Week 5
MTH-1320 – PreCalculus

Hello and Welcome to the weekly resources for MTH-1320 – PreCalculus!

This week is <u>Week 5 of class</u>, and typically in this week of the semester. your professors are covering these topics below. If you do not see the topics your particular section of class is learning this week, please take a look at other weekly resources listed on our website for additional topics throughout of the semester.

We also invite you to **look at the group tutoring chart on our website to see if this course has a group tutoring session offered this semester**.

If you have any questions about these study guides, group tutoring sessions, private 30 minute tutoring appointments, the Baylor Tutoring YouTube channel or any tutoring services we offer, please visit our website www.baylor.edu/tutoring or call our drop in center during open business hours. M-Th 9am-8pm on class days 254-710-4135.

Key Words: Quadratic Functions, Power functions, Polynomial Functions

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Topic of the Week: Quadratic functions

A quadratic function is a function of degree 2, and its graph resembles a parabola (or a smile!)
The **general form** of a quadratic equation is

$$f(x) = ax^2 + bx + c$$

Where a, b, c are real constants and a ≠ 0 (otherwise the function wouldn't be of degree 2).

Parabolas are easier to recognize (and graph) when written in their **standard form**

$$f(x) = a(x - h)^2 + k$$

Where (h, k) is the vertex of the parabola (either it's lowest or highest point).
If a > 0 the parabola opens upward, if a < 0 it opens downward

Finding the vertex of a parabola:

1) Calculate the x coordinate using the formula

$$h = \frac{-b}{2a}$$

2) Evaluate f(x) at x = h to find k

Finding the roots (x-intercepts) of a parabola:

- Method 1:

1) Factor the general form of the equation
2) Set each factor to 0
3) Solve for x

- Method 2:
  1) Use the quadratic formula using the values of a, b, c from the general form of the equation

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

  2) Don't forget to evaluate the plus or minus!
- Method 3:
  1) Rewrite quadratic equation in standard form
  2) Set it equal to 0
  3) Solve for x (very similar to completing the square

Highlight #1: Power Functions and Polynomial Functions

A power function is a function that consist of three elements: a real number constant k, a variable x, and a real number exponent e. A power function looks like this

$$f(x) = kx^e$$

K is called the **coefficient** of the power function.
Note! The exponent does not have to be an integer, and it can be both negative, and a fraction.

We are interested in the graphs of these functions and in understanding their **end-behavior,** which is the behavior of the function as x increases towards positive infinity and decreases towards negative infinity.

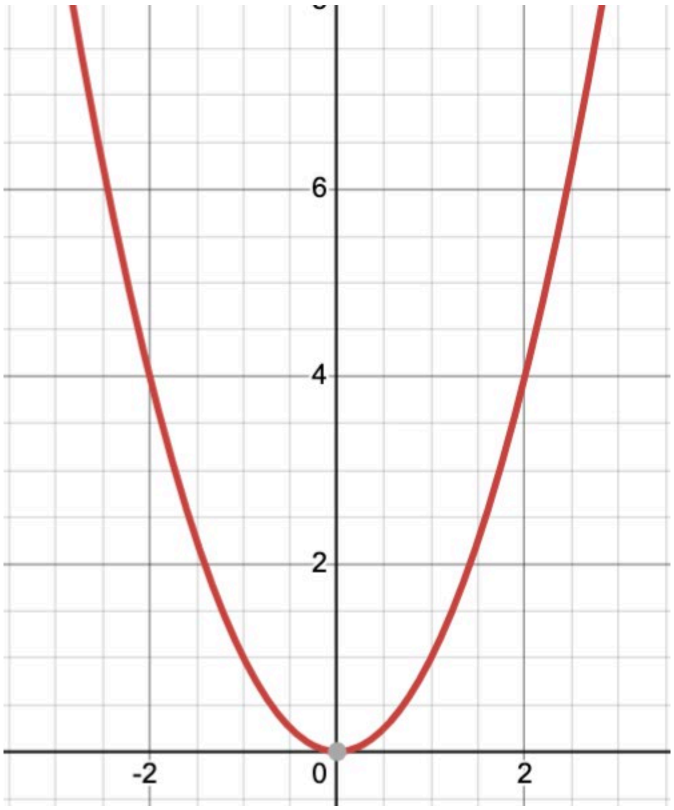
The formal way of writing end behavior looks like this:

