



## SECTION 2

Time — 25 minutes

20 Questions

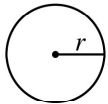
Turn to Section 2 (page 4) of your answer sheet to answer the questions in this section.

**Directions:** For this section, solve each problem and decide which is the best of the choices given. Fill in the corresponding circle on the answer sheet. You may use any available space for scratchwork.

Notes

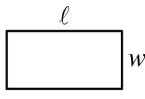
- The use of a calculator is permitted.
- All numbers used are real numbers.
- Figures that accompany problems in this test are intended to provide information useful in solving the problems. They are drawn as accurately as possible EXCEPT when it is stated in a specific problem that the figure is not drawn to scale. All figures lie in a plane unless otherwise indicated.
- Unless otherwise specified, the domain of any function  $f$  is assumed to be the set of all real numbers  $x$  for which  $f(x)$  is a real number.

Reference Information

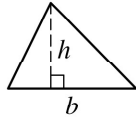


$$A = \pi r^2$$

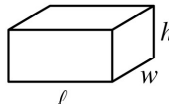
$$C = 2\pi r$$



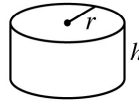
$$A = \ell w$$



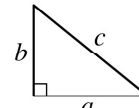
$$A = \frac{1}{2}bh$$



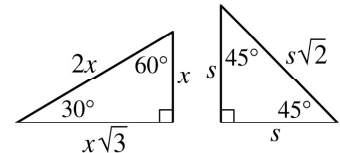
$$V = \ell wh$$



$$V = \pi r^2 h$$



$$c^2 = a^2 + b^2$$



Special Right Triangles

The number of degrees of arc in a circle is 360.

The sum of the measures in degrees of the angles of a triangle is 180.

1. When 70,000 is written as  $7.0 \times 10^n$ , what is the value of  $n$ ?

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

2. On a car trip Sam drove  $m$  miles, Kara drove twice as many miles as Sam, and Darin drove 20 fewer miles than Kara. In terms of  $m$ , how many miles did Darin drive?

- (A)  $2m + 20$   
(B)  $2m - 20$   
(C)  $\frac{m}{2} + 20$   
(D)  $\frac{m + 20}{2}$   
(E)  $\frac{m}{2} - 20$



3. If  $x$  and  $y$  are positive integers, what are all the solutions  $(x, y)$  of the equation  $3x + 2y = 11$ ?

(A) (1,4) only  
 (B) (3,1) only  
 (C) (1,4) and (2,2)  
 (D) (1,4) and (3,1)  
 (E) (2,2) and (3,1)

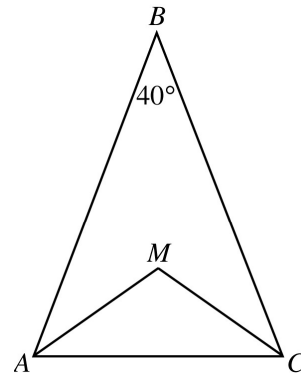
4. A company's profit,  $P$ , in dollars, for producing  $x$  machines in one day is given by  $P = 500x - 20x^2$ . If the company produces 10 machines in one day, then, according to this formula, what is the profit for that day?

(A) \$5,000  
 (B) \$4,000  
 (C) \$3,000  
 (D) \$2,000  
 (E) \$1,000

$$12 - n, 12, 12 + n$$

5. What is the average (arithmetic mean) of the 3 quantities in the list above?

(A) 4  
 (B) 12  
 (C) 18  
 (D)  $4 + \frac{n}{3}$   
 (E)  $12 + \frac{n}{3}$



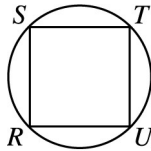
6. In isosceles triangle  $ABC$  above,  $\overline{AM}$  and  $\overline{CM}$  are the angle bisectors of angle  $BAC$  and angle  $BCA$ . What is the measure of angle  $AMC$ ?

(A)  $110^\circ$   
 (B)  $115^\circ$   
 (C)  $120^\circ$   
 (D)  $125^\circ$   
 (E)  $130^\circ$



7. A fruit salad is made from pineapples, pears, and peaches mixed in the ratio of 2 to 3 to 5, respectively, by weight. What fraction of the mixture by weight is pineapple?

