



## 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 scratch work.

Notes

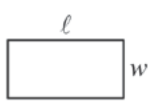
1. The use of a calculator is permitted.
2. All numbers used are real numbers.
3. Figures that accompany problems in this test are intended to provide information useful in solving the problems. They are drawn as accurately as possible EXCEPT when it is stated in a specific problem that the figure is not drawn to scale. All figures lie in a plane unless otherwise indicated.
4. 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



$$A = \pi r^2$$

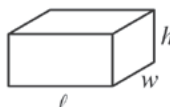
$$C = 2\pi r$$



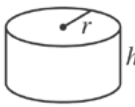
$$A = \ell w$$



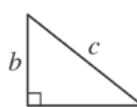
$$A = \frac{1}{2}bh$$



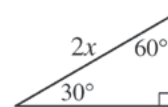
$$V = \ell wh$$



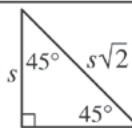
$$V = \pi r^2 h$$



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



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.

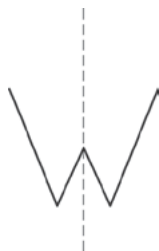
1. If  $10 + x$  is 5 more than 10, what is the value of  $2x$ ?

(A) -5  
(B) 5  
(C) 10  
(D) 25  
(E) 50

2. The result when a number is divided by 2 is equal to the result when that same number is divided by 4. What is that number?

(A) -4  
(B) -2  
(C) 0  
(D) 2  
(E) 4

GO ON TO THE NEXT PAGE 



3. If this page was folded along the dotted line in the figure above, the left half of the letter W would exactly coincide with the right half of W. Which of the following letters, as shown, CANNOT be folded along a vertical line so that its left half would coincide with its right half?

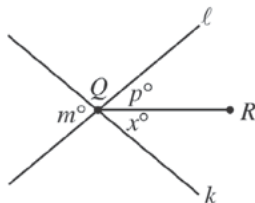
(A)

(B)

(C)

(D)

(E)



Note: Figure not drawn to scale.

4. In the figure above, lines  $\ell$  and  $k$  intersect at point  $Q$ . If  $m = 40$  and  $p = 25$ , what is the value of  $x$ ?

(A) 15  
(B) 20  
(C) 25  
(D) 40  
(E) 65

$x$	$y$
-2	-3
0	3
1	6
2	9
4	15

5. Which of the following equations is satisfied by the five pairs of numbers listed in the table above?

(A)  $y = x^3 + 3$

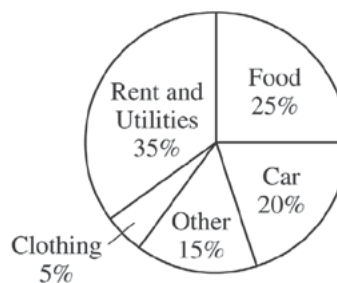
(B)  $y = 3x + 3$

(C)  $y = -3x + 6$

(D)  $y = x^2 + 6$

(E)  $y = x^2 - 7$

DAVID'S MONTHLY EXPENSES



6. The circle graph above shows how David's monthly expenses are divided. If David spends \$450 per month for food, how much does he spend per month on his car?

(A) \$200  
(B) \$320  
(C) \$360  
(D) \$400  
(E) \$450



7. If  $n$  and  $k$  are positive integers and  $8^n = 2^k$ , what is the value of  $\frac{n}{k}$ ?

(A)  $\frac{1}{4}$   
(B)  $\frac{1}{3}$   
(C)  $\frac{1}{2}$   
(D) 3  
(E) 4

8. In a certain store, the regular price of a refrigerator is \$600. How much money is saved by buying this refrigerator at 20 percent off the regular price rather than buying it on sale at 10 percent off the regular price with an additional discount of 10 percent off the sale price?

