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. The lowest temperature on a winter morning was −8°F. Later that same day the temperature reached a high of 24°F. By how many degrees Fahrenheit did the temperature increase?

   A. 3°
   B. 8°
   C. 16°
   D. 24°
   E. 32°

2. Disregarding sales tax, how much will you save when you buy an $11 compact disc that is on sale for 25% off?

   F. $0.28
   G. $0.44
   H. $2.75
   J. $3.00
   K. $8.25

3. As part of a school project, Akio wants to find the average cost of renting a newly released videotape from video rental stores in his neighborhood. He surveys 4 stores and finds the cost of renting a newly released videotape from the 4 stores to be $3.50, $3.40, $3.50, and $3.00, respectively. Using this data, what is the average cost of renting a newly released videotape from these 4 stores?

   A. $3.25
   B. $3.30
   C. $3.35
   D. $3.45
   E. $3.50

4. In the figure below, $\overline{AC}$ is parallel to $\overline{DE}$ with X on $\overline{AC}$ and B on $\overline{DE}$. Also $\overline{AB} \cong \overline{BC}$, and the measure of $\angle XAB$ is 110°. What is the measure of $\angle ACB$?
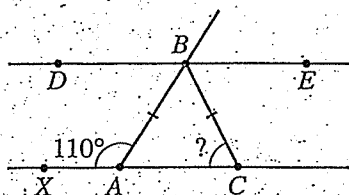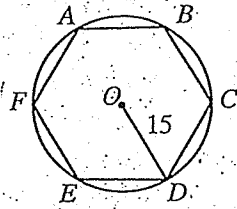
   F. 35°
   G. 40°
   H. 55°
   J. 70°
   K. 110°

DO YOUR FIGURING HERE.

DO YOUR FIGURING HERE.

5. Regular hexagon *ABCDEF* is inscribed in a circle, as shown below. If the length of radius $\overline{OD}$ is 15 centimeters, how long is $\overline{AB}$, in centimeters?
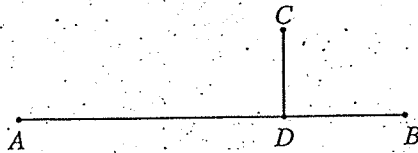
A. 15

B. 18

C. 30

D. 5π

E. $\dfrac{225\pi}{6}$

6. The price of a pumpkin is directly proportional to its weight. If a pumpkin that weighs 15.0 pounds costs $3.25, how much will an 11.4-pound pumpkin cost?

F. $0.95
G. $1.23
H. $1.95
J. $2.47
K. $4.28

7. In the figure below, *D* is a point on $\overline{AB}$, and $\overline{CD}$ is perpendicular to $\overline{AB}$. Based on this information, which of the following is the best conclusion?

A. $\angle CDA \cong \angle CDB$.
B. $\angle CDA$ is larger than $\angle CDB$.
C. $\overline{AB}$ bisects $\overline{CD}$.
D. $\overline{CD}$ and $\overline{DB}$ are equal in length.
E. Point *C* is equidistant from *A* and *B*.

8. If $3x - 7 = 4x - 16$, then $x = ?$

F. -23

G. -9

H. $-\dfrac{23}{7}$

J. $\dfrac{23}{7}$

K. 9

9. Which of the following is always equal to $a(5 - a) - 6(a + 4)$?

A. $-2a - 24$

B. $-2a + 4$

C. $-a^2 - a - 24$

D. $-a^2 - a + 4$

E. $-2a^3 - 24$

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10. One marble is drawn at random from a bag containing 3 red, 2 blue, and 4 green marbles. What is the probability that the marble drawn is NOT blue?

