

## Problem 1

$$\frac{10 - 9 + 8 - 7 + 6 - 5 + 4 - 3 + 2 - 1}{1 - 2 + 3 - 4 + 5 - 6 + 7 - 8 + 9} =$$

- (A)  $-1$     (B)  $1$     (C)  $5$     (D)  $9$     (E)  $10$

## Problem 2

Which of the following is not equal to  $\frac{5}{4}$ ?

- (A)  $\frac{10}{8}$     (B)  $1\frac{1}{4}$     (C)  $1\frac{3}{12}$     (D)  $1\frac{1}{5}$     (E)  $1\frac{10}{40}$

## Problem 3

What is the largest difference that can be formed by subtracting two numbers chosen from the set  $\{-16, -4, 0, 2, 4, 12\}$ ?

- (A)  $10$     (B)  $12$     (C)  $16$     (D)  $28$     (E)  $48$

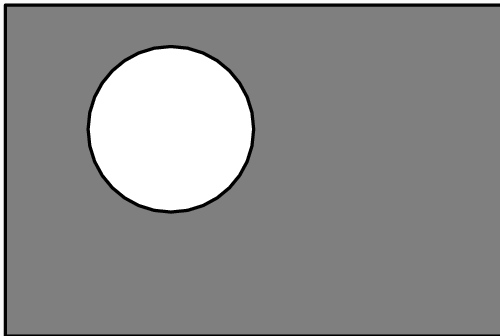
## Problem 4

During the softball season, Judy had 35 hits. Among her hits were 1 home run, 1 triple and 5 doubles. The rest of her hits were singles. What percent of her hits were singles?

- (A)  $28\%$     (B)  $35\%$     (C)  $70\%$     (D)  $75\%$     (E)  $80\%$

## Problem 5

A circle of diameter 1 is removed from a  $2 \times 3$  rectangle, as shown. Which whole number is closest to the area of the shaded region?



- (A)  $1$     (B)  $2$     (C)  $3$     (D)  $4$     (E)  $5$

## Problem 6

Suppose that  $\triangle_{b\ c}^a$  means  $a + b - c$ . For example,  $\triangle_{4\ 6}^5$  is  $5 + 4 - 6 = 3$ . Then the sum

$$\triangle_{3\ 4}^1 + \triangle_{5\ 6}^2 \text{ is}$$

- (A)  $-2$     (B)  $-1$     (C)  $0$     (D)  $1$     (E)  $2$

## Problem 7

The digit-sum of 998 is  $9 + 9 + 8 = 26$ . How many 3-digit whole numbers, whose digit-sum is 26, are even?

- (A) 1    (B) 2    (C) 3    (D) 4    (E) 5

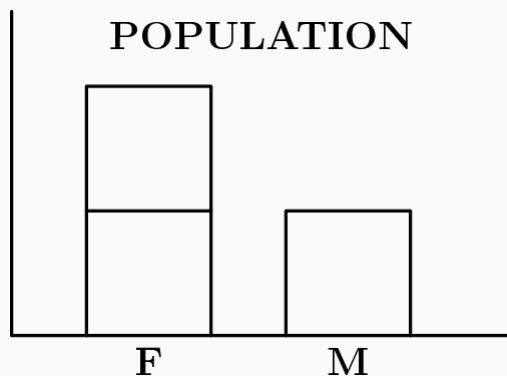
## Problem 8

A store owner bought 1500 pencils at \$0.10 each. If he sells them for \$0.25 each, how many of them must he sell to make a profit of exactly \$100.00?

