



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:

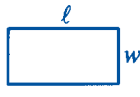
1. The use of a calculator is permitted. All numbers used are real numbers.
2. Figures that accompany problems in this test are intended to provide information useful in solving the problems. They are drawn as accurately as possible EXCEPT when it is stated in a specific problem that the figure is not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

Reference Information

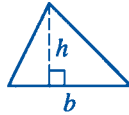


$$A = \pi r^2$$

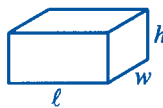
$$C = 2\pi r$$



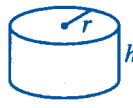
$$A = \ell w$$



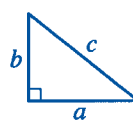
$$A = \frac{1}{2}bh$$



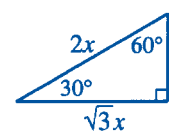
$$V = \ell wh$$



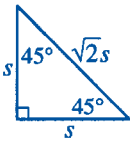
$$V = \pi r^2 h$$



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



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.

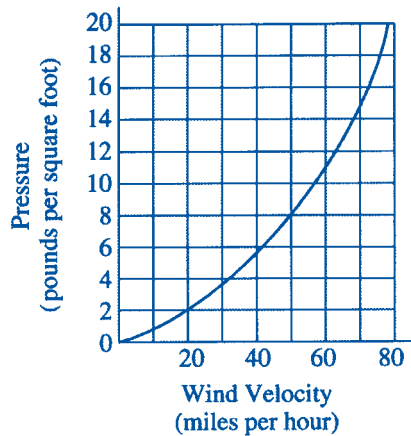
1. If $5p + m = 7$ and $m = 7$, what is the value of p ?

- (A) 0
(B) $\frac{1}{5}$
(C) $\frac{2}{5}$
(D) $\frac{7}{5}$
(E) $\frac{14}{5}$

2. There are 20 packages of bagels on a shelf in a store and each package contains the same number of bagels. If 3 of these packages contain a total of 18 bagels, how many bagels are there in 7 of these packages?

- (A) 21
(B) 36
(C) 40
(D) 42
(E) 49

GO ON TO THE NEXT PAGE



3. According to the graph above, when the wind velocity is 70 miles per hour, which of the following is closest to the pressure, in pounds per square foot?

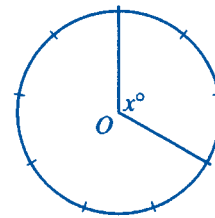
(A) 13.5
(B) 14.0
(C) 15.0
(D) 16.0
(E) 16.5

4. In the number 0.257, which of the following does the digit 7 represent?

(A) $7 \times \frac{1}{10}$
(B) $7 \times \frac{1}{100}$
(C) $7 \times \frac{1}{1,000}$
(D) $7 \times \frac{1}{10,000}$
(E) $7 \times \frac{1}{100,000}$

5. If $xyz = z$ and the value of x is 0, which of the following must be true?

(A) $y = 0$
(B) $z = 0$
(C) $xy = 1$
(D) $y = 1$
(E) $z = 1$



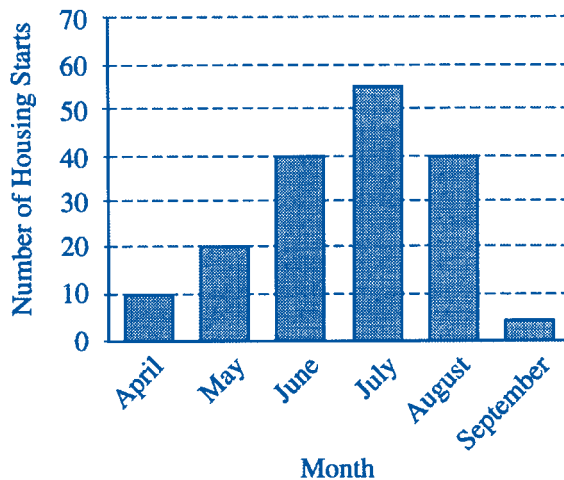
6. The circle above has center O and is divided into 9 equal arcs. What is the value of x ?

(A) 110
(B) 118
(C) 120
(D) 124
(E) 125

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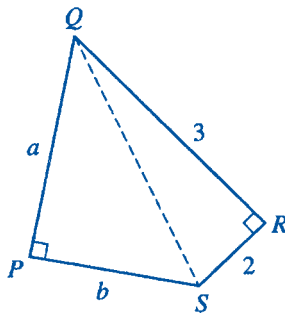


HOUSING STARTS BY THE
XYZ CONSTRUCTION COMPANY



7. The bar graph above shows the number of houses started by the XYZ Construction Company over a 6-month period. For which of the following months was there the greatest increase over the previous month in the number of housing starts?

