Math Lesson Plan: Video Game Animator

Student: Paxton (13-year-old auditory homeschooler)

Subject: 8th Grade Math (Pre-Algebra)

Dates: August 18-22, 2025

Materials Needed

- A computer with internet access
- A headset with a microphone for auditory instruction and recording
- Access to GeoGebra Classic (Graphing) or Desmos for the coordinate plane
- A digital notebook (like Google Docs or Microsoft Word) for notes and coordinates
- A free screen recording tool (like Loom or Screencastify) for the final project submission

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Overall Learning Objectives

By the end of this week, Paxton will be able to:

1. Design a 2D character on a coordinate plane by plotting and connecting points.
2. Graph a linear equation in the form y = mx + b to represent a path of motion.
3. Verbally describe and apply geometric transformations (translations, reflections, rotations) to a figure on the coordinate plane.
4. Create and present a multi-step animation sequence for his character, justifying each movement with mathematical reasoning.

Oklahoma Academic Standards (OAS) Alignment

- **PA.A.2.2:** Identify and graph linear equations in the form y = mx + b.
- **PA.GM.2.1:** Predict and describe the effects of transformations (translations, reflections, and rotations) on two-dimensional figures.
- **PA.GM.2.2:** Informally prove or disprove the congruency of two-dimensional figures using transformations.

Daily Lesson Plan

Day 1: Monday, Aug 18 - Mission: Character Creation

- **Daily Objective:** Paxton will plot at least 10 coordinate pairs to create a simple 2D character on a digital graphing tool.
- **Warm-Up (Auditory Focus):** Listen to these coordinate pairs and visualize where they are on a graph: (0,0), (5,0), (0,-5), (-2, 3). Which one is on the origin? Which one is in the fourth quadrant?
- **Instruction & Activity (The "Mission"):**
    1. Open GeoGebra or Desmos. We will call this our "Animation Canvas."
    2. Today's mission is to design the hero of our video game. It can be a robot, an alien, an

animal, or anything you can imagine. Keep the design simple, using straight lines.
3. In your digital notebook, create a list of at least 10 coordinate pairs (x, y) that will form the outline of your character. For example, the corner of an eye could be at (-2, 4).
4. On the Animation Canvas, plot each point. Then, connect the dots to create your character's final shape.
5. Take a screenshot of your completed character and save it. This is your "Model Sheet."

- **Check for Understanding (Formative Assessment):** Verbally describe your character's location. "The head of my robot is in Quadrant II, and its feet are on the x-axis." Point to a specific vertex on your character and state its coordinate pair.
- **Wrap-Up:** Great work creating your character! Tomorrow, we'll give it its first ability: moving in a perfectly straight line across the screen.

Day 2: Tuesday, Aug 19 - Mission: The Laser Path

- **Daily Objective:** Paxton will write and graph at least two different linear equations in the form $y = mx + b$.
- **Warm-Up (Auditory Focus):** Think about the word "slope." What does it mean in the real world (like on a hill or a roof)? How might that relate to a line on a graph?
- **Instruction & Activity (The "Mission"):**
  1. Load your character's Model Sheet onto the Animation Canvas.
  2. Today, we are programming a path of movement. We will use linear equations. The equation **y = mx + b** is the code for a straight line.
     - **b** is the y-intercept: where the path **begins** on the y-axis.
     - **m** is the slope: how steep the path is. We describe this as "rise over run." A slope of 2 (or 2/1) means "go up 2 units for every 1 unit you go right."
  3. Let's create a path starting at (0, -5). So, b = -5. Let's make the slope 3. So, m = 3. Your equation is **y = 3x - 5**. Type this into GeoGebra/Desmos. See the line appear?
  4. Now, it's your turn. Create two different "laser paths" for your character. Experiment! What happens if the slope (m) is negative? What if the slope is a fraction, like 1/2? Record the equations for your two favorite paths in your notebook.
- **Check for Understanding (Formative Assessment):** Verbally explain one of your equations. "This path is y = -2x + 4. It starts at 4 on the y-axis and goes down 2 units for every 1 unit it moves to the right."
- **Wrap-Up:** Your character can now move in a straight line. But what about jumping or dodging? Tomorrow, we'll learn the code for a "jump" move.

