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.

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1. A cookie recipe that yields 24 cookies requires $1\frac{3}{4}$ cups of butter. When the ingredients in this recipe are increased proportionally, how many cups of butter are required for the recipe to yield 72 cookies?

   A. $2\frac{5}{8}$

   B. 3

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

   D. $5\frac{1}{4}$

   E. $10\frac{1}{2}$

2. The age, in years, of each of the first 6 presidents of the United States at his first inauguration was 57, 61, 57, 57, 58, and 57, respectively. Which of the following values is closest to the mean age, in years, of the first 6 presidents at their respective first inaugurations?

   F. 57
   G. 57.5
   H. 57.8
   J. 58.7
   K. 59

3. The temperature F in degrees Fahrenheit is related to the temperature K in kelvins by the equation $F = 1.8K - 459.67$. Which of the following temperatures, in kelvins, is closest to 120 degrees Fahrenheit?

   A. 322
   B. 461
   C. 526
   D. 580
   E. 676

DO YOUR FIGURING HERE.

DO YOUR FIGURING HERE.

4. For nonzero values of x and y, which of the following expressions is eqnivalent to $-\frac{18x^3y^2}{3xy}$?

F. $-6x^2y$

G. $-6x^3y^2$

H. $-6x^4y^3$

J. $-15x^2y$

K. $-21x^2y$

5. If $\sqrt{a} = b$ and $b = 9$, $a = ?$

A. 3

B. 18

C. 81

D. $\frac{9}{2}$

E. $\frac{81}{4}$

6. Damon and 4 of his coworkers are having lunch. Each of the 5 people will pay for his or her own lunch, but they agree to divide the tip equally among themselves. The total for the 5 lunches is $80.00, and the gronp will add a tip of 15% of the total. Each person's portion of the tip will be how much?

F. $1.50

G. $2.40

H. $3.00

J. $5.00

K. $5.33

7. The number 0.000 000 000 087 3 is equivalent to which of the following expressions?

A. 8.73×10^{-13}

B. 8.73×10^{-11}

C. 8.73×10^{-10}

D. 8.73×10^{11}

E. 8.73×10^{13}

8. The circular spinner dial for a new board game is divided into 6 congruent sectors. What is the arc measure, in degrees, of each sector?

F. $30°$

G. $36°$

H. $45°$

J. $60°$

K. $72°$

9. When $5\frac{4}{9}$ is written as an improper fraction in lowest terms, the numerator of the fraction is:

   A. 20
   B. 29
   C. 36
   D. 45
   E. 49

DO YOUR FIGURING HERE.

10. $2\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} + 3\begin{bmatrix} 2 & 1 \\ -1 & -2 \end{bmatrix} = ?$

   F. $\begin{bmatrix} 8 & 3 \\ 2 & 2 \end{bmatrix}$

   G. $\begin{bmatrix} 8 & 7 \\ 3 & 2 \end{bmatrix}$

   H. $\begin{bmatrix} 8 & 8 \\ 7 & 7 \end{bmatrix}$

   J. $\begin{bmatrix} 9 & 5 \\ 8 & 8 \end{bmatrix}$

   K. $\begin{bmatrix} 15 & 15 \\ 10 & 10 \end{bmatrix}$

11. The speed of one motorcycle exceeds 4 times the speed of another motorcycle by 24 mph. The speed of the slower motorcycle is g mph. Which of the following expressions represents the speed of the faster motorcycle, in miles per hour?

   A. $g + 6$
   B. $g + 24$
   C. $g - 24$
   D. $4g + 24$
   E. $4g - 24$

12. In the Coaltown High School cafeteria, the student council is laying a triangular carpet in a corner that is designated to be a lounge. The carpet is a right triangle with the 2 shorter sides having lengths of 12 feet and 8 feet, as shown in the figure below. What is the area, in square feet, of the carpet?

   F. 10
   G. 20
   H. 40
   J. 48
   K. 96

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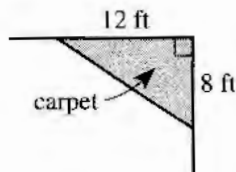
13. Students studying motion observed a cart rolling at a constant rate along a straight line. The table below gives the distance, d feet, the cart was from a reference point at 1-second intervals from $t = 0$ seconds to $t = 5$ seconds.

t	0	1	2	3	4	5
d	12	17	22	27	32	37

Which of the following equations represents this relationship between d and t ?