(A) \$6  
(B) \$12  
(C) \$24  
(D) \$54  
(E) \$60

9. If the function  $f$  is defined by  $f(x) = 3x + 4$ , then  $2f(x) + 4 =$

(A)  $5x + 4$   
(B)  $5x + 8$   
(C)  $6x + 4$   
(D)  $6x + 8$   
(E)  $6x + 12$

10. What is the greatest possible area of a triangle with one side of length 7 and another side of length 10?

(A) 17  
(B) 34  
(C) 35  
(D) 70  
(E) 140

11. A total of 120,000 votes were cast for 2 opposing candidates, Garcia and Pérez. If Garcia won by a ratio of 5 to 3, what was the number of votes cast for Pérez?

(A) 15,000  
(B) 30,000  
(C) 45,000  
(D) 75,000  
(E) 80,000

12. If a positive integer  $n$  is picked at random from the positive integers less than or equal to 10, what is the probability that  $5n + 3 \leq 14$ ?

(A) 0  
(B)  $\frac{1}{10}$   
(C)  $\frac{1}{5}$   
(D)  $\frac{3}{10}$   
(E)  $\frac{2}{5}$

13. If  $t$  is a number greater than 1, then  $t^2$  is how much greater than  $t$ ?

(A) 1  
(B) 2  
(C)  $t$   
(D)  $t(t - 1)$   
(E)  $(t - 1)(t + 1)$

14. The height of a right circular cylinder is 5 and the diameter of its base is 4. What is the distance from the center of one base to a point on the circumference of the other base?

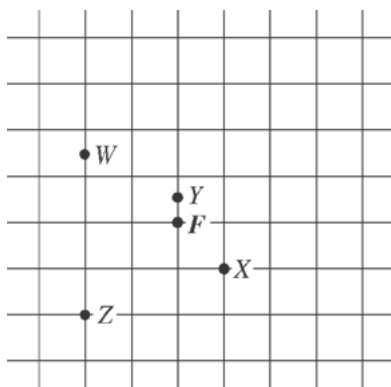
(A) 3  
(B) 5  
(C)  $\sqrt{29}$  (approximately 5.39)  
(D)  $\sqrt{33}$  (approximately 5.74)  
(E)  $\sqrt{41}$  (approximately 6.40)



15. If  $p$  and  $n$  are integers such that  $p > n > 0$  and  $p^2 - n^2 = 12$ , which of the following can be the value of  $p - n$ ?

- I. 1
  - II. 2
  - III. 4
- (A) I only  
(B) II only  
(C) I and II only  
(D) II and III only  
(E) I, II, and III

**Questions 16-18** refer to the following figure and information.



The grid above represents equally spaced streets in a town that has no one-way streets.  $F$  marks the corner where a firehouse is located. Points  $W$ ,  $X$ ,  $Y$ , and  $Z$  represent the locations of some other buildings. The fire company defines a building's  $m$ -distance as the minimum number of blocks that a fire truck must travel from the firehouse to reach the building. For example, the building at  $X$  is an  $m$ -distance of 2, and the building at  $Y$  is an  $m$ -distance of  $\frac{1}{2}$  from the firehouse.

16. What is the  $m$ -distance of the building at  $W$  from the firehouse?

- (A) 2  
(B)  $2\frac{1}{2}$   
(C) 3  
(D)  $3\frac{1}{2}$   
(E)  $4\frac{1}{2}$

17. What is the total number of different routes that a fire truck can travel the  $m$ -distance from  $F$  to  $Z$ ?

- (A) Six  
(B) Five  
(C) Four  
(D) Three  
(E) Two

18. All of the buildings in the town that are an  $m$ -distance of 3 from the firehouse must lie on a

- (A) circle  
(B) square  
(C) right isosceles triangle  
(D) pair of intersecting lines  
(E) line



19. If  $x$  and  $y$  are positive integers, which of the following is equivalent to  $(2x)^{3y} - (2x)^y$  ?

(A)  $(2x)^{2y}$   
(B)  $2^y(x^3 - x^y)$   
(C)  $(2x)^y[(2x)^{2y} - 1]$   
(D)  $(2x)^y(4x^y - 1)$   
(E)  $(2x)^y[(2x)^3 - 1]$

20. If  $j$ ,  $k$ , and  $n$  are consecutive integers such that  $0 < j < k < n$  and the units (ones) digit of the product  $jn$  is 9, what is the units digit of  $k$  ?

