**33.** The table below shows the total number of goals scored in each of 43 soccer matches in a regional tournament. What is the average number of goals scored per match, to the nearest 0.1 goal?

Total number of goals in a match	Number of matches with this total
0	4
1	10
2	5
3	9
4	7
5	5
6	1
7	2

A. 1.0
B. 2.8
C. 3.0
D. 6.1
E. 17.1

34. Lines a, b, c, and d are shown below and $a \parallel b$. Which of the following is the set of all angles that *must* be supplementary to $\angle x$?
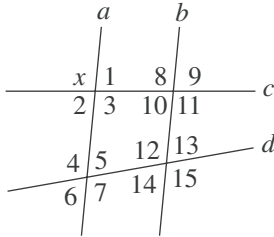
F. $\{1, 2\}$
G. $\{1, 2, 5, 6\}$
H. $\{1, 2, 9, 10\}$
J. $\{1, 2, 5, 6, 9, 10\}$
K. $\{1, 2, 5, 6, 9, 10, 13, 14\}$

35. $(3x^3)^3$ is equivalent to:

A. x
B. $9x^6$
C. $9x^9$
D. $27x^6$
E. $27x^9$

36. Which of the following is equivalent to the inequality $4x - 8 > 8x + 16$?

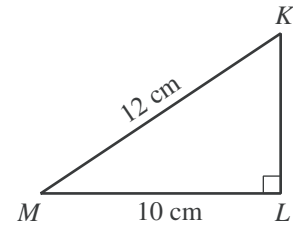**F.** $x < -6$
G. $x > -6$
H. $x < -2$
J. $x > 2$
K. $x < 6$

37. As shown in the standard (x,y) coordinate plane below, $P(6,6)$ lies on the circle with center $(2,3)$ and radius 5 coordinate units. What are the coordinates of the image of P after the circle is rotated 90° clockwise ($\circlearrowright$) about the center of the circle?
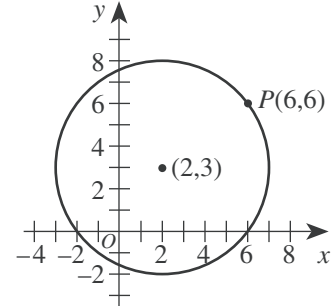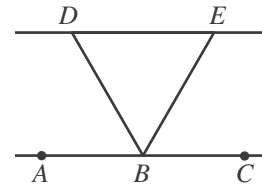

A. $(2, \ 3)$
B. $(3, \ 2)$
C. $(5, -1)$
D. $(6, \ 0)$
E. $(7, \ 3)$

38. For right triangle $\triangle KLM$ below, what is $\sin \angle M$?

F. $\dfrac{10}{12}$
G. $\dfrac{12}{10}$
H. $\dfrac{\sqrt{44}}{10}$
J. $\dfrac{10}{\sqrt{44}}$
K. $\dfrac{\sqrt{44}}{12}$

39. In the figure below, B lies on $\overline{AC}$, $\overline{BD}$ bisects $\angle ABE$, and $\overline{BE}$ bisects $\angle CBD$. What is the measure of $\angle DBE$?

A. 90°
B. 60°
C. 45°
D. 30°
**E.** Cannot be determined from the given information

40. If there are 8×10^{12} hydrogen molecules in a volume of 4×10^4 cubic centimeters, what is the average number of hydrogen molecules per cubic centimeter?

F. 5×10^{-9}
G. 2×10^3
H. 2×10^8
J. 32×10^{16}
**K.** 32×10^{48}

GO ON TO THE NEXT PAGE.

41. In the figure below, a radar screen shows 2 ships. Ship A is located at a distance of 20 nautical miles and bearing 170°, and Ship B is located at a distance of 30 nautical miles and bearing 300°. Which of the following is an expression for the straight-line distance, in nautical miles, between the 2 ships?

(Note: For $\triangle ABC$ with side of length a opposite $\angle A$, side of length b opposite $\angle B$, and side of length c opposite $\angle C$, the law of cosines states $c^2 = a^2 + b^2 - 2ab \cos \angle C$.)
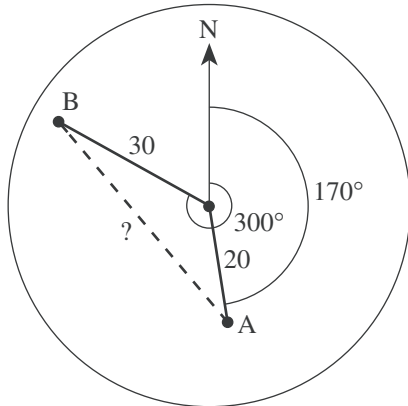

