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MATHEMATICS TEST

60 Minutes—60 Questions

DIRECTIONS: Solve each of the problems in the time allowed, then fill in the corresponding bubble on your answer sheet (page 111). Do not spend too much time on any one problem; skip the more difficult problems and go back to them later. You may use a calculator on this test. For this test you should assume that figures are NOT necessarily drawn to scale, that all geometric figures lie in a plane, and that the word *line* is used to indicate a straight line.

DO YOUR FIGURING HERE.

1. Which of the following expressions is equivalent to $6x + 12y - 15z$?
   A. $3(x + 12y - 15z)$
   B. $3(2x + 4y - 5z)$
   C. $3(3x + 4y) - 5z$
   D. $6(x + 2y - 3z)$
   E. $15(x + y - z)$

2. When written in symbols, "the product of a and b, raised to the third power" is represented as:
   F. $a^3 b^3$
   G. $(a + b^3)$
   H. $(ab)^3$
   J. $\dfrac{a^3}{b^3}$
   K. ab^3

3. Tyler took a road trip on his motorcycle. When he left, the odometer read 22,687 miles, and when he returned, it read 23,002 miles. In total, Tyler rode for 5 hours. Based on the odometer readings, what was his average speed during the trip, to the nearest mile per hour?
   A. 79
   B. 76
   C. 64
   D. 63
   E. 58

4. The interior dimensions of a rectangular rabbit cage are 5 feet by 4 feet by 2 feet. What is the volume, in cubic feet, of the interior of the rabbit cage?
   F. 11
   G. 20
   H. 28
   J. 40
   K. 44

5. If z is a real number and $3^z = 81$, then $7 \times 2^z = ?$
   A. 14
   B. 28
   C. 56
   D. 84
   E. 112

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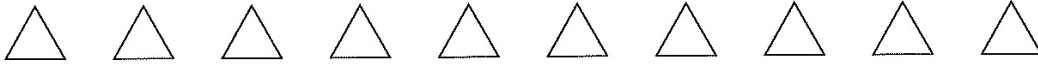
6. For the students at Bayside College, the ratio of professors to students is 2:43. There are currently 9,030 students enrolled. Which of the following statements is (are) true?

    I. There are 420 professors.

    II. Each professor has 43 students in his or her course.

    III. Professors comprise $\dfrac{2}{43}$ of the Bayside population.

    F. I only
    G. II only
    H. III only
    J. I and III only
    K. I, II, and III

7. If the probability that a specific event will occur is 0.09, what is the probability that the event will NOT occur?
    A. 0.00
    B. 0.11
   **C.** 0.70
    D. 0.91
    E. 1.00

8. As shown below, the diagonals of rectangle $ABCD$ intersect at the point $(-4, 2)$ in the standard (x, y) coordinate plane. Point D is at $(1, -1)$. Which of the following are the coordinates of point B?
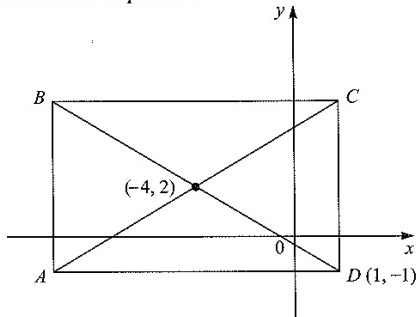
    F. $(1, 5)$
    G. $(-6, 4)$
    H. $(-9, -1)$
    J. $(-9, 5)$
    K. $(-11, 6)$

9. Which of the following expressions is equivalent to $\dfrac{16s + 48}{8}$?

    A. $48s$
    B. $8s$
    C. $2s + 6$
    D. $2s + 48$
    E. $s + 6$

10. The expression $5m(-3m + 6n) - 9mn$ is equivalent to:
    F. $30mn - 8m$
    G. $21mn - 15m^2$
    H. $15mn - 9m^2$
    J. $6mn$
    K. $-15m^2$

DO YOUR FIGURING HERE.

