Awesometh Degree of a Function

Polynomials

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Grade Level	10th – 11th Grade	**Time Frame**	1-2 class period(s)
Subject	Mathematics	**Duration**	90 minutes
Course	Algebra 2		

Essential Question

How do we know if a pattern is correct or not?

Summary

This lesson is an introduction to polynomials. Solving polynomials is not included in this lesson, and would be the next lesson after this one. Academic language as well as patterns in polynomial family functions is explored. Prerequisite knowledge would be an understanding of functions and exponents in general, as well as the ability to graph (or work a graphing calculator).

Snapshot

Engage

Students will brainstorm prior knowledge with a two-minute paper.

Explore

Students will construct polynomials and look for patterns.

Explain

Students will share the patterns found and will learn academic language associated with the patterns.

Extend

Students will determine if statements are always, sometimes, or never true.

Evaluate

Students will write a word splash paragraph over the content.

Standards

ACT College and Career Readiness Standards - Mathematics (6-12)

AF705: Identify characteristics of graphs based on a set of conditions or on a general equation such as $y = ax^2 + c$

Oklahoma Academic Standards Mathematics (Algebra 2)

A2.F.1.5: Analyze the graph of a polynomial function by identifying the domain, range, intercepts, zeros, relative maxima, relative minima, and intervals of increase and decrease.

Attachments

- Always, Sometimes, Never KEY—Awesometh Degree of a Function.docx
- Always, Sometimes, Never KEY—Awesometh Degree of a Function.pdf
- Always, Sometimes, Never Worksheet—Awesometh Degree of a Function - Spanish.docx
- Always, Sometimes, Never Worksheet—Awesometh Degree of a Function - Spanish.pdf
- Always, Sometimes, Never Worksheet—Awesometh Degree of a Function.docx
- Always, Sometimes, Never Worksheet—Awesometh Degree of a Function.pdf
- Data Sheet Explore—Awesometh Degree of a Function - Spanish.docx
- Data Sheet Explore—Awesometh Degree of a Function - Spanish.pdf
- Data Sheet Explore—Awesometh Degree of a Function.docx
- Data Sheet Explore—Awesometh Degree of a Function.pdf
- Polynomial Card Sort—Awesometh Degree of a Function - Spanish.docx
- Polynomial Card Sort—Awesometh Degree of a Function - Spanish.pdf
- Polynomial Card Sort—Awesometh Degree of a Function.docx
- Polynomial Card Sort—Awesometh Degree of a Function.pdf
- Teacher Guide Polynomials Intro—Awesometh Degree of a Function.pptx

Materials

- Graphing calculator, or other graphing software (Explore)
- Card sort set, cut out (one for each student; Explore)
- Data sheet (one for each student; Explore)
- Whiteboard; something to write on for all students to see (Explain)
- Always, Sometimes, Never Worksheet (one for each student; Extend)
- Lined paper (Engage and Evaluate)

Engage

Have the words "Polynomial Functions" displayed on the board when students come in. Have them take out a piece of paper, and do a Two-Minute Paper over everything they know - or think they know - about polynomial functions.

Only Two Minutes!

Set a timer. Do it. Do not let this Engage last more than 5 minutes TOTAL. This is just meant to get the students out of whatever subject they were just in and get in the math zone.

After the two minutes, have some students share what they've written, but keep it casual and short. Have them keep that paper and use the rest of it for their Evaluate activity.

Explore

Pass out a cut out set of the Card Sort to each student. In each card sort are numbers, variables, exponents, and addition operations. Also, pass out the data collection sheet. Allow students some quiet thinking time to use the cards to construct equations, and then input their equations into a graphing calculator, or other graphing software. Have them record their equations, along with a sketch of their graph and any observations, on their data sheet.

Dropping Breadcrumbs

Depending on your group of students, you may see a lot of creativity and a variety of graphs being made - or you will see a lot of the same. Feel out the vibe of each hour, and give hints or ask questions to foster the creativity needed to get reasonable observations. Negative signs are included, and encourage the students to use them.

