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MATHEMATICS TEST

60 Minutes—60 Questions

DIRECTIONS: Solve each problem, choose the correct answer, and then fill in the corresponding oval on your answer document.

Do not linger over problems that take too much time. Solve as many as you can; then return to the others in the time you have left for this test.

You are permitted to use a calculator on this test. You may use your calculator for any problems you choose,

but some of the problems may best be done without using a calculator.

Note: Unless otherwise stated, all of the following should be assumed.

1. Illustrative figures are NOT necessarily drawn to scale.
2. Geometric figures lie in a plane.
3. The word *line* indicates a straight line.
4. The word *average* indicates arithmetic mean.

1. Which of the following expressions is equivalent to $a(4 - a) - 5(a + 7)$?

- A. $-2a - 35$
- B. $-2a + 7$
- C. $-a^2 - a - 35$
- D. $-a^2 - a + 7$
- E. $-2a^3 - 35$

2. Which of the following inequalities orders the numbers 0.2, 0.03, and $\frac{1}{4}$ from least to greatest?

- F. $0.2 < 0.03 < \frac{1}{4}$
- G. $0.03 < 0.2 < \frac{1}{4}$
- H. $0.03 < \frac{1}{4} < 0.2$
- J. $\frac{1}{4} < 0.03 < 0.2$
- K. $\frac{1}{4} < 0.2 < 0.03$

3. If $x^2 + 4 = 29$, then $x^2 - 4 = ?$

- A. 5
- B. $\sqrt{21}$
- C. 21
- D. 25
- E. 33

DO YOUR FIGURING HERE.

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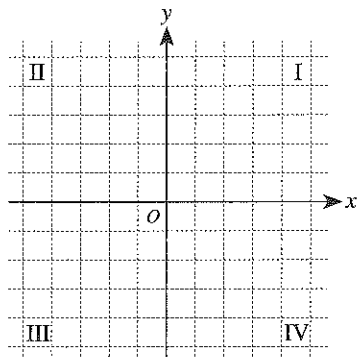
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4. The vertices of a rectangle are $(-1,-2)$, $(4,-2)$, $(4,3)$, and $(-1,3)$. When the rectangle is graphed in the standard (x,y) coordinate plane below, what percent of the total area of the rectangle lies in Quadrant III?

DO YOUR FIGURING HERE.



- F. 8%
 G. 12%
 H. 12.5%
 J. 32%
 K. 48%
5. In 1985, the cost of clothing for a certain family was \$620. In 1995, 10 years later, the cost of clothing for this family was \$1,000. Assuming the cost increased linearly, what was the cost of this family's clothing in 1991?
- A. \$908
 B. \$848
 C. \$812
 D. \$810
 E. \$772
6. The square root of a certain number is approximately 9.2371. The certain number is between what 2 integers?
- F. 3 and 4
 G. 4 and 5
 H. 9 and 10
 J. 18 and 19
 K. 81 and 99
7. A bag contains 10 pieces of flavored candy: 4 lemon, 3 strawberry, 2 grape, and 1 cherry. One piece of candy will be randomly picked from the bag. What is the probability the candy picked is NOT grape flavored?
- A. $\frac{1}{5}$
 B. $\frac{1}{4}$
 C. $\frac{1}{2}$
 D. $\frac{3}{4}$
 E. $\frac{4}{5}$

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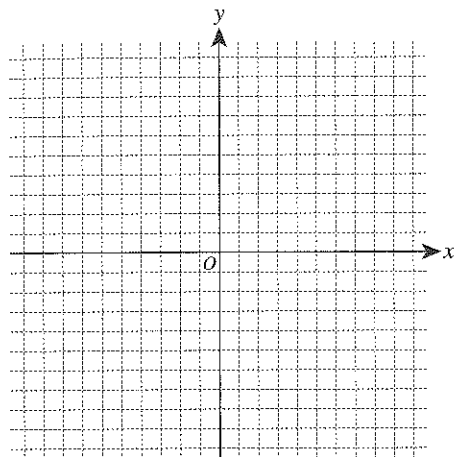
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8. When points A and $B(-3,4)$ are graphed in the standard (x,y) coordinate plane below, the midpoint of \overline{AB} will be $(1,2)$. What will be the coordinates of point A ?

DO YOUR FIGURING HERE.