(A) 0  
(B) 1  
(C) 2  
(D) 3  
(E) 4

**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

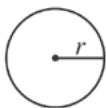
Turn to Section 6 (page 6) of your answer sheet to answer the questions in this section.

**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 scratch work.

Notes

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2. All numbers used are real numbers.
3. 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.
4. 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



$$A = \pi r^2$$

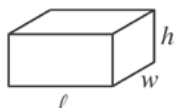
$$C = 2\pi r$$



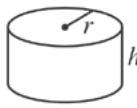
$$A = \ell w$$



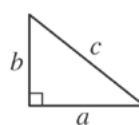
$$A = \frac{1}{2}bh$$



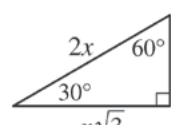
$$V = \ell wh$$



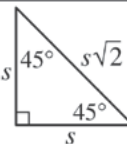
$$V = \pi r^2 h$$



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



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.

4, 11, 18, ...

1. In the sequence above, the first term is 4 and each term after the first is 7 more than the previous term. What is the 12th term of the sequence?

- (A) 77  
(B) 81  
(C) 84  
(D) 86  
(E) 92

2. If  $(x - 2)^2 = 49$ , then  $x$  could be

- (A) -9  
(B) -7  
(C) 2  
(D) 5  
(E) 9

3. The average (arithmetic mean) of  $t$  and  $y$  is 15, and the average of  $w$  and  $x$  is 15. What is the average of  $t$ ,  $w$ ,  $x$ , and  $y$ ?

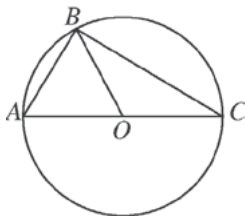
- (A) 7.5  
(B) 15  
(C) 22.5  
(D) 30  
(E) 60

GO ON TO THE NEXT PAGE



All of Kay's brothers can swim.

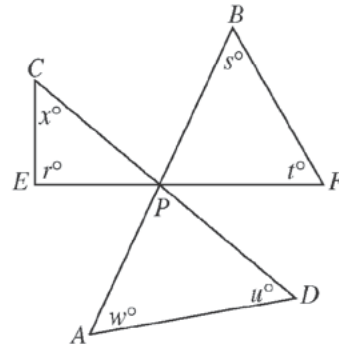
4. If the statement above is true, which of the following must also be true?
- (A) If Fred cannot swim, then he is not Kay's brother.  
 (B) If Dave can swim, then he is not Kay's brother.  
 (C) If Walt can swim, then he is Kay's brother.  
 (D) If Pete is Kay's brother, then he cannot swim.  
 (E) If Mark is not Kay's brother, then he cannot swim.



5. In the figure above, triangle  $ABC$  is inscribed in the circle with center  $O$  and diameter  $\overline{AC}$ . If  $AB = AO$ , what is the degree measure of  $\angle ABO$ ?
- (A)  $15^\circ$   
 (B)  $30^\circ$   
 (C)  $45^\circ$   
 (D)  $60^\circ$   
 (E)  $90^\circ$

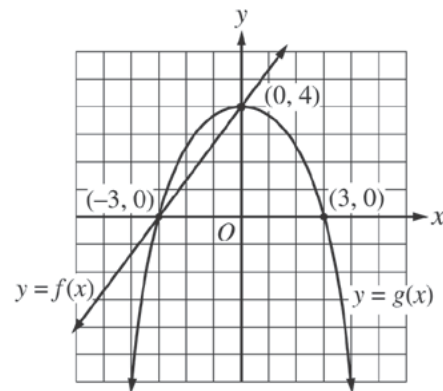
6. Each of the following is equivalent to  $\frac{a}{b}(bc + k)$  EXCEPT

- (A)  $a\left(\frac{c + k}{b}\right)$   
 (B)  $a\left(c + \frac{k}{b}\right)$   
 (C)  $\frac{a}{b}(k + bc)$   
 (D)  $ac + \frac{ak}{b}$   
 (E)  $\frac{abc + ak}{b}$



Note: Figure not drawn to scale.