Working Alone

It's hard to find a LEARN lesson that has working alone as part of the lesson. This is because the collaborative aspect of groups is a huge skill for students. However, sometimes silence is golden, even for students. There will be opportunities for collaboration later in the lesson, so let the students (and yourself) decompress in the silence and let them explore the idea of different equations without the pressure or preconception of a partner.

Explain

Once the students have investigated enough to fill out the data sheet completely, start the Inverted Pyramid process. Have students find an elbow partner, and share the relationships between the equation, graph shape, and any other general trends.

Stick To The Point

It's easy to let the students keep talking if it's sounding academic. But they will always find more details, and keep going. Set a timer for each part of the inverted pyramid (about 6 minutes for the first part, 3 minutes for the second part, and 7 minutes for the last part since that's your chance to explain to the whole group) and stick to it. If you don't, you'll look up and suddenly 30 minutes is magically gone and there's nothing to show for it except pairs sharing.

After the partner share happens, have the partners create a group of four, and share their findings. Finally, have students share to the whole group. During the sharing, write the observations on the board and explain why those observations are true, or why they aren't.

Making The Connection

Now, in the whole group, is the time to introduce the academic language of polynomial functions and corresponding graphs. Use the student observations to reveal and enforce the academic language, so that it's a natural connection between what the students have experienced in the Explore and the deeper idea.

Extend

When the inverted pyramid is done, pass out the Always, Sometimes, Never True workpage. Allow students to work in their pairs, and have them evaluate the statements and determine the "truthiness" of each statement.

Be The Lifesaver

Student work time is a prime opportunity to walk around and see how each student is doing as an informal formative assessment. The Extend is when the learning from Explore and Explain is reinforced in a long-term memory kind of way, but also where misinformation can breed. Clear up those misconceptions, and use this time to remediate those who need it, while letting those who don't need it have some great math conversations with their partners.

Thinking Faster?

Need an optional interpretation for advanced student? Each student has three signs (or pieces of paper) that say Always, Sometimes, or Never. Display each statement on the board, and have students lift the sign they think corresponds with the statement, then having a student share a justification (or counter example). Why only advanced students? Some of the statements are deep-thinkers, and so the students would need to process a thoughtful statement more quickly with this method than the individually paced workpage. If you think your students are ready, go for it! This option is a little more engaging and doesn't have the 'work' vibe.

Evaluate

Have students look back on their 2-minute paper from the Engage. Post the following words for the students to see:

- Polynomial
- Degree
- X- and Y-Intercepts
- Maximum and Minimum
- End Behavior
- Turning Points

Have students participate in a Word Splash with these words. On the same piece of paper from Engage, they will write a paragraph using all of the words listed. Have the students share out their paragraphs if they wish, but have everyone turn their paragraphs in when done.

Establishing Expectations

The responses possible for this is very varied. It can be as simple as definitions in paragraph form, or a true synthesis and application of these ideas. You need to be super clear on which you expect before the students start writing, and stay true to that expectation when reading the responses.

Resources

- Two-Minute Paper (Engage): K20 Center. (n.d.). Two-minute paper. K20 Learn. Retrieved from https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f506cf73
- Card Sort (Explore): K20 Center. (n.d.). Card sort. K20 Learn. Retrieved from https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f506976b
- Inverted Pyramid (Explain): K20 Center. (n.d.). Inverted pyramid. K20 Learn. Retrieved from https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f507a918
- Always, Sometimes, Never True (Extend): K20 Center. (n.d.). Always, sometimes, never true. K20 Learn. Retrieved from https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f50685d2
- Word Splash (Evaluate): K20 Center. (n.d.). Word splash. K20 Learn. Retrieved from https://learn.k20center.ou.edu/strategy/fe96d3de46cfdc1f385aab7e7500a888