SECTION 2

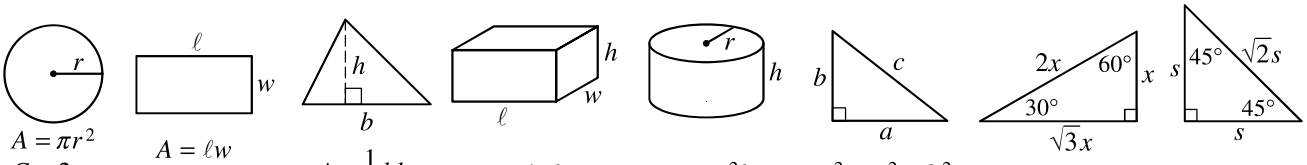
Time — 30 minutes
25 Questions

Directions: In this section solve each problem, using any available space on the page for scratchwork. Then decide which is the best of the choices given and fill in the corresponding oval on the answer sheet.

Notes:

1. The use of a calculator is permitted. All numbers used are real numbers.
2. 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.

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

1. If $\frac{x^2 + n}{x^2 + 4} = 1$, then $n =$

(A) 4

(B) 3

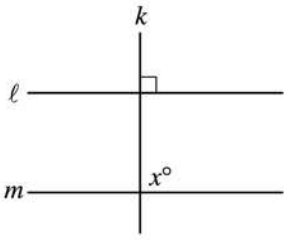
(C) 1

(D) $\frac{1}{4}$

(E) –3

2. On a certain job, Robin was paid \$6 an hour for the first 10 hours she worked. For the time she worked beyond 10 hours, she was paid \$9 an hour. If she worked 20 hours on this job, how much was Robin paid?

(A) \$60
(B) \$90
(C) \$120
(D) \$150
(E) \$180



Note: Figure not drawn to scale.

3. In the figure above, lines ℓ and m are not parallel. Which of the following CANNOT be the value of x ?

(A) 89
(B) 90
(C) 91
(D) 92
(E) 93

4. If $x^2 = k$, where x and k are integers, which of the following could be the value of k ?

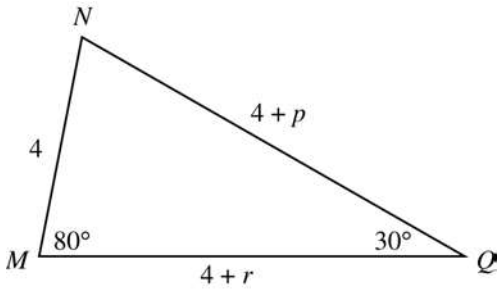
(A) 3
(B) 6
(C) 9
(D) 12
(E) 15

5. When a number x is subtracted from 36 and the difference is divided by x, the result is 2. What is the value of x ?

(A) 12
(B) 17
(C) 18
(D) 21
(E) 24

6. A class has twice as many boys as girls. The students in the class stand in one line, with a girl at the front of the line. Which of the following must be true?

(A) The last person in line is a girl.
(B) The last person in line is a boy.
(C) There are more girls than boys in the class.
(D) There are at least two girls standing next to each other.
(E) There are at least two boys standing next to each other.



7. In the triangle above, which of the following must be true?

(A) $p = r$
(B) $p < r$
(C) $p > r$
(D) $p = 4$
(E) $p > 4$

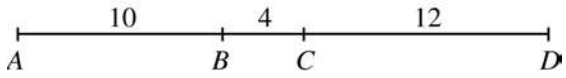
GO ON TO THE NEXT PAGE

8. For all positive integers a and b, if $a \neq b$, let $a \diamond b$ be defined as $\frac{a+b}{a-b}$. What is the value of $1{,}011 \diamond 11$?

(A) 1.011
(B) 1.022
(C) 1.121
(D) 2.111
(E) 10.220

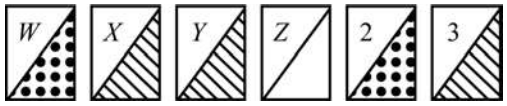
9. If $3^{x-2} = 3$, then $x =$

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



10. In the figure above, points B and C divide line segment AD as shown. What is the length of the line segment whose endpoints are the midpoints of line segments AB and CD ?

(A) 15
(B) 13
(C) 11
(D) 8
(E) 7



11. If a card is to be selected at random from those in the figure above, which of the following has the greatest probability of being selected?

