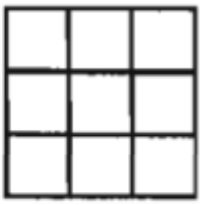
1 / 13

1988 Q16

16. Placing no more than one X in each small square, what is the greatest number of X's that can be put on the grid shown without getting three X's in a row vertically, horizontally, or diagonally?



A) 2 B) 3 C) 4

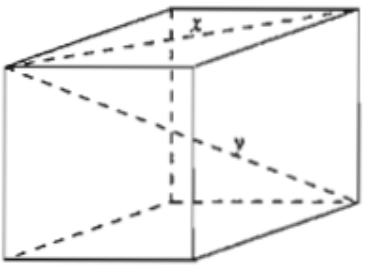
D) 5 E) 6

16. E The arrangement pictured shows 6 X's is possible. If there were 7 X's on a 3x3 board, then one row must contain 3 X's.

2 / 13

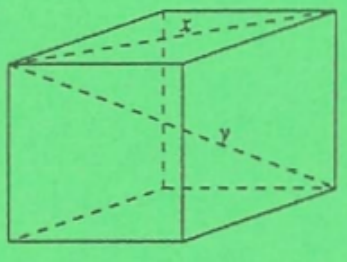
1997 Q17

17. A cube has eight vertices (corners) and twelve edges. A segment, such as x, which joins two vertices not joined by an edge is called a diagonal. Segment y is also a diagonal. How many diagonals does a cube have?



(A) 6 **(B)** 8 **(C)** 12 **(D)** 14 **(E)** 16

17. **(E)** There are two diagonals, such as x, in each of the six faces for a total of twelve face diagonals. There are also four space diagonals, such as y, which are within the cube. This makes a total of 16.



1990 Q17

17. A straight concrete sidewalk is to be 3 feet wide, 60 feet long and 3 **inches** thick. How many cubic yards of concrete must a contractor order for the sidewalk if concrete must be ordered in a whole number of cubic yards?

A) 2 B) 5 C) 12 D) 20 E) more than 20

17. A The number of cubic feet is $3 \times 60 \times \frac{1}{4} = 45$. Since there are 27 cubic feet in 1 cubic yard, there are $\frac{45}{27} = 1\frac{2}{3}$ cubic yards of concrete required. Thus 2 cubic yards must be ordered.

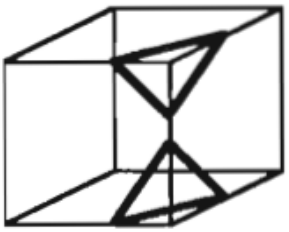
OR

Since 3 feet = 1 yard, 60 feet = 20 yards. Also 3 inches = $\frac{3}{36} = \frac{1}{12}$ yard. Thus $1 \times 20 \times \frac{1}{12} = 1\frac{2}{3}$ cubic yards of concrete are needed, so 2 cubic yards must be ordered.

1990 Q18

18. Each corner of a rectangular prism is cut off. Two (of the eight) cuts are shown. How many edges does the new figure have?

A) 24 B) 30 C) 36 D) 42 E) 48



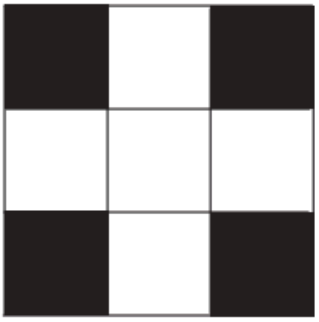
18. C The original prism had 12 edges. Each "cut-off" corner yields 3 additional edges, so the new figure has a total of 12 + 8 x 3 = 36 edges.

2006 Q18

18. A cube with 3-inch edges is made using 27 cubes with 1-inch edges. Nineteen of the smaller cubes are white and eight are black. If the eight black cubes are placed at the corners of the larger cube, what fraction of the surface area of the larger cube is white?

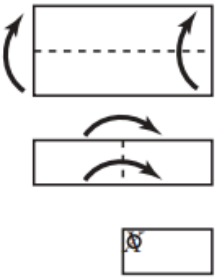
(A) $\frac{1}{9}$ **(B)** $\frac{1}{4}$ **(C)** $\frac{4}{9}$ **(D)** $\frac{5}{9}$ **(E)** $\frac{19}{27}$

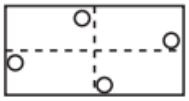
18. **(D)** Four black and five white squares are visible on each of the six faces of the cube. So $\frac{5}{9}$ of the surface will be white.