(A) May
(B) June
(C) July
(D) August
(E) September



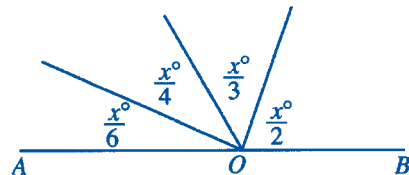
Note: Figure not drawn to scale.

8. In quadrilateral $PQRS$ above, what is the value of $a^2 + b^2$?

(A) 8
(B) 10
(C) 11
(D) 12
(E) 13

9. The price of a certain type of cherry can range from \$2.50 to \$3.00 per pound, and the price of a certain type of roll can range from \$0.80 to \$1.10 per dozen. To be sure of having enough money to buy c pounds of these cherries and r dozen of these rolls, a person needs at least how many dollars, in terms of c and r ?

(A) $\frac{c+r}{3+1.1}$
(B) $\frac{c}{3} + \frac{r}{1.1}$
(C) $2.5c + 0.8r$
(D) $3c + 1.1r$
(E) $(3+1.1)(c+r)$



Note: Figure not drawn to scale.

10. In the figure above, point O lies on line AB . What is the value of x ?

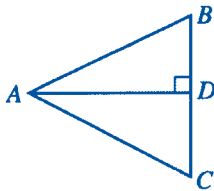
(A) 90
(B) 120
(C) 144
(D) 156
(E) 168

GO ON TO THE NEXT PAGE



11. If $s = a + 2$ and $t = a - 2$, which of the following represents the product of s and t for every number a ?

(A) $2a$
 (B) 4
 (C) a^2
 (D) $a^2 - 4$
 (E) $a^2 - 4a - 4$



Note: Figure not drawn to scale.

12. In $\triangle ABC$ above, the bisector of $\angle BAC$ is perpendicular to BC at point D . If $AB = 6$ and $BD = 3$, what is the measure of $\angle BAC$?

(A) 15°
 (B) 30°
 (C) 45°
 (D) 60°
 (E) 75°

13. In January the price of a certain item was \$120. In February the price increased by 10 percent. During a sale in March, the February price was discounted by 10 percent. What was the price of the item during the sale in March?

(A) \$106.80
 (B) \$118.80
 (C) \$120.00
 (D) \$121.20
 (E) \$132.00

14. Line ℓ , line m , and point P lie in a plane such that $\ell \parallel m$ and P is between ℓ and m . If line t in the same plane passes through point P , which of the following could be true?

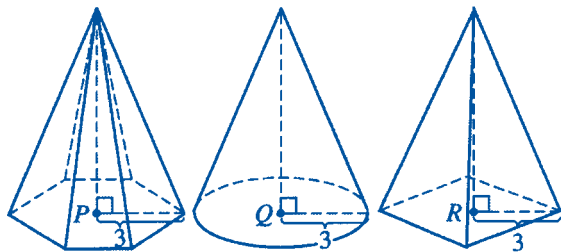
I. t intersects ℓ but not m .
 II. t intersects both ℓ and m .
 III. t does not intersect either ℓ or m .

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

15. If x is positive and $\frac{\sqrt{x}}{\sqrt{5}} = \frac{\sqrt{5}}{\sqrt{x}}$, then $x =$

(A) 0
 (B) 1
 (C) $\sqrt{5}$
 (D) 5
 (E) 25

GO ON TO THE NEXT PAGE 



Solid I

Solid II

Solid III

16. The height of each solid shown above is 7. The base of solid I has 6 sides of equal length, 6 angles of equal measure, and center P . The base of solid II is a circle with center Q . The base of solid III is a square with center R . Which of the following is true?

- (A) Solid I has the greatest volume.
- (B) Solid II has the greatest volume.
- (C) Solid III has the greatest volume.
- (D) The volumes of solids I and II are equal.
- (E) The volumes of solids II and III are equal.

$$x^3 \geq x^2 \text{ for all positive numbers } x.$$

17. Which of the following values for x shows that the statement above is false?

- (A) -1
- (B) 0
- (C) $\frac{1}{2}$
- (D) 1
- (E) 2

18. The school nurse at Pine Street High School surveyed the heights of all of the female students at the school. The median of the heights was 165 centimeters and the mode was 162 centimeters. Which of the following statements must be true?

