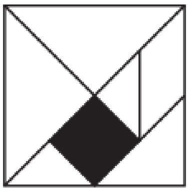
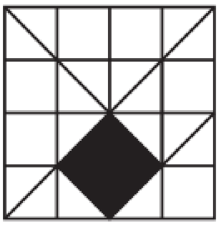
1998 Q13

13. What is the ratio of the area of the shaded square to the area of the large square? (The figure is drawn to scale.)



(A) $\frac{1}{6}$ **(B)** $\frac{1}{7}$ **(C)** $\frac{1}{8}$ **(D)** $\frac{1}{12}$ **(E)** $\frac{1}{16}$

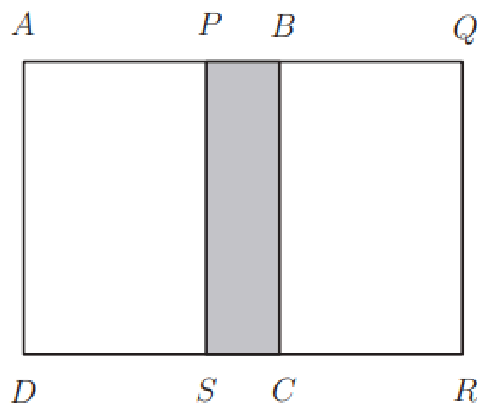
13. **Answer (C):** Divide the square into 16 smaller squares as shown. The shaded square is formed from 4 half-squares, so its area is 2. The ratio 2 to 16 is $\frac{1}{8}$.



Note: There are several other ways to divide the region to show this.

2011 Q13

13. Two congruent squares, $ABCD$ and $PQRS$, have side length 15. They overlap to form the 15 by 25 rectangle $AQRD$ shown. What percent of the area of rectangle $AQRD$ is shaded?



(A) 15 **(B)** 18 **(C)** 20 **(D)** 24 **(E)** 25

13. **Answer (C):** The shaded rectangle $PBCS$ has height $BC = 15$ and length $SC = DC + SR - DR = 15 + 15 - 25 = 5$.

Rectangle $AQRD$ has the same height and length 25. The portion of rectangle $AQRD$ that is shaded is $\frac{15\times5}{15\times25} = \frac{5}{25}$, which is 20%.

1993 Q14

14. The nine squares in the table shown are to be filled so that every row and every column contains each of the numbers 1, 2, 3. Then $A + B =$

1		
	2	A
		B

(A) 2 **(B)** 3 **(C)** 4 **(D)** 5 **(E)** 6

14. **(C)** Only 3's can complete the 2 by 2 square whose diagonal is given. If two entries in a row or column are known, the third is determined. Use this to complete the table:

1		
	2	

$\Rightarrow$

1	3	
3	2	

$\Rightarrow$

1	3	2
3	2	1
2	1	

$\Rightarrow$

1	3	2
3	2	$A=1$
2	1	$B=3$

Thus, $A + B = 4$.

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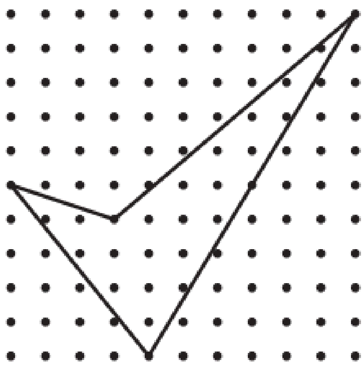
2004 Q14

14. What is the area enclosed by the geoboard quadrilateral below?



(A) 15 **(B)** $18\frac{1}{2}$ **(C)** $22\frac{1}{2}$ **(D)** 27 **(E)** 41

14. **(C)** To find the area, subtract the areas of regions A, B, C, D and E from that of the surrounding square.

Square: $10 \times 10 = 100$

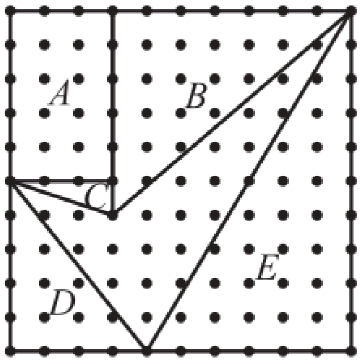
Region A: $3 \times 5 = 15$

Region B: $\frac{1}{2} \times 6 \times 7 = 21$

Region C: $\frac{1}{2} \times 1 \times 3 = 1\frac{1}{2}$

Region D: $\frac{1}{2} \times 4 \times 5 = 10$

Region E: $\frac{1}{2} \times 6 \times 10 = 30$



The area is $100 - (15 + 21 + 1\frac{1}{2} + 10 + 30) = 100 - 77\frac{1}{2} = 22\frac{1}{2}$ square units.