(A) A card with a letter
(B) A card with a number
(C) A card with stripes
(D) A card with dots
(E) A card with both a letter and stripes

12. If a is an even integer and b is an odd integer, which of the following must be even?

(A) $ab + 1$
(B) $a^2 + 3$
(C) $a^2 + b^2$
(D) $a^2b^2 + 1$
(E) $b^2 + 3$

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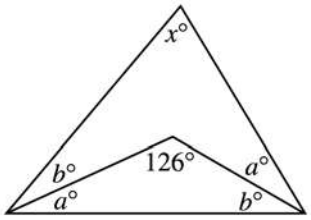

Note: Figure not drawn to scale.

13. In the figure above, what is the value of x ?

(A) 72
(B) 70
(C) 68
(D) 66
(E) 64

14. The sum of four consecutive odd integers w, x, y, and z is 24. What is the median of the set $\{w, x, y, z, 24\}$?

(A) 3
(B) 5
(C) 7
(D) 9
(E) 24

15. Which of the following is equal in value to 1 plus (100 percent of 1) ?

(A) 100 percent of 1
(B) 101 percent of 1
(C) 110 percent of 1
(D) 200 percent of 1
(E) 201 percent of 1

16. The ratio of j to k to l to m to p is 5 to 4 to 3 to 2 to 1. If $j = 60$, what is the value of m ?

(A) 8
(B) 12
(C) 24
(D) 55
(E) 57

17. Lines ℓ and m and two circles lie in a plane. If ℓ passes through the centers of the two circles and if m is parallel to ℓ, which of the following could NOT be the number of points at which m intersects the circles?

(A) 0
(B) 1
(C) 3
(D) 4
(E) 5

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18. The first term of a sequence of numbers is -3. Each term after the first is obtained by multiplying the preceding term by -1 and then subtracting 1. What is the 75th term of the sequence?

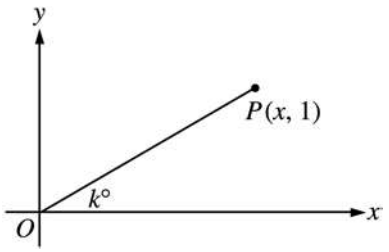
(A) -73
(B) -3
(C) 2
(D) 4
(E) 73

19. In a certain school, there are k classes with n students in each class. If a total of p pencils are distributed equally among these students, how many pencils are there for each student?

(A) $\frac{p}{kn}$
(B) $\frac{kn}{p}$
(C) $\frac{kp}{n}$
(D) $\frac{np}{k}$
(E) npk

20. If 14 milliliters of a certain liquid has a mass of 16 grams, what is the mass, in grams, of 28 liters of this liquid? (1 liter = 1,000 milliliters.)

(A) 8
(B) 32
(C) 3,200
(D) 8,000
(E) 32,000



21. In the figure above, if $k = 30$, what is the x-coordinate of point P?

(A) 1
(B) $\sqrt{2}$
(C) $\sqrt{3}$
(D) 2
(E) $\sqrt{5}$

22. If $x - 3 < 2$ and $y + 1 < -3$, then the value of $x + y$ could be

(A) 0
(B) 1
(C) 2
(D) 4
(E) 8

GO ON TO THE NEXT PAGE

	a	b	c	d
a	0	4	7	8
b	-	0	3	4
c	-	-	0	1
d	-	-	-	0

23. The table above shows the results of subtracting the numbers a, b, c, and d from each other. Each number in the body of the table gives the difference when the number at the far left of the table is subtracted from the number at the top of the table. For example, $d - a = 8$. If $c = 20$, what is the value of $a + b + c + d$?

(A) 63
(B) 65
(C) 67
(D) 69
(E) 71

24. If a and x represent real numbers for which $x^2 = -a$, which of the following statements could be true?

I. $a > 0$
II. $a = 0$
III. $a < 0$

(A) None
(B) II only
(C) III only
(D) I and II only
(E) II and III only

25. In a bag of marbles, $\frac{1}{2}$ of the marbles are red, $\frac{1}{4}$ of them are green, and $\frac{1}{5}$ of them are blue. If the remaining 2 marbles are white, what is the number of green marbles in the bag?

(A) 4
(B) 5
(C) 8
(D) 10
(E) 40

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.