A. $d = t + 12$
B. $d = 5t + 7$
C. $d = 5t + 12$
D. $d = 12t + 5$
E. $d = 29t$

14. Rajeev went on a delivery trip that began and ended at his truck terminal. He used all of the time during the trip driving, unloading, or resting. Rajeev began his trip on Tuesday at 7:00 a.m. when he left the terminal. During his driving time, he drove 1,200 miles at an average speed of 50 miles per hour. His driving time was twice as long as his unloading time, and his resting time was 30 hours. When did Rajeev end his delivery trip?

F. Wednesday at 7:00 a.m.
G. Wednesday at 7:00 p.m.
H. Friday at 1:00 a.m.
J. Saturday at 1:00 a.m.
K. Saturday at 1:00 p.m.

15. For the equation $3x + 15y = 9$, which of the following expressions represents x in terms of y ?

A. $-15y + 3$
B. $-6y$
C. $-5y + 3$
D. $-5y + 9$
E. $-2y$

16. The perimeter of a parallelogram is 80 inches, and the length of 1 side is 16 inches. If it can be determined, what are the lengths, in inches, of the other 3 sides?

F. 16, 16, 16
G. 16, 16, 32
H. 16, 24, 24
J. 16, 32, 32
K. Cannot be determined from the given information

DO YOUR FIGURING HERE.

Use the following information to answer questions 17–19.

The Tully family and the Quan family ate dinner together at Eugenio's Pasta Restaurant. An *order of pasta* comes in 1 of 2 sizes, large or small, and consists of 1 of 6 types of pasta and 1 of 5 types of sauce. The table below gives the number of large and small orders of pasta bought by each family, and the price each family paid for their orders of pasta (without tax and tip).

| Family | Number of orders | | Price |
	large	small	
Tully	6	4	$26.00
Quan	2	4	$14.00

17. The price is the same for each order of a given size. What is the price of a large order of pasta?

    A. $1.50
    B. $2.00
    C. $2.50
    D. $3.00
    E. $5.00

18. How many different possible orders of pasta can a person get?

    F.   2
    G. 10
    H. 12
    J. 30
    K. 60

19. The Tully family also bought 5 salads priced at $2.00 per salad and 12 breadsticks priced at $1.50 for an order of 3 breadsticks. What was the total price of the pasta, salads, and breadsticks the Tully family bought, without tax and tip?

    A. $29.50
    B. $30.00
    C. $42.00
    D. $43.00
    E. $54.00

18

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20. In the figure below, parallel lines $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ are cut by transversals $\overleftrightarrow{AC}$ and $\overleftrightarrow{BD}$ that intersect at E. Two angle measures are given. What is the measure of $\angle ABD$?
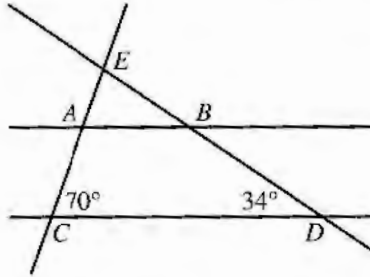

- **F.** 110°
- **G.** 112°
- **H.** 138°
- **J.** 144°
- **K.** 146°

21. The total cost, c dollars, for Main Street Orchestra to perform a concert at Milly's Auditorium is determined by $c = r + 20m$, where r is the rental fee, in dollars, of the auditorium and m is the number of orchestra members playing. The Friday night rental fee for Milly's Auditorium is $500. There will be 30 orchestra members playing in Friday night's concert. For the total price of exactly 200 tickets to equal the total cost of performing the concert, what should be the price of each ticket?

- **A.** $2.60
- **B.** $2.65
- **C.** $3.00
- **D.** $4.50
- **E.** $5.50

22. An experiment consisted of rolling a 6-sided cube with the digits 1 through 6 on its faces, 1 digit per face. The cube was rolled 50 times, and after each roll, the number appearing on the top face was recorded. The number of times each digit was recorded is represented in the bar graph shown below. In what percent of the total number of rolls did a 5 appear on the top face of the cube?