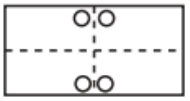


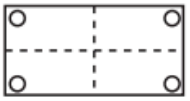
1998 Q18

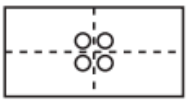
18. As indicated by the diagram at the right, a rectangular piece of paper is folded bottom to top, then left to right, and finally, a hole is punched at X. What does the paper look like when unfolded?

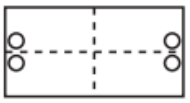


(A) 

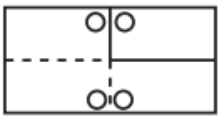
(B) 

(C) 

(D) 

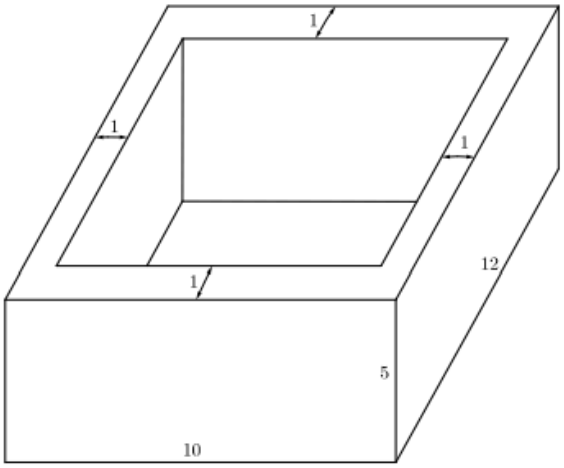
(E) 

18. **Answer (B):** The folded rectangle appears in the upper right corner of the sheet of paper, and the hole is punched in its upper left corner. Only Figure (B) has a hole in the upper left corner of the upper right rectangle of the unfolded sheet.



2013 Q18

18. Isabella uses one-foot cubical blocks to build a rectangular fort that is 12 feet long, 10 feet wide, and 5 feet high. The floor and the four walls are all one foot thick. How many blocks does the fort contain?

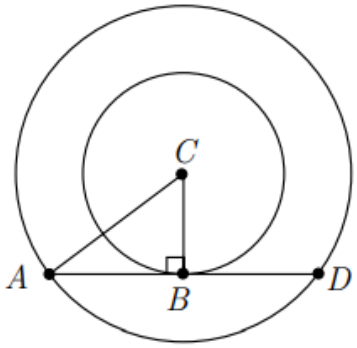


(A) 204 **(B)** 280 **(C)** 320 **(D)** 340 **(E)** 600

18. **Answer (B):** The fort, including the inside, occupies a volume of $12 \times 10 \times 5 = 600$ cubic feet. The inside of the fort is $12 - 2 = 10$ feet long, $10 - 2 = 8$ feet wide, and $5 - 1 = 4$ feet high, so it occupies a volume of $10 \times 8 \times 4 = 320$ cubic feet. Therefore the walls and floor occupy $600 - 320 = 280$ cubic feet, so the fort contains 280 blocks.

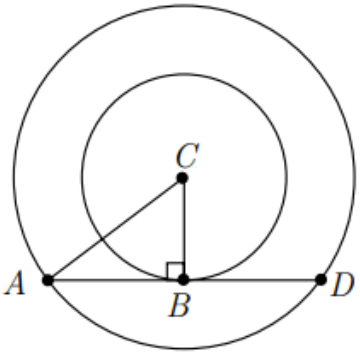
2010 Q19

19. The two circles pictured have the same center C. Chord $\overline{AD}$ is tangent to the inner circle at B, AC is 10, and chord $\overline{AD}$ has length 16. What is the area between the two circles?



(A) 36π **(B)** 49π **(C)** 64π **(D)** 81π **(E)** 100π

19. **Answer (C):** In the right triangle ABC, AB is 8. By the Pythagorean Theorem, $8^2+BC^2 = 10^2$ so $BC = 6$. The area of the outer circle is $10^2\pi = 100\pi$ and the area of the inner circle is $6^2\pi = 36\pi$. The area between the circles is $100\pi - 36\pi = 64\pi$.



2014 Q19

19. A cube with 3-inch edges is to be constructed from 27 smaller cubes with 1-inch edges. Twenty-one of the cubes are colored red and 6 are colored white. If the 3-inch cube is constructed to have the smallest possible white surface area showing, what fraction of the surface area is white?

