Table of Activities

Part 1: The Illusion of Motion (2 sessions)

Students participate in two introductory activities that provide the motivation and inspiration for the unit: viewing and discussing a short animated film, and programming their graphing calculators, which gives them an opportunity to explore and apply a mathematical process similar to computer animation.

Activity 1A: Viewing Animated Films

1A.1: ***Viewing an Animation***	Students view an animation several times as they note the motion of a character.
1A.2: ***Small-Group Work***	Students share their ideas in small groups and then discuss them with the class.

Activity 1B: Programming Animations I

1B.1: ***Programming the Calculators***	Students transfer code into their graphing calculators to create a simple animation.
1B.2: ***Class Discussion***	The class discusses the functions of the commands in the calculator program.

Activity 1C: Introduction to the Unit Project

1C.1: ***The Unit Project***	Students are introduced to the unit project and receive an assessment checklist to help them monitor their work throughout the unit.
1C.2: ***Framing Questions***	Students are introduced to the framing questions of the unit.

Part 2: Geometric Transformations 1 (4 sessions)

Students mathematically transform an object on the 2-D Cartesian coordinate plane. They apply translations and reflections and are introduced to the concept of *isometry*. Students learn mathematical notation, represent transformations using matrices, and learn how operations with matrices help them systematize transformations.

Students brainstorm ideas for their flipbooks by creating sketches and storylines. They then use the sketches to build their understanding of geometric transformations.

Activity 2A: What Are Transformations?

2A.1: ***Introducing Transformations***	Students perform a transformation on a geometric object.
2A.2: ***Writing Definitions***	Students apply another transformation and consider properties common to the two transformations. Students then generate definitions of a transformation.
2A.3: ***Project Work***	Students create figures for their flipbook animations.

Activity 2B: Shifting Objects: Translations

2B.1: ***Translation Vectors***	Students determine how vectors can be used to represent translations.
(Optional) 2B.2: ***Verifying Congruence***	Students explore algebraic verifications of congruence between the pre-image and the image of a geometric object.

Note: This activity is located in **Appendix B: Optional Activity 2B.2**.

2B.3: ***Matrices***	Students learn to represent coordinate points with matrices and to use matrix addition to translate objects on the plane.
2B.4: ***Project Work***	Students create flipbook frames using translations.

Activity 2C: Mirror Image—Reflections

2C.1: ***What Are Reflections?***	Students reflect a geometric object over several different lines on the plane.
2C.2: ***Properties of Reflections***	Students explore invariants under reflections.
2C.3: ***Matrix Multiplication***	Students learn to perform matrix multiplication.
2C.4: ***Representing and Applying Reflections***	Students work in small groups to generate reflection matrices.
2C.5: ***Project Work***	Students create flipbook frames using reflections.

Part 3: Geometric Transformations II (3 sessions)

Students explore using dilations to create the illusion of depth and distance. In studying these nonrigid transformations of the plane, students learn that not all transformations preserve a figure's length, area, and perimeter. Students strengthen their understanding of similarity and proportion as they compare geometric figures and their dilations.

Students continue to use matrices to systematize the process of animation. They represent dilations with matrices and apply dilations to the figures in their flipbooks.

Activity 3A: Understanding Dilations

3A.1: ***Shrinking and Enlarging***	Students dilate triangles and compare the pre-image to the image of each dilation.
3A.2: ***Moving the Center***	Students explore ways to dilate figures using different locations for the center of dilation.

Activity 3B: Scalar Multiplication

3B.1: ***Using Matrices to Represent Dilations***	Students find dilation matrices that change geometric objects by specified scale factors.
3B.2: ***Exploring Scalar Multiplication***	Students use matrices to dilate geometric objects.

Activity 3C: Project Work

3C.1: ***More Dilations***	Students explore a series of frames that complete the story with the "Pop" figure.
3C.2: ***Applying a Dilation to Transform an Object***	Students apply dilations to their flipbook frames.

Part 4: Wrap Up (2 sessions)

As an optional activity, students work with a graphing calculator program that uses matrix transformations, and then apply their learning to create a simple calculator animation.

Students finalize their flipbooks, gather the documentation they've created for their mathematical guides, and reflect on their work in the unit. Students present their completed flipbooks to the class.

(Optional) Activity 4A: Programming Animations II

4A.1: ***Zig-Zag***	Students explore a calculator program that uses matrices to transform geometric objects.
4A.2: ***Class Discussion***	The class discusses the functions of commands in the calculator program. Students create their own calculator animations.

Activity 4B: Completing the Unit Project

4B.1: ***Assembling the Work***	Students gather their project components and reflect on the unit.
4B.2: ***Small-Group Critiques***	Students work in groups and use peer feedback to revise their flipbooks.

Activity 4C: Presenting the Work

Students present their flipbooks to the class.