- (A)  $\frac{1}{5}$   
 (B)  $\frac{3}{10}$   
 (C)  $\frac{2}{5}$   
 (D)  $\frac{1}{2}$   
 (E)  $\frac{2}{3}$



8. In the figure above, square  $RSTU$  is inscribed in the circle. What is the degree measure of arc  $\widehat{ST}$ ?

- (A)  $45^\circ$   
 (B)  $60^\circ$   
 (C)  $90^\circ$   
 (D)  $120^\circ$   
 (E)  $180^\circ$

9. If  $P$  and  $Q$  are two sets of numbers, and if every number in  $P$  is also in  $Q$ , which of the following CANNOT be true?

- (A) 4 is in both  $P$  and  $Q$ .  
 (B) 5 is in neither  $P$  nor  $Q$ .  
 (C) 6 is in  $P$ , but not in  $Q$ .  
 (D) 7 is in  $Q$ , but not in  $P$ .  
 (E) If 8 is not in  $Q$ , then 8 is not in  $P$ .

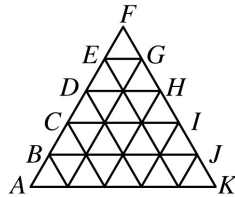
10. What is the maximum number of rectangular blocks measuring 3 inches by 2 inches by 1 inch that can be packed into a cube-shaped box whose interior measures 6 inches on an edge?

- (A) 24  
 (B) 28  
 (C) 30  
 (D) 36  
 (E) 40



11. If  $a \neq 0$  and  $\frac{5}{x} = \frac{5+a}{x+a}$ , what is the value of  $x$ ?

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



12. The figure above is composed of 25 small triangles that are congruent and equilateral. If the area of  $\triangle DFH$  is 10, what is the area of  $\triangle AFK$ ?

- (A) 40
- (B) 42.5
- (C) 50
- (D) 52.5
- (E) 62.5

$$3x + 2y + 2z = 19$$

$$3x + y + z = 14$$

13. If the equations above are true, which of the following is the value of  $y + z$ ?

- (A) -5
- (B) -4
- (C) 0
- (D) 4
- (E) 5

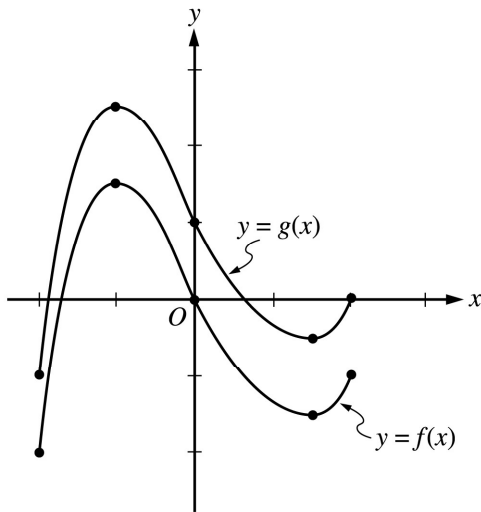
14. A boat costs  $x$  dollars, and this cost is to be shared equally by a group of people. In terms of  $x$ , how many dollars less will each person contribute if there are 4 people in the group instead of 3?

- (A)  $\frac{x}{12}$
- (B)  $\frac{x}{4}$
- (C)  $\frac{x}{3}$
- (D)  $\frac{7x}{12}$
- (E)  $7x$



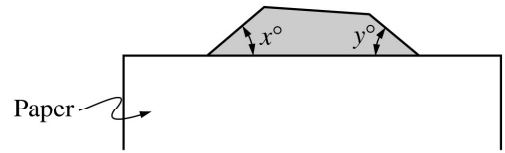
15. If  $y = 2x + 3$  and  $x < 2$ , which of the following represents all the possible values for  $y$ ?

- (A)  $y < 7$   
 (B)  $y > 7$   
 (C)  $y < 5$   
 (D)  $y > 5$   
 (E)  $5 < y < 7$



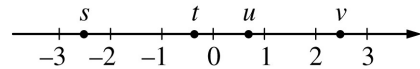
16. The graphs of the functions  $f$  and  $g$  in the interval from  $x = -2$  to  $x = 2$  are shown above. Which of the following could express  $g$  in terms of  $f$ ?