- **F.** 2%
- **G.** 4%
- **H.** 9%
- **J.** $16\frac{2}{3}$%
- **K.** 18%

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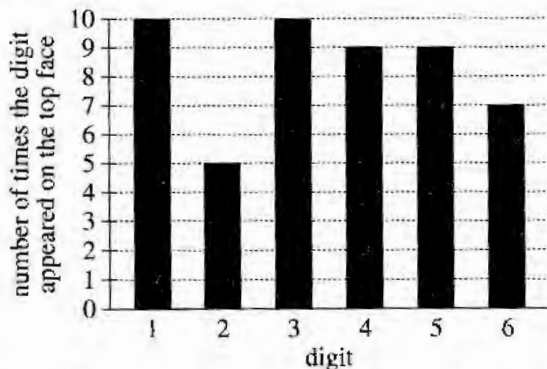
23. The length of a rectangle is 12 feet longer than the rectangle's width. The area of the rectangle is 140 square feet. The width of the rectangle, w feet, is the positive solution to which of the following equations?

   A. $w^2 = 140$
   B. $w(w + 12) = 140$
   C. $w(w - 12) = 140$
   D. $2w + 2(w + 12) = 140$
   E. $2w + 2(w - 12) = 140$

24. What is the length, in coordinate units, of the line segment with endpoints $(-8,4)$ and $(4,9)$ in the standard (x,y) coordinate plane?

   F. $\sqrt{41}$
   G. $\sqrt{119}$
   H. $\sqrt{169}$
   J. $\sqrt{185}$
   K. $\sqrt{313}$

25. The point $(6,3)$ and the line $y = 7$ are graphed in the standard (x,y) coordinate plane below. After the point has been reflected across the line, what are the coordinates of the point's image?
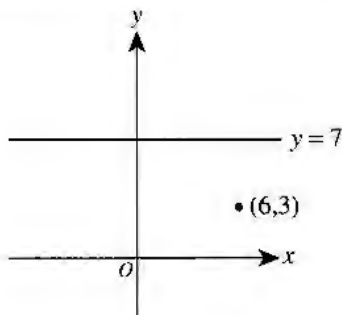
   A. $(-6, 11)$
   B. $(2, 11)$
   C. $(6, -11)$
   D. $(6, -3)$
   E. $(6, 11)$

26. The diameter of a circle is 6 feet. What is the area, in square feet, of the circle?

   F. 3π
   G. 6π
   H. 9π
   J. 36π
   K. 144π

27. In a chemistry course, a student scored 99 on one test, 98 on another test, and 88 on each of the other tests. The student's test average for the course, where each test is weighted equally, is exactly 91. What is the *total number* of tests that the student has taken in the course?

   A. 3
   B. 4
   C. 5
   D. 7
   E. 12

20

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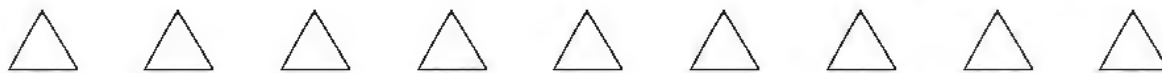
DO YOUR FIGURING HERE.

28. A cash prize will be given to the winning group of the talent show at Aspen High School. The winning group will receive a cash prize that, when divided equally among the students in that group, gives each student in the group a whole-dollar share of the prize. Considering that a group of 2, 3, 4, or 5 students could win the show, what is the least possible amount that the cash prize can be?

F. $ 12
G. $ 15
H. $ 30
J. $ 60
K. $120

29. Which of the following expressions is a factor of the polynomial $x^2 - x - 72$?

A. $x - 9$
B. $x - 8$
C. $x + 2$
D. $x + 9$
E. $x + 36$

30. Javier will have a pool installed in his backyard. The interior of the pool is a right circular cylinder with a uniform depth of 5 feet and a radius of 8 feet. The maximum volume of water that can be in the pool is 75% of the volume of the pool. Which of the following values is closest to the maximum number of cubic feet of water that can be in the pool?

