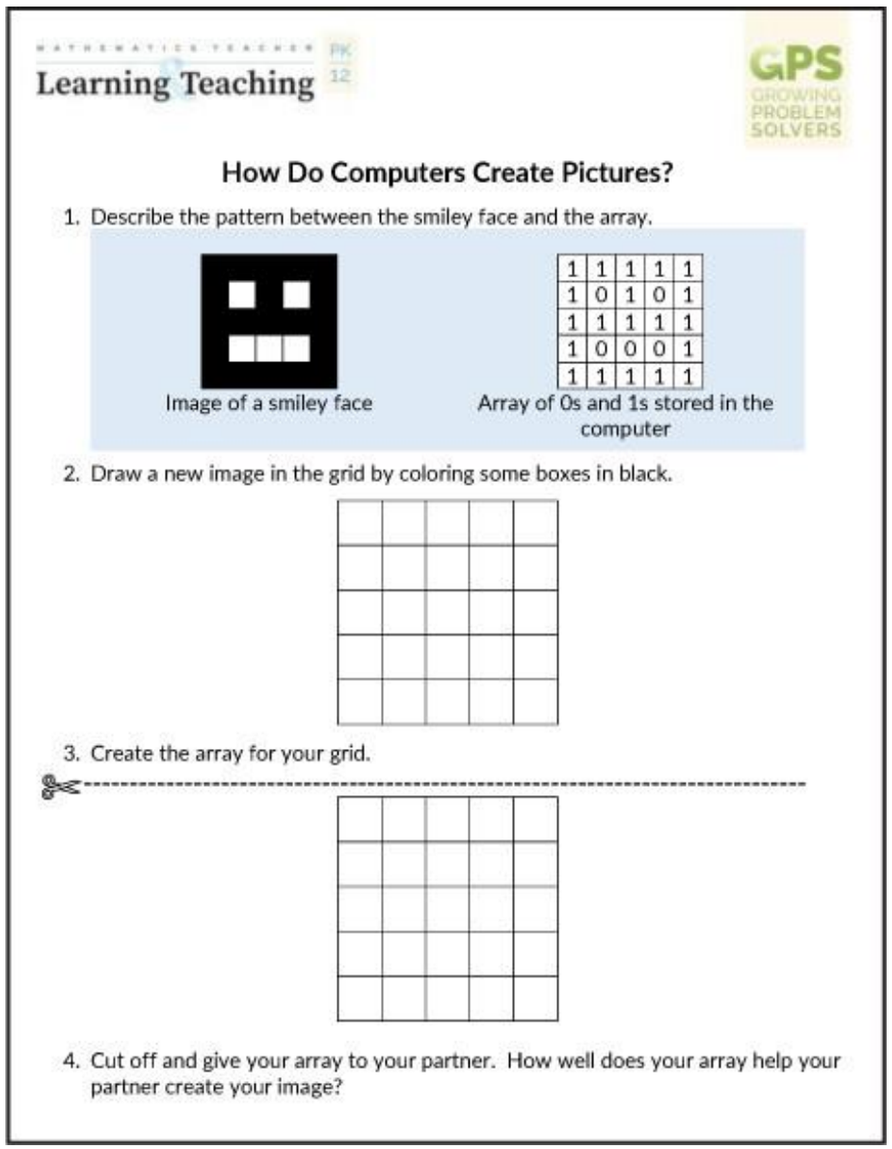
From: Flavin E, Lee JH, Chamberlin MT, Powers RA. GPS: Artificial Intelligence Image Processing. *Mathematics Teacher: Learning and Teaching PK-12. 2024;117(11):848-852. doi:10.5951/MTLT.2024.0103*

DOI: https://doi.org/10.5951/MTLT.2024.0103



Learning Teaching PK 12

GPS GROWING PROBLEM SOLVERS

How Do Computers Create Pictures?