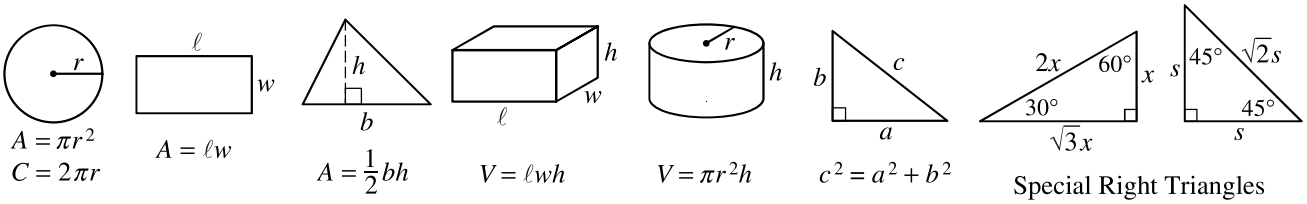
SECTION 3
Time — 30 minutes
25 Questions

Directions: This section contains two types of questions. You have 30 minutes to complete both types. You may use any available space for scratchwork.

Notes:

1. The use of a calculator is permitted. All numbers used are real numbers.
2. 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.

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

Directions for Quantitative Comparison Questions

Questions 1-15 each consist of two quantities in boxes, one in Column A and one in Column B. You are to compare the two quantities and on the answer sheet fill in oval

A if the quantity in Column A is greater;
B if the quantity in Column B is greater;
C if the two quantities are equal;
D if the relationship cannot be determined from the information given.

AN E RESPONSE WILL NOT BE SCORED.

Notes:

1. In some questions, information is given about one or both of the quantities to be compared. In such cases, the given information is centered above the two columns and is not boxed.
2. In a given question, a symbol that appears in both columns represents the same thing in Column A as it does in Column B.
3. Letters such as x, n, and k stand for real numbers.

EXAMPLES

	Column A	Column B	Answers
E1	5^2	20	● B C D E
E2	x (150°, x°)	30	A B ● D E
E3	$r + 1$ (r and s are integers.)	$s - 1$	A B C ● E

SUMMARY DIRECTIONS FOR COMPARISON QUESTIONS

Answer: **A if the quantity in Column A is greater;**
B if the quantity in Column B is greater;
C if the two quantities are equal;
D if the relationship cannot be determined from the information given.

$k > 0$

	Column A	Column B
1.	$(-1)(-2)(-k)$	$(1)(2)(k)$

On a map, a 2-inch line segment represents an actual distance of 5 miles.

	Column A	Column B
2.	The length of a line segment on the map that represents an actual distance of 3 miles	1 inch

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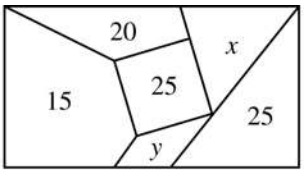
m and k are positive integers.
$m + k = 3$

	Column A	Column B
3.	m	k



Note: Figure not drawn to scale.

The rectangular lot is divided into six subdivisions whose areas, in acres, are shown. The total area of the lot is 100 acres.

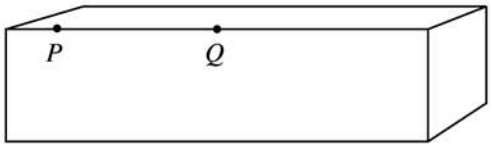
	Column A	Column B
4.	$(x + y)$ acres	25 percent of the area of the rectangular lot

$x > 2$

	Column A	Column B
5.	x	2.5

$\frac{x}{y} = \frac{3}{5}$

	Column A	Column B
6.	$\frac{2y}{x}$	$\frac{2x}{y}$



The rectangular solid is to be cut into two rectangular solids.

	Column A	Column B
7.	The total surface area of the two resulting pieces if the cut is made through point P	The total surface area of the two resulting pieces if the cut is made through point Q

$(n + 3)^2 - 9 = y$
$n > 0$

	Column A	Column B
8.	n^2	y

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SUMMARY DIRECTIONS FOR COMPARISON QUESTIONS

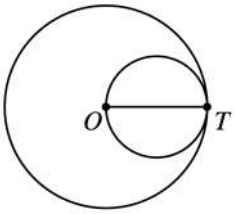
Answer:
A if the quantity in Column A is greater;
B if the quantity in Column B is greater;
C if the two quantities are equal;
D if the relationship cannot be determined from the information given.

9.

h is a multiple of 4.
k is a multiple of 8.

Column A	Column B
h	k

10.



The outer circle has center O and circumference p.
OT is a diameter of the inner circle.

Column A	Column B
The circumference of the inner circle	$\frac{1}{2}p$

11.

