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Happy Feet's Fancy Footwork

By Britt Norlander

• *Learn how animators use* coordinate grids *to make a penguin boogie on the big screen. Then, make your own animation!*

   In next month's *Happy Feet,* a penguin named Mumble shows off his smooth dance moves. *MATH* went behind the scenes to find out how the movie's animators made Mumble's flippers stomp and shuffle.

   (See picture, "Film Still: Happy Feet.")

   As with any animation, moviemakers first sketched a series of still images called *frames*. For instance, a leg kick is made up of several frames with Mumble's leg at a slightly different height in each one. "There is a little bit of movement in each frame," Chris DeFaria, the Warner Bros. Studios executive in charge of *Happy Feet*, told *MATH*. These frames flash onscreen so quickly that your brain can't make out the individual images. "In every second, 24 frames move through the projector," said DeFaria. "So if you want to make something move for 1 second, you need to move it in 24 consecutive frames."

Film Still: Happy Feet

(Credit: Warner Bros. Entertainment Inc.)

   Hand-drawing the more than 100,000 frames needed for the movie would be too time-consuming. Instead, animators created computer images of all the characters. You can then think of each frame as a *coordinate grid*--crisscrossing horizontal and vertical lines. The points where those lines intersect match up with different parts of a character's body. On the computer, animators can move one or more of those points to create the next frame. "A point on the tip of Mumble's toe allows us to move his foot forward," said DeFaria.

   Sound like movie magic? It's time to test your animation skills with a fun flipbook of coordinate grids. No dancing required!

What to Do

   Each point on a coordinate grid is identified with two numbers called an *ordered pair*--for example, (3, 1). The first number tells you how many spaces to move left or right along the horizontal *x*-axis. The second number tells you how many points to move up or down along the vertical *y*-axis. With this information, and by following these directions, you'll be able to make a cool flipbook!

   1. Make one frame of your flipbook: Use a ruler and pencil to draw a square, 10 units wide and 10 units tall, on a sheet of graph paper.

2. Label the bottom edge as the *x*-axis and the left, vertical edge as the *y*-axis. (See sample below.)

3. Number the lines along each axis from 1 to 10, with 0 in the bottom-left corner.

4. Repeat steps 1 to 3 until you have created a total of five frames. Number each frame from 1 to 5.

5. Use the chart below to draw the image in each frame. For each frame, make a dot at each listed ordered pair. Then, use a marker to connect the dots to complete each section of a stick figure's body. Connect the dots for each body section in the alphabetical order in which the coordinates are given. (As an example, we have completed Frame 1 on the coordinate grid.) Each frame will show the stick figure in a slightly different position.

(See picture, "Chart and Coordinate Grid.")

6. Use scissors to cut out each frame along its 10-by-10 outline.

7. Then, position each frame on a separate index card. Align the right and bottom edge of each frame with the same edges of the index card. Glue each frame--picture-side up!--onto the cards. Allow the glue to dry.

8. Stack the index cards in order with Frame 1 on the top and Frame 5 on the bottom. Then, staple the left side of the stack.

9. Hold the book's stapled side in your left hand. Using your right thumb, flip through the pages from 1 to 5. Watch the stick figure jump!

Chart and Coordinate Grid

(Credit: SCHOLASTIC MATH)
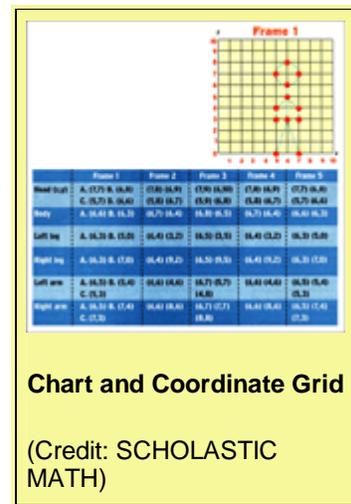
Answers

Make sure students are properly graphing the ordered pairs. A common mistake might be to plot the points (*y, x*), rather than (*x, y*). Also check that students are connecting the points according to the alphabetical order as laid out in frame #1.
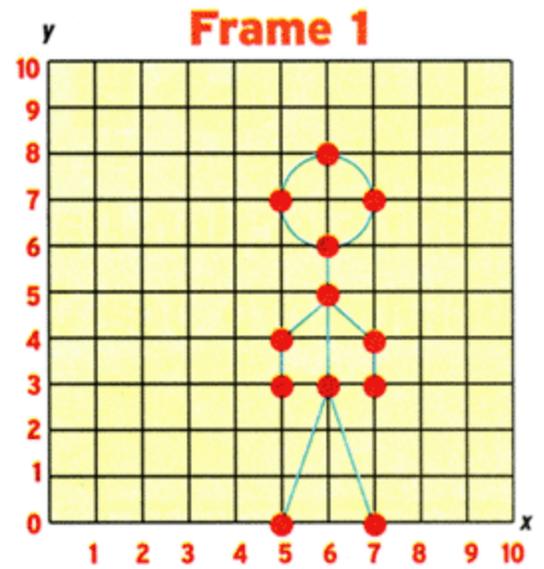
Frame 1

	Frame 1	Frame 2	Frame 3	Frame 4	Frame 5
Head (x,y)	A. (7,7) B. (6,8) C. (5,7) D. (6,6)	(7,8) (6,9) (5,8) (6,7)	(7,9) (6,10) (5,9) (6,8)	(7,8) (6,9) (5,8) (6,7)	(7,7) (6,8) (5,7) (6,6)
Body	A. (6,6) B. (6,3)	(6,7) (6,4)	(6,8) (6,5)	(6,7) (6,4)	(6,6) (6,3)
Left leg	A. (6,3) B. (5,0)	(6,4) (3,2)	(6,5) (3,5)	(6,4) (3,2)	(6,3) (5,0)
Right leg	A. (6,3) B. (7,0)	(6,4) (9,2)	(6,5) (9,5)	(6,4) (9,2)	(6,3) (7,0)
Left arm	A. (6,5) B. (5,4) C. (5,3)	(6,6) (4,6)	(6,7) (5,7) (4,8)	(6,6) (4,6)	(6,5) (5,4) (5,3)
Right arm	A. (6,5) B. (7,4) C. (7,3)	(6,6) (8,6)	(6,7) (7,7) (8,8)	(6,6) (8,6)	(6,5) (7,4) (7,3)