1. Describe the pattern between the smiley face and the array.

Image of a smiley face

1	1	1	1	1
1	0	1	0	1
1	1	1	1	1
1	0	0	0	1
1	1	1	1	1

Array of 0s and 1s stored in the computer

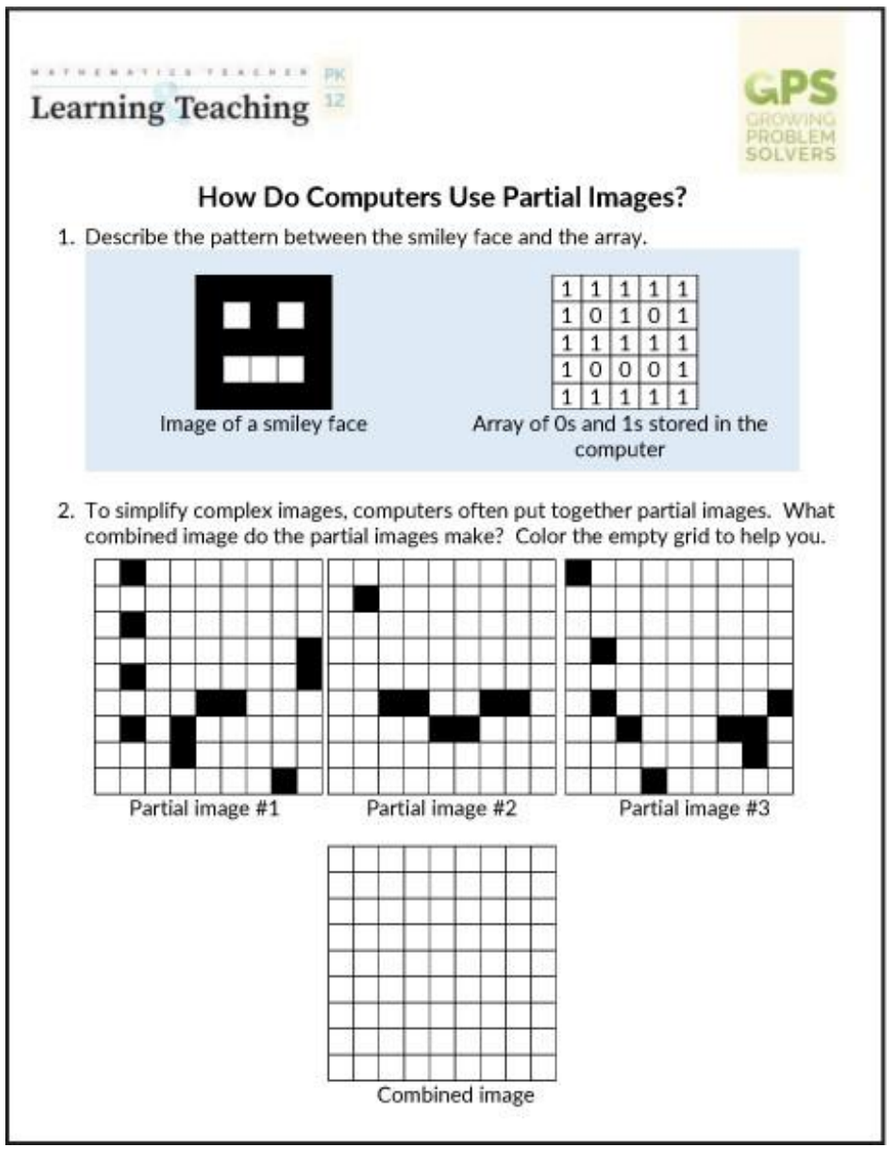
2. Draw a new image in the grid by coloring some boxes in black.

3. Create the array for your grid.

4. Cut off and give your array to your partner. How well does your array help your partner create your image?

From: Flavin E, Lee JH, Chamberlin MT, Powers RA. GPS: Artificial Intelligence Image Processing. *Mathematics Teacher: Learning and Teaching PK-12. 2024;117(11):848-852. doi:10.5951/MTLT.2024.0103*

DOI: https://doi.org/10.5951/MTLT.2024.0103


Mathematics Teacher Learning Teaching PK 12

GPS Growing Problem Solvers

How Do Computers Use Partial Images?