- (A)  $g(x) = f(x + 1)$   
 (B)  $g(x) = f(x) + 1$   
 (C)  $g(x) = f(x + 1) + 1$   
 (D)  $g(x) = f(x - 1)$   
 (E)  $g(x) = f(x) - 1$



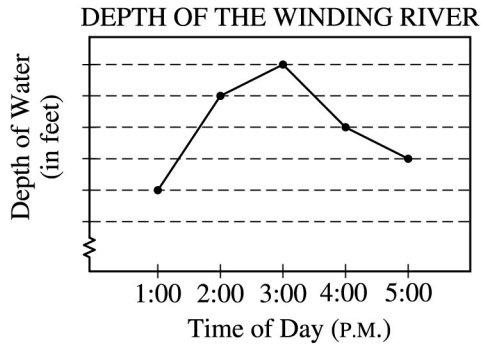
17. In the figure above, a shaded polygon which has equal sides and equal angles is partially covered with a sheet of blank paper. If  $x + y = 80$ , how many sides does the polygon have?

- (A) Ten  
 (B) Nine  
 (C) Eight  
 (D) Seven  
 (E) Six



18. If  $s$ ,  $t$ ,  $u$ , and  $v$  are the coordinates of the indicated points on the number line above, which of the following is greatest?

- (A)  $|s + t|$   
 (B)  $|s + v|$   
 (C)  $|s - t|$   
 (D)  $|s - v|$   
 (E)  $|s + u|$



19. On the day of a rainstorm, the depth of the water at a certain location along the Winding River was recorded hourly, and the results are indicated in the line graph above. Each unit on the vertical axis represents 1 foot. If the depth of the water decreased 10 percent from 3:00 P.M. to 4:00 P.M., what was the depth of the water at 4:00 P.M.?
- (A) 3 feet  
 (B) 15 feet  
 (C) 18 feet  
 (D) 20 feet  
 (E) 30 feet

20. For all numbers  $a$  and  $b$ , let  $a \odot b$  be defined by  $a \odot b = ab + a + b$ . For all numbers  $x$ ,  $y$ , and  $z$ , which of the following must be true?

- I.  $x \odot y = y \odot x$   
 II.  $(x - 1) \odot (x + 1) = (x \odot x) - 1$   
 III.  $x \odot (y + z) = (x \odot y) + (x \odot z)$
- (A) I only  
 (B) II only  
 (C) III only  
 (D) I and II only  
 (E) I, II, and III

**S T O P**

If you finish before time is called, you may check your work on this section only.  
 Do not turn to any other section in the test.



## SECTION 6

Time — 25 minutes

18 Questions

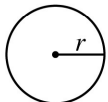
Turn to Section 6 (page 6) of your answer sheet to answer the questions in this section.

**Directions:** This section contains two types of questions. You have 25 minutes to complete both types. For questions 1-8, solve each problem and decide which is the best of the choices given. Fill in the corresponding circle on the answer sheet. You may use any available space for scratchwork.

Notes

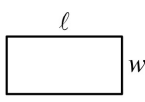
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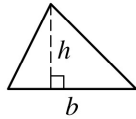


$$A = \pi r^2$$

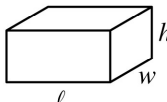
$$C = 2\pi r$$



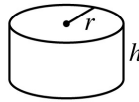
$$A = \ell w$$



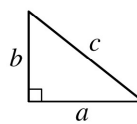
$$A = \frac{1}{2}bh$$



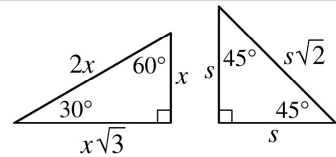
$$V = \ell wh$$



$$V = \pi r^2 h$$



$$c^2 = a^2 + b^2$$



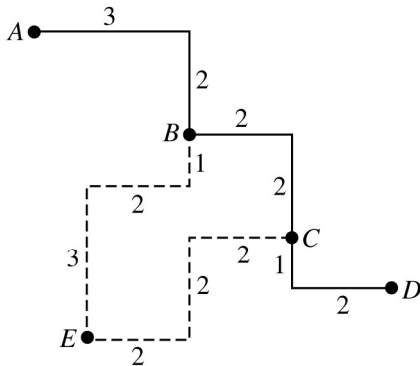
Special Right Triangles

The number of degrees of arc in a circle is 360.

The sum of the measures in degrees of the angles of a triangle is 180.