- (A) 400    (B) 667    (C) 1000    (D) 1500    (E) 1900

## Problem 9

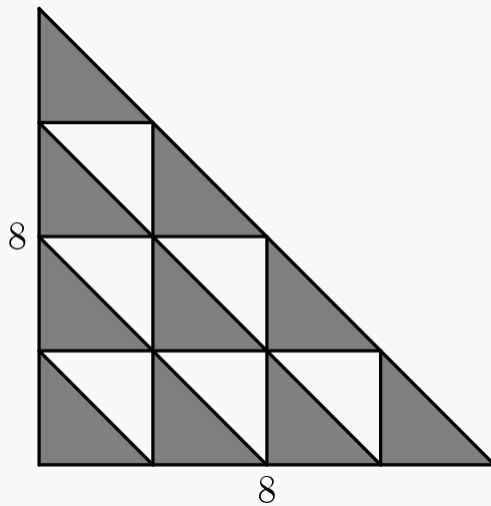
The population of a small town is 480. The graph indicates the number of females and males in the town, but the vertical scale-values are omitted. How many males live in the town?



- (A) 120    (B) 160    (C) 200    (D) 240    (E) 360

## Problem 10

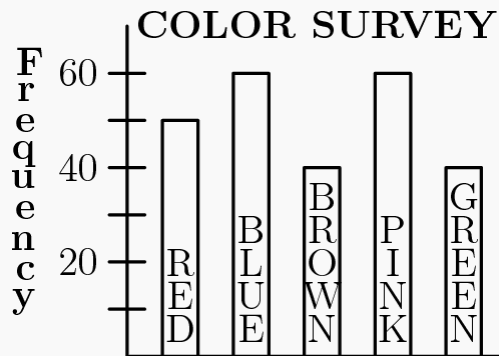
An isosceles right triangle with legs of length 8 is partitioned into 16 congruent triangles as shown. The shaded area is



- (A) 10    (B) 20    (C) 32    (D) 40    (E) 64

## Problem 11

The bar graph shows the results of a survey on color preferences. What percent preferred blue?



- (A) 20%    (B) 24%    (C) 30%    (D) 36%    (E) 42%

## Problem 12

The five tires of a car (four road tires and a full-sized spare) were rotated so that each tire was used the same number of miles during the first 30,000 miles the car traveled. For how many miles was each tire used?

- (A) 6000    (B) 7500    (C) 24,000    (D) 30,000    (E) 37,500

### Problem 13

Five test scores have a mean (average score) of 90, a median (middle score) of 91 and a mode (most frequent score) of 94. The sum of the two lowest test scores is

- (A) 170    (B) 171    (C) 176    (D) 177    (E) not determined by the information given

### Problem 14

When four gallons are added to a tank that is one-third full, the tank is then one-half full. The capacity of the tank in gallons is

- (A) 8    (B) 12    (C) 20    (D) 24    (E) 48

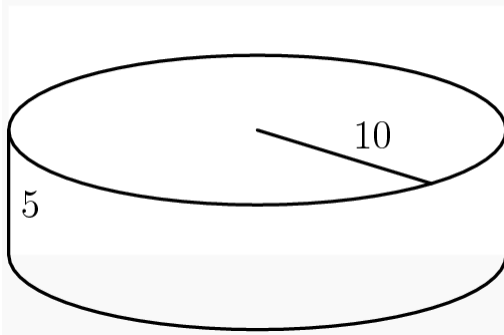
### Problem 15

What is the 1992<sup>nd</sup> letter in this sequence?