- F. $(-7,6)$
 G. $(-2,1)$
 H. $(-1,3)$
 J. $(-1,8)$
 K. $(5,0)$
9. Andrea manages a company that currently has 116 customers, which is 8 more than twice the number of customers the company had 1 year ago. How many customers did the company have 1 year ago?
- A. 50
 B. 54
 C. 62
 D. 66
 E. 100
10. Joseph will have a 200-foot-long fence installed around his yard. The A+ Fence Company charges a \$500.00 fee, plus a set amount per foot of fence. The A+ Fence Company has given Joseph an estimate of \$2,200.00 to install the fence around his yard. What is the set amount per foot of fence?
- F. \$ 4.00
 G. \$ 4.80
 H. \$ 8.50
 J. \$11.00
 K. \$13.50
11. For a math homework assignment, Karla found the area and perimeter of a room of her house. She reported that the area of her rectangular living room is 180 square feet and that the perimeter is 54 feet. When drawing a sketch of her living room the next day, she realized that she had forgotten to write down the dimensions of the room. What are the dimensions of Karla's living room, in feet?
- A. 9 by 20
 B. 10 by 18
 C. 12 by 15
 D. 14 by 13
 E. 16 by 11

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Use the following information to answer questions 12–14.

DO YOUR FIGURING HERE.

Carrie's Chocolate Shop and Tamika's Treat Shop both sell candy in boxes. The table below lists the price (the total amount the customer pays) of each box of candy sold at the shops. For each shop, there is a linear relationship between the price of a box of candies and the number of candies in that box. These are the only numbers of candies that can be purchased at the shops.

Candies per box (n)	Price at Carrie's Chocolate Shop (c)	Price at Tamika's Treat Shop (t)
5	\$1.50	\$2.25
10	\$2.50	\$2.75
15	\$3.50	\$3.25
20	\$4.50	\$3.75
25	\$5.50	\$4.25
30	\$6.50	\$4.75

12. Jeremy has \$10.00 in quarters to spend on candy. What is the maximum number of quarters he would have left after paying for a box of 25 candies at Tamika's Treat Shop?

(Note: Each quarter is worth \$0.25.)

- F. 10
- G. 17
- H. 22
- J. 23
- K. 30

13. At Tamika's Treat Shop, what is the average price per candy in a box of 20, to the nearest \$0.01?

- A. \$0.08
- B. \$0.19
- C. \$0.23
- D. \$0.30
- E. \$0.45

14. Which of the following equations gives the relationship between the price in dollars, c , and the number of candies, n , in a box of candies at Carrie's Chocolate Shop?

- F. $c = 0.2n + 0.5$
- G. $c = 0.3n$
- H. $c = 0.5n + 1.5$
- J. $c = n - 3.5$
- K. $c = 1.4n - 5.5$

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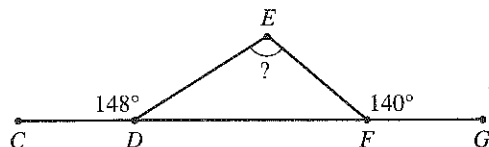
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15. Which of the following is a solution to the equation $x^2 - 36x = 0$?

- A. 72
- B. 36
- C. 18
- D. 6
- E. -6

DO YOUR FIGURING HERE.

16. In the figure below, vertices D and F of $\triangle DEF$ lie on \overline{CG} , the measure of $\angle CDE$ is 148° , and the measure of $\angle EFG$ is 140° . What is the measure of $\angle DEF$?



- F. 72°
 - G. 98°
 - H. 100°
 - J. 108°
 - K. 116°
17. A company ships notepads in rectangular boxes that each have inside dimensions measuring 9 inches long, 9 inches wide, and 12 inches tall. Each notepad is in the shape of a cube with an edge length of 3 inches. What is the maximum number of notepads that will fit in 1 closed box?
- A. 10
 - B. 11
 - C. 12
 - D. 22
 - E. 36
18. The function f is defined as $f(x) = -4x^3 - 4x^2$. What is $f(-4)$?
- F. -320
 - G. -192
 - H. 16
 - J. 192
 - K. 320
19. Which of the following (x,y) pairs is the solution for the system of equations $x + 2y = 4$ and $-2x + y = 7$?
- A. $(-2,3)$
 - B. $(-1,2.5)$
 - C. $(1,1.5)$
 - D. $(2,1)$
 - E. $(4,0)$
20. Which of the following is a value of x that satisfies $\log_x 36 = 2$?
- F. 4
 - G. 6
 - H. 8
 - J. 16
 - K. 18

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21. A 5-inch-by-7-inch photograph was cut to fit exactly into a 4-inch-by-6-inch frame. What is the area, in square inches, of the part of the photograph that was cut off?