1. If  $x + k = 12$  and  $p(x + k) = 36$ , what is the value of  $p$ ?
- (A) 3  
(B) 4  
(C) 6  
(D) 9  
(E) 12

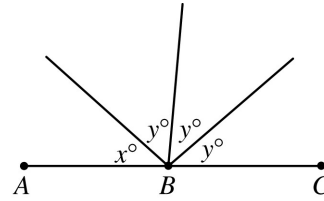
2. If 13 is added to one-half of a certain number, the result is 37. What is the original number?
- (A) 24  
(B) 40  
(C) 48  
(D) 61  
(E) 80



3. In the figure above, the usual route from Town  $A$  to Town  $D$  is indicated by the solid line. The broken line indicates a detour route from  $B$  to  $C$  through  $E$ . Each line segment is labeled with its length in miles. How many more miles is the trip from Town  $A$  to Town  $D$  via the detour than via the usual route?
- (A) 4  
(B) 8  
(C) 10  
(D) 12  
(E) 18

$x$	$y$
1	7.5
2	13.0
3	18.5
4	24.0

4. Which of the following equations expresses  $y$  in terms of  $x$  for each of the four pairs of values shown in the table above?
- (A)  $y = 5x + 7.5$   
(B)  $y = 5.5x + 2$   
(C)  $y = 5.5x + 7.5$   
(D)  $y = 7.5x$   
(E)  $y = 7.5x + 5.5$



Note: Figure not drawn to scale.

5. In the figure above, point  $B$  lies on  $\overline{AC}$ . If  $x$  and  $y$  are integers, which of the following is a possible value of  $x$ ?
- (A) 30  
(B) 35  
(C) 40  
(D) 50  
(E) 55





6. The least and greatest numbers in a list of 7 real numbers are 2 and 20, respectively. The median of the list is 6, and the number 3 occurs most often in the list. Which of the following could be the average (arithmetic mean) of the numbers in the list?

- I. 7
- II. 8.5
- III. 10

- (A) I only
- (B) I and II only
- (C) I and III only
- (D) II and III only
- (E) I, II, and III

Family	Number of Consecutive Nights
Jackson	10
Callan	5
Epstein	8
Liu	6
Benton	8

8. The table above shows the number of consecutive nights that each of five families stayed at a certain hotel during a 14-night period. If the Liu family's stay did not overlap with the Benton family's stay, which of the 14 nights could be a night on which only one of the five families stayed at the hotel?

- (A) The 3rd
- (B) The 5th
- (C) The 6th
- (D) The 8th
- (E) The 10th

7. In the  $xy$ -coordinate plane, how many points are a distance of 4 units from the origin?

- (A) One
- (B) Two
- (C) Three
- (D) Four
- (E) More than four



**Directions:** For Student-Produced Response questions 9-18, use the grids at the bottom of the answer sheet page on which you have answered questions 1-8.

Each of the remaining 10 questions requires you to solve the problem and enter your answer by marking the circles in the special grid, as shown in the examples below. You may use any available space for scratchwork.

Write answer in boxes. →

Grid in result. →

← Fraction line

← Decimal point

Either position is correct.

**Note:** You may start your answers in any column, space permitting. Columns not needed should be left blank.

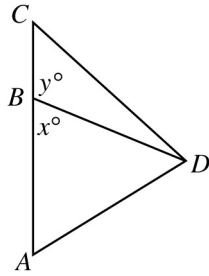
- Mark no more than one circle in any column.
- Because the answer sheet will be machine-scored, **you will receive credit only if the circles are filled in correctly.**
- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- No question has a negative answer.
- **Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If  $\begin{array}{|c|c|c|c|} \hline 3 & 1 & / & 2 \\ \hline \bullet & & & \bullet \\ \hline \end{array}$  is gridded, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)

- **Decimal Answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid. For example, if you obtain an answer such as 0.6666..., you should record your result as .666 or .667. **A less accurate value such as .66 or .67 will be scored as incorrect.**

Acceptable ways to grid  $\frac{2}{3}$  are:

9. If a cake is cut into thirds and each third is cut into fourths, how many pieces of cake are there?

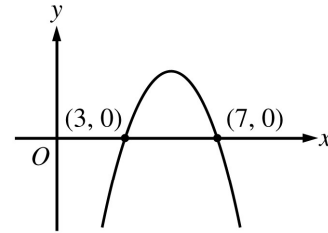
10. If  $y = \frac{h}{x}$ , where  $h$  is a constant, and if  $y = 3$  when  $x = 4$ , what does  $y$  equal when  $x = 6$ ?



Note: Figure not drawn to scale.

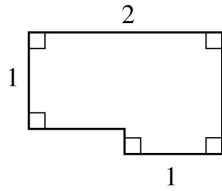
11. In the figure above, point  $B$  lies on side  $\overline{AC}$ . If  $55 < x < 60$ , what is one possible value of  $y$ ?

