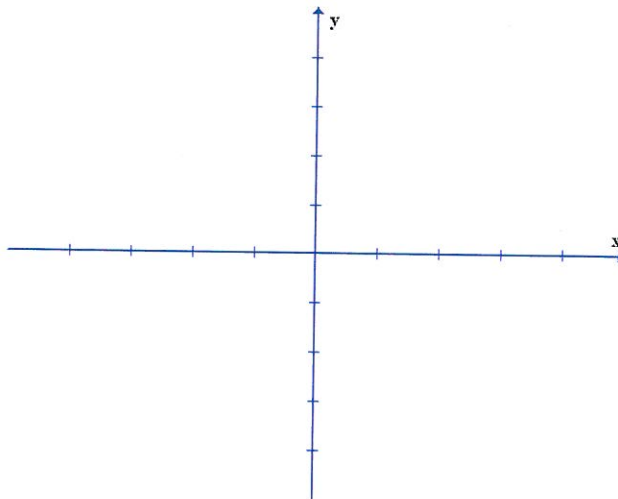
Power Functions

1. y is directly proportional to the square of x and when $x = 3$, $y = 36$. Create a power function relating x and y and use it to find y when x is 7.
2. a is inversely proportional to the cube root of b and when $b = 27$, $a = 8$. Create a power function relating a and b and use it to find b when $a = 16$.
3. Driving to Tucson from Scottsdale at 65mph would take approximately two hours. Is the time the drive takes directly or inversely proportional to the speed? Write a formula for the proportion and use it to figure out what speed you would need to average in order to get there in 1 and a half hours.
4. Find the equation of the power function through the points $(2, 24)$ and $(-4, -192)$.

Behavior of Polynomials

1. Given the polynomial $f(x) = x^4 + 3x^3 - 28x^2 - 60x$ answer the following questions:

- What is the degree of f ?
- Use your graphing calculator to draw a graph of f . Be sure to choose a window that allows you to see the whole graph.



- Identify all of the intercepts of f . Write your answers as points (a,b) .
- Rewrite the polynomial in factored form.
- Identify all the intervals where f is increasing and decreasing. Write your answers in interval notation.
- Estimate the location and value of any relative extrema (e.g local minimums and local maximums).

Degrees and Zeros

2. Determine the degree and zeros of the following polynomials

Polynomial	Degree	Zeros
$f(x) = (x + 3)(x - 5)^2$		
$g(x) = (x + 2)(x - 1)(x - 4)$		
$k(x) = (3x + 2)(x - 3)^2$		
$f(x) = x(x + 3)(3x - 5)^2$		
$m(x) = x(x - 3)$		
$n(x) = x^2(x - 3)$		
$p(x) = x^2(x - 3)^2$		
$q(x) = x^2(x - 3)^3$		

3. Take a look at the zeros of the last four functions from the previous problem:

$$m(x) = x(x - 3) \quad n(x) = x^2(x - 3) \quad p(x) = x^2(x - 3)^2 \quad q(x) = x^2(x - 3)^3$$

What do you notice at the zeros? What kind of generalizations can you make?

When a zero is repeated an even number of times ...

When a zero is repeated an odd number of times...

End Behavior

4. Using limit notation, describe the end behavior of the following polynomials. See if you can complete this activity without using your calculator.

a. $f(x) = x^7 - 3x^6 + 45x^4 - 321x + 729$

b. $g(x) = x^2 + 3x^4 - 17x^7 + 3x^3 + 17 - 4x$

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

d. $k(x) = -2(x-3)^2(2x-5)(x^2+4)$