A. 2
 B. 10
 C. 11
 D. 12
 E. 24

DO YOUR FIGURING HERE.

22. A line contains the points A , B , C , and D . Point B is between points A and C . Point D is between points C and B . Which of the following inequalities *must* be true about the lengths of these segments?

F. $BC < AB$
 G. $BD < AB$
 H. $BD < CD$
 J. $CD < AB$
 K. $CD < BC$

23. If x and y are positive integers such that the greatest common factor of x^2y^2 and xy^3 is 45, then which of the following could y equal?

A. 45
 B. 15
 C. 9
 D. 5
 E. 3

24. To test a new medicine, each of 300 volunteers was assigned a distinct number from 1 to 300. Next, a calculator was used to simulate drawing 150 balls from among 300 congruent balls. The balls were numbered the same way as the volunteers so that 150 volunteers to receive the new medication would be chosen without bias. The other volunteers received a placebo. Weeks later, the 2 groups were compared. Which of the following phrases best describes the company's testing?

F. Randomized census
 G. Randomized experiment
 H. Nonrandomized experiment
 J. Randomized sample survey
 K. Nonrandomized sample survey

25. One caution sign flashes every 4 seconds, and another caution sign flashes every 10 seconds. At a certain instant, the 2 signs flash at the same time. How many seconds elapse until the 2 signs next flash at the same time?

A. 6
 B. 7
 C. 14
 D. 20
 E. 40

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26. For all nonzero values of a and b , the value of which of the following expressions is *always* negative?

- F. $a - b$
- G. $-a - b$
- H. $|a| + |b|$
- J. $|a| - |b|$
- K. $-|a| - |b|$

DO YOUR FIGURING HERE.

27. Graphed in the same standard (x,y) coordinate plane are a circle and a parabola. The circle has radius 3 and center $(0,0)$. The parabola has vertex $(-3,-2)$, has a vertical axis of symmetry, and passes through $(-2,-1)$. The circle and the parabola intersect at how many points?

- A. 0
- B. 1
- C. 2
- D. 3
- E. 4

28. 40% of 250 is equal to 60% of what number?

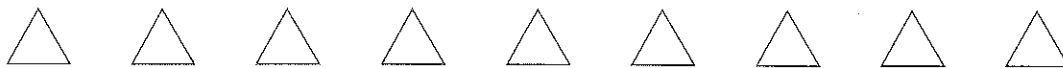
- F. 150
- G. 160
- H. $166\frac{2}{3}$
- J. 270
- K. 375

29. Which of the following inequalities is equivalent to $-2x - 6y > 2y - 4$?

- A. $x < -4y + 2$
- B. $x > -4y + 2$
- C. $x < 2y + 2$
- D. $x < 4y + 2$
- E. $x > 4y + 2$

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30. For an angle with measure α in a right triangle,

$\sin \alpha = \frac{40}{41}$ and $\tan \alpha = \frac{40}{9}$. What is the value of $\cos \alpha$?

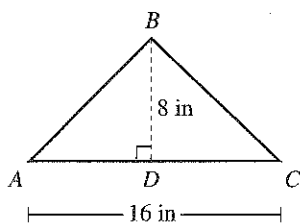
- F. $\frac{9}{41}$
 G. $\frac{41}{9}$
 H. $\frac{9}{40}$
 J. $\frac{9}{\sqrt{1,519}}$
 K. $\frac{9}{\sqrt{3,281}}$

DO YOUR FIGURING HERE.

31. The perimeter of rectangle $ABCD$ is 96 cm. The ratio of the side lengths $AB:BC$ is 3:5. What is the length, in centimeters, of \overline{AB} ?

- A. 6
 B. 18
 C. 30
 D. 36
 E. 60

32. For $\triangle ABC$ shown below, base \overline{AC} has a length of 16 inches and altitude \overline{BD} has a length of 8 inches. The area of a certain square is equal to the area of $\triangle ABC$. What is the length, in inches, of a side of the square?



- F. 6
 G. 8
 H. 12
 J. 16
 K. 32

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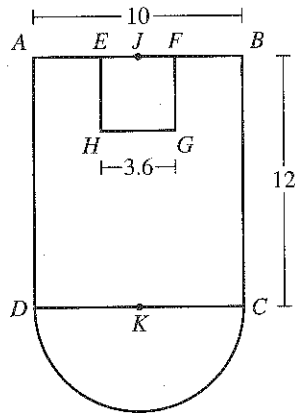


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DO YOUR FIGURING HERE.