7. In the figure above,  $\overline{AB}$ ,  $\overline{CD}$ , and  $\overline{EF}$  intersect at  $P$ . If  $r = 90$ ,  $s = 50$ ,  $t = 60$ ,  $u = 45$ , and  $w = 50$ , what is the value of  $x$ ?
- (A) 45  
 (B) 50  
 (C) 65  
 (D) 75  
 (E) It cannot be determined from the information given.



8. Based on the portions of the graphs of the functions  $f$  and  $g$  shown above, what are all values of  $x$  between  $-6$  and  $6$  for which  $g(x) > f(x)$ ?
- (A)  $-6 < x < -3$  only  
 (B)  $-3 < x < 0$  only  
 (C)  $0 < x < 3$  only  
 (D)  $3 < x < 6$  only  
 (E)  $-6 < x < -3$  and  $0 < x < 3$

GO ON TO THE NEXT PAGE



**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 scratch work.

Answer:  $\frac{7}{12}$

Write answer in boxes. →

7	/	1	2
•	•	•	•
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Grid in result. →

← Fraction line

Answer: 2.5

2	.	5
•	•	•
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

← Decimal point

Answer: 201

Either position is correct.

2	0	1
•	•	•
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4

2	0	1
•	•	•
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4

**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  $\frac{31}{2}$  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:
- |   |   |   |
|---|---|---|
| 2 | / | 3 |
| • | • | • |
| 0 | 0 | 0 |
| 1 | 1 | 1 |
| 2 | 2 | 2 |
| 3 | 3 | 3 |
| 4 | 4 | 4 |
| 5 | 5 | 5 |
| 6 | 6 | 6 |

.	6	6	6
•	•	•	•
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6

.	6	6	7
•	•	•	•
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6

9. When her son's class held its magazine drive, Dr. Nelson bought 7 one-year magazine subscriptions for the waiting room in her office. She bought 4 subscriptions that have 12 issues per year, 2 subscriptions that have 4 issues per year, and 1 subscription that has 52 issues per year. Altogether, how many magazines will her office receive from these subscriptions?

10. Three more than twice a number is equal to 4. What is the number?



SALES OF BOOK *B*

	Total Number of Copies Sold
End of 1st week	3200
End of 2nd week	5500
End of 3rd week	6800
End of 4th week	7400
End of 5th week	7700

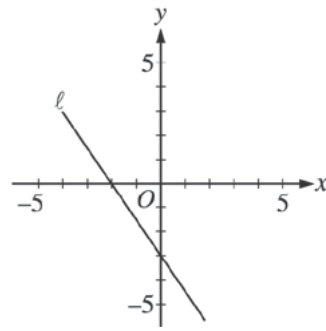
11. The table above shows the total number of copies of Book *B* that were sold by the end of each of the first 5 weeks of its publication. How many copies of the book were sold during the 3rd week of its publication?

12. If  $\frac{j}{k} = 32$  and  $k = \frac{3}{2}$ , what is the value of  $\frac{1}{2}j$ ?

$$\begin{aligned}x + y + 3z &= 600 \\x + y + z &= 400\end{aligned}$$

13. In the system of equations above, what is the value of  $x + y$ ?

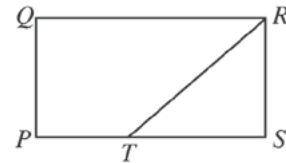
14. There are 25 trays on a table in the cafeteria. Each tray contains a cup only, a plate only, or both a cup and a plate. If 15 of the trays contain cups and 21 of the trays contain plates, how many contain both a cup and a plate?



15. In the figure above, line  $\ell$  intersects the  $x$ -axis at  $x = -2$  and the  $y$ -axis at  $y = -3$ . If line  $m$  (not shown) passes through the origin and is perpendicular to line  $\ell$ , what is the slope of line  $m$ ?

16. If  $6 < |x - 3| < 7$  and  $x < 0$ , what is one possible value of  $|x|$ ?

17. What is the product of the smallest prime number that is greater than 50 and the greatest prime number that is less than 50?



18. In the figure above,  $PQRS$  is a rectangle. The area of  $\triangle RST$  is 7 and  $PT = \frac{2}{5}PS$ . What is the area of  $PQRS$ ?