F. $0.75\pi(8^2)(5)$
G. $0.75\pi(5^2)(8)$
H. $0.75[5(8)]^2$
J. $(8^2)(5)\pi - 75$
K. $(5^2)(8)\pi - 75$

31. In $\triangle ABC$ shown below, $\sin C = \frac{4}{5}$ and the length of $\overline{AB}$ is 10 inches. What is the length, in inches, of $\overline{AC}$?
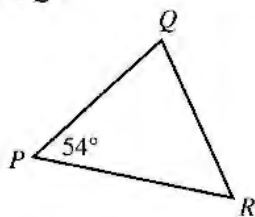
A. 3
B. $\sqrt{41}$
C. 8
D. 9
E. $\frac{25}{2}$
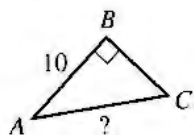
32. In isosceles triangle $\triangle PQR$ shown below, $\overline{PQ} \cong \overline{QR}$ and the measure of $\angle P$ is 54°. If it can be determined. what is the measure of $\angle Q$?

F. 36°
G. 54°
H. 72°
J. 81°
K. Cannot be determined from the given information

33. A function is defined by $g(a) = -2a + 7$, and its domain is the set of integers from 1 through 30, inclusive. For how many values of a is $g(a)$ negative?

A. 26
B. 27
C. 28
D. 29
E. 30

34. Given that n is a positive integer and b is 3 times n, what is the least common denominator, in terms of n, for the addition of $\frac{1}{b}$ and $\frac{1}{n}$?

F. $(n + 3)n$

G. $(n + 3)$

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

J. $3n$

K. $3n^2$

35. Nichelle has 84 solid-colored disks that are either red, blue, or green. She lines them up on the floor and finds that there are 24 more red disks than green and 15 more green disks than blue. How many red disks does she have?

A. 10
B. 15
C. 25
D. 41
E. 49

36. The measures of 4 interior angles of a pentagon are 70°, 100°, 110°, and 135°, respectively. What is the measure of the 5th interior angle?

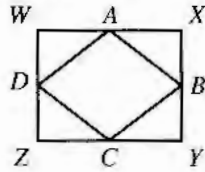F. 35°
G. 55°
H. 83°
J. 108°
K. 125°

DO YOUR FIGURING HERE.

37. The midpoints of the sides of rectangle $WXYZ$ are the vertices of rhombus $ABCD$. The dimensions of rectangle $WXYZ$ are 6 cm by 8 cm. What is the perimeter, in centimeters, of rhombus $ABCD$?
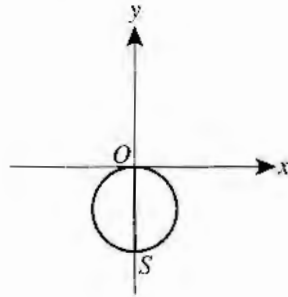
A. 20
B. 25
C. 28
D. 40
E. 48

38. In the standard (x,y) coordinate plane below, a circle has a radius of r coordinate units and passes through the origin, O. The circle has diameter $\overline{OS}$, where S lies on the negative y-axis. In terms of r, what are the coordinates of S ?

F. $(0, -2\pi r)$
G. $(0, -2r)$
H. $(0, -r)$
J. $(0, -0.5r)$
K. $(0, \quad r)$

39. Let k be a constant of proportionality and let w, x, y, and z be positive real number variables. In which of the following equations does x vary directly with y, directly with the square of w, and inversely with z ?

A. $x = \dfrac{kw^2}{yz}$

B. $x = \dfrac{kw^2 y}{z}$

C. $x = \dfrac{ky}{w^2 z}$

D. $x = \dfrac{kz}{w^2 y}$

E. $x = kw^2 yz$

40. What is the set of real solutions for $|x|^2 - |x| - 2 = 0$?

F. $\{2\}$
G. $\{-2, 2\}$
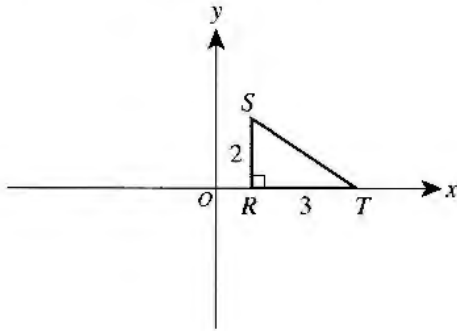H. $\{-1, 2\}$
J. $\{1, 2\}$
K. $\{-2, -1, 1, 2\}$

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DO YOUR FIGURING HERE.

Use the following information to answer questions 41–44.