$1 < s + t < r$

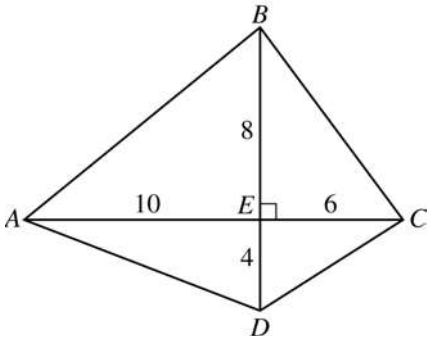
Column A	Column B
$\frac{r + s + t}{r - s - t}$	0

12.

x, y, s, and t are positive integers.
$x < y < 10$
$s < t < 10$

Column A	Column B
The maximum possible value of $y - x$	The minimum possible value of $s + t$

13.



The diagonals of quadrilateral $ABCD$ intersect at right angles at E. $AE = 10$, $BE = 8$, $CE = 6$, and $DE = 4$.

Column A	Column B
$AB^2 + CD^2$	$AD^2 + BC^2$

14.

For all positive integers j and k, let $j \diamond k$ be defined to be the sum of the k consecutive integers beginning with j. For example, $9 \diamond 4 = 9 + 10 + 11 + 12$.

Column A	Column B
$100 \diamond 99$	$99 \diamond 100$

15.

Angle B in $\triangle ABC$ and angle S in $\triangle RST$ are right angles. The lengths of sides AC and RT are equal.

Column A	Column B
The length of side AB	The length of side RS

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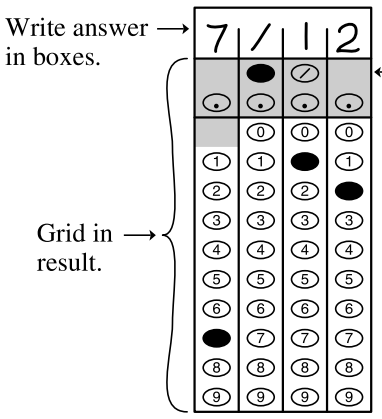
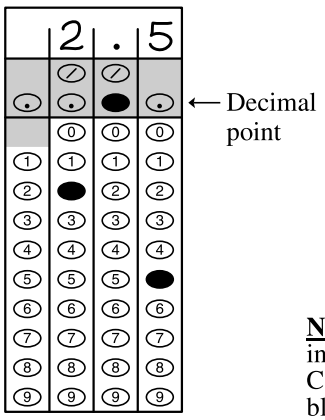
Directions for Student-Produced Response Questions

Each of the remaining 10 questions requires you to solve the problem and enter your answer by marking the ovals in the special grid, as shown in the examples below.

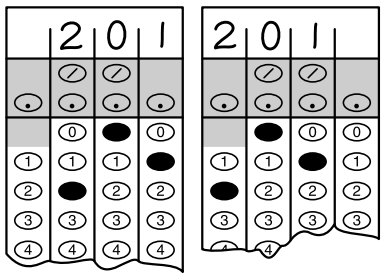
Answer: $\frac{7}{12}$ or 7/12



Answer: 2.5



Answer: 201
Either position is correct.

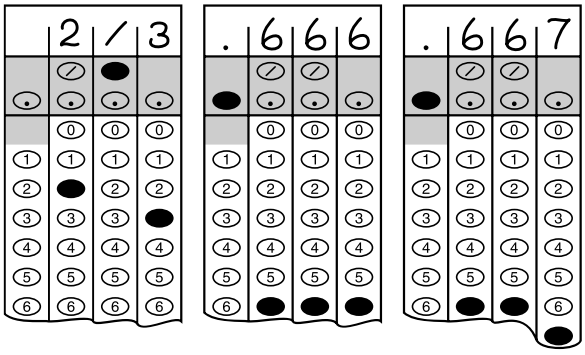


Note: You may start your answers in any column, space permitting. Columns not needed should be left blank.

- Mark no more than one oval in any column.
- Because the answer sheet will be machine-scored, **you will receive credit only if the ovals 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 ovals 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 $2\frac{1}{2}$ must be gridded as 2.5 or 5/2. (If  is gridded, it will be interpreted as $\frac{21}{2}$, not $2\frac{1}{2}$.)

- **Decimal Accuracy:** If you obtain a decimal answer, **enter the most accurate value the grid will accommodate.** For example, if you obtain an answer such as 0.6666 . . . , you should record the result as .666 or .667. **Less accurate values such as .66 or .67 are not acceptable.**

Acceptable ways to grid $\frac{2}{3}$ = .6666 . . .