- (A) The height of half of the female students is 165 centimeters.
- (B) The most frequently occurring height of the female students is 162 centimeters.
- (C) The average (arithmetic mean) of the heights of the female students is 163.5 centimeters.
- (D) More female students are 165 centimeters tall than 162 centimeters tall.
- (E) More female students are shorter than 165 centimeters than are taller than 165 centimeters.

-
19. If $5n + p = 3$ and $2m - 10n = 2$, what is the value of $m + p$?

- (A) 2
- (B) 4
- (C) 5
- (D) 7
- (E) 8

-
20. If $2^x = y$, which of the following must be equal to 2^{x+1} ?

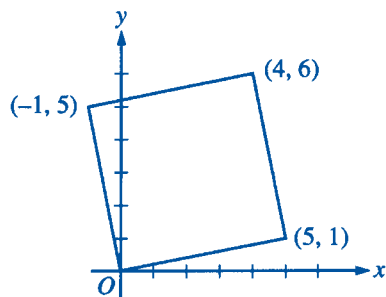
- (A) $y + 1$
- (B) $y + 2$
- (C) $2y$
- (D) $4y$
- (E) $\frac{y^2}{2}$

GO ON TO THE NEXT PAGE



21. If x is 5 percent of r and r is 20 percent of s , what percent of s is x ?

(A) 1%
(B) 4%
(C) 10%
(D) 40%
(E) 100%



22. What is the area of the square shown above?

(A) 5
(B) 6
(C) 20
(D) 25
(E) 26

23. For all values of a , let $\langle a \rangle$ be defined as $\langle a \rangle = 4a - 4$. Which of the following equals $\langle 6 \rangle - \langle 5 \rangle$?

(A) $\langle 2 \rangle$
(B) $\langle 3 \rangle$
(C) $\langle 4 \rangle$
(D) $\langle 5 \rangle$
(E) $\langle 6 \rangle$

24. The average (arithmetic mean) of three different positive integers is 12. If the first of these integers is 9 times the second integer, what is the least possible value of the third integer?

(A) 6
(B) 4
(C) 3
(D) 2
(E) 1

25. If n is a positive integer, which of the following CANNOT be the units digit of 3^n ?

(A) 1
(B) 3
(C) 5
(D) 7
(E) 9

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.

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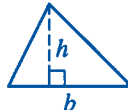


$$A = \pi r^2$$

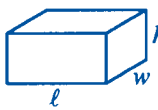
$$C = 2\pi r$$



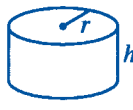
$$A = \ell w$$



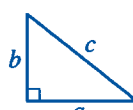
$$A = \frac{1}{2}bh$$



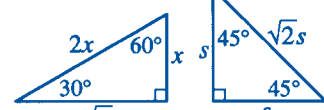
$$V = \ell wh$$



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



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



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.

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.

EXAMPLESColumn AColumn BAnswers

E1

5²

20

☒ (A) ☐ (B) ☐ (C) ☐ (D) ☐ (E)

E2

 x

30

☐ (A) ☐ (B) ☒ (C) ☐ (D) ☐ (E)

E3

 $r + 1$ $s - 1$
☐ (A) ☐ (B) ☐ (C) ☒ (D) ☐ (E)

GO ON TO THE NEXT PAGE

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.

Column A

Column B

$$x = 0$$

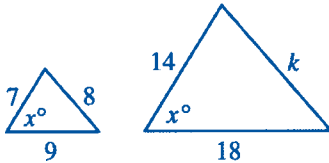
1.

$$\frac{x+1}{x-1}$$

$$0$$

Set S consists of all integers from -50 to 0 , inclusive. Set T consists of all integers from 0 to 50 , inclusive.

2.

The number of integers in set S The number of integers in set T 

3.

$$k$$

$$16$$

The sum of k and 7 equals the sum of m and 8 .

4.

$$k$$

$$m$$

Column A

Column B

m and p are 3-digit integers greater than 100 .
 The tens digit of m is 5 .
 The tens digit of p is 7 .