A. $\sqrt{20^2 + 30^2 - 2(20)(30)\cos 60°}$

B. $\sqrt{20^2 + 30^2 - 2(20)(30)\cos 130°}$

C. $\sqrt{20^2 + 30^2 - 2(20)(30)\cos 170°}$

D. $\sqrt{20^2 + 30^2 - 2(20)(30)\cos 300°}$

E. $\sqrt{20^2 + 30^2 - 2(20)(30)\cos 470°}$

42. What rational number is halfway between $\frac{1}{5}$ and $\frac{1}{3}$?

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

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

H. $\frac{2}{15}$

J. $\frac{4}{15}$

K. $\frac{8}{15}$

43. In isosceles trapezoid $ABCD$, $\overline{AB}$ is parallel to $\overline{DC}$, $\angle BDC$ measures 25°, and $\angle BCA$ measures 35°. What is the measure of $\angle DBC$?
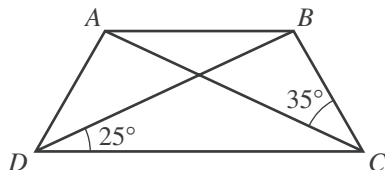
A. 85°
B. 95°
C. 105°
D. 115°
E. 125°

44. In the figure below, the area of the larger square is 50 square centimeters and the area of the smaller square is 18 square centimeters. What is x, in centimeters?
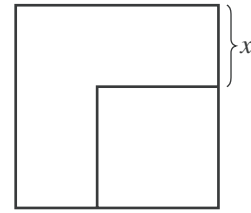
F. 2
G. $2\sqrt{2}$
H. $4\sqrt{2}$
J. 16
K. 32

**45.** Which of the following is a rational number?

A. $\sqrt{2}$

B. $\sqrt{\pi}$

C. $\sqrt{7}$

D. $\sqrt{\dfrac{5}{25}}$

E. $\sqrt{\dfrac{64}{49}}$

46. If $a < b$, then $|a - b|$ is equivalent to which of the following?

F. $a + b$
G. $-(a + b)$
H. $\sqrt{a - b}$
J. $a - b$
K. $-(a - b)$

47. Tom has taken 5 of the 8 equally weighted tests in his U.S. History class this semester, and he has an average score of exactly 78.0 points. How many points does he need to earn on the 6th test to bring his average score up to exactly 80.0 points?

A. 90
B. 88
C. 82
D. 80
E. 79

GO ON TO THE NEXT PAGE.

48. In the complex plane, the horizontal axis is called the *real axis* and the vertical axis is called the *imaginary axis*. The complex number $a + bi$ graphed in the complex plane is comparable to the point (a,b) graphed in the standard (x,y) coordinate plane. The *modulus* of the complex number $a + bi$ is given by $\sqrt{a^2 + b^2}$. Which of the complex numbers z_1, z_2, z_3, z_4, and z_5 below has the greatest modulus?
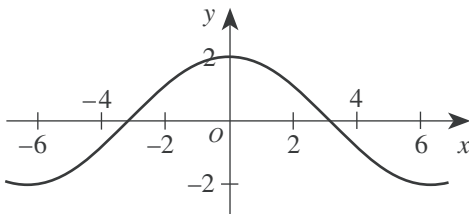
imaginary
axis

$\bullet\ z_1$

$\bullet\ z_5$

$\bullet\ z_2$

O → real axis

$\bullet\ z_4$

$\bullet\ z_3$
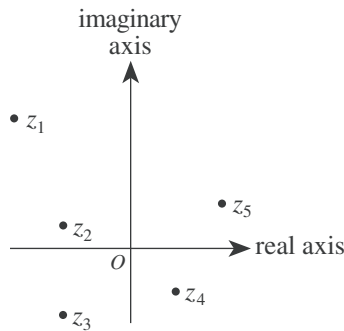
F. z_1
G. z_2
H. z_3
J. z_4
K. z_5

49. In the real numbers, what is the solution of the equation $8^{2x + 1} = 4^{1 - x}$?

A. $-\dfrac{1}{3}$

B. $-\dfrac{1}{4}$

C. $-\dfrac{1}{8}$

D. 0

E. $\dfrac{1}{7}$

50. The graph of the trigonometric function $y = 2 \cos\left(\dfrac{1}{2}x\right)$ is shown below.

y

-4 4

-6 -2 O 2 6 x

-2

The function is:

F. even (that is, $f(x) = f(-x)$ for all x).
G. odd (that is, $f(-x) = -f(x)$ for all x).
H. neither even nor odd.
J. the inverse of a cotangent function.
K. undefined at $x = \pi$.

51. An integer from 100 through 999, inclusive, is to be chosen at random. What is the probability that the number chosen will have 0 as at least 1 digit?