12. The price of a certain item was \$10 in 1990 and it has gone up by \$2 per year since 1990. If this trend continues, in what year will the price be \$100?



13. The figure above shows the graph of a quadratic function in the  $xy$ -plane. Of all the points  $(x, y)$  on the graph, for what value of  $x$  is the value of  $y$  greatest?

14. The number  $n$  is a 2-digit number. When  $n$  is divided by 10, the remainder is 9, and when  $n$  is divided by 9, the remainder is 8. What is the value of  $n$ ?



15. The area of the figure above is  $\frac{9}{4}$ . What is the perimeter of the figure?

16. If  $j$  is chosen at random from the set  $\{4, 5, 6\}$  and  $k$  is chosen at random from the set  $\{10, 11, 12\}$ , what is the probability that the product of  $j$  and  $k$  is divisible by 5?

17. Tom and Alison are both salespeople. Tom's weekly compensation consists of \$300 plus 20 percent of his sales. Alison's weekly compensation consists of \$200 plus 25 percent of her sales. If they both had the same amount of sales and the same compensation for a particular week, what was that compensation, in dollars? (Disregard the dollar sign when gridding your answer.)

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$$tx + 12y = -3$$

18. The equation above is the equation of a line in the  $xy$ -plane, and  $t$  is a constant. If the slope of the line is  $-10$ , what is the value of  $t$ ?

**STOP**

If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section in the test.



## SECTION 9

Time — 20 minutes

16 Questions

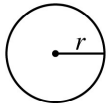
Turn to Section 9 (page 7) of your answer sheet to answer the questions in this section.

**Directions:** For this section, solve each problem and decide which is the best of the choices given. Fill in the corresponding circle on the answer sheet. You may use any available space for scratchwork.

Notes

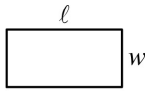
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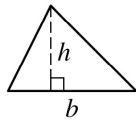


$$A = \pi r^2$$

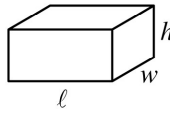
$$C = 2\pi r$$



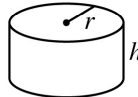
$$A = \ell w$$



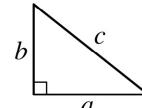
$$A = \frac{1}{2}bh$$



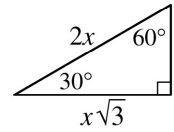
$$V = \ell wh$$



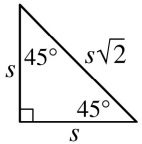
$$V = \pi r^2 h$$



$$c^2 = a^2 + b^2$$



Special Right Triangles

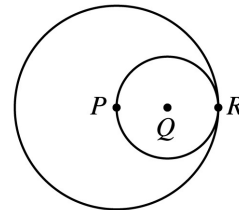


The number of degrees of arc in a circle is 360.

The sum of the measures in degrees of the angles of a triangle is 180.

1. If  $\frac{1}{3}y + 9 = 0$ , then  $y =$

- (A) -27  
(B) -9  
(C) -3  
(D) 3  
(E) 27

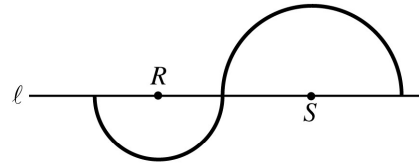


2. In the figure above,  $P$ ,  $Q$ , and  $R$  lie on the same line.  $P$  is the center of the larger circle, and  $Q$  is the center of the smaller circle. If the radius of the larger circle is 4, what is the radius of the smaller circle?

- (A) 1  
(B) 2  
(C) 4  
(D) 8  
(E) 16



3. Roy planted corn on  $\frac{1}{5}$  of his land. If he planted 45 acres of corn, how many acres of land does he have?
- (A) 90  
 (B)  $112\frac{1}{2}$   
 (C) 135  
 (D) 225  
 (E)  $337\frac{1}{2}$



5. The two semicircles in the figure above have centers  $R$  and  $S$ , respectively. If  $RS = 12$ , what is the total length of the darkened curve?
- (A)  $8\pi$   
 (B)  $9\pi$   
 (C)  $12\pi$   
 (D)  $15\pi$   
 (E)  $16\pi$

6, 10, 18, 34, 66

4. The first number in the list above is 6. Which of the following gives a rule for finding each successive number in the list?
- (A) Add 4 to the preceding number.  
 (B) Take  $\frac{1}{2}$  of the preceding number and then add 7 to that result.  
 (C) Double the preceding number and then subtract 2 from that result.  
 (D) Subtract 2 from the preceding number and then double that result.  
 (E) Triple the preceding number and then subtract 8 from that result.