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

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

    H. $\frac{7}{9}$

    J. $\frac{7}{24}$

    K. $\frac{12}{81}$

11. Wanda programs her calculator to perform a linear function, but she doesn't tell you what that function is. When $n = 6$, the value of the function is 2. When $n = 12$, the value is 4. Which of the following expressions explains what the calculator will display when any number, n, is entered?
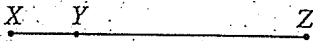
    A. $\frac{n}{3}$

    B. $n - 4$

    C. $n - 8$

    D. $2n - 10$

    E. $2n - 20$

12. On the line segment below, the ratio of lengths XY to YZ is 1:3. What is the ratio of XY to XZ?

    $X \quad Y \qquad\qquad Z$

    F. 1:4
    G. 1:2
    H. 3:1
    J. 4:1
    K. Cannot be determined from the given information

13. If a board 7 feet 10 inches long is cut into 2 equal parts, as shown below, what will be the length, to the nearest inch, of each part?
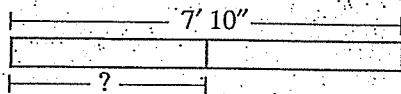
    A. 3' 5"
    B. 3' 9"
    C. 3' 11"
    D. 4' 2"
    E. 4' 5"

    |← 7' 10" →|
    |← ? →|

14. The speed of one train exceeds twice the speed of another by 30 mph. If r mph is the speed of the slower train, which of the following expresses the speed, in miles per hour, of the faster train?
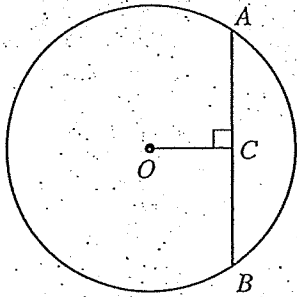
    F. $r + 15$
    G. $r - 30$
    H. $r + 30$
    J. $2r - 30$
    K. $2r + 30$

DO YOUR FIGURING HERE.

15. The circle shown below has a radius of 10 meters, and the length of chord $\overline{AB}$ is 16 meters. If O marks the center of the circle, what is the length of $\overline{OC}$?

A. $2\sqrt{3}$
B. 6
C. 12
D. $4\sqrt{21}$
E. 36

16. What is the value of the expression $x^3 - 2x^2 + 4x + 4$ for $x = -2$?

F. 12
G. -2
H. -4
J. -8
K. -20

17. What is the next term after $-\frac{1}{4}$ in the geometric sequence $16, -4, 1, -\frac{1}{4}, \cdots$?

A. $-\frac{1}{8}$

B. 0

C. $\frac{1}{16}$

D. $\frac{1}{8}$

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

18. On the blueprint for Betty's house, $\frac{1}{4}$ inch represents an actual length of 1 foot. What is the area, in square feet, of Betty's rectangular bedroom, which is $2\frac{1}{2}$ inches by 3 inches on the blueprint?

F. 30
G. 44
H. 60
J. 120
K. 244

19. If $a > 0$ and $b < 0$, then the sum of a and b:

A. is always positive.
B. is always negative.
C. is always zero.
D. cannot be zero, but can be any other real number.
E. can be any real number.

20. If $x + \frac{3}{4} = \frac{1}{28}$, then $x = ?$

    F.   21

    G. $\frac{11}{14}$

    H. $\frac{1}{21}$

    J. $-\frac{1}{16}$

    K. $-\frac{5}{7}$

21. What is the slope of the line given by the equation $3x + 5y = -15$?

    A. -3

    B. $-\frac{5}{3}$

    C. $-\frac{3}{5}$

    D. 3

    E. 5

22. The length of a side of a square is represented as $(2x - 3)$ inches. Which of the following general expressions represents the area of the square, in square inches?

    F. $4x^2 - 12x + 9$

    G. $4x^2 - 12x + 6$

    H. $4x^2 - 6x + 9$

    J. $4x^2 - 9$

    K. $8x - 12$

23. Which of the following is a polynomial factor of $x^2 - 2x - 15$?

    A. $15 - x$
    B. $5 + x$
    C. $3 + x$
    D. $2 - x$
    E. x

24. In the equation $m = \frac{3}{1 + q}$, q represents a positive integer. As q gets larger and larger without bound, the value of m:

    F.   gets closer and closer to 0.
    G.   gets closer and closer to 1.
    H.   gets closer and closer to 3.
    J.   remains constant.
    K.   gets larger and larger.