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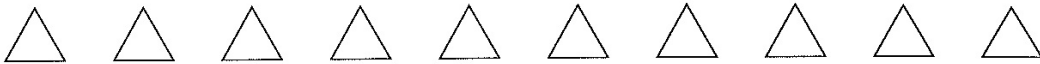
11. Jose recently took a history test that had certain questions worth 3 points each, while the rest were worth 5 points each. He correctly answered the same number of 3-point questions as 5-point questions, and earned a score of 72 points. How many 5-point questions did he answer correctly?
A. 9
B. 11
C. 15
D. 24
E. 26

12. A rectangular poster measures 22 inches by 16 inches. Pietro estimates that the area is 264 square inches. His estimate is what percent *less* than the actual area?
F. 75%
G. 50%
H. 45%
J. 30%
K. 25%

13. The *geometric mean* of 2 positive numbers is the square root of the product of the 2 numbers. What is the geometric mean of 16 and 64?
A. 28
B. 32
C. 40
D. 256
E. 1,024

14. A model for the braking distance, d feet, required to stop a certain car when it is traveling x miles per hour is $d = \left(\dfrac{x^2}{20}\right) + x$. According to this model, what is the braking distance, in feet, required to stop this car when it is traveling at 30 miles per hour?
F. 30
G. 52
H. 75
J. 90
K. 102

15. The expression $2x^2 + 10x - 28$ can be written as the product of 2 binomials with integer coefficients. One of the binomials is $(x + 7)$. Which of the following is the other binomial?
A. $2x^2 - 4$
B. $2x^2 + 4$
C. $2x - 6$
D. $2x - 4$
E. $x + 4$

16. The cost for a business to produce x television commercials in 1 year is $225x + \$17,000$. How many commercials can the company produce in 1 year at a cost of $35,000?
F. 75
G. 80
H. 100
J. 155
K. 231

DO YOUR FIGURING HERE.

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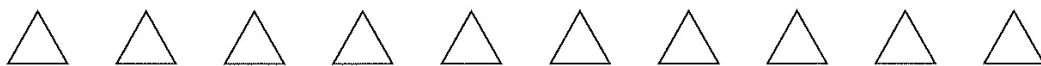
DO YOUR FIGURING HERE.

17. Given $f(x) = \dfrac{x^2 + \frac{3}{8}}{x + \frac{2}{5}}$, what is $f\left(\frac{1}{4}\right)$?

   A. $\dfrac{35}{52}$

   B. 1

   C. $\dfrac{52}{30}$

   D. $\dfrac{20}{9}$

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

18. Jim has $13 more than his friend Brian, who has x dollars. Jim spends $25 on Saturday, and then works on Sunday and earns $32. Which of the following is an expression for the amount of money, in dollars, Jim has after working on Sunday?
   F. 20
   G. $x - 7$
   H. $x - 20$
   J. $2x + 7$
   K. $x + 20$

19. A rectangle is 4 times as long as it is wide. The area of the rectangle is 196 square centimeters. What is the perimeter of the rectangle, in centimeters?
   A. 35
   B. 56
   C. 70
   D. 88
   E. 119

20. Which of the following is a factored form of the expression $7x^2 + 10x - 8$?
   F. $(x - 1)(7x + 8)$
   G. $(x - 4)(7x + 2)$
   H. $(x - 8)(7x - 1)$
   J. $(x + 2)(7x - 4)$
   K. $(x + 4)(7x - 2)$