A. $\dfrac{19}{900}$

B. $\dfrac{81}{900}$

C. $\dfrac{90}{900}$

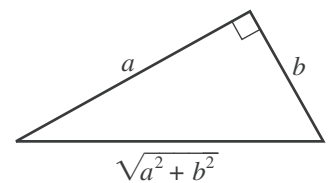**D.** $\dfrac{171}{900}$

E. $\dfrac{271}{1,000}$

52. In the figure below, line q in the standard (x,y) coordinate plane has equation $-2x + y = 1$ and intersects line r, which is distinct from line q, at a point on the x-axis. The angles, $\angle a$ and $\angle b$, formed by these lines and the x-axis are congruent. What is the slope of line r ?

y

r 3 q

2

1

$\angle b$ $\angle a$

-2 -1 O 1 x

-1
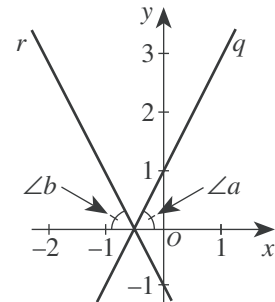
F. -2

G. $-\dfrac{1}{2}$

H. $\dfrac{1}{2}$

J. 2

K. Cannot be determined from the given information

53. In the right triangle below, $0 < b < a$. One of the angle measures in the triangle is $\tan^{-1}\left(\dfrac{a}{b}\right)$. What is $\cos\left[\tan^{-1}\left(\dfrac{a}{b}\right)\right]$?

A. $\dfrac{a}{b}$

B. $\dfrac{b}{a}$

C. $\dfrac{a}{\sqrt{a^2 + b^2}}$

D. $\dfrac{b}{\sqrt{a^2 + b^2}}$

E. $\dfrac{\sqrt{a^2 + b^2}}{a}$

a b

$\sqrt{a^2 + b^2}$

GO ON TO THE NEXT PAGE.

Use the following information to answer questions 54–56.

The radio signal from the transmitter site of radio station WGGW can be received only within a radius of 52 miles in all directions from the transmitter site. A map of the region of coverage of the radio signal is shown below in the standard (x,y) coordinate plane, with the transmitter site at the origin and 1 coordinate unit representing 1 mile.
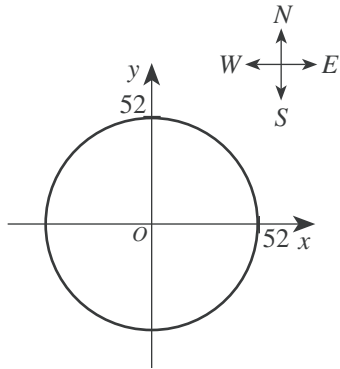
54. Which of the following is closest to the area, in square miles, of the region of coverage of the radio signal?

F. 2,120
G. 2,700
H. 4,250
J. 8,500
K. 16,990

55. Which of the following is an equation of the circle shown on the map?

A. $x + y = 52$
B. $(x + y)^2 = 52$
C. $(x + y)^2 = 52^2$
D. $x^2 + y^2 = 52$
E. $x^2 + y^2 = 52^2$

56. The transmitter site of radio station WGGW and the transmitter site of another radio station, WGWB, are on the same highway 100 miles apart. The radio signal from the transmitter site of WGWB can be received only within a radius of 60 miles in all directions from the WGWB transmitter site. For how many miles along the highway can the radio signals of *both* stations be received?

(Note: Assume the highway is straight.)

F. 8
G. 12
H. 40
J. 44
K. 48

57. The graphs of the equations $y = x - 1$ and $y = (x - 1)^4$ are shown in the standard (x,y) coordinate plane below. What real values of x, if any, satisfy the inequality $(x - 1)^4 < (x - 1)$?
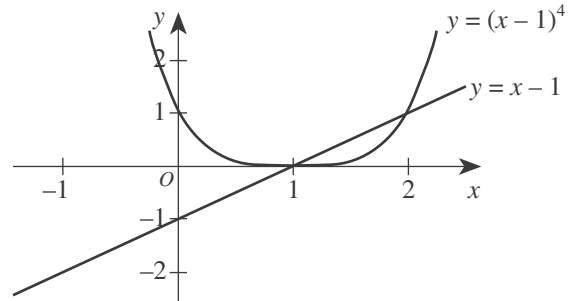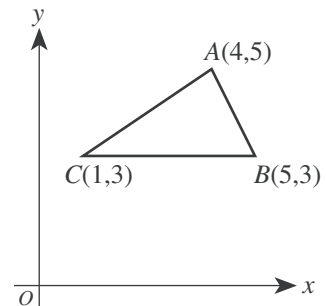

A. No real values
B. $x < 0$ and $x > 1$
C. $x < 1$ and $x > 2$
D. $0 < x < 1$
E. $1 < x < 2$

58. For every positive 2-digit number, x, with tens digit t and units digit u, let y be the 2-digit number formed by reversing the digits of x. Which of the following expressions is equivalent to $x - y$?

F. $9(t - u)$
G. $9(u - t)$
H. $9t - u$
J. $9u - t$
K. 0

59. In the figure below, the vertices of $\triangle ABC$ have (x,y) coordinates (4,5), (5,3), and (1,3), respectively. What is the area of $\triangle ABC$?

A. 4
B. $4\sqrt{2}$
C. $4\sqrt{3}$
D. 8
E. $8\sqrt{2}$

60. The sum of an infinite geometric series with first term a and common ratio $r < 1$ is given by $\frac{a}{1 - r}$. The sum of a given infinite geometric series is 200, and the common ratio is 0.15. What is the second term of this series?

F. 25.5
G. 30
H. 169.85
J. 170
K. 199.85

END OF TEST 2

STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

DO NOT RETURN TO THE PREVIOUS TEST.