



## 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. A line in the standard  $(x,y)$  coordinate plane passes through the points  $(-2,-6)$  and  $(5,3)$ . The slope of the line:
- A. is positive.
  - B. is zero.
  - C. is negative.
  - D. is undefined.
  - E. cannot be determined from the given information.

**DO YOUR FIGURING HERE.**

2. What is the sum of the complex numbers  $3 - 4i$  and  $5 + 3i$ ?
- F. 7
  - G. 27
  - H.  $-1 + 8i$
  - J.  $8 - i$
  - K.  $15 - 12i$

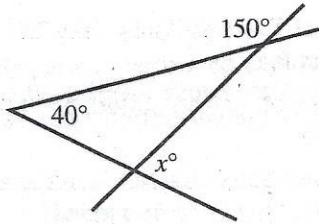
3. Last year at RT University, the ratio of the number of students accepted to the number of students applying for admission was 2 to 7. RT University accepted 630 students last year. How many students applied to RT University last year?
- A. 810
  - B. 1,260
  - C. 2,205
  - D. 2,835
  - E. 4,410



4. Three line segments intersect as shown in the figure below, forming angles with measures of  $150^\circ$ ,  $40^\circ$ , and  $x^\circ$ , respectively. What is the value of  $x$ ?

DO YOUR FIGURING HERE.

- F. 95  
G. 85  
H. 80  
J. 75  
K. 70



5. A carnival game is played using an open box with a rectangular bottom measuring 6 inches by 13 inches. A square with side lengths of 4 inches is painted on the bottom of the box. The game is played by dropping a small bead into the open box. If the bead comes to rest in the painted square, the player wins a prize. Assuming a bead dropped into the box comes to rest at a random spot on the bottom of the box, which of the following is closest to the probability that the bead comes to rest in the painted square?

- A. 0.05  
B. 0.10  
C. 0.21  
D. 0.31  
E. 0.67

6. What is the slope-intercept form of  $9x - y - 5 = 0$ ?

- F.  $y = -9x - 5$   
G.  $y = -9x + 5$   
H.  $y = 9x - 5$   
J.  $y = 9x + 5$   
K.  $y = 5x - 9$

7. The line below contains  $X$ ,  $Y$ , and  $Z$ , in that order. The ratio of the length of  $\overline{XY}$  to the length of  $\overline{YZ}$  is 5:9. If it can be determined, what is the ratio of the length of  $\overline{XY}$  to the length of  $\overline{XZ}$ ?



- A. 5:14  
B. 5:4  
C. 9:5  
D. 14:5  
E. Cannot be determined from the given information
8. The solution set of  $2x + 4 \geq -8$  is the set of all real values of  $x$  such that:
- F.  $x \geq -8$   
G.  $x \geq -6$   
H.  $x \leq -6$   
J.  $x \geq -2$   
K.  $x \leq -2$





9. Which of the following is equivalent to  $(a^3)^{21}$ ?

- A.  $63a$
- B.  $24a$
- C.  $3a^{21}$
- D.  $a^{24}$
- E.  $a^{63}$

DO YOUR FIGURING HERE.

10. If  $f(x) = 3x^2 + 7x - 8$ , then  $f(-3) = ?$

- F.  $-47$
- G.  $-2$
- H.  $2$
- J.  $40$
- K.  $52$

11. Two sides of a triangle are equal in length. The third side is 3 centimeters longer than either of the other 2 sides. Given that the perimeter of the triangle is 93 centimeters, what is the length, in centimeters, of the longest side?

- A. 29
- B. 30
- C. 31
- D. 33
- E. 34

12. The 220 graduating seniors of Madison High School will sit in the center section of the school auditorium at the graduation ceremony. How many rows of seats will be needed to seat all of the graduating seniors if the first row has 10 seats and each succeeding row has 2 more seats than the previous row?

- F. 10
- G. 11
- H. 12
- J. 15
- K. 30

13. In the standard  $(x,y)$  coordinate plane, the point  $(3,-7)$  is the midpoint of the line segment with endpoints  $(9,-11)$  and:

- A.  $(-3,-25)$
- B.  $(-3,-3)$
- C.  $(3,-2)$
- D.  $(3,3)$
- E.  $(6,-9)$



## DO YOUR FIGURING HERE.

Use the following information to answer questions 14–16.

A community theater group performed at 5 local schools. For each school, the table below shows the total number of tickets sold and the total dollar amount collected from ticket sales.

School	Number of tickets sold	Ticket sales
A	200	\$1,400
B	250	\$1,650
C	300	\$1,800
D	150	\$1,350
E	275	\$1,625

14. At School A, only 2 types of tickets were sold: premium tickets for \$10 each and value tickets for \$6 each. How many value tickets were sold at School A?
- F. 22  
G. 50  
H. 100  
J. 150  
K. 178

15. The theater group had to pay each school a facility charge. For use of its facility, School C charged the theater group 10% of the ticket sales and a fixed fee of \$200. How much money did School C charge the theater group for use of its facility?
- A. \$180  
B. \$200  
C. \$210  
D. \$218  
E. \$380

16. What is the difference between the median and the mean number of tickets sold at the 5 schools?
- F. 75  
G. 65  
H. 50  
J. 40  
K. 15

17. What is the area, in square decimeters, of a right triangle with side lengths of 10 dm, 26 dm, and 24 dm?
- A. 432  
B. 312  
C. 260  
D. 240  
E. 120



**DO YOUR FIGURING HERE.**

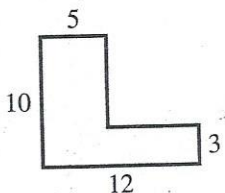
18. The mean of a list of 7 numbers is 85. The first 6 numbers on the list are 82, 93, 68, 93, 70, and 98. What is the 7th number on the list?