1. Describe the pattern between the smiley face and the array.

Image of a smiley face

1	1	1	1	1
1	0	1	0	1
1	1	1	1	1
1	0	0	0	1
1	1	1	1	1

Array of 0s and 1s stored in the computer

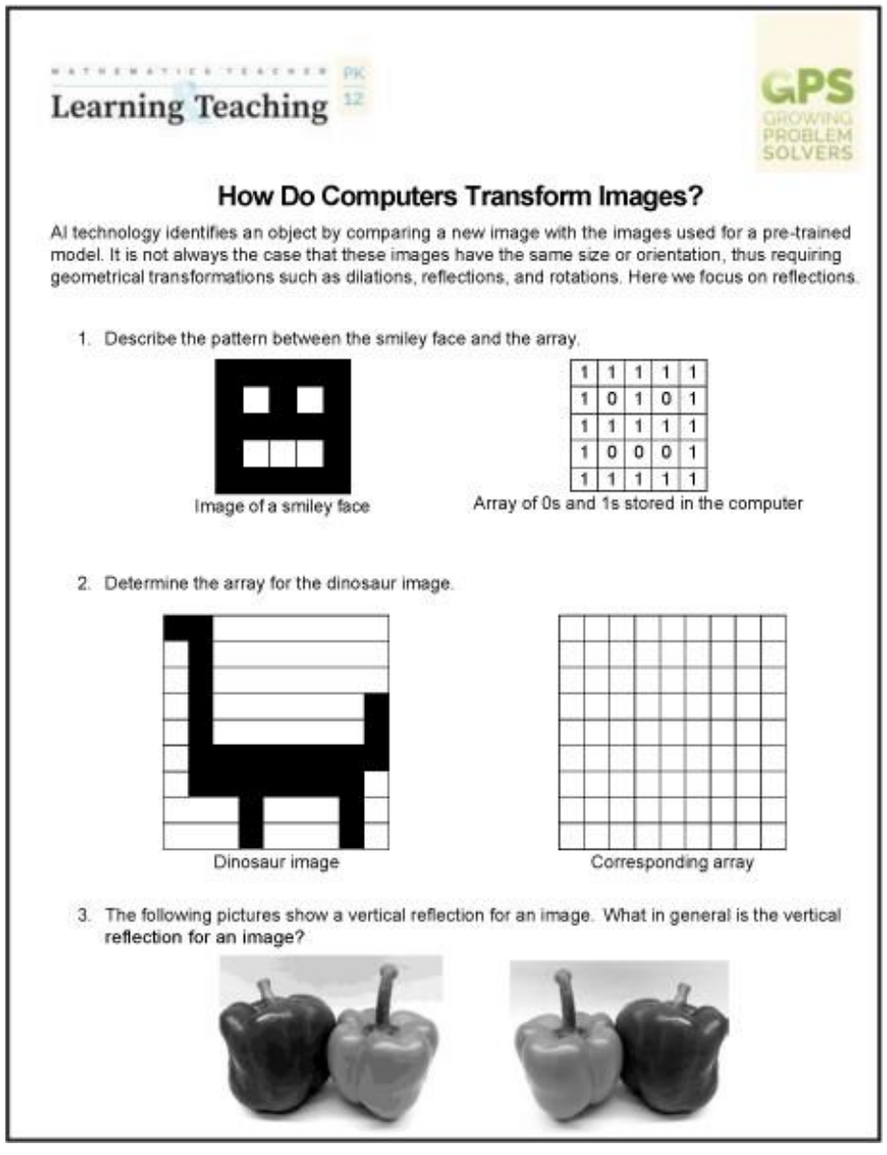
2. To simplify complex images, computers often put together partial images. What combined image do the partial images make? Color the empty grid to help you.

Partial image #1 Partial image #2 Partial image #3

Combined image

From: Flavin E, Lee JH, Chamberlin MT, Powers RA. GPS: Artificial Intelligence Image Processing. *Mathematics Teacher: Learning and Teaching PK-12. 2024;117(11):848-852. doi:10.5951/MTLT.2024.0103*

DOI: https://doi.org/10.5951/MTLT.2024.0103



Mathematics Teacher: Learning Teaching PK 12

GPS GROWING PROBLEM SOLVERS

How Do Computers Transform Images?

AI technology identifies an object by comparing a new image with the images used for a pre-trained model. It is not always the case that these images have the same size or orientation, thus requiring geometrical transformations such as dilations, reflections, and rotations. Here we focus on reflections.