21. Which of the following is equivalent to $\sqrt[4]{8}$?

   A. $\dfrac{1}{8^4}$

   B. 1
   C. $\sqrt{2}$

   D. $8^{\frac{1}{4}}$

   E. 4^8
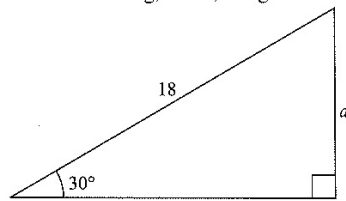
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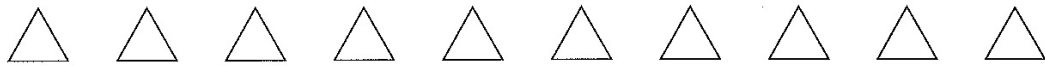
22. The admission to "Carnival Night" at a middle school is $3. There are many different games that the students can participate in, all costing the same. The graph below shows the total cost per student for admission and games as a function of the number of games purchased. Which of the following is the price of a single game?
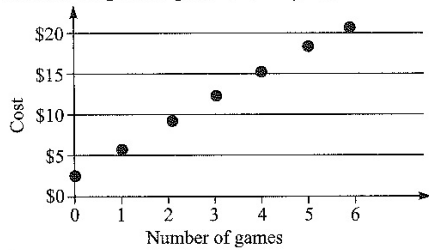
F. $1
G. $2
H. $3
J. $4
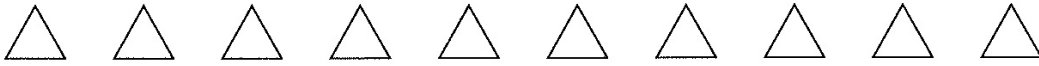K. $5

23. The figure below shows a right triangle with a hypotenuse equal to 18 cm. How long, in cm, is leg a of this triangle?

A. 6

B. $\dfrac{9\sqrt{3}}{3}$

C. 9

D. $9\sqrt{3}$

E. $18\sqrt{3}$

24. When 5 consecutive odd integers that are each greater than 34 are added, what is the smallest possible sum?
F. 195
G. 185
H. 152
J. 147
K. 144

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25. As shown below, a 33-foot ramp forms an angle of 21°
with the ground, which is horizontal. Which of the fol-
lowing is an expression for the unknown side of the
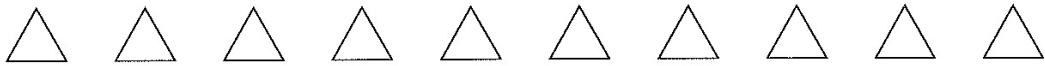triangle?

DO YOUR FIGURING HERE.
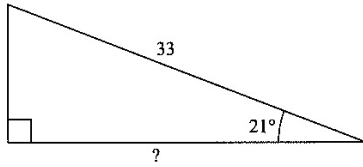
- **A.** 33 sin 21°
- **B.** 33 cos 21°
- **C.** 33 tan 21°
- **D.** 33 csc 21°
- **E.** 33 cot 21°

26. If $2x + 17 = |-35|$, then $x =$?
- **F.** −26
- **G.** −9
- **H.** 5
- **J.** 9
- **K.** 26

27. Marianne went to the local market to purchase some fruit.
Each box of oranges sold for $3 and each box of pears
for $5. Marianne purchased a total of 18 boxes of fruit
for $68. How many boxes of oranges did she purchase?
- **A.** 5
- **B.** 7
- **C.** 9
- **D.** 11
- **E.** 16

28. In $\triangle ABD$ below, E lies on $\overline{AD}$, and w, x, y, and z are
angle measures in degrees. The measure of angle D is
55°. What is $w + x + y + z$?
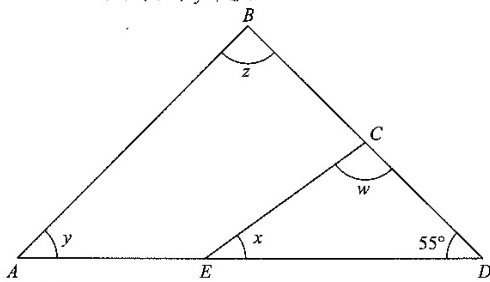
- **F.** 85°
- **G.** 125°
- **H.** 250°
- **J.** 260°
- **K.** 305°

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29. The diameter, d, of the rubber hoses manufactured by a certain company must satisfy the inequality $|d - 4| \le 0.002$. What is the maximum diameter, in inches, such a rubber hose may have?
  A. 0.008
  B. 2.000
  C. 3.998
  D. 4.000
  E. 4.002

30. The area of a trapezoid is 32 square feet. If the two parallel bases measure 3 feet and 5 feet respectively, what is the height in feet?
  F. 4
  G. 8
  H. 15
  J. 22
  K. 28

31. In the standard (x, y) coordinate plane point A has coordinates $(-2, 7)$ and point B has coordinates $(8, -3)$. If (r, s) is the midpoint of $\overline{AB}$, what is $r + s$?
  A. 0
  B. 2
 C. 4
  D. 5
  E. 10

Use the following information to answer Questions 32–34.

