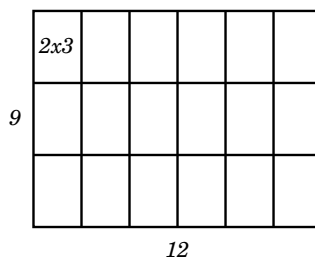


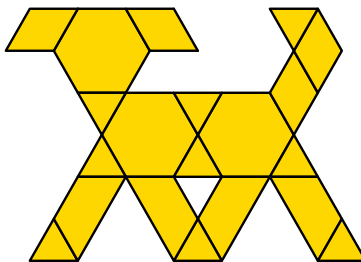
## Test 1 - Solutions

1. A first-grade teacher is going to have her students make a number of paper dinosaurs for a counting project. She needs one hundred  $2 \text{ in} \times 3 \text{ in}$  rectangles, on which students will trace and then cut out dinosaurs. If her construction paper has dimensions  $9 \text{ in} \times 12 \text{ in}$ , how many sheets of paper will she need for this project?



As shown in the picture above, the teacher can cut a  $9 \text{ in} \times 12 \text{ in}$  sheet of paper into eighteen  $2 \text{ in} \times 3 \text{ in}$  rectangles. Since  $\frac{100}{18} = 5\frac{10}{18}$ , she needs 6 sheets of paper.

2. If the area of the hexagon is 1 square unit, what is the area of the dog shown below?



The dog figure consists of 3 hexagons, 4 trapezoids, 4 parallelograms, and 9 triangles. The area of each trapezoid is  $\frac{1}{2}$  square units, the area of each parallelogram is  $\frac{1}{3}$  square units, and the area of each triangle is  $\frac{1}{6}$  square units. Thus the total area is  $3 + \frac{4}{2} + \frac{4}{3} + \frac{9}{6} = 3 + 2 + \frac{8}{6} + \frac{9}{6} = 5 + \frac{17}{6} = 5 + 2\frac{5}{6} = 7\frac{5}{6}$  square units.

For extra credit: what is the perimeter of this dog?

Let  $a$  be the length of each side of the triangles, parallelograms, and hexagons. (Then three sides of a trapezoid have length  $a$  and one side has length  $2a$ .) The area of an equilateral triangle with side 1 unit is  $\frac{\sqrt{3}}{4}$  square units. Then the area of an equilateral triangle with side  $a$  units is  $\frac{\sqrt{3}a^2}{4}$  units. Since the area of each triangle in the picture is  $\frac{1}{6}$  square units, we have  $\frac{\sqrt{3}a^2}{4} = \frac{1}{6}$ . Multiplying both sides by  $\frac{4}{\sqrt{3}}$  gives  $a^2 = \frac{4}{6\sqrt{3}} = \frac{2}{3\sqrt{3}}$ . Then  $a = \frac{\sqrt{2}}{\sqrt{3\sqrt{3}}}$ . The perimeter of the dog is  $39a = \frac{39\sqrt{2}}{\sqrt{3\sqrt{3}}}$ .

3. Let the side of each of the small squares be 1 unit. Find the number of squares in, the area, and the perimeter of each of the shown figures. Notice the pattern and use it to predict the above quantities for the 50th figure in this sequence.

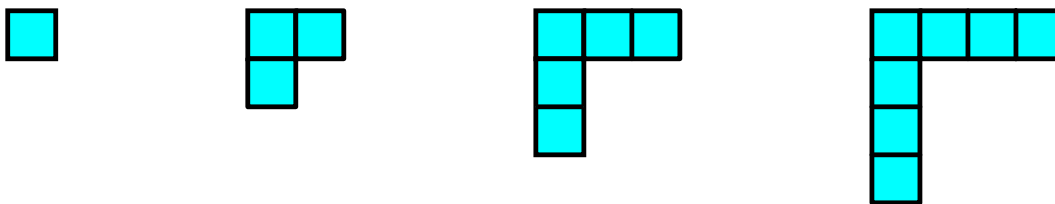


Figure in sequence	Number of squares	Area	Perimeter
1st	1	1	4
2nd	3	3	8
3rd	5	5	12
4th	7	7	16
50th	99	99	200

*Pattern: the number of squares in the figure always increases by 2. So does the area (the area is equal to the number of squares since the area of each square is 1 square unit). The perimeter increases by 4, and is equal to 4 times the number of the figure in the sequence.*

For extra credit: find formulas for the above quantities for the  $n$ -th figure in the sequence.

*Using the pattern described above, we obtain that the  $n$ -th figure consists of  $1+2(n-1) = 2n-1$  squares. Its area is  $2n-1$  square units. Its perimeter is  $4n$  units.*

4. Bob and Cindy bought a pizza. Bob ate  $\frac{1}{3}$  of the pizza and Cindy ate  $\frac{1}{4}$  of the pizza.

- (a) How much pizza was left?

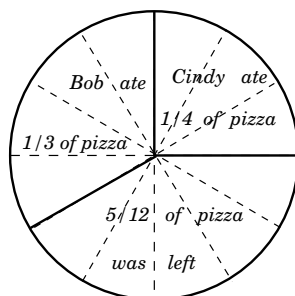
*They ate  $\frac{1}{3} + \frac{1}{4} = \frac{4}{12} + \frac{3}{12} = \frac{7}{12}$  of the pizza, so  $1 - \frac{7}{12} = \frac{12}{12} - \frac{7}{12} = \frac{5}{12}$  of the pizza was left.*

- (b) If the weight of the remaining pizza is  $\frac{5}{9}$  lb, what was the weight of the whole pizza?

*The weight of the whole pizza was  $\frac{5}{9} \div \frac{5}{12} = \frac{5}{9} \times \frac{12}{5} = \frac{60}{45} = \frac{4}{3}$  lb.*

For extra credit: show how you can check your answers.

*To check our answer to part (a), we can use a picture:*



*To check our answer to part (b), we will calculate the weight of  $\frac{1}{12}$  of pizza (one slice on the picture) first. If the weight of  $\frac{5}{12}$  of pizza (5 slices) is  $\frac{5}{9}$  lb, then the weight of  $\frac{1}{12}$  of pizza (one slice) is  $\frac{1}{9}$  lb. Then the weight of the whole pizza (12 slices) is  $\frac{12}{9} = \frac{4}{3}$  lb.*