5.

$$m$$

$$p$$

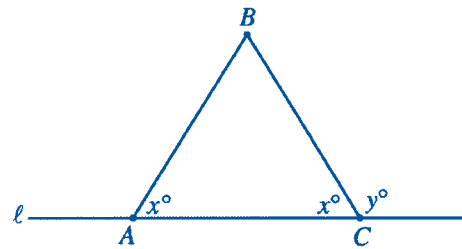
$$a > 0$$

$$\frac{a}{b} = 3$$

6.

$$a$$

$$b$$



7.

$$y$$

$$180 - 2x$$

R , S , and T are nonzero digits of the positive decimal numerals $RS.T$ and $0.0RST$

8.

$$\frac{10 \times RS.T}{10,000}$$

$$0.0RST$$

GO ON TO THE NEXT PAGE

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.

Column A

Column B

x , y , and z are consecutive prime numbers in increasing order, and $x = 2$.

9.

$$\frac{1}{x} + \frac{1}{y} + \frac{1}{z}$$

1

The volume of a sphere with radius r is equal to $\frac{4}{3}\pi r^3$.

10.

The volume of a sphere with radius 6

The total volume of two spheres, each with radius 3

When tossed in the air, a coin is equally as likely to land with heads up as it is with tails up. The coin is to be tossed twice.

11.

The probability that the coin will land heads up both times

The probability that the coin will land heads up on the first toss and tails up on the second toss

For all positive numbers n and k , let $n \square k$ be defined by $n \square k = (n - k)k$.

$$0 < r < s$$

12.

$$r \square s$$

$$s \square r$$

Column A

Column B

13.

$$a(b - c) + f$$

$$ab - c + f$$

Eight different chemical elements make up more than 99 percent of Earth's crust.

14.

The percent of Earth's crust made up of all chemical elements other than those eight

1 percent

15.

The area of a rectangle with perimeter 40

The area of a rectangle with perimeter 60

GO ON TO THE NEXT PAGE

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 $7/12$

Write answer in boxes. →

Grid in result. →

Fraction line

Answer: 2.5

Decimal point

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 $2\frac{1}{2}$ 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 $\frac{2}{3} = .6666\dots$

| | | | |
|---|---|---|---|
| 2 | / | 3 | |
| 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 | 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 |

16. If $\frac{3}{5} = \frac{x}{2.5}$, what is the value of x ?

17. If $3^j = 27$ and $3^{j+k} = 243$, what is the value of k ?

GO ON TO THE NEXT PAGE

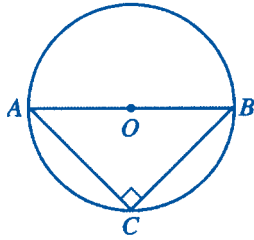
18. The first term of a sequence of numbers is 2. If each term after the first is 3 more than twice the preceding term, what is the fourth term of this sequence?

20. If a , b , and c are the lengths of the sides of $\triangle ABC$, what is one possible value of $\frac{a}{b+c}$?

19. If $3 + \sqrt{a} = 5.3$, what is the value of $3 - \sqrt{a}$?

21. A circus clown has 8 different hats, 10 different ties, 4 different pairs of pants, and 5 different jackets from which to choose when dressing for a performance. What is the total number of different combinations of 1 hat, 1 tie, 1 pair of pants, and 1 jacket from which the clown can choose when dressing for a performance?

GO ON TO THE NEXT PAGE 



22. In the figure above, the circle with center O has radius 7, AB is a diameter, and $AC = BC$. What is the area of $\triangle ABC$?

23. For a concert, tickets that were purchased in advance of the day of the concert cost \$5.00 each and tickets purchased the day of the concert cost \$8.00 each. The total amount collected in ticket sales was the same as if every ticket purchased had cost \$5.50. If 100 tickets were purchased in advance, what was the total number of tickets purchased?

24. Each of the 8 edges of a pyramid with a square base is 4 inches long, and each edge of a cube is 4 inches long. The base of the pyramid is set on one face of the cube so that their vertices coincide. The new solid that is formed has how many faces?

25. Chairs ready for shipment at the Northern Chair factory come down a ramp in single file. Inspector A checks every third chair, beginning with the third. Inspector B checks every fifth chair, beginning with the fifth. If 98 chairs came down the ramp while both inspectors were working on Monday, how many of these chairs were not checked by either of these two inspectors?