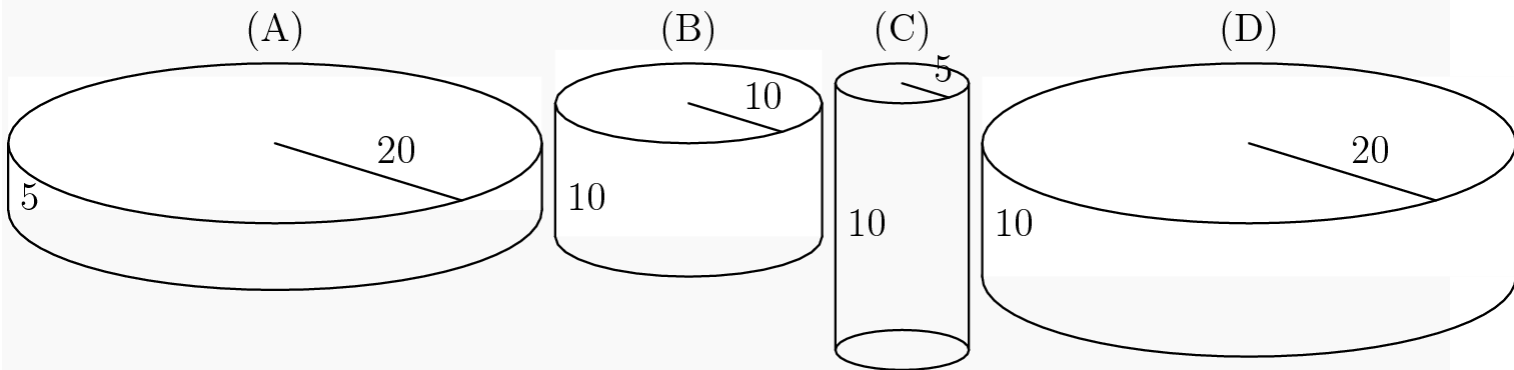
ABCDED CBA ABCDED CBA ABCDED CBA ABCDED C . . .

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

### Problem 16



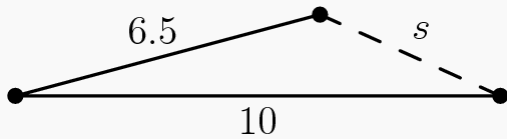
Which cylinder has twice the volume of the cylinder shown above?



- (E) None of the above

## Problem 17

The sides of a triangle have lengths 6.5, 10, and  $s$ , where  $s$  is a whole number. What is the smallest possible value of  $s$ ?



- (A) 3    (B) 4    (C) 5    (D) 6    (E) 7

## Problem 18

On a trip, a car traveled 80 miles in an hour and a half, then was stopped in traffic for 30 minutes, then traveled 100 miles during the next 2 hours. What was the car's average speed in miles per hour for the 4-hour trip?

- (A) 45    (B) 50    (C) 60    (D) 75    (E) 90

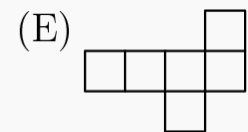
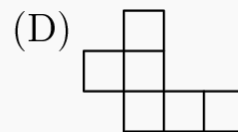
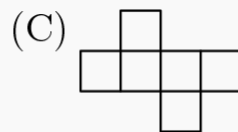
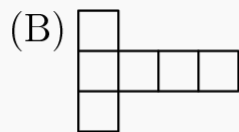
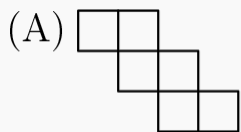
## Problem 19

The distance between the 5<sup>th</sup> and 26<sup>th</sup> exits on an interstate highway is 118 miles. If any two exits are at least 5 miles apart, then what is the largest number of miles there can be between two consecutive exits that are between the 5<sup>th</sup> and 26<sup>th</sup> exits?