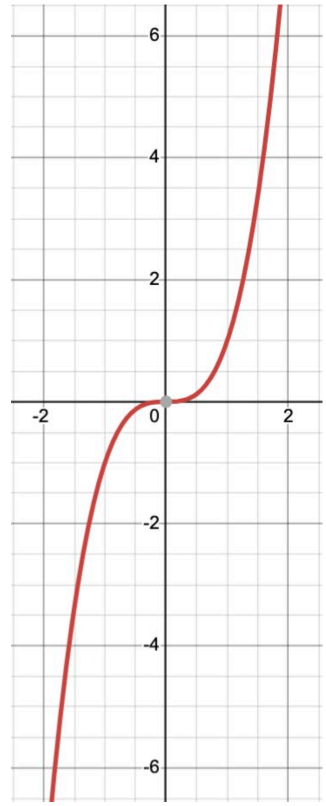
$$x \to \infty (or - \infty) \qquad f(x) \to \cdots$$

And is read "as x approaches infinity (or negative infinity), f(x) approaches …"

If the exponent is a positive integer, f(x) will always approach either ∞ or -∞, as shown in the following graphs.

Note! If the exponent is even, the function is called an **even function** and will be symmetric around the y axis. If the exponent is odd, the function is an **odd function** and is symmetric around the origin.





Even function

$x \to \infty \quad f(x) \to \infty$

$x \to -\infty \quad f(x) \to \infty$

Odd function

$x \to \infty \quad f(x) \to \infty$

$x \to \infty \quad f(x) \to$

$-\infty$

Highlight 2: Polynomial Functions

A polynomial function is a sum of power functions. The general form of a polynomial function is

$$f(x) = a_n x^n + a_{n-1}x^{n-1} + \ldots + a_2 x^2 + a_1 x + a_0$$

Where $a_n, a_{n-1}, \ldots, a_1, a_0$ $are\ real\ coefficients$, and all exponents are non-negative.
For the polynomial to be in general form, the terms ($a_n x^n$, $a_{n-1}x^{n-1}$,….) must be organized with the exponents going from highest to lowest.

The first term of the polynomial equation is called the **leading term.** The coefficient of the leading term is called the **leading coefficient**. The exponent of the leading term also tells us the **polynomial's degree** (by definition, the degree of a polynomial is the highest exponent present in the equation)

Highlight 3: Determining the end-behavior of a polynomial function

To determine the end-behavior of a polynomial function

1. Find the leading term by identifying the term with the highest exponent
2. Treat the leading term as a power function
3. Determine the leading term's end behavior (Is it even? Odd? What happens as x goes to positive/negative infinity)
4. The end-behavior of the leading term is also the end-behavior of the polynomial function

The rest of the terms in the equation determine the zeroes and turning points.
To find the zeroes of the equation, set the polynomial to 0 and solve for x.

Check Your Learning

1. **What is the end behavior of the following functions as x$\rightarrow\ \infty$ and x $\rightarrow\ -\infty$?**

a) f(x) = $3x^2$
b) f(x) = $5x^2\ +\ 2x\ \ +\ 15x^3$

Thanks for checking out these weekly resources!
Don't forget to check out our website for group tutoring times, video tutorials and lots of other resources: www.baylor.edu/tutoring ! Answers to check your learning questions are below!

Answers to Check Your Understanding

1.

a) x$\rightarrow\ -\infty$, f(x) $\rightarrow\ \infty$ **x $\rightarrow\ \infty$, f(x) $\rightarrow\ \infty$**
b) x$\rightarrow\ -\infty$, f(x) $\rightarrow\ -\infty$ **x $\rightarrow\ \infty$, f(x) $\rightarrow\ \infty$**