6. If  $h$  and  $k$  are positive numbers and  $h + k = 7$ ,

then  $\frac{7 - k}{h} =$

- (A) 1  
(B) 0  
(C)  $-1$   
(D)  $h$   
(E)  $k - 1$

8. If  $x^2 = x + 6$ , which of the following must be true?

- (A)  $x = 6$   
(B)  $x < 3$   
(C)  $x > 0$   
(D)  $x^2 < x$   
(E)  $x^2 > x$

Country	Total Population	Population Density
A	6,500,000 people	600 people per square mile
B	7,600,000 people	400 people per square mile

7. The table above shows the populations of two countries and their population densities. The number of square miles in the area of Country B is approximately how much greater than the number of square miles in the area of Country A?

- (A) 200  
(B) 3,600  
(C) 5,000  
(D) 8,000  
(E) 905,000,000



9. Let the function  $f$  be defined by  $f(x) = 5x - 2a$ , where  $a$  is a constant. If  $f(10) + f(5) = 55$ , what is the value of  $a$ ?

(A)  $-5$   
(B)  $0$   
(C)  $5$   
(D)  $10$   
(E)  $20$

10. A number is called “even-odd” if it is halfway between an even integer and an odd integer. If  $x$  is an even-odd number, which of the following must be true?

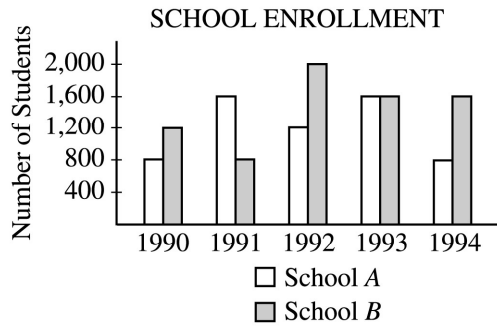
I.  $2x$  is an integer.  
II.  $2x$  is even-odd.  
III.  $x$  is halfway between two even integers.

(A) I only  
(B) II only  
(C) I and II only  
(D) II and III only  
(E) I, II, and III

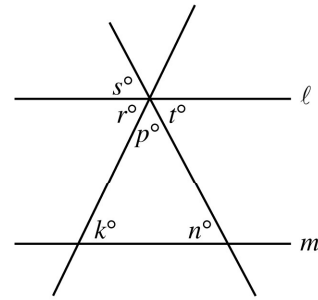
11. If  $m$  is a positive integer, which of the following is NOT equal to  $(2^4)^m$ ?

(A)  $2^{4m}$   
(B)  $4^{2m}$   
(C)  $2^m(2^{3m})$   
(D)  $4^m(2^m)$   
(E)  $16^m$





12. According to the graph above, in which year was the ratio of the number of students enrolled at School *B* to the number of students enrolled at School *A* the greatest?
- (A) 1990  
 (B) 1991  
 (C) 1992  
 (D) 1993  
 (E) 1994



13. In the figure above,  $\ell \parallel m$ . Which of the following must equal 180 ?
- (A)  $k + n + r$   
 (B)  $k + p + s$   
 (C)  $n + p + s$   
 (D)  $n + p + t$   
 (E)  $r + s + t$

14. How many different ordered pairs  $(x, y)$  are there such that  $x$  is an even integer, where  $4 \leq x \leq 10$ , and  $y$  is an integer, where  $4 < y < 10$  ?
- (A) 8  
 (B) 12  
 (C) 20  
 (D) 30  
 (E) 36



$$n(t) = 500(0.81)^t$$

15. The function above can be used to model the population of a certain endangered species of animal. If  $n(t)$  gives the number of the species living  $t$  decades after the year 1900, which of the following is true about the population of the species from 1900 to 1920 ?
- (A) It increased by about 1,000.  
(B) It increased by about 320.  
(C) It decreased by about 180.  
(D) It decreased by about 320.  
(E) It decreased by about 1,000.

16. A sphere of radius  $r$  inside a cube touches each one of the six sides of the cube. What is the volume of the cube, in terms of  $r$  ?
- (A)  $r^3$   
(B)  $2r^3$   
(C)  $4r^3$   
(D)  $\frac{4}{3}\pi r^3$   
(E)  $8r^3$

**STOP**

If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section in the test.