- (A) 8    (B) 13    (C) 18    (D) 47    (E) 98

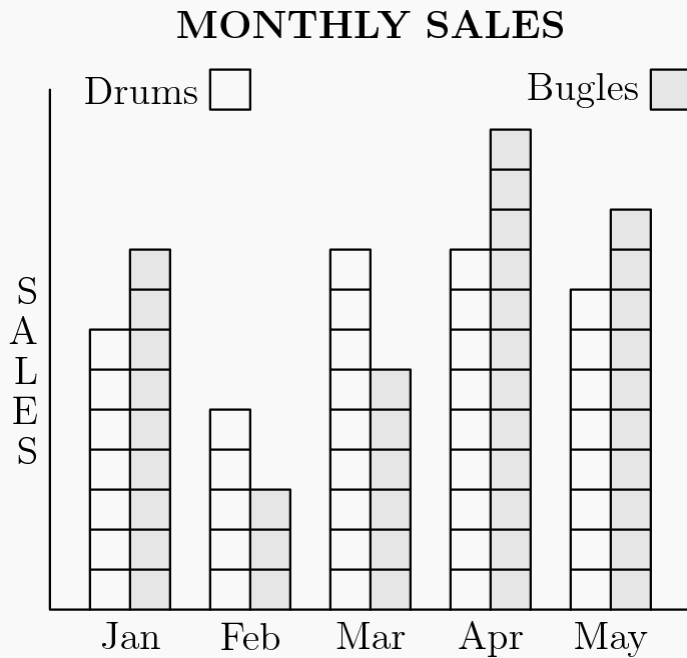
## Problem 20

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



## Problem 21

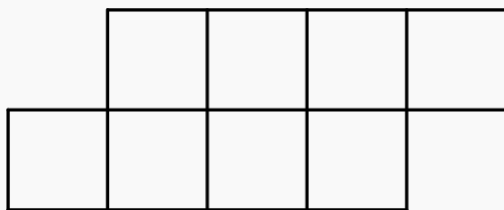
Northside's Drum and Bugle Corps raised money for a trip. The drummers and bugle players kept separate sales records. According to the double bar graph, in what month did one group's sales exceed the other's by the greatest percent?



- (A) Jan    (B) Feb    (C) Mar    (D) Apr    (E) May

## Problem 22

Eight  $1 \times 1$  square tiles are arranged as shown so their outside edges form a polygon with a perimeter of 14 units. Two additional tiles of the same size are added to the figure so that at least one side of each tile is shared with a side of one of the squares in the original figure. Which of the following could be the perimeter of the new figure?



- (A) 15    (B) 17    (C) 18    (D) 19    (E) 20

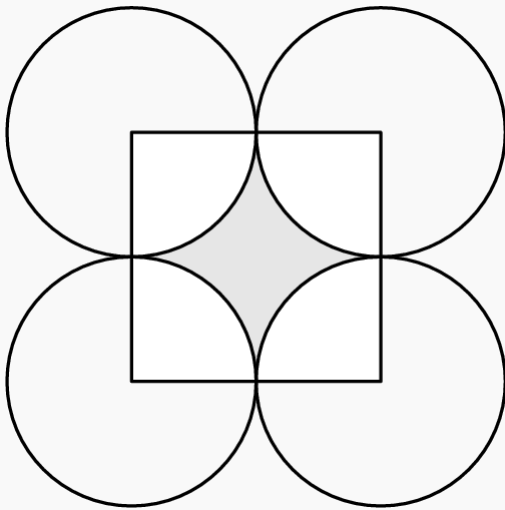
### Problem 23

If two dice are tossed, the probability that the product of the numbers showing on the tops of the dice is greater than 10 is

- (A)  $\frac{3}{7}$     (B)  $\frac{17}{36}$     (C)  $\frac{1}{2}$     (D)  $\frac{5}{8}$     (E)  $\frac{11}{12}$

### Problem 24

Four circles of radius 3 are arranged as shown. Their centers are the vertices of a square. The area of the shaded region is closest to



- (A) 7.7    (B) 12.1    (C) 17.2    (D) 18    (E) 27

### Problem 25

One half of the water is poured out of a full container. Then one third of the remainder is poured out. Continue the process: one fourth of the remainder for the third pouring, one fifth of the remainder for the fourth pouring, etc. After how many pourings does exactly one tenth of the original water remain?

- (A) 6    (B) 7    (C) 8    (D) 9    (E) 10

1. (B) Group the numerator in pairs from the left, and group the denominator in pairs from the left:

$$\frac{\overbrace{10-9}^1 + \overbrace{8-7}^1 + \overbrace{6-5}^1 + \overbrace{4-3}^1 + \overbrace{2-1}^1}{\underbrace{1-2}_{-1} + \underbrace{3-4}_{-1} + \underbrace{5-6}_{-1} + \underbrace{7-8}_{-1} + 9}$$

Hence, the answer is  $\frac{5(1)}{4(-1) + 9} = \frac{5}{5} = 1$ .