STOP

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SECTION 7
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:

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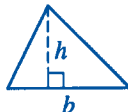


$$A = \pi r^2$$

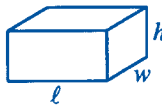
$$C = 2\pi r$$



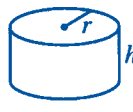
$$A = \ell w$$



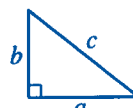
$$A = \frac{1}{2}bh$$



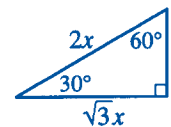
$$V = \ell wh$$



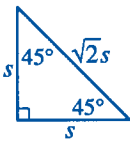
$$V = \pi r^2 h$$



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



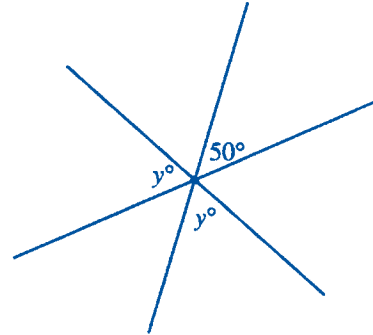
Special Right Triangles



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. A certain type of candy bar weighs 3 ounces. What is the total weight, in pounds, of the contents of a box that contains 160 of these candy bars?
 (16 ounces = 1 pound)

(A) 48
 (B) 30
 (C) 28
 (D) 24
 (E) 10



2. In the figure above, three lines intersect at a point. What is the value of y ?

(A) 65
 (B) 70
 (C) 75
 (D) 80
 (E) 85

GO ON TO THE NEXT PAGE

1. Add 3.
 2. Multiply by 4.
 3. Subtract 6.
 4. Divide by 5.
3. The sequence of operations above is to be applied, in order, to a number x such that the result of each operation is used as the starting value for the next operation. Which of the following expressions represents the result after step 4 has been completed?

- (A) $4(x + 3) - \frac{6}{5}$
- (B) $\frac{4(x + 3)}{5} - 6$
- (C) $\frac{4(x + 3) - 6}{5}$
- (D) $\frac{4(x + 3 - 6)}{5}$
- (E) $\frac{4x + 3 - 6}{5}$

4. A crate contains 63 oranges, 47 apples, and 95 pears. If 1 more of each type of fruit were added to the crate, each of the three types of fruit could be divided equally among a group of people. What is the greatest possible number of people in such a group?
- (A) 8
- (B) 12
- (C) 15
- (D) 16
- (E) 32

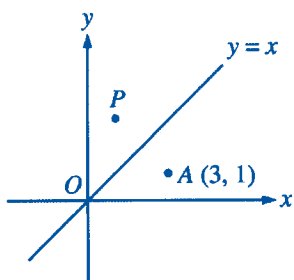
5. A 50-foot rope is cut into four pieces so that the length of the second piece is twice the length of the first piece, the length of the third piece is twice the length of the second piece, and the length of the fourth piece is 8 feet. What is the length, in feet, of the shortest piece?

- (A) 6
- (B) 7
- (C) $7\frac{1}{2}$
- (D) 8
- (E) $10\frac{1}{2}$

6. If $\frac{x}{4} < 12$ and $y = x + 3$, which of the following must be true?
- (A) $x < 3$
- (B) $x < 16$
- (C) $y > 6$
- (D) $y < 19$
- (E) $y < 51$

7. If the average (arithmetic mean) of r and s is 20 and the average of x , y , and z is 30, what is the average of r , s , x , y , and z ?

(A) 23
(B) 24
(C) 25
(D) 26
(E) 27



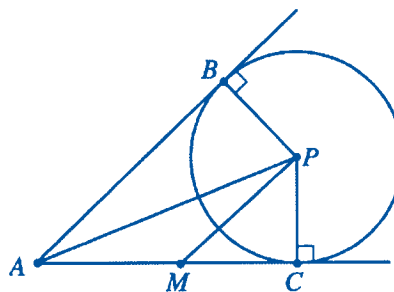
8. In the figure above, point P is the reflection of point A through the line $y = x$. What is the slope of the line that passes through points A and P ?

(A) -1
(B) $-\frac{1}{2}$
(C) 0
(D) $\frac{1}{2}$
(E) 1

9. For integers q , r , s , and t , if q is a factor of r , and r is a factor of s , which of the following must be true?

I. q is a factor of s .
II. If q is a factor of t , then r is a factor of t .
III. If s is a factor of t , then q is a factor of t .

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



10. In the figure above, the circle has center P and radius r . Lines AB and AC are tangent to the circle. If M is the midpoint of segment AC and the measure of $\angle PMC$ equals the measure of $\angle MPC$, what is the length, in terms of r , of segment PA ?

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

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.