# 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 8

Time — 20 minutes

16 Questions

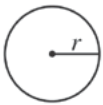
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Notes

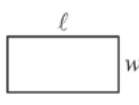
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Reference Information



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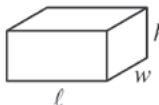
$$C = 2\pi r$$



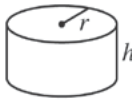
$$A = \ell w$$



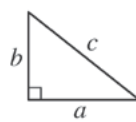
$$A = \frac{1}{2}bh$$



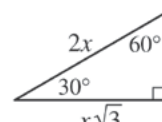
$$V = \ell wh$$



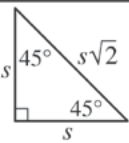
$$V = \pi r^2 h$$



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



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. On Wednesday Heather ran 3 miles in 30 minutes. If she ran for 45 minutes at this rate on Thursday, how far did Heather run on Thursday?

(A) 3.5 miles  
(B) 4 miles  
(C) 4.5 miles  
(D) 5 miles  
(E) 5.5 miles

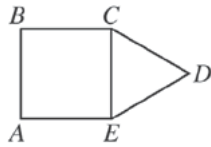
2. If  $(2m)k = 6$ , then  $mk =$

(A) 3  
(B) 4  
(C) 5  
(D) 6  
(E) 12

3. If 3 times a number is equal to  $\frac{3}{2}$ , what is the number?

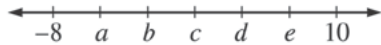
(A)  $\frac{1}{3}$   
(B)  $\frac{1}{2}$   
(C)  $\frac{2}{3}$   
(D) 2  
(E) 3

GO ON TO THE NEXT PAGE 



4. In the figure above,  $CDE$  is an equilateral triangle and  $ABCE$  is a square with an area of 1. What is the perimeter of polygon  $ABCDE$ ?

(A) 4  
(B) 5  
(C) 6  
(D) 7  
(E) 8



5. On the number line above, the tick marks are equally spaced and their coordinates are shown. Of these coordinates, which has the smallest positive value?

(A)  $a$   
(B)  $b$   
(C)  $c$   
(D)  $d$   
(E)  $e$

10, 18, 4, 15, 3, 21,  $x$

6. If  $x$  is the median of the 7 numbers listed above, which of the following could be the value of  $x$ ?

(A) 5  
(B) 8  
(C) 9  
(D) 14  
(E) 16

7. Two spheres, one with radius 7 and one with radius 4, are tangent to each other. If  $P$  is any point on one sphere and  $Q$  is any point on the other sphere, what is the maximum possible length of  $\overline{PQ}$ ?

(A) 7  
(B) 11  
(C) 14  
(D) 18  
(E) 22

NUMBER OF PREMIUM MEMBERS

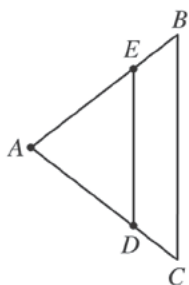
Year	2000	2001	2002
Store A	250	400	750
Store B	500	1,000	1,250

AVERAGE NUMBER OF VIDEO  
RENTALS PER PREMIUM MEMBER  
AT STORE B

Year	Rentals
2000	12
2001	15
2002	20

8. The first table above shows the number of premium members at two video rental stores,  $A$  and  $B$ , during the years 2000–2002. The second table shows the average (arithmetic mean) number of video rentals per premium member at store  $B$  during each of those years. Based on this information, which of the following best approximates the total number of video rentals by premium members at Store  $B$  during the years 2000–2002?

(A) 24,000  
(B) 46,000  
(C) 58,000  
(D) 70,000  
(E) 130,000



Note: Figure not drawn to scale.