OR

Regroup the numerator and denominator into positive and negative terms,

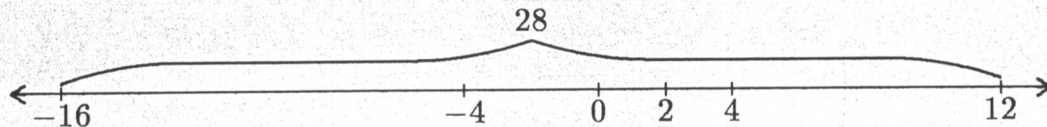
$$\frac{(10 + 8 + 6 + 4 + 2) - (9 + 7 + 5 + 3 + 1)}{(1 + 3 + 5 + 7 + 9) - (2 + 4 + 6 + 8)} = \frac{30 - 25}{25 - 20} = \frac{5}{5} = 1.$$

2. (D)  $1\frac{1}{5} = \frac{6}{5} \neq \frac{5}{4}$ .

3. (D) To obtain the largest difference, subtract the smallest number,  $-16$ , from the largest number,  $12$ . Thus  $12 - (-16) = 28$ .

OR

Graphing the numbers on the number line, the difference is represented by the distance between two points. The largest difference would be represented by the longest distance between numbers, which is the distance between  $-16$  and  $12$ , a distance of  $28$ .



4. (E) Judy had a total of 35 hits, of which  $35 - (1 + 1 + 5) = 28$  were singles.

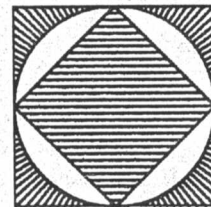
Thus  $\frac{28}{35} = \frac{4}{5}$  or 80% were singles.

OR

Out of 35 hits,  $1 + 1 + 5 = 7$  were not singles, so  $\frac{7}{35} = \frac{1}{5}$  or 20% were not singles. Thus  $100\% - 20\% = 80\%$  were singles.



5. (E) The area of the circle is between  $1/2$  and 1. To see this, draw squares around and inside the circle. The area of the large square is 1, the area of the small square is  $1/2$ , and the circle fits between the two squares. The area of the rectangle with the circle removed is therefore between 5 and 5.5, so the whole number closest to this area is 5.



OR

The area of the rectangle is  $2 \times 3 = 6$ , and the area of the circle with radius  $\frac{1}{2}$  is  $\pi \left(\frac{1}{2}\right)^2 = \frac{\pi}{4}$ , which is slightly larger than  $\frac{3}{4}$ . Thus the area of the resulting figure is slightly smaller than  $6 - \frac{3}{4}$ , so it is closest to 5.

6. (D)  $(1 + 3 - 4) + (2 + 5 - 6) = 0 + 1 = 1$ .

OR

Note that  $\begin{array}{c} a \\ \triangle \\ b \quad c \end{array} + \begin{array}{c} d \\ \triangle \\ e \quad f \end{array} = \begin{array}{c} x \\ \triangle \\ y \quad z \end{array}$  where  $x = a + d$ ,  $y = b + e$  and  $z = c + f$ ; i.e., the sum of two 'triangular expressions' is the value of the 'triangular expression' obtained by summing the respective components. It follows that the required sum is  $(1 + 2) + (3 + 5) - (4 + 6) = 3 + 8 - 10 = 1$ .

7. (A) The only 3-digit whole numbers with a digit-sum of 26 are 899, 989 and 998. Of these, only 998 is even. Thus there is only one such number.
8. (C) Since he bought 1500 pencils at \$0.10 each, he paid  $1500 \times \$0.10 = \$150$ . To make \$100 profit he must take in  $\$150 + \$100 = \$250$ . Therefore, selling the pencils for \$0.25 each, he must sell  $\$250 \div \$0.25 = 1000$  pencils.
9. (B) The ratio of males to the total population is 1 to 3. Thus, there are  $1/3$  of 480, or 160 males in the town.
10. (B) The area of each of the small shaded triangles is  $\frac{1}{2} \times 2 \times 2 = 2$ . There are ten of these, so the shaded area is  $2 \times 10 = 20$ .