Day 3: Wednesday, Aug 20 - Mission: The Jump and Flip

- **Daily Objective:** Paxton will correctly apply one translation and one reflection to his character, recording the new coordinates.
- **Warm-Up (Auditory Focus):** Listen carefully. If you are standing at the number 3 on a number line, and I tell you to "translate positive five," where do you end up? If you are at 3, and I say "reflect across zero," where do you end up?
- **Instruction & Activity (The "Mission"):**
  1. A **translation** is a "slide" or "jump." We just add or subtract from the coordinates! To move **right 4**, we add 4 to every x-coordinate. To move **down 2**, we subtract 2 from every y-coordinate.
  2. Take your original character's coordinates from Day 1. Write them in your notebook. Now, create a new list of coordinates by translating your character **left 5 and up 3**. (Hint: subtract 5 from x, add 3 to y). Plot these new points on the canvas to see your character "jump."
  3. A **reflection** is a "flip" over a line. To reflect across the y-axis, every x-coordinate becomes its opposite (e.g., 3 becomes -3). To reflect across the x-axis, every y-coordinate becomes its opposite.
  4. Go back to your original character's coordinates. Create a new list of coordinates by

reflecting it across the x-axis. Plot these points. Does it look like your character is looking at its reflection in water?

- **Check for Understanding (Formative Assessment):** If one point on your character is (2, 6), what are its new coordinates after a translation of right 3, down 1? What are its new coordinates after a reflection over the y-axis? Explain your answer out loud.
- **Wrap-Up:** Fantastic! Now your character can jump and flip. There's one more key move to learn: the spin attack! We'll tackle that tomorrow.

Day 4: Thursday, Aug 21 - Mission: The Spin Move

- **Daily Objective:** Paxton will apply a 90-degree and a 180-degree rotation around the origin to his character.
- **Warm-Up (Auditory Focus):** Picture a clock. If the minute hand is on the 12, and it rotates 90 degrees clockwise, what number is it pointing to? What about 180 degrees?
- **Instruction & Activity (The "Mission"):**
  1. A **rotation** is a "spin" around a point. We'll use the origin (0,0) as our spinning point. There are simple rules (or "codes") for this!
  2. **Code for 90° Clockwise Rotation:** The point (x, y) becomes (y, -x). So, (2, 5) becomes (5, -2).
  3. **Code for 180° Rotation:** The point (x, y) becomes (-x, -y). So, (2, 5) becomes (-2, -5).
  4. Go back to your original character's coordinates. Apply the 90° clockwise rotation rule to every point and plot the new "spun" character.
  5. Now try again, but with the 180° rotation rule. Does it look like your character did a half-turn?
- **Check for Understanding (Formative Assessment):** Verbally explain the rule for a 180-degree rotation. If a character's foot is at (-4, -1), where will it be after a 90-degree clockwise rotation?
- **Wrap-Up:** You've mastered all the core animation moves! Tomorrow is the final showcase, where you'll combine everything to create a unique animation sequence for your character.

Day 5: Friday, Aug 22 - Summative Assessment: The Animation Showcase

- **Daily Objective:** Paxton will create, record, and verbally present a 4-step animation sequence applying the week's concepts.
- **The Final "Mission":**
  1. Plan a 4-step "story" for your character on your Animation Canvas. You must use at least **one linear path**, **one translation or reflection**, and **one rotation**.
  2. **Example Storyboard:**
     - **Step 1: Starting Position.** Character appears at its original coordinates.
     - **Step 2: Linear Movement.** Character moves along the path $y = -x + 5$ until it reaches the y-axis.
     - **Step 3: Transformation 1.** From its new position, the character performs a 180-degree rotation to face the other way.
     - **Step 4: Transformation 2.** The character translates 8 units down to "exit" the screen.
  3. Open your screen recording tool (Loom, Screencastify).
  4. Record your screen and your voice. Start by introducing your character. Then, guide me through your 4-step animation. For each step, show the "before" and "after" on the canvas and **verbally explain the math** you used. For example, say "Next, I am applying a 180-degree rotation, so I am changing every (x, y) coordinate to (-x, -y)."
  5. Keep the recording under 5 minutes. Submit the link to your video as your final project.

Differentiation and Support

- **For Support:** If Paxton finds the concepts difficult, we can simplify the tasks. For example, he could design a much simpler character (a triangle or square), use simpler slope values (like 1 or -1), or focus on only one type of transformation per day. The final project could be reduced to 3 steps.
- **For Challenge:** If Paxton masters the concepts quickly, he can be challenged to create a more complex character, use fractional slopes, explore reflections over lines other than the axes (e.g., reflect over the line y = x), or learn the rules for 90° counter-clockwise rotations. His final project could require more steps or a more complex combination of moves.