25. The book *Fahrenheit 451* by Ray Bradbury is about a society in which all books are banned and burned. The title of the book gives the approximate temperature at which paper starts to burn. Since Fahrenheit, F, and Celsius, C, temperatures are related by the formula $C = \frac{5}{9}(F - 32)$, which of the following would make an equivalent title for the book?

   A. *Celsius 219*
   B. *Celsius 233*
   C. *Celsius 268*
   D. *Celsius 754*
   E. *Celsius 844*

26. The length of a rectangle is 6 inches longer than the width. If the perimeter of the rectangle is 48 inches, what is the width, in inches?

   F. 8
   G. 9
   H. 15
   J. 21
   K. 27

27. What are all the solutions for x if $2x^2 - 3x - 20 = 0$?

   A. $x = -20$ only

   B. $x = -5$ or $x = 2$

   C. $x = -4$ or $x = \frac{5}{2}$

   D. $x = -\frac{5}{2}$ or $x = 4$

   E. $x = -2$ or $x = 5$

28. In Terell's history class, all tests count equally. So far, Terell has taken 2 of the 3 tests in history and earned scores of 93% and 82%, respectively. What is the minimum percent Terell needs on the third test to have a test average of at least 85% ?

   F. 89%
   G. 88%
   H. 87%
   J. 83%
   K. 80%

29. If a, b, and c are positive integers such that $a^b = x$ and $c^b = y$, then $xy = $?

   A. ac^b

   B. ac^{2b}

   C. $(ac)^b$

   D. $(ac)^{2b}$

   E. $(ac)^{b^2}$

30. What is the area, in square inches, of a circle with a diameter equal to 10 inches?

F. 100
G. 25
H. 10π
J. 25π
K. 100π

31. To get a driver's license, an applicant must pass a written test and a driving test. Past records show that 80% of the applicants pass the written test and 60% of those who have passed the written test pass the driving test. Based on these figures, how many applicants in a random group of 1,000 applicants would you expect to get driver's licenses?

A. 200
B. 480
C. 600
D. 750
E. 800

32. If $\sin A = \frac{4}{5}$, then which of the following could be $\tan A$?

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

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

H. 1

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

K. 4

33. If x is any number other than 4 and 5, then $\frac{(4-x)(x-5)}{(x-4)(x-5)} = ?$

A. −20
B. −1
C. 0
D. 1
E. 20

34. $\sqrt{50} + \sqrt{128} = ?$

F. $13\sqrt{2}$
G. $14\sqrt{2}$
H. $2\sqrt{5} + 2\sqrt{8}$
J. $89\sqrt{2}$
K. $\sqrt{178}$

35. Triangle $\triangle ABC$ is similar to $\triangle DEF$. $\overline{AB}$ is 8 inches long, $\overline{BC}$ is 10 inches long, and $\overline{AC}$ is 16 inches long. If the longest side of $\triangle DEF$ is 40 inches long, what is the perimeter, in inches, of $\triangle DEF$?
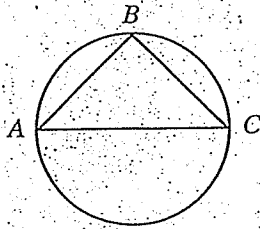
A. 74
B. 85
C. 90
D. 136
E. 170

DO YOUR FIGURING HERE.

36. Sides $\overline{AB}$, $\overline{BC}$, $\overline{CD}$, and $\overline{DA}$ of square $ABCD$ have midpoints L, M, N, and K, as shown below. If $\overline{AB}$ is 6 inches long, what is the area, in square inches, of the shaded region?

F. $4\frac{1}{2}$

G. $6\sqrt{2}$

H. 9

J. $12\sqrt{2}$

K. 18
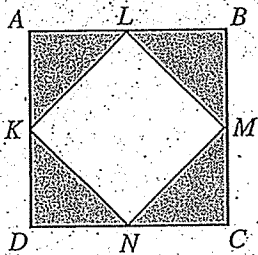
37. In the figure below, $\overline{AC}$ is a diameter of the circle, B is a point on the circle, and $\overline{AB} \cong \overline{BC}$. What is the degree measure of $\angle ABC$?