In the standard (x,y) coordinate plane below, R is located at $(1,0)$, S is located at $(1,2)$, and T is located at $(4,0)$ to form right triangle $\triangle RST$. The given lengths are in coordinate units.

41. What is the slope of $\overline{ST}$?

A. $-\frac{3}{2}$

B. $-\frac{2}{3}$

C. $\frac{1}{2}$

D. $\frac{2}{3}$

E. $\frac{3}{2}$

42. What is the midpoint of $\overline{ST}$?

F. $(2, 1)$

G. $\left(2, \frac{3}{2}\right)$

H. $\left(\frac{5}{2}, 1\right)$

J. $\left(3, \frac{1}{2}\right)$

K. $\left(3, \frac{3}{2}\right)$

43. Which of the following expressions gives the measure of $\angle STR$?

A. $\cos^{-1}\left(\frac{2}{3}\right)$

B. $\sin^{-1}\left(\frac{2}{3}\right)$

C. $\sin^{-1}\left(\frac{3}{2}\right)$

D. $\tan^{-1}\left(\frac{2}{3}\right)$

E. $\tan^{-1}\left(\frac{3}{2}\right)$

44. Right triangle △*RST* will be rotated about the *x*-axis to form a right circular cone. How long, in coordinate units, is the radius of the cone's base?

F. 2
G. 3
H. 4
J. 6
K. 9

45. A cube has a total surface area of 216 square centimeters. Which of the following expressions gives the area, in square centimeters, of a single face of the cube?

A. $\sqrt{216}$

B. $\sqrt[3]{216}$

C. $\dfrac{216}{6} \cdot \dfrac{216}{6}$

D. $\dfrac{216}{6}$

E. $\dfrac{216}{4}$

46. When graphed in the standard (*x*,*y*) coordinate plane, the lines $x = -3$ and $y = x - 5$ intersect at what point?

F. (2, 2)
G. (2,−5)
H. (−3, 2)
J. (−3,−5)
K. (−3,−8)

47. In the standard (*x*,*y*) coordinate plane, which of the following lines is perpendicular to the line $3y = 4x + 2$?

A. $y = -\dfrac{4}{3}x - 2$

B. $y = -\dfrac{3}{4}x + 6$

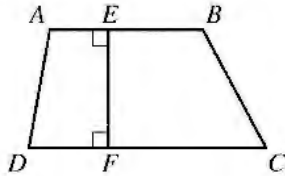C. $y = \dfrac{3}{4}x - 2$

D. $y = \dfrac{4}{3}x + 1$

E. $4y = 3x + 5$

48. For every negative real value of x, all of the following statements are true EXCEPT:

F. $|x| > 0$

G. $2x < 0$

H. $x^5 < 0$

J. $x - x^2 < 0$

K. $|x| - x = 0$

49. In trapezoid $ABCD$ illustrated below, $\overline{AB}$ is 8 units long, $\overline{CD}$ is 12 units long, and $\overline{EF}$ is 6 units long. Also, $\angle AEF$ and $\angle DFE$ are right angles. What is the area of $ABCD$, in square units?

A. 60
B. 72
C. 84
D. 120
E. 288

50. Let a be a prime number greater than 10,000 and let $x = \sqrt{a}$. Which of the following expressions represents a rational number?

F. $\frac{x}{2}$

G. $\sqrt{x}$

H. $2x$

J. x^2

K. $x + 2$

51. Melanie is standing 80 feet from the launch site of a hot-air balloon when the balloon lifts off from the ground and rises vertically. Melanie's horizontal line of sight is 5 feet above the ground. When the bottom of the balloon is 50 feet above the ground, as shown below, which of the following expressions gives the angle that Melanie's horizontal line of sight makes with her line of sight to the bottom of the balloon?
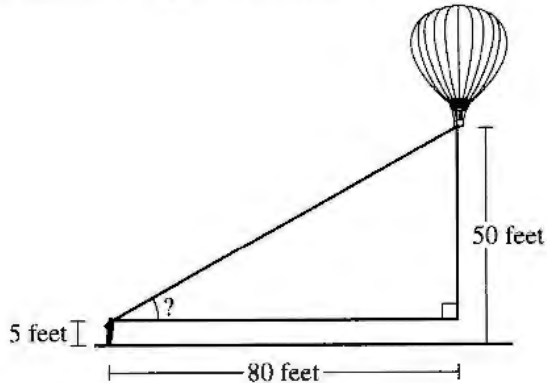
A. $\tan^{-1}\left(\dfrac{45}{80}\right)$