Use the following information to answer questions 33–36.

In the figure shown below, $ABCD$ is a rectangle, $EFGH$ is a square, and \overline{CD} is the diameter of a semicircle. Point K is the midpoint of \overline{CD} . Point J is the midpoint of both \overline{AB} and \overline{EF} . Points E and F lie on \overline{AB} . The 3 given lengths are in meters.



33. The length of \overline{EH} is what percent of the length of \overline{AD} ?
- A. 15.6%
 - B. 30%
 - C. 36%
 - D. 43.2%
 - E. 50%
34. What is the length, in meters, of \overline{JD} ?
- F. 13
 - G. 15.6
 - H. 17
 - J. $\sqrt{44}$
 - K. $\sqrt{244}$
35. What is the length, in meters, of arc \widehat{CD} ?
- A. 2.5π
 - B. 5π
 - C. 6.25π
 - D. 10π
 - E. 25π
36. The figure will be placed in the standard (x,y) coordinate plane so that K is at the origin, \overline{AB} is parallel to the x -axis, and 1 meter equals 1 coordinate unit. Which of the following values could be the y -coordinate of H ?
- F. 1.8
 - G. 3.6
 - H. 8.4
 - J. 10
 - K. 12

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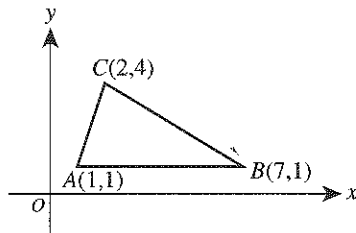


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37. What is the length, in coordinate units, of the altitude from C to \overline{AB} in $\triangle ABC$ shown in the standard (x,y) coordinate plane below?

DO YOUR FIGURING HERE.

- A. 3
B. 5
C. 6
D. $\sqrt{10}$
E. $\sqrt{13}$



38. At a local post office, on average, 3 customers are in line when the post office closes each day. The probability, P , that exactly n customers are in line when the post office closes can be modeled by the equation $P = \frac{3^n e^{-3}}{n!}$. Given that $e^{-3} \approx 0.05$, which of the following values is closest to the probability that exactly 2 customers are in line when the post office closes?

- F. 0.08
G. 0.11
H. 0.15
J. 0.23
K. 0.45

39. What is the amplitude of the function

$$f(x) = \frac{1}{2} \cos(3x + \pi) ?$$

- A. $\frac{1}{3}$
B. $\frac{1}{2}$
C. $\frac{3}{2}$
D. 2
E. 3

40. License plates on cars in a certain state consist of 3 letters taken from the 26 letters, A through Z, followed by 3 digits taken from the 10 digits, 0 through 9. Which of the following expressions gives the number of distinct license plates that are possible given that repetition of both letters and digits is allowed?

- F. $10^3 \cdot 26^3$
G. $(10 + 26)^3$
H. $2(26!)^3(10!)^3$
J. $(3 + 3)^{26+10}$
K. $(26! \cdot 10!)^3 + (26! \cdot 10!)^3$

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41. For 20 quiz scores in a typing class, the table below gives the frequency of the scores in each score interval. Which score interval contains the median of the scores?

DO YOUR FIGURING HERE.

Score interval	Frequency
96-100	3
91-95	1
86-90	3
81-85	4
76-80	9

- A. 96-100
 B. 91-95
 C. 86-90
 D. 81-85
 E. 76-80
42. In the complex numbers, where $i^2 = -1$,
 $\frac{1}{1+i} \cdot \frac{1-i}{1-i} = ?$
- F. $i - 1$
 G. $1 + i$
 H. $1 - i$
 J. $\frac{1-i}{2}$
 K. $\frac{1+i}{2}$
43. Temperatures measured in degrees Fahrenheit (F) are related to temperatures measured in degrees Celsius (C) by the formula $F = \frac{9}{5}C + 32$. There is 1 value of x for which x degrees Fahrenheit equals x degrees Celsius. What is that value?
- A. -72
 B. -40
 C. -32
 D. 0
 E. 32

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44. The table below gives experimental data values for variables x and y . Theory predicts that y varies directly with x . Based on the experimental data, which of the following values is closest to the constant of variation?