A. 45°
B. 60°
C. 75°
D. 90°
E. Cannot be determined from the given information

38. In the standard (x,y) coordinate plane, what are the coordinates of the midpoint of a line segment with endpoints $(-1,3)$ and $(2,7)$?

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

G. $\left(1, \frac{9}{2}\right)$

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

J. $(1,4)$

K. $(3,4)$

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39. In a downhill ski race, Margo posted a time of 2 minutes and 24 seconds for a course 1.2 miles long. About how many miles per hour did she average for the race?

A. 60
B. 30
C. 20
D. 3
E. 2

40. For the 2 functions $f(x)$ and $g(x)$, tables of values are shown below. What is the value of $g(f(3))$?

x	$f(x)$		x	$g(x)$
−5	7		−2	3
−2	−5		1	−1
1	3		2	−3
3	2		3	−5

F. −5
G. −3
H. −1
J. 2
K. 7

41. For positive real numbers x, y, and z, which of the following expressions is equivalent to $x^{\frac{1}{2}}y^{\frac{2}{3}}z^{\frac{5}{6}}$?

A. $\sqrt[3]{xy^2z^3}$

B. $\sqrt[6]{xy^2z^5}$

C. $\sqrt[6]{x^3y^2z^5}$

D. $\sqrt[6]{x^3y^4z^5}$

E. $\sqrt[11]{xy^2z^5}$

42. A formula for the area of a rhombus is $A = \frac{1}{2}d_1d_2$, where d_1 and d_2 are the lengths of the diagonals. Which of the following is an expression for d_2 ?

F. $\frac{2A}{d_1}$

G. $\frac{A}{2d_1}$

H. $\frac{Ad_1}{2}$

J. $2(A - d_1)$

K. $A - \frac{d_1}{2}$
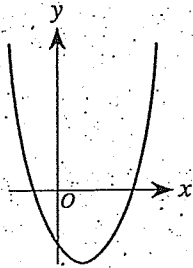
DO YOUR FIGURING HERE.

43. The line graphed below shows the predicted gasoline use for a certain car. Which of the following is the closest estimate of this car's predicted *rate* of gasoline use, in miles per gallon?
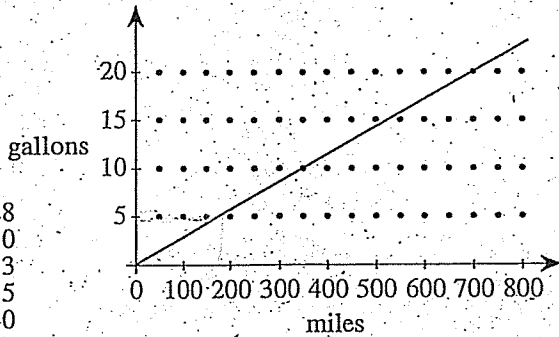

- A. 28
- B. 30
- C. 33
- D. 35
- E. 40

44. The graph of $y = ax^2 + bx + c$ in the standard (x,y) coordinate plane is shown below.


When $y = 0$, which of the following best describes the solution set for x ?

- F. 2 real solutions
- G. 1 double real solution only
- H. 1 real and 1 imaginary solution
- J. 1 double imaginary solution only
- K. 2 imaginary solutions

45. If $|y| = y + 6$, then $y = ?$
- A. −12
- B. −6
- C. −3
- D. 0
- E. 6

46. What fraction lies exactly halfway between $\frac{2}{3}$ and $\frac{3}{4}$?

- F. $\frac{3}{5}$
- G. $\frac{5}{6}$
- H. $\frac{7}{12}$
- J. $\frac{9}{16}$
- K. $\frac{17}{24}$
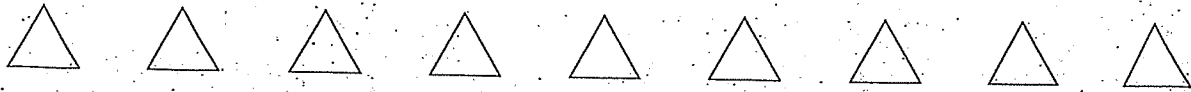
47. Elliott writes a check for $15. He records the check in his check register, which up to this time has shown the correct balance. When figuring his new balance, he accidentally *adds* $15 instead of subtracting. The balance in his check register now shows:

A. $30 less than it should.
B. $15 less than it should.
C. the correct amount.
D. $15 more than it should.
E. $30 more than it should.