A local fitness club has a swimming pool—installed on level ground—that is a right cylinder with a diameter of 20 feet and a height of 5 feet. A diagram of the pool and its entry ladder is shown below.
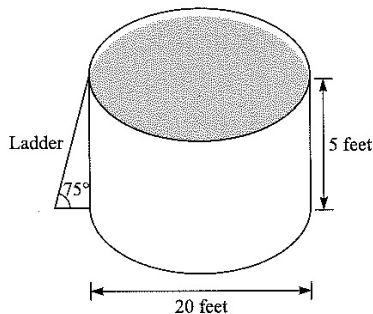

32. To the nearest cubic foot, what is the volume of water that will be in the pool when it is filled with water to a depth of 4 feet?
  (Note: The volume of a cylinder is given by $\pi r^2 h$, where r is the radius and h is the height.)
 F. 5,024
  G. 1,882
  H. 1,256
  J. 251
  K. 126

DO YOUR FIGURING HERE.
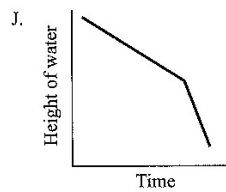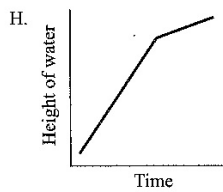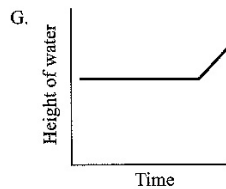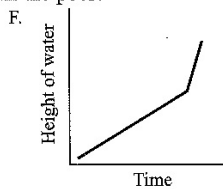
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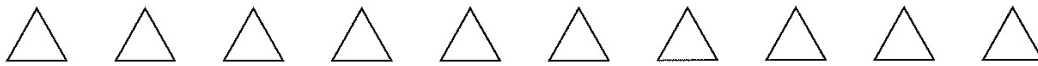
33. A solar cover is made for the pool. The cover will rest on the top of the pool and will include a wedge-shaped flap that forms a 30° angle at the center of the cover, as shown in the figure below. A zipper will be sewn along 1 side of the wedge-shaped flap and around the arc. Which of the following is closest to the length, in feet, of the zipper?
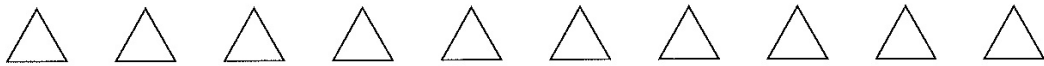
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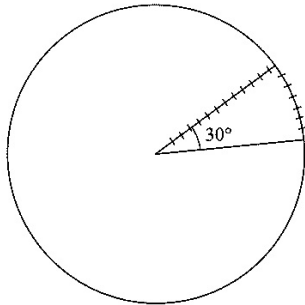
A. 41
B. 25
C. 20
D. 15
E. 10

34. A hose connected to a hydraulic pump was used to fill the pool. The pump had been on the medium setting for 10 hours and had filled the pool to the 3-foot mark when someone realized that the pump could be set to a higher setting that increased the flow by 33%. The pool was then filled to the 4-foot mark at the greater flow rate. Which of the following graphs shows the relationship between the time spent filling the pool and the height of the water in the pool?

F.

G.

H.

J.

K.
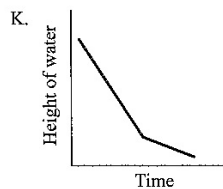
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35. For all nonzero y and z, $\dfrac{(y \times 10^{-4})(z \times 1,000,000)}{(y \times 0.0001)(z \times 10^{6})} = ?$

DO YOUR FIGURING HERE.

