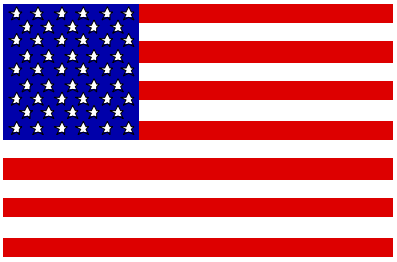
Draw the American Flag



The American flag has symmetrical stars and stripes, offering us a chance to practice Heiser's First Law of Drawing: NEVER DRAW ANYTHING TWICE! Instead, draw the first stripe or star, then duplicate it. Duplicating not only saves effort, but more importantly ensures that the objects are identical in every way: size, shape, orientation, color, pattern and border. We will also use the computer to align the stars in a uniform pattern.

Create a new drawing (File / New…). Options / Autogrid will already be on. Choose View / Show Rulers.

Draw thirteen stripes

Well, actually we will draw just the seven red stripes! Select the rectangle tool:

To get a flag roughly 3" by 5", the stripe should be 1/4" high (two dots on the grid); 13 stripes times 1/4" equals 3 1/4". The stripe will be 5" wide, which is 5 grid squares. Make sure the stripe is selected (handles showing); fill it with red and set the edge width to none.

Edit / Duplicate (command-D) the stripe. Align the new stripe directly under the original one, with an empty white gap equal to the width of the red stripe, or nudge the new stripe left once and down three times with the arrow keys.

Duplicate five more times. Because you showed the program where you wanted the first copy, the new stripes will be spaced the same way. They will "automagically" land in just the right places!

Draw a square blue field

Select the rectangle tool. Shift-drag a square field as tall as four red and three white stripes. Fill it with blue. Set the pen width to none. Arrange / Lock it, so it won't get moved or reshaped while you're working on the stars. Check it with Options / Object Size… Is it square? The height and width should be the same.

Make a star

Turn Autogrid off, in the Options menu, because the star is way too small to fit on the eighth-inch grid. Zoom to 800% or 1600% for accuracy. Find the southeast corner of the blue field, so you can see the height of a stripe.

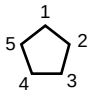
Since the star has five symmetrical points we need to start with a regular pentagon. Choose the **regular** polygon tool:

Set Edit / Polygon Sides… to 5 sides. This menu item used to be in the Options menu, but either way it's a big problem: you can't find this menu item unless the regular polygon tool is selected! Change line width to hairline or none.

Draw a pentagon with its bottom edge horizontal, about half as tall as one stripe.

Choose the polygon tool:

This one lets us draw an arbitrary polygon by clicking all of the vertices. Click on alternate vertices of the pentagon: 1, 3, 5, 2, 4. When you click on the starting point, the polygon will complete. If it won't, set Automatic Polygon Closing in Graphics in the Edit / Preferences menu. When you complete a polygon, it gets its selection handles and fills with color. The pentagon and star are stacked together; drag them apart, then erase the pentagon. This star has a hole in its center! That's because we painted the center four times; any even number of paintings undo each other like negative numbers do. Rather than patch the hole, let's use it as a guide to draw the final star. Select the polygon tool again. Redraw the star, going around the outside in ten clicks. Double-click to finish the star. Drag the stars apart. Erase the guide star. That's a lot of trouble to make one star, but it's perfect and we're going to save a lot of effort cloning this star.



Make an array of stars

Zoom to 200% to see the whole blue field. Duplicate the star five times. Move end stars carefully into position in the bottom corners of the blue field. They should be about half a star width from the bottom and side edges. The middle stars can be anywhere in between the end stars.

Shift–click on the stars to select all six. Arrange / Align Objects…

Top to Bottom: Align (any alignment is OK)

Left to Right: Distribute space.

Arrange / Group the six stars. This is important so we can later distribute the space evenly between nine rows of stars instead of between fifty individual stars.

Edit / Duplicate the six-star group four times. Move the top row of stars into position. Edit / Duplicate the top row again. Arrange / Ungroup the copy. Delete one star. Re–select all five remaining stars very carefully! Choose Undo Move if anything moves while you're shift–clicking. A better way to select the stars without moving them is by dragging diagonally over the five stars. Group the five stars into their own group. Duplicate the five-star group three times. Now you have five rows of six and four rows of five. Move the rows around so they alternate 656565656.

Select all nine rows of stars at once. Drag diagonally to select, or shift–click. If you select the blue field by mistake, just shift-click on it again to unselect it. Arrange / Align Objects…

Top to Bottom: Distribute

Left to Right: Align centers.

Group them. Nudge the whole array to center it in the blue field.

Check for quality

Are there exactly fifty stars? Thirteen stripes? Is the blue field four red stripes high? Are all the stars spaced exactly the same? Look along the diagonals to see.