16. If $3x - 5 = x + 8$, what is the value of x?

17. A store has 660 books in stock. If 30 percent of these books are on sale, how many books are not on sale?

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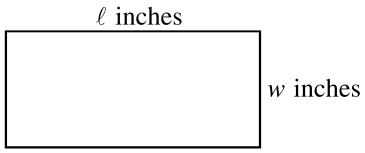

Note: Figure not drawn to scale.

18. The perimeter of the rectangle above is p inches and the area of the rectangle is 36 square inches. If ℓ and w are integers, what is one possible value of p ?

19. If $x + \frac{1}{x} = 2$, what is the value of $x^2 + \frac{1}{x^2}$?

20. If $\frac{1}{4}$ of $\frac{4}{3}$ is subtracted from 2, what is the resulting value?

21. Tim wrote a seven-digit phone number on a piece of paper. He later tore the paper accidentally and the last two digits were lost. What is the maximum number of arrangements of two digits, using the digits 0 through 9, that he could use in attempting to reconstruct the correct phone number?

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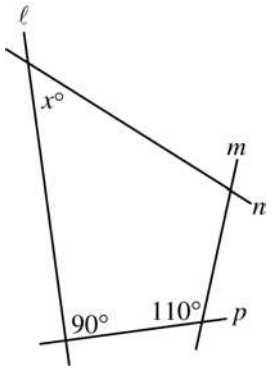
22. If the slope of the line that passes through the points $(a, 0)$ and $(1, -2)$ is $\frac{1}{2}$, what is the value of a ?

23. $\lfloor x \rfloor$ is defined as the greatest integer less than x.

$\lceil x \rceil$ is defined as the least integer greater than x.

What is the value of $\lceil 25.8 \rceil - \lfloor 13.9 \rfloor$?



24. In the figure above, if the angle (not shown) where lines n and p intersect is twice as large as the angle (also not shown) where lines ℓ and m intersect, what is the value of x ?

25. One adult and 10 children are in an elevator. If the adult's weight is 4 times the average (arithmetic mean) weight of the children, then the adult's weight is what fraction of the total weight of the 11 people in the elevator?

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 6
Time — 15 minutes
10 Questions

Directions: In this section solve each problem, using any available space on the page for scratchwork. Then decide which is the best of the choices given and fill in the corresponding oval on the answer sheet.

Notes:

1. The use of a calculator is permitted. All numbers used are real numbers.
2. 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.

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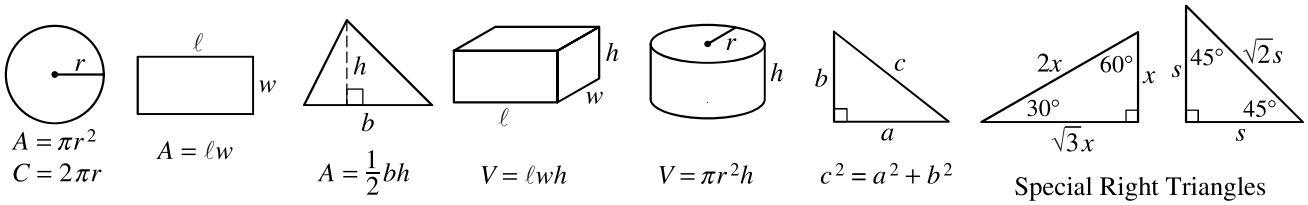


$A = \pi r^2$
$C = 2\pi r$

$A = \ell w$

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

$V = \ell wh$

$V = \pi r^2 h$

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

Special Right Triangles

The number of degrees of arc in a circle is 360.
The measure in degrees of a straight angle is 180.
The sum of the measures in degrees of the angles of a triangle is 180.