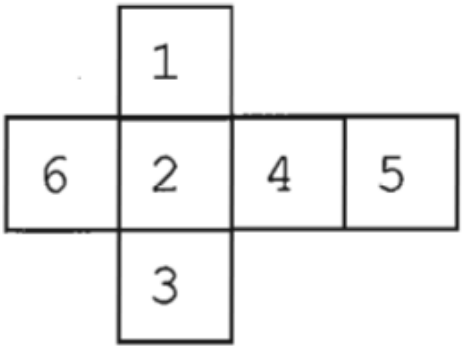
(A) $\frac{5}{54}$ **(B)** $\frac{1}{9}$ **(C)** $\frac{5}{27}$ **(D)** $\frac{2}{9}$ **(E)** $\frac{1}{3}$

19. **Answer (A):** The amount of white surface area is smallest when you place one white cube in the interior of the larger cube. Place each of the other 5 white cubes at the center of a face so that 1 white face and 8 red faces are visible on that face. The total surface area of the larger cube is $6 \cdot 3^2 = 54$ square inches, so the fraction of the surface area that is white is $\frac{5}{54}$.

1989 Q20

20. The figure may be folded along the lines shown to form a number cube. Three number faces come together at each corner of the cube. What is the largest sum of three numbers whose faces come together at a corner?

A) 11 B) 12 C) 13 D) 14 E) 15



20. D Each number will share a corner with every number on the cube except the one on the opposite face. Thus the combinations involving 1-3, 2-5, and 4-6 cannot occur. Consequently the largest sum is $6 + 5 + 3 = 14$.

1999 Q20

20. Figure 1 is called a "stack map." The numbers tell how many cubes are stacked in each position. Fig. 2 shows these cubes, and Fig. 3 shows the view of the stacked cubes as seen from the front.
Which of the following is the front view for the stack map in Fig. 4?

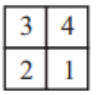


Figure 1

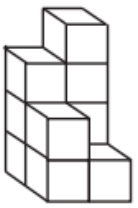


Figure 2

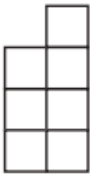


Figure 3

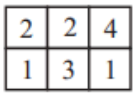
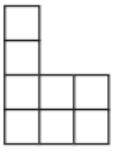
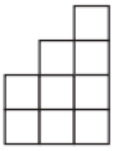
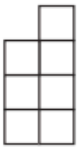
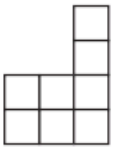
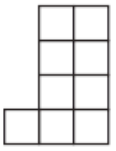
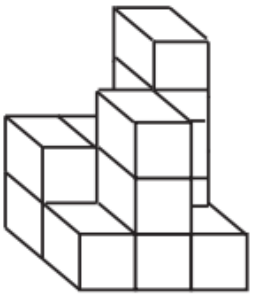


Figure 4

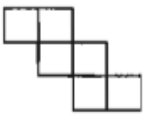
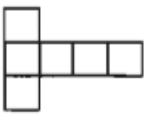
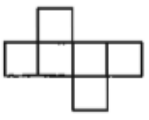
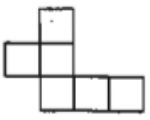
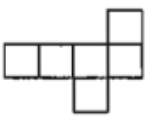
(A)  (B)  (C)  (D)  (E) 

20. **Answer (B):** The front view shows the larger of the numbers of cubes in the front or back stack in each column. Therefore the desired front view will have, from left to right, 2, 3, and 4 cubes. This is choice B.

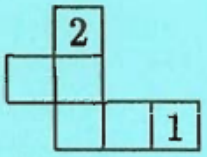


1992 Q20

20. Which pattern of identical squares could NOT be folded along the lines shown to form a cube?

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

20. **(D)** Any attempt to fold the squares would result in square 1 being superimposed on square 2. Have students cut and fold the other four patterns into cubes.



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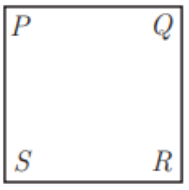
1998 Q20

20. Let $PQRS$ be a square piece of paper. P is folded onto R and then Q is folded onto S. The area of the resulting figure is 9 square inches. Find the perimeter of square $PQRS$.



(A) 9 **(B)** 16 **(C)** 18 **(D)** 24 **(E)** 36

20. **Answer (D):** After folding the square twice the resulting figure is an isosceles triangle with area 9 square inches. Since there are 4 such congruent triangles in the square, the area of the square is 36 square inches. Therefore, the sides of $PQRS$ are 6 inches, and the perimeter is 24 inches.