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

   B. 1
   C. 10
   D. yz
   E. $\dfrac{y^4}{z^5}$

36. What is the median of the following 9 test scores?
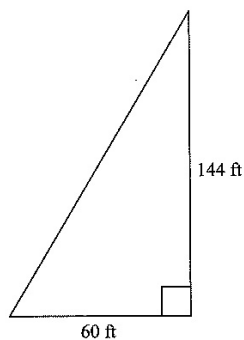   88, 92, 81, 97, 89, 94, 81, 95, 100
   F. 81
   G. 89
   H. 90.5
   J. 92
   K. 94

37. Which of the following radian measures is equivalent to 810° ?
   A. 2.5π
   B. 3π
   C. 4.5π
   D. 5.2π
   E. 6π

Use the following information to answer Questions 38–40.

Celina has a garden in her backyard that is shaped like a right triangle, as shown below.

144 ft

60 ft

38. If a bag of fertilizer costs $5.99 and covers approximately 360 square feet, which of the following is closest to the cost, in dollars, of fertilizing Celina's garden?
   F. $37.00
   G. $60.00
   H. $72.00
   J. $96.00
   K. $144.00

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39. Celina wants to put a fence around her garden to protect it from animals. Before she buys the fencing, she calculates the perimeter of the garden. What is its perimeter, in feet?
A. 204
B. 216
C. 300
D. 360
E. 408

**DO YOUR FIGURING HERE.**

40. The angle opposite the 60-foot side of the garden measures approximately 26.4°. Celina wants to change the shape of her garden. It will still be a right triangle with the 144-foot side as one leg, but she is going to extend the 60-foot side until the angle opposite that side is about 37°. By approximately how many feet would Celina need to extend the 60-foot side?
(Note: $\sin 37° = 0.60$, $\cos 37° = 0.80$, $\tan 37° = 0.75$)
F. 26
G. 48
H. 55
J. 60
K. 108

41. What is the point in the standard (x, y) coordinate plane that is the center of a circle with the equation $(x + 6)^2 + (y - 9)^2 = 25$?
A. $(-9, 6)$
B. $(-6, 9)$
C. $(0, 5)$
D. $(6, -9)$
E. $(-9, 6)$

**42.** Brendan's average score after 4 math quizzes was 78. His score on the 5th quiz was 93. If all 5 of the quizzes are weighted equally, which of the following is closest to his average score after 5 quizzes?
F. 93
G. 90
H. 87
J. 81
K. 78

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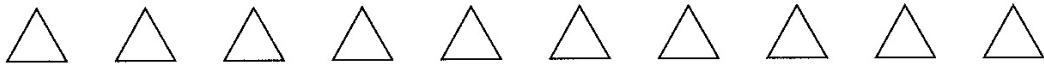
43. Ratings for a particular 2-hour television program reveal that the greatest number of viewers tuned in right at the start of the program and a majority of them remained tuned in for the 1st half-hour of the program. For the next hour, the number of viewers steadily declined, until it jumped back up for the last half-hour. Among the following graphs, which one best represents the relationship between the rating of the program, in thousands of viewers, and the time, in minutes, from the start to the finish of the program?

A.

B.

C.

D.

E.

