

Lesson Plan: Graph Transformations DP Mathematics (AAHL 2.16)

Duration: 60 minutes

Learning Objectives:

1. Understand the concept of graph transformations and their types (translation, reflection, dilation/stretch, compression, and more).
2. Apply various transformations to the sine wave and analyze their effects.
3. Relate graph transformations to real-world phenomena and mathematical concepts.

Materials Needed:

- Graphing calculators or graphing software
- Whiteboard and markers
- Handouts with graph transformation explanations and examples
- Access to an online graphing applet (optional)

Key Terms:

- Graph Transformation
- Translation, Reflection, Dilation/Stretch, Compression
- Absolute Value Transformation
- Phase Shift, Squaring Function, Amplitude, Period, Axis Crossing Points, Reciprocal Function

Introduction (10 minutes):

- Warm-up Discussion: What are graph transformations? Discuss the basic concept and ask students to share examples of transformations they see in everyday life.
- Objective Announcement: Explain that today's lesson will explore graph transformations using the sine wave as a base function, emphasizing the importance of these transformations in various fields of study.

Instructional Sequence:

1. The Original Wave (10 minutes):

- Exploration: Begin with the function $\sin(x)$. Discuss its properties: amplitude, period, and axis crossing points. Mention real-life examples, such as sound waves.
- Interactive Demonstration: Use a graphing calculator or software to plot $\sin(x)$ and discuss its shape and properties.

2. Absolute Changes (10 minutes):

- Group Activity: Students apply the absolute value transformation, $|\sin(x)|$, to $\sin(x)$ and discuss the outcome. Focus on the change in negative values and its graphical representation.
- Visualization: Use graphing tools to show $\sin|x|$ and facilitate discussion on its implications.

3. Flipping and Shifting (10 minutes):

- Hands-On Experimentation: Students explore adding a constant (phase shift) and reflecting over the x-axis. Each group shares their findings and observations.

- Conceptual Understanding: Discuss the mathematical significance of these transformations.

4. Squaring the Wave (10 minutes):

- Creative Task: Encourage students to square the sine function and observe changes. Discuss how this affects the graph's period and amplitude.
- Critical Thinking: Prompt students to consider how these transformations affect the interpretation of the function.

Inquiry-Based Activities (15 minutes):

- Inquiry Challenge: Can students predict a graph before applying a transformation?
- Real-World Connection: How do these transformations relate to real-world phenomena?
- Mathematical Detective: Given a transformed graph, can students identify the transformations used?
- Creative Twist: Students use transformations to create a unique wave pattern and describe its properties.

Conclusion (5 minutes):

- Recap the day's activities, emphasizing the importance of understanding graph transformations in analyzing complex functions.
- Highlight the relevance of these concepts in fields like engineering and computer science, as well as in everyday problem-solving.

Assessment:

- Formative Assessment: Observation of group activities, inquiry challenges, and participation in discussions.
- Summative Assessment: A quiz on graph transformations, including identification and application of transformations on functions.

Homework:

- Assign problems that require students to apply different transformations to given functions and predict the outcome. Encourage the use of graphing software to verify their answers.

Additional Notes:

- Ensure that all students have access to graphing calculators or software to fully engage in the activities.
- Adapt the depth of discussion to match students' familiarity with the IB DP Mathematics curriculum, ensuring all students can follow along and contribute.