48. Six plants, each of a different plant type, are to be arranged on a display shelf's 6 spots. If each spot must have a plant, in how many different arrangements can the plants be placed?

F. 6
G. 21
H. 30
J. 36
K. 720

49. In the standard (x,y) coordinate plane, what is the distance between the points $(3,-4)$ and $(-5,2)$?

A. 4
B. 6
C. 8
D. 10
E. 14

50. A formula for the volume, V, of a right circular cylinder is $V = \pi r^2 h$, where r is the radius and h is the height. The cylindrical tank shown below has radius 5 meters and height 4 meters and is filled with water.
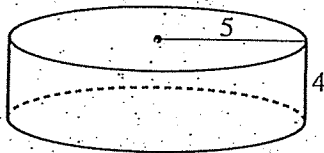
If 1 cubic meter of water weighs approximately 2,205 pounds, then the weight, in pounds, of the water in the tank is:

F. less than 200,000.
G. between 200,000 and 400,000.
H. between 400,000 and 600,000.
J. between 600,000 and 800,000.
K. more than 800,000.

51. What are the values of θ, between 0° and 360°, when $\tan\theta = -1$?

A. 225° and 315° only
B. 135° and 315° only
C. 135° and 225° only
D. 45° and 135° only
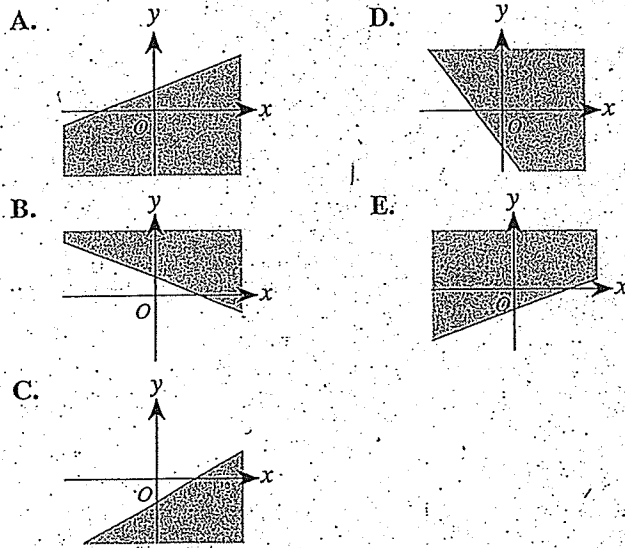E. 45°, 135°, 225°, and 315°
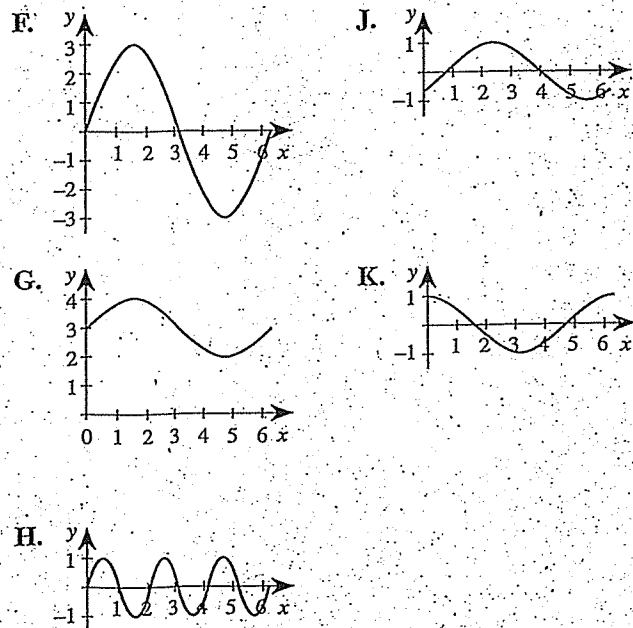
DO YOUR FIGURING HERE.