DO YOUR FIGURING HERE.
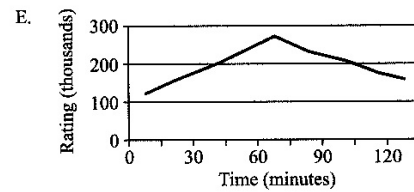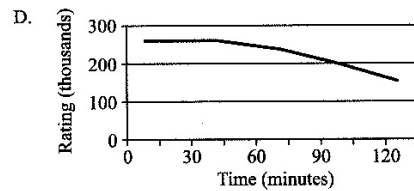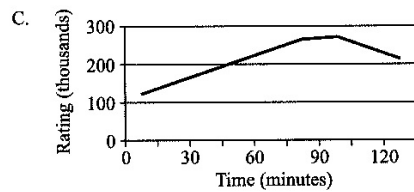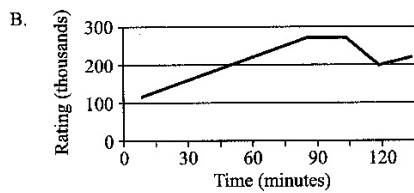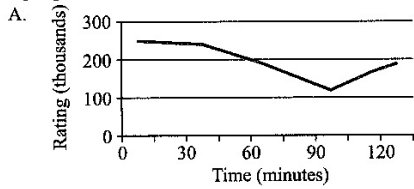
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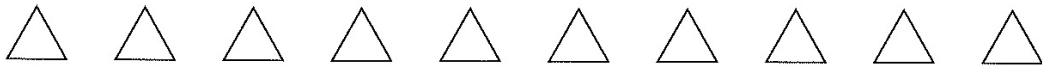
44. The sides of a right triangle measure 20 cm, 21 cm, and 29 cm. What is the sine of the angle adjacent to the side that measures 20 cm?

F. $\dfrac{20}{29}$

G. $\dfrac{21}{29}$

H. $\dfrac{20}{21}$

J. $\dfrac{29}{21}$

K. $\dfrac{29}{20}$

DO YOUR FIGURING HERE.

45. In the figure below, a square is circumscribed about a circle with a diameter of 20 cm. Points Q, R, S, and T are the midpoints of the square's sides. What is the total area, in cm^2, of the shaded regions?
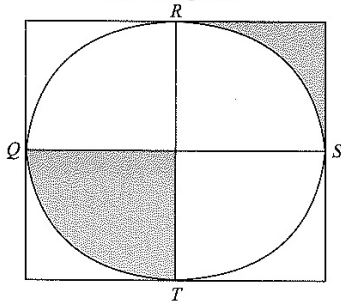
A. 20
B. 78.5
C. 100
D. 314
E. 400

46. Point $R(1, 5)$ is in the standard (x, y) coordinate plane. What must be the coordinates of point S so that the line $x = -3$ is the perpendicular bisector of $\overline{RS}$?
F. $(1, -11)$
G. $(-3, 5)$
H. $(-5, 1)$
J. $(-7, 5)$
K. $(-9, -3)$

47. Which of the following is a factored form of $3x^2 - 13x - 10$?
A. $(3x + 2)(x - 5)$
B. $(3x - 2)(x + 5)$
C. $(x + 3)(3x - 5)$
D. $(x + 2)(3x + 5)$
E. $(3x - 13)(x - 10)$

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48. Let $x \blacksquare y = (x - 2y)^2$ for all integers x and y. Which of the following is the value of $5 \blacksquare -3$?
- F. 121
- G. 64
- H. 41
- J. 1
- K. −31

49. What is the distance, in units, between the points in the standard (x, y) coordinate plane $(-1, 3)$ and $(-6, -9)$?
- A. 17
- B. 13
- C. 12
- D. 9
- E. 5

50. What is the perimeter of parallelogram $ABCD$ that has vertices with (x, y) coordinates $A(-3, -2)$, $B(-1, 5)$, $C(4, 6)$, $D(2, -1)$?
- F. 15
- G. $2\sqrt{10} + 2\sqrt{29}$
- H. $2\sqrt{26} + 2\sqrt{53}$
- J. $4\sqrt{79}$
- K. 158

51. The graph of the line with equation $-2x - 3y = -15$ does NOT have points in what quadrant(s) of the standard (x, y) coordinate plane below?

$$y \uparrow$$

```
        II    |    I
              |
  ------------+------------→ x
              |
        III   |    IV
```
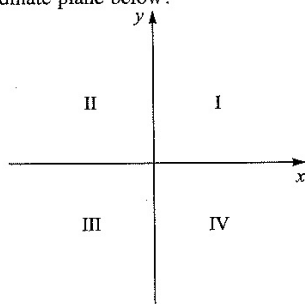
- A. Quadrant I only
- B. Quadrant II only
- C. Quadrant III only
- D. Quadrant IV only
- E. Quadrants II and IV only