OR

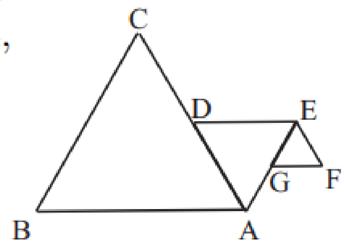
By Pick's Theorem, the area of a polygon with vertices in a lattice is

$$(\text{number of points inside}) + \frac{\text{number of points on boundary}}{2} - 1.$$

In this case, the area is $21 + \frac{5}{2} - 1 = 22\frac{1}{2}$.

2000 Q15

15. Triangle ABC, ADE, and EFG are all equilateral. Points D and G are midpoints of $\overline{AC}$ and $\overline{AE}$, respectively. If $AB = 4$, what is the perimeter of figure $ABCDEFG$?



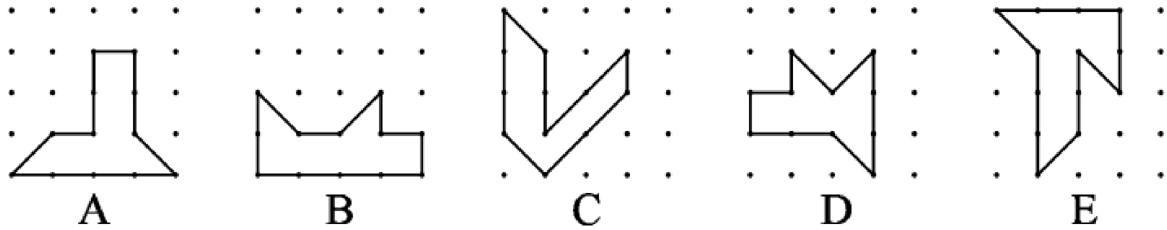
(A) 12 **(B)** 13 **(C)** 15 **(D)** 18 **(E)** 21

15. **Answer (C):** We have

$$AB + BC + CD + DE + EF + FG + GA = 4 + 4 + 2 + 2 + 1 + 1 + 1 = 15$$

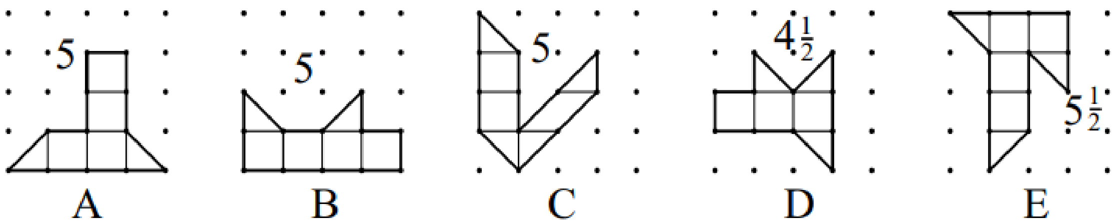
2002 Q15

15. Which of the following polygons has the largest area?



(A) A **(B)** B **(C)** C **(D)** D **(E)** E

15. **(E)** Areas may be found by dividing each polygon into triangles and squares as shown.



Note: Pick's Theorem may be used to find areas of geoboard polygons. If I is the number of dots inside the figure, B is the number of dots on the boundary and A is the area, then $A = I + \frac{B}{2} - 1$. Geoboard figures in this problem have no interior points, so the formula simplifies to $A = \frac{B}{2} - 1$. For example, in polygon D the number of boundary points is 11 and $\frac{11}{2} - 1 = 4\frac{1}{2}$.

2004 Q15

15. Thirteen black and six white hexagonal tiles were used to create the figure below. If a new figure is created by attaching a border of white tiles with the same size and shape as the others, what will be the difference between the total number of white tiles and the total number of black tiles in the new figure?

(A) 5 **(B)** 7 **(C)** 11 **(D)** 12 **(E)** 18

15. **(C)** The next border requires an additional $6 \times 3 = 18$ white tiles. A total of 24 white and 13 black tiles will be used, so the difference is $24 - 13 = 11$.