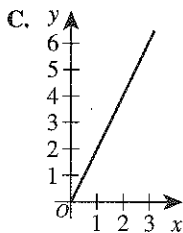
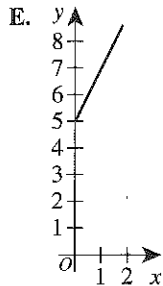
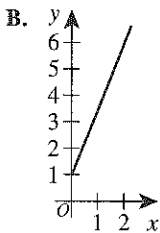
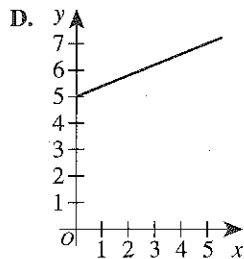
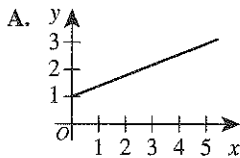
DO YOUR FIGURING HERE.

(Note: The variable y varies directly with the variable x provided that $y = kx$ for some nonzero constant k , called the *constant of variation*.)

x	y
2.75	0.140
8.50	0.425
14.75	0.750
16.75	0.850
21.00	1.050

- F. -2.61
- G. 0.05
- H. 3.61
- J. 15.90
- K. 20.00

45. During a snowstorm, the relationship between the depth of accumulated snow, y inches, and the elapsed time, x hours, was modeled by the equation $2x - 5y = -5$. One of the following graphs in the standard (x,y) coordinate plane models the equation for positive values of x and y . Which one?



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Your First Practice Test

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DO YOUR FIGURING HERE.

46. Diana is baking bread, and the original recipe calls for $1\frac{1}{2}$ teaspoons of yeast and $2\frac{1}{2}$ cups of flour. Diana will use the entire contents of a packet that contains $2\frac{1}{4}$ teaspoons of yeast and will use the same ratio of ingredients called for in the original recipe. How many cups of flour will Diana use?

F. $1\frac{7}{8}$

G. $3\frac{1}{4}$

H. $3\frac{1}{2}$

J. $3\frac{3}{4}$

K. 4

47. For all nonzero values of x , $\frac{12x^6 - 9x^2}{3x^2} = ?$

A. $4x^3 - 3x$

B. $4x^3 - 3$

C. $4x^4 - 9x^2$

D. $4x^4 - 3x$

E. $4x^4 - 3$

48. Four matrices are given below.

$$W = \begin{bmatrix} 1 & 2 \\ 5 & 8 \end{bmatrix} \quad X = \begin{bmatrix} 3 & 9 \\ 7 & 4 \end{bmatrix} \quad Y = \begin{bmatrix} 1 & 3 & 7 \\ 4 & 2 & 6 \end{bmatrix} \quad Z = \begin{bmatrix} 5 & 8 \\ 2 & 9 \\ 3 & 7 \end{bmatrix}$$

Which of the following matrix products is undefined?

F. WX

G. WY

H. YZ

J. XW

K. XZ

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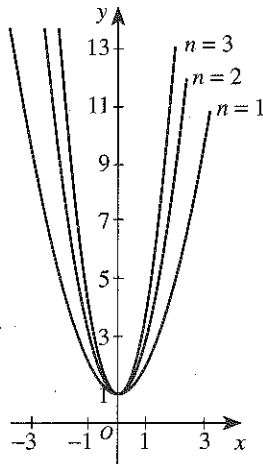


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49. The 3 parabolas graphed in the standard (x,y) coordinate plane below are from a family of parabolas. A general equation that defines this family of parabolas contains the variable n in addition to x and y . For one of the parabolas shown, $n = 1$; for another, $n = 2$; and for the third, $n = 3$. Which of the following could be a general equation that defines this family of parabolas for all $n \geq 1$?

DO YOUR FIGURING HERE.

- A. $y = nx^2 + 1$
- B. $y = \frac{1}{n}x^2 + 1$
- C. $y = x^2 + n$
- D. $y = -nx^2 + 1$
- E. $y = -\frac{1}{n}x^2 + 1$



50. After polling a class of 20 music students by a show of hands, you find that 8 students play the guitar and 9 students play the piano. Given that information, what is the minimum number of students in this music class who play both the guitar and the piano?
- F. 0
 - G. 1
 - H. 8
 - J. 9
 - K. 17
51. A teacher assigns each of her 18 students a different integer from 1 through 18. The teacher forms pairs of study partners by using the rule that the sum of the pair of numbers is a perfect square. Assuming the 9 pairs of students follow this rule, the student assigned which number *must* be paired with the student assigned the number 1?
- A. 16
 - B. 15
 - C. 9
 - D. 8
 - E. 3

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52. Lucky found \$8.25 in pennies, nickels, dimes, and quarters while walking home from school one week. When she deposited this money in the bank, she noticed that she had twice as many nickels as pennies, 1 fewer dime than nickels, and 1 more quarter than nickels. How many quarters did Lucky find that week?
- F. 3
 G. 9
 H. 16
 J. 21
 K. 26

DO YOUR FIGURING HERE.