52. Lines a and b intersect at point $(2, 5)$ in the standard (x, y) coordinate plane. Lines a and c intersect at point $(1, 4)$. Which of the following is an equation for line a?
- F. $y = 3x$
- G. $y = 4x$
- H. $y = x + 3$
- J. $y = 3x - 1$
- K. Cannot be determined from the given information

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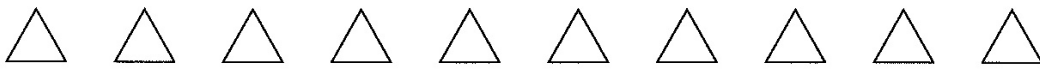
53. $3^0 + 3^2 + 3^{-2} = ?$

 A. 0

 B. $\dfrac{1}{9}$

 C. 9

 D. $10\dfrac{1}{9}$

 E. 19

54. The circumference of a circle is 10π inches. What is the area, in square inches, of the circle?

 F. 5

 G. $\dfrac{25}{\pi}$

 H. 10

 J. 5π

 K. 25π

55. In the (x, y) coordinate plane, what is the radius of the circle with a diameter having endpoints $(-2, 8)$ and $(1, 4)$?
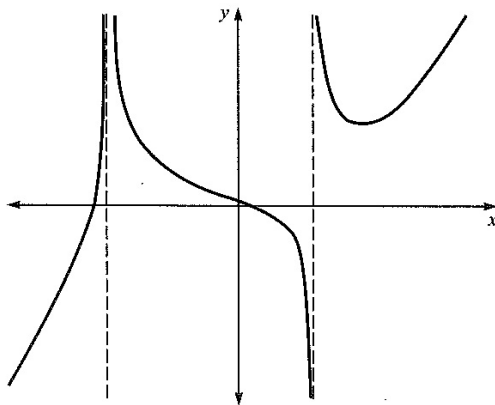
 A. 2.5

 B. 5

 C. 9

 D. 16.5

 E. 25

56. The graph of the function $f(x) = \dfrac{x^3 - 4}{x^2 + 3x - 10}$ is shown in the standard (x, y) coordinate plane below. Which of the following, if any, is a list of each of the *vertical* asymptotes of $f(x)$?

 F. $x = 0$

 G. $x = -5$ and $x = 2$

 H. $x = -1$ and $x = 7$

 J. $y = 3x - 10$

 K. This function has no vertical asymptotes.

DO YOUR FIGURING HERE.

GO ON TO THE NEXT PAGE.

6 △ △ △ △ △ △ △ △ **6**

57. The roots of a polynomial are $-\dfrac{3}{5}$ and $\dfrac{1}{3}$. Which one of the following could be the polynomial?

    A. $y = 4(3x + 5)(3x - 1)$
    B. $y = 4(5x + 3)(3x - 1)$
    C. $y = (5x - 3)(3x + 1)$

    D. $y = \left(x + \dfrac{5}{3}\right)(3x + 1)$

    E. $y = (x + 3)(x - 1)$

DO YOUR FIGURING HERE.

58. What is the real value of a in the equation $\log_2 2 + \log_2 32 = \log_4 a$?

    F. 4,096
    G. 2,048
    H. 128
    J. 64
    K. 6

59. If $h(x) = f(x) + g(x)$, where $f(x) = 3x^2 - 5x - 11$ and $g(x) = -3x^2 + 23x - 16$, then $h(x)$ is *always* divisible by which of the following?

    A. 2
    B. 6
    C. 9
    D. 12
    E. 18

60. What is the maximum value of $2a$ for a and b satisfying the system of inequalities below?

    $$a \geq 0$$
    $$b \geq 0$$
    $$a + b \leq 8$$

    F. 1
    G. 2
    H. 8
    J. 16
    K. Cannot be determined from the given information

END OF THE MATHEMATICS TEST
STOP! IF YOU HAVE TIME LEFT OVER, CHECK YOUR WORK ON THIS SECTION ONLY.