52. Which of the following is an equation of a circle with its center at (3,4) and tangent to the x-axis in the standard (x,y) coordinate plane?

F. $(x-3)^2 + (y-4)^2 = 16$

G. $(x-4)^2 + (y-3)^2 = 16$

H. $(x-4)^2 + (y-3)^2 = 9$

J. $(x-3)^2 + (y-4)^2 = 9$

K. $(x+4)^2 + (y+3)^2 = 16$

53. Which of the following best represents the graph of $y \leq ax + b$ for some positive a and negative b ?

A.

D.

B.

E.

C.

54. One of the graphs below is that of $y = A \sin\theta$ for θ between 0 and 6.28 radians, where A is a constant. Which graph?

F.

J.

G.

K.

H.
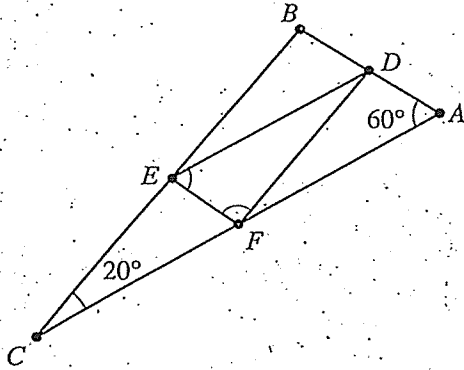
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55. In the figure below, D, E, and F are the midpoints of the sides $\overline{AB}$, $\overline{BC}$, and $\overline{AC}$, respectively. If the measure of $\angle BCA$ is 20°, and the measure of $\angle BAC$ is 60°, what is the sum of the measures of $\angle DFE$ and $\angle FED$?

A. 60°
B. 80°
C. 100°
D. 120°
E. 160°

56. A formula for the surface area (A) of the rectangular solid shown below is $A = 2lw + 2lh + 2wh$ where l represents length; w, width; and h, height. By doubling each of the dimensions (l, w, and h), the surface area will be multiplied by what factor?
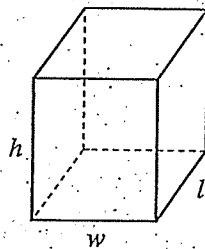
F. 2
G. 4
H. 6
J. 8
K. 12

57. If $\sin x = \frac{\sqrt{3}}{2}$ and $\cos x = -\frac{1}{2}$, then $\sec x = ?$

A. -2

B. $-\sqrt{3}$

C. $-\frac{2}{\sqrt{3}}$

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

E. 2

DO YOUR FIGURING HERE.

58. In a rhombus, all 4 sides are the same length. Rhombus $ABCD$ below has vertices at $A(0,0)$ and $C(4,6)$. What is the slope of diagonal $\overline{BD}$?
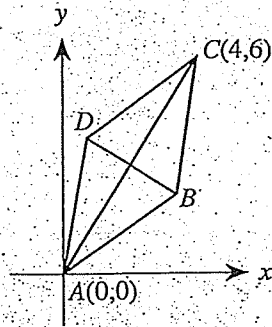

F. $-\dfrac{3}{2}$

G. $-\dfrac{2}{3}$

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

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

K. Cannot be determined from the given information

59. Yvette earned a score of 56 on a recent 25-question multiple-choice exam. The scoring for the exam was +6 for each correct answer, −2 for each incorrect answer, and 0 for each unanswered question. What is the *maximum* number of questions Yvette could have answered correctly?

A. 9
B. 10
C. 11
D. 13
E. 14

60. In the standard (x,y) coordinate plane, the graphs of the 3 equations $x - 1 = 0$, $y + 2 = 0$, and $x + y = 4$ form the boundary of a triangle. What is the area of this triangle, expressed in square coordinate units?

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

G. $\dfrac{9}{2}$

H. 8

J. $\dfrac{25}{2}$

K. $\dfrac{49}{2}$

END OF TEST 2

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

DO NOT RETURN TO THE PREVIOUS TEST.