1. Describe the pattern between the smiley face and the array.

Image of a smiley face

1	1	1	1	1
1	0	1	0	1
1	1	1	1	1
1	0	0	0	1
1	1	1	1	1

Array of 0s and 1s stored in the computer

2. Determine the array for the dinosaur image.

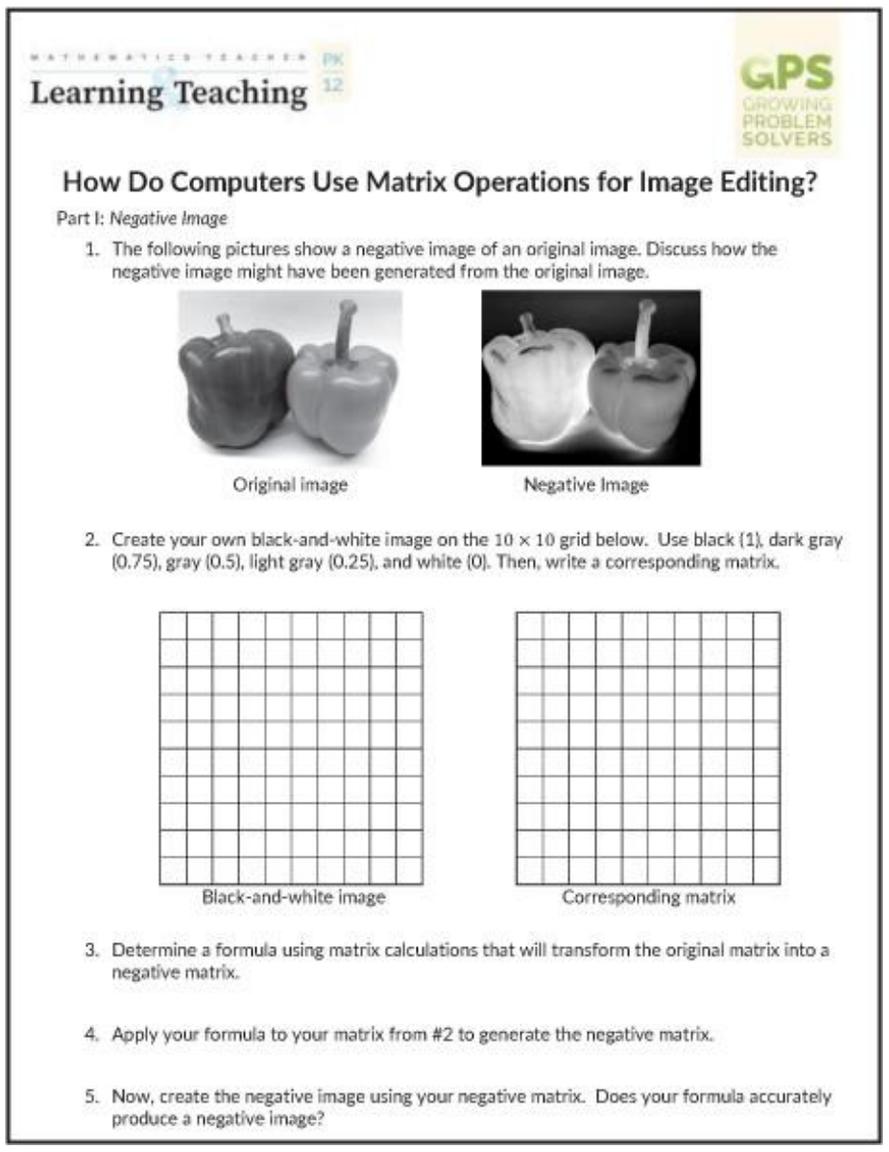
Dinosaur image

Corresponding array

3. The following pictures show a vertical reflection for an image. What in general is the vertical reflection for an image?

From: Flavin E, Lee JH, Chamberlin MT, Powers RA. GPS: Artificial Intelligence Image Processing. *Mathematics Teacher: Learning and Teaching PK-12. 2024;117(11):848-852. doi:10.5951/MTLT.2024.0103*

DOI: https://doi.org/10.5951/MTLT.2024.0103



Learning Teaching PK 12

GPS GROWING PROBLEM SOLVERS

How Do Computers Use Matrix Operations for Image Editing?

Part I: *Negative Image*

1. The following pictures show a negative image of an original image. Discuss how the negative image might have been generated from the original image.

Original image

Negative Image

2. Create your own black-and-white image on the 10×10 grid below. Use black (1), dark gray (0.75), gray (0.5), light gray (0.25), and white (0). Then, write a corresponding matrix.

Black-and-white image

Corresponding matrix

3. Determine a formula using matrix calculations that will transform the original matrix into a negative matrix.

4. Apply your formula to your matrix from #2 to generate the negative matrix.

5. Now, create the negative image using your negative matrix. Does your formula accurately produce a negative image?