1. Which of the following numbers is between 0 and 1 ?

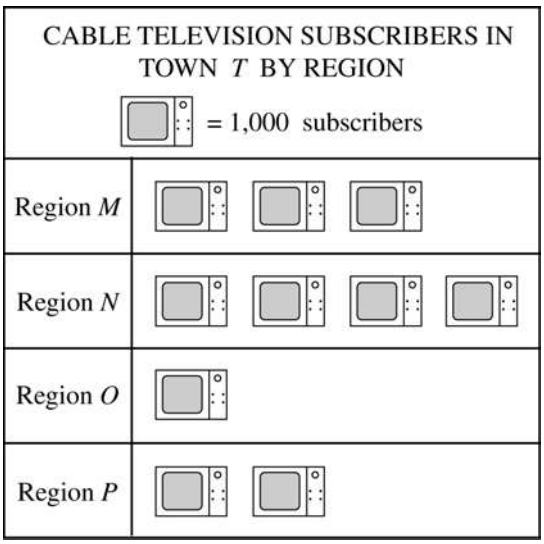
(A) $\frac{10}{5}$

(B) $\frac{9}{4}$

(C) $\frac{8}{3}$

(D) $\frac{7}{9}$

(E) $\frac{6}{5}$



2. If the four regions shown in the graph above are the only regions in Town T, the total of which two regions accounts for exactly 70 percent of all cable television subscribers in Town T ?

(A) Regions M and N
(B) Regions M and O
(C) Regions N and O
(D) Regions N and P
(E) Regions O and P

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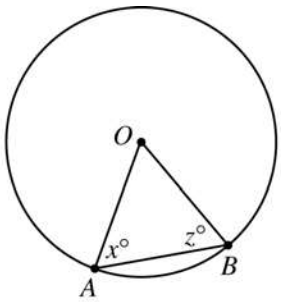

Note: Figure not drawn to scale.

3. In the figure above, points A and B lie on the circle with center O. If $x = 80$, what is the value of z ?

(A) 80
(B) 60
(C) 50
(D) 40
(E) 10

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4. If $x = -2$ and $y = -3$, what is the value of $x^2(x - y)$?

(A) −20
(B) −4
(C) 4
(D) 8
(E) 20

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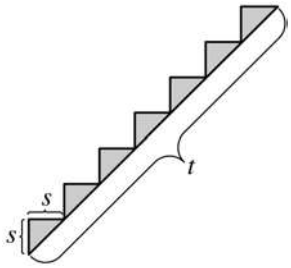
5. In a certain game, each of 5 players received a score between 0 and 100, inclusive. If their average (arithmetic mean) score was 80, what is the greatest possible number of the 5 players who could have received a score of 50 ?

(A) None
(B) One
(C) Two
(D) Three
(E) Four

6. A certain fraction is equivalent to $\frac{1}{2}$. If 3 is added to its numerator and 2 is added to its denominator, the resulting fraction is equivalent to $\frac{3}{4}$. What is the numerator of the original fraction?

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



7. On the staircase shown above, both the depth and the height of each step are s, and each step forms a right angle. What is the value of t in terms of s ?

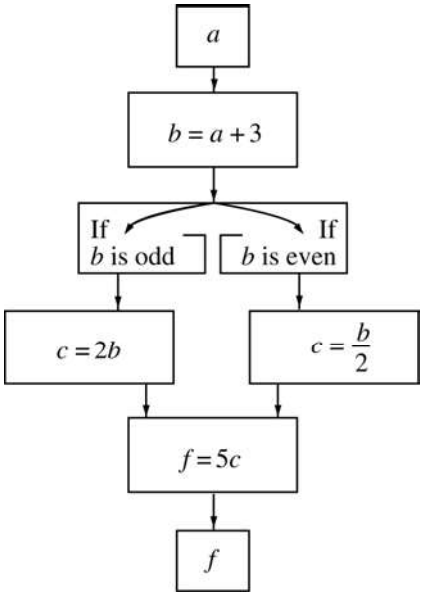
(A) $10s$
(B) $14s$
(C) $7s\sqrt{2}$
(D) $7s\sqrt{3}$
(E) $2s^2$

---

8. What is the least positive integer that is the product of 3 different prime numbers greater than 2 ?

(A) 27
(B) 45
(C) 63
(D) 75
(E) 105

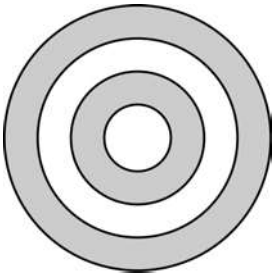
GO ON TO THE NEXT PAGE



9. A person selects a value for a and then follows the steps shown in the diagram above to result in a value of f. Which of the following statements must be true for all positive integer values of a ?

I. f is even.
II. f has 5 as a factor.
III. $b < c < f$

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



10. In the figure above, the four circles have the same center and their radii are 1, 2, 3, and 4, respectively. What is the ratio of the area of the small shaded ring to the area of the large shaded ring?

(A) 1:2
(B) 1:4
(C) 3:5
(D) 3:7
(E) 5:7

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.