OR

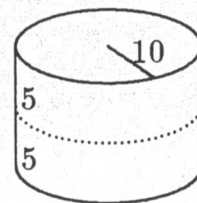
The area of the large triangle is  $\frac{1}{2} \times 8 \times 8 = 32$ . Only 10 of the 16 small triangles are shaded. Thus the shaded area is  $\frac{10}{16}$  of 32, or 20.

11. (B) The total frequency for all colors is  $50 + 60 + 40 + 60 + 40 = 250$ . The frequency for blue is 60. Thus the percent that preferred blue is  $60/250$ , or 24%.
12. (C) The total number of miles of wear is  $30,000 \times 4 = 120,000$ . Since the wear is shared equally by each of the 5 tires, each tire traveled  $120,000 \div 5 = 24,000$  miles.

OR

Since each of the tires was on for  $\frac{4}{5}$  of the driving, it follows that each was used  $\frac{4}{5} \times 30,000 = 24,000$  miles.

13. (B) If the mean is 90, then the sum of all five scores is  $5 \times 90 = 450$ . Since the median of the five scores is 91, at least one score must be 91 and two other scores must be greater than or equal to 91. Since 94 is the mode, there are two scores of 94. The sum of the remaining scores must equal  $450 - (94 + 94 + 91) = 171$ .
14. (D) Since 4 gallons is the difference between being  $1/3$  full and  $1/2$  full, it follows that 4 gallons is  $\frac{1}{2} - \frac{1}{3} = \frac{1}{6}$  of the capacity of the tank. Thus the capacity of the tank must be 24 gallons.
15. (C) The pattern repeats every 9 letters. Dividing 1992 by 9 yields a remainder of 3. Therefore, the 1992<sup>nd</sup> letter corresponds to the third letter in the sequence, which is C.
16. (B) Cylinder (B) can be obtained by stacking one copy of the given cylinder on top of another. The formula for the volume of a cylinder with radius  $r$  and height  $h$  is  $V = \pi r^2 h$ . Use this to show that none of the other cylinders has twice the volume of the given cylinder:



Cylinder	Volume
Given :	$\pi \times 10^2 \times 5 = 500\pi$
(A) :	$\pi \times 20^2 \times 5 = 2000\pi$
(C) :	$\pi \times 5^2 \times 20 = 500\pi$
(D) :	$\pi \times 20^2 \times 10 = 4000\pi$

**Note.** If the radius remains the same and the height is doubled, then the volume will double, as in (B). Doubling the radius while the height remains the same will multiply the volume by 4, as in (A).

17. (B) For any triangle, the sum of the lengths of any two sides must be greater than the length of the third side. Thus  $6.5 + s$  must be greater than 10. The smallest such whole number for  $s$  is 4.



18. (A) During the 4 hours, the car traveled a total of  $80 + 0 + 100 = 180$  miles for an average speed of  $180/4 = 45$  miles per hour.

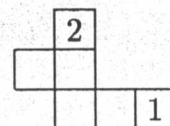
19. (C) There are 21 segments between the 5<sup>th</sup> and 26<sup>th</sup> exits. Using the minimum length of 5 miles, 20 segments would yield  $20 \times 5 = 100$  miles. This leaves  $118 - 100 = 18$  miles for the other segment.

OR

There are 21 segments between the 5<sup>th</sup> and 26<sup>th</sup> exits. If each segment were its minimal 5 miles length, then the total distance between the 5<sup>th</sup> and 26<sup>th</sup> exits would be 105 miles. Since  $118 - 105 = 13$ , all 13 additional miles could occur between one pair of consecutive exits. Such a pair would be  $5 + 13 = 18$  miles apart.