B. $\tan^{-1}\left(\dfrac{50}{75}\right)$

C. $\tan^{-1}\left(\dfrac{75}{50}\right)$

D. $\tan^{-1}\left(\dfrac{80}{45}\right)$

E. $\tan^{-1}\left(\dfrac{80}{50}\right)$

52. One of the following inequalities is graphed below in the standard (x,y) coordinate plane. Which one?
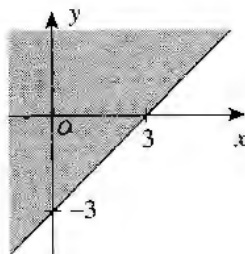
F. $y \le x - 3$
G. $y \ge x - 3$
H. $y \ge x + 3$
**J.** $y \le 3x - 3$
K. $y \ge 3x - 3$

DO YOUR FIGURING HERE.

53. A box contains 6 identically sized, solid-colored balls. One ball is green, 2 are yellow, and 3 are red. A ball is drawn at random and returned to the box, then a second ball is drawn at random. What is the probability that the first ball is red and the second ball is green?

A. $\dfrac{1}{12}$

B. $\dfrac{1}{10}$

C. $\dfrac{1}{3}$

D. $\dfrac{2}{3}$

E. $\dfrac{7}{10}$

54. The dimensions shown below are in feet. What is the area, in square feet, of the shaded rectangle?
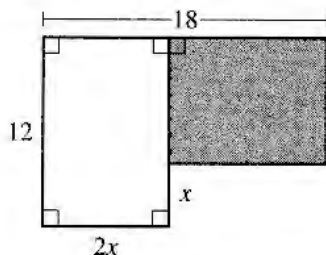
F. $2x^2$

G. $2x^2 - 48x + 216$

H. $2x^2 - 42x + 216$

J. $216 - 2x^2$

K. $216 - 3x$

55. The graph of $y = \sin x$ in the standard (x,y) coordinate plane is reflected over the x-axis, shifted up a units, and then shifted left 0.5π units. Which of the following equations represents the graph after the 3 transformations?

A. $y = a - \sin(x - 0.5\pi)$

B. $y = a - \sin(x + 0.5\pi)$

C. $y = a + \sin(x - 0.5\pi)$

D. $y = 0.5\pi - \sin(x + a)$

E. $y = 0.5\pi + \sin(x - a)$

56. For all positive real numbers x, which of the following expressions is equivalent to $\dfrac{\left(\dfrac{x^{24}}{x^6}\right)}{\left(\dfrac{1}{x^2}\right)}$?
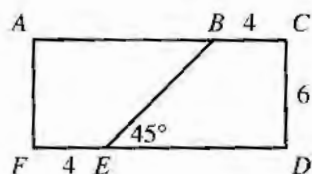
F. x^2

G. x^8

H. x^{12}

J. x^{16}

K. x^{20}

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57. Two numbers have a product of −48 and a sum of 0. What is the lesser of the 2 numbers?

A. $-4\sqrt{3}$
B. $-3\sqrt{2}$
C. $-2\sqrt{3}$
D. 0
E. 3

DO YOUR FIGURING HERE.

58. As shown below, $\overline{BE}$ divides rectangle $ACDF$ into 2 congruent trapezoids. The measure of $\angle BED$ is 45°. The lengths of $\overline{BC}$, $\overline{CD}$, and $\overline{EF}$ are given in feet. What is the area, in square feet, of rectangle $ACDF$?

F. 10
G. 14
H. 60
J. 72
K. 84

59. What is $\frac{1}{3}\%$ of $\frac{6}{7}$?

A. $\frac{1}{350}$

B. $\frac{9}{350}$

C. $\frac{99}{3,500}$

D. $\frac{1}{35}$

E. $\frac{2}{7}$

60. For what real value of x, if any, is $\log_{(x+3)}(x^2 + 3) = 2$ true?

F. −2
G. −1
H. 0
J. 1
K. There is no such value of x.

END OF TEST 2

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