53. Given $10^{\left(\frac{2x-1}{x}\right)} = 1$, $x = ?$
- A. $-\frac{1}{2}$
 B. $-\frac{1}{8}$
 C. $\frac{1}{2}$
 D. $\frac{10}{19}$
 E. 1

54. The table below shows the results of a survey of 250 people who were asked whether they like to read and whether they play a musical instrument.

	Play a musical instrument	Do NOT play a musical instrument	Total
Like to read	50	60	110
Do NOT like to read	40	100	140
Total	90	160	250

According to the results, what is the probability that a randomly selected person who was surveyed likes to read, given that the person plays a musical instrument?

- F. $\frac{1}{5}$
 G. $\frac{5}{9}$
 H. $\frac{5}{11}$
 J. $\frac{9}{25}$
 K. $\frac{11}{25}$

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55. Mario was riding a bicycle with wheels 26 inches in diameter. During 1 minute of Mario's ride, the wheels made exactly 200 revolutions. At what average speed, in *feet per second*, was Mario riding during that minute?

DO YOUR FIGURING HERE.

- A. $\frac{65}{9}\pi$
 B. $\frac{65}{18}\pi$
 C. $\frac{130}{9}\pi$
 D. $\frac{845}{18}\pi$
 E. $\frac{1,690}{9}\pi$

56. Whenever j and k are positive integers such that $(\sqrt{3})^j = 27^k$, what is the value of $\frac{j}{k}$?

- F. $\frac{1}{6}$
 G. $\frac{3}{2}$
 H. 3
 J. 4
 K. 6

57. A finite arithmetic sequence has 7 terms, and the first term is $\frac{3}{4}$. What is the difference between the mean and the median of the 7 terms?

- A. 0
 B. $\frac{3}{4}$
 C. $\frac{4}{3}$
 D. 3
 E. 4

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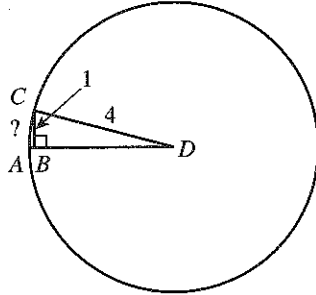
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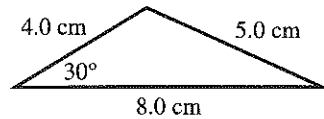
58. In the circle with center D shown below, the length of radius \overline{CD} is 4 cm, the length of \overline{BC} is 1 cm, and \overline{BC} is perpendicular to radius \overline{AD} at B . When $\angle ADC$ is measured in degrees, which of the following expressions represents the length, in centimeters, of \widehat{AC} ?

DO YOUR FIGURING HERE.



- F. $\frac{\pi}{45} \left(\sin^{-1} \left(\frac{1}{4} \right) \right)$
- G. $\frac{\pi}{45} \left(\cos^{-1} \left(\frac{1}{4} \right) \right)$
- H. $\frac{2\pi}{45} \left(\sin^{-1} \left(\frac{1}{4} \right) \right)$
- J. $\frac{2\pi}{45} \left(\cos^{-1} \left(\frac{1}{4} \right) \right)$
- K. $\frac{2\pi}{45} \left(\tan^{-1} \left(\frac{1}{4} \right) \right)$

59. The lengths of the triangle shown below are rounded to the nearest 0.1 cm. What is the area, to the nearest 1 cm^2 , of this triangle?



(Note: The area of any triangle with sides of length a , b , and c opposite angles of measure A , B , and C , respectively, is given by $\frac{1}{2}ab \sin C$.)

- A. 4
- B. 5
- C. 8
- D. 10
- E. 14

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60. The probability distribution of the discrete random variable X is shown in the table below. What is the expected value of X ?

DO YOUR FIGURING HERE.

x	Probability $P(X = x)$
0	$\frac{1}{6}$
1	$\frac{1}{12}$
2	$\frac{1}{4}$
3	$\frac{1}{12}$
4	$\frac{1}{12}$
5	0
6	$\frac{1}{3}$

- F. $\frac{1}{6}$
 G. $\frac{1}{3}$
 H. 1
 J. 2
 K. $3\frac{1}{6}$

END OF TEST 2**STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.****DO NOT RETURN TO THE PREVIOUS TEST.**