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.



21. (B) Compute the ratios for each month:

Month	Drums	Bugles	Diff.	Diff.: Lower	% exc.
Jan :	7	9	2	2:7	29%
Feb :	5	3	2	2:3	67%
Mar :	9	6	3	3:6	50%
Apr :	9	12	3	3:9	33%
May :	8	10	2	2:8	25%



Thus the percent is greatest in February.

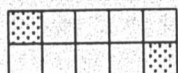
**Note.** Students can estimate the required ratio by visually comparing the difference between the columns to the shorter column.



22. (C) When a new tile is added to the original figure, it may have one or two sides in common with the given tiles, as shown. When a tile shares one side, the original perimeter is increased by 2. When a tile shares two sides, there is no change in the perimeter. By adding two tiles, the only possible changes to the perimeter are increases of 0, 2 or 4. Hence, the possible values of the perimeter are 14, 16 or 18.

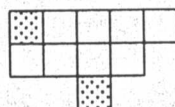


Note. Examples of the three possibilities are shown.



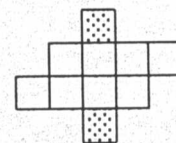
original = 14

new perimeter = 14



original = 14

new perimeter = 16



original = 14

new perimeter = 18

23. (B) Make a table and fill in the products greater than 10.

$\times$	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
<b>1</b> :	1	2	3	4	5	6
<b>2</b> :	2	4	6	8	10	<u>12</u>
<b>3</b> :	3	6	9	<u>12</u>	<u>15</u>	<u>18</u>
<b>4</b> :	4	8	<u>12</u>	<u>16</u>	<u>20</u>	<u>24</u>
<b>5</b> :	5	10	<u>15</u>	<u>20</u>	<u>25</u>	<u>30</u>
<b>6</b> :	6	<u>12</u>	<u>18</u>	<u>24</u>	<u>30</u>	<u>36</u>

Since there are 17 such products out of a possible 36 products, the probability is  $17/36$ .

24. (A) The four quarter-circles that lie inside the square have a total area equal to the area of one of the circles,  $9\pi$ . The length of a side of the square is equal to two radii, 6, and thus the square has area 36. The difference is  $36 - 9\pi < 36 - 9(3) = 9$ , so it is closest to 7.7. (The area, to one decimal place, is 7.7.)

25. (D) After the first pouring,  $\frac{1}{2}$  remains. After the second pouring  $\frac{1}{2} \times \frac{2}{3}$  remains. After the third pouring  $\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4}$  remains. How many pourings until  $\frac{1}{10}$  remains?

$$\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \times \frac{5}{6} \times \frac{6}{7} \times \frac{7}{8} \times \frac{8}{9} \times \frac{9}{10} = \frac{1}{10}$$

indicates 9 pourings.

OR

Make a table for the information:

<u>Pouring</u>	<u>Amount Poured</u>	<u>Amount Remaining</u>
1	$\frac{1}{2}$	$1 - \frac{1}{2} = \frac{1}{2}$
2	$\frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$	$\frac{1}{2} - \frac{1}{6} = \frac{1}{3}$
3	$\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$	$\frac{1}{3} - \frac{1}{12} = \frac{1}{4}$
4	$\frac{1}{5} \times \frac{1}{4} = \frac{1}{20}$	$\frac{1}{4} - \frac{1}{20} = \frac{1}{5}$
$\vdots$	$\vdots$	$\vdots$
$n$	$\frac{1}{n+1} \times \frac{1}{n} = \frac{1}{n(n+1)}$	$\frac{1}{n} - \frac{1}{n(n+1)} = \frac{1}{n+1}$
$\vdots$	$\vdots$	$\vdots$
9	$\frac{1}{10} \times \frac{1}{9} = \frac{1}{90}$	$\frac{1}{9} - \frac{1}{90} = \frac{1}{10}$

Thus  $\frac{1}{10}$  remains after the 9<sup>th</sup> pouring.