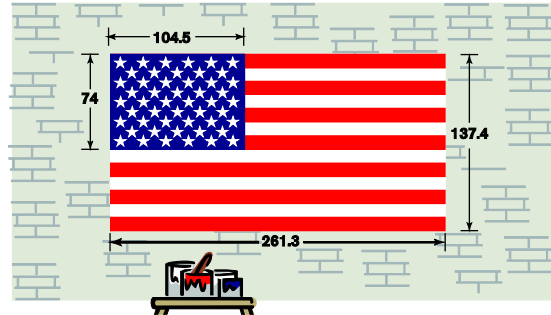


MATHCOUNTS® Problem of the Week Archive

Independence Day – July 3, 2017

Problems & Solutions

To celebrate Independence Day, students attending a summer camp painted the American flag mural, show here, with the dimensions in centimeters. If the area of each of the stars is 22.2 cm^2 , how many square centimeters of the flag is painted blue?



To determine the area of the flag painted blue we can find the area of the entire blue region then subtract the combined area of the stars. The area of the blue portion of the flag containing the stars is $74 \times 104.5 = 7733 \text{ cm}^2$. There are 50 stars on the flag, each with an area of 22.2 cm^2 . The total combined area of the stars is $22.2 \times 50 = 1110 \text{ cm}^2$. That means the area of the flag that is painted blue is $7733 - 1110 = 6623 \text{ cm}^2$.

Assuming each of the stripes has the same thickness, what is the positive difference, in square meters, between the area of the flag covered in white stars and the area of the flag covered in white stripes? Express your answer as a decimal to the nearest tenth.

In the previous problem we determined the area of the flag covered in white stars to be 1110 cm^2 . Now we need to find the area of the flag covered in white stripes. First we notice that not all the white stripes are the same length. Let's look at the stripes in two groups. The first group of stripes spans the entire width of the flag. There are a total of 6 stripes in this section (3 red and 3 white). That means that half of the total area of this section is covered with white stripes. The height of this section of the flag is $137.4 - 74 = 63.4 \text{ cm}$. So the area of this section is $63.4 \times 261.3 = 16,566.42 \text{ cm}^2$. Half of that area, 8283.21 cm^2 , is covered in white stripes. The second group of stripes doesn't span the entire width of the flag, just $261.3 - 104.5 = 156.8 \text{ cm}$. The height of this section of stripes is 74 cm . So the total area of the flag covered by this group of 7 stripes is $74 \times 156.8 = 11,603.2 \text{ cm}^2$. But only 3 of the 7 stripes are painted white. That means only $(3/7)(11,603.2) = 4972.8 \text{ cm}^2$ of this portion of the flag is covered in white stripes. The total area of the flag covered in white stripes is $8283.21 + 4972.8 = 13,256.01 \text{ cm}^2$. Therefore, the positive difference between the area of the flag covered in white stripes and the area of the flag covered in white stars is $13,256.01 - 1110 = 12,146.01 \div (100)^2 = 12,146.01 \div 10,000 = 1.2 \text{ m}^2$. (Calculations may be slightly different if you calculate the thickness of each stripe as $137.4 \div 13 = 10.56923$, and calculate the area using this figure.)

Again, assuming each of the stripes has the same thickness, what percent of the flag mural is *not* painted white?

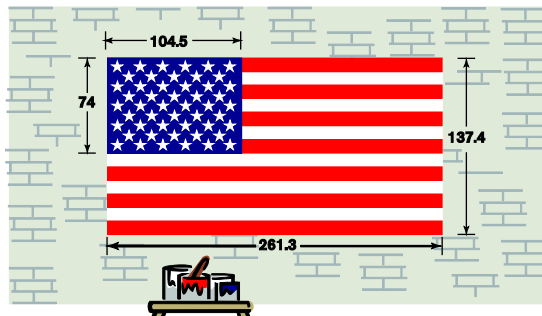
The entire flag has an area of $137.4 \times 261.3 = 35,902.62 \text{ cm}^2$. Only the stars and some of the stripes are painted white. From the previous problems, the total area of the flag that is painted white is $1110 + 13,256.01 = 14,366.01 \text{ cm}^2$. That means that $35,902.62 - 14,366.01 = 21,536.61 \text{ cm}^2$ is the area of the flag not painted white. This is equivalent to $21,536.61/35,902.62 = 0.5998617928 \approx 60\%$ of the flag mural.

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Assuming each of the stripes has the same thickness, what is the positive difference, in square meters, between the area of the flag covered in white stars and the area of the flag covered in white stripes? Express your answer as a decimal to the nearest tenth.

Again, assuming each of the stripes has the same thickness, what percent of the flag mural is *not* painted white?