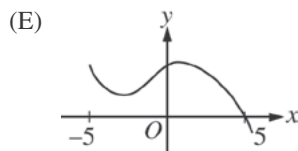
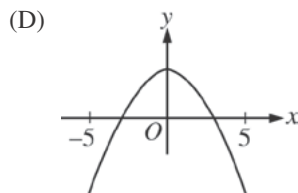
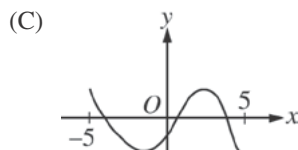
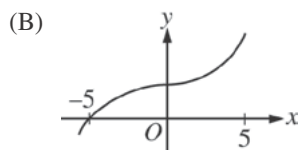
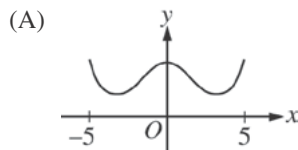
9. In  $\triangle ABC$  above,  $AB = AC$ ,  $E$  is the midpoint of  $\overline{AB}$ , and  $D$  is the midpoint of  $\overline{AC}$ . If  $AE = x$  and  $ED = 4$ , what is length  $BC$ ?

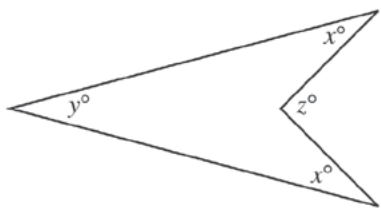
- (A) 6
- (B) 8
- (C)  $2x$
- (D)  $4x$
- (E)  $4x^2$

10. A student was given a piece of rope and told to cut it into two equal pieces, keep one piece, and pass the other piece to the next student. Each student was to repeat this process until every student in the class had exactly one piece of rope. Which of the following could be the fraction of the original rope that one of the students had?

- (A)  $\frac{1}{14}$
- (B)  $\frac{1}{15}$
- (C)  $\frac{1}{16}$
- (D)  $\frac{1}{17}$
- (E)  $\frac{1}{18}$

11. Which of the following is the graph of a function  $f$  such that  $f(x) = 0$  for exactly two values of  $x$  between  $-5$  and  $5$ ?





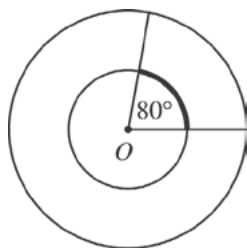
Note: Figure not drawn to scale.

12. If  $x = 20$  and  $y = 30$  in the figure above, what is the value of  $z$ ?

(A) 60  
(B) 70  
(C) 80  
(D) 90  
(E) 100

13. If  $x$  and  $y$  are integers,  $7 < y < 16$ , and  $\frac{x}{y} = \frac{2}{5}$ , how many possible values are there for  $x$ ?

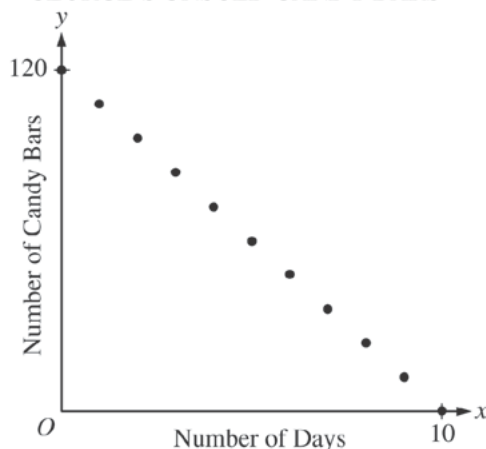
(A) One  
(B) Two  
(C) Three  
(D) Four  
(E) Five



14. Point  $O$  is the center of both circles in the figure above. If the circumference of the large circle is 36 and the radius of the small circle is half of the radius of the large circle, what is the length of the darkened arc?

(A) 10  
(B) 8  
(C) 6  
(D) 4  
(E) 2

GEORGE'S UNSOLD CANDY BARS



15. The graph above shows the number of George's unsold candy bars over a 10-day period. The points on the graph all lie on which of the following lines?

(A)  $y = 10x - 120$   
(B)  $y = 10x + 120$   
(C)  $y = 12x - 120$   
(D)  $y = 120 - 10x$   
(E)  $y = 120 - 12x$

16. Let  $\nabla x$  be defined as  $x + \frac{1}{x}$  for all nonzero integers  $x$ . If  $\nabla x = t$ , where  $t$  is an integer, which of the following is a possible value of  $t$ ?

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