- F. 83
- G. 84
- H. 90
- J. 91
- K. 93

19. Which of the following is the sine of the smallest angle in a right triangle with side lengths 7, 24, and 25 inches, respectively?

- A.  $\frac{7}{25}$
- B.  $\frac{7}{24}$
- C.  $\frac{24}{25}$
- D.  $\frac{24}{7}$
- E.  $\frac{25}{7}$

20. In the figure shown below, all angles are right angles, and the side lengths given are in feet. What is the area, in square feet, of the figure?



- F. 49
- G. 71
- H. 86
- J. 105
- K. 120

21. A triangle has a perimeter of 26 cm and sides of length  $x$  cm,  $(x + 3)$  cm, and  $(x + 5)$  cm. What is the value of  $x$ ?

- A. 6
- B.  $8\frac{2}{3}$
- C. 9
- D. 11
- E. 26

22. A truck sprang a leak in its radiator, which held 480 ounces of fluid when it started to leak. Assuming the truck continues at 35 mph and its radiator leaks 4 ounces of fluid per minute, how many miles will the truck travel before the radiator is empty?

- F. 13.7
- G. 17.5
- H. 35.0
- J. 70.0
- K. 120.0

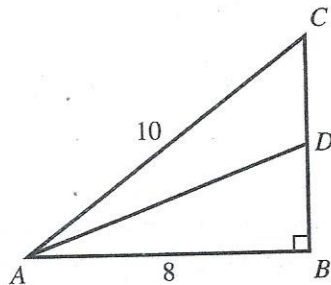


DO YOUR FIGURING HERE.

23. An ice cream shop sells ice cream cones with exactly 1 of 3 ice cream flavors in the cone. The 3 flavors are vanilla, chocolate, and strawberry. Last Saturday, the shop sold 42 cones. It sold 11 more with chocolate than with vanilla and 2 more with vanilla than with strawberry. How many cones with strawberry ice cream did the shop sell that Saturday?

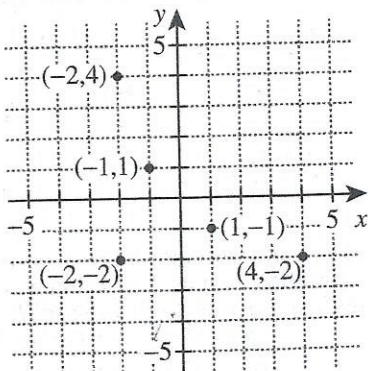
- A. 9  
B. 11  
C. 14  
D. 20  
E. 27

24. In  $\triangle ABC$  below,  $D$  is the midpoint of  $\overline{CB}$ ,  $\angle ABC$  is a right angle,  $AB = 8$  m, and  $AC = 10$  m. What is  $AD$ , in meters?



- F.  $\sqrt{41}$   
G.  $\sqrt{73}$   
H.  $\sqrt{82}$   
J.  $\sqrt{91}$   
K.  $\sqrt{105}$

25. Lyman has plotted 5 points in the standard  $(x,y)$  coordinate plane below. He then plots a new point as follows: the  $x$ -coordinate of the new point is the mean of the  $x$ -coordinates of the 5 points already plotted; the  $y$ -coordinate of the new point is the mean of the  $y$ -coordinates of the 5 points already plotted. Which of the following ordered pairs gives the coordinates of Lyman's new point?



- A.  $(-2, -2)$   
B.  $(-1, -1)$   
C.  $(0, 0)$   
D.  $(1, 1)$   
E.  $(2, 2)$



DO YOUR FIGURING HERE.

26. The 1st and 2nd terms of a certain geometric sequence are 10 and  $-5$ , respectively. What is the 5th term of the geometric sequence?

F.  $-\frac{5}{8}$

G.  $-\frac{5}{16}$

H.  $\frac{5}{8}$

J.  $\frac{5}{16}$

K.  $\frac{5}{32}$

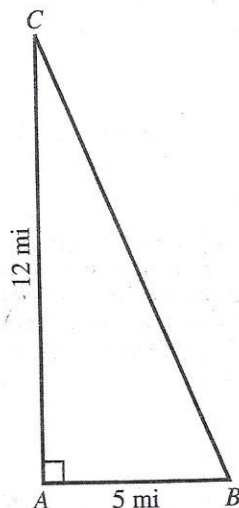
27. Alani works 8 hours per day 5 days each week at a custom embroidery shop. Each day Alani is paid either \$1.00 per shirt that she stitches or \$10.00 per hour, whichever daily amount is higher. Alani stitched the following numbers of shirts: 60 on Monday, 52 on Tuesday, 85 on Wednesday, 80 on Thursday, and 90 on Friday. What is Alani's total pay for these 5 days?

- A. \$367.00  
 B. \$400.00  
 C. \$415.00  
 D. \$457.70  
 E. \$587.20

28. Which of the following most precisely describes the roots of the equation  $5x^2 + 7x + 2 = 0$ ?

- F. 1 rational (double) root  
 G. 1 irrational (double) root  
 H. 2 rational roots  
 J. 2 irrational roots  
 K. 2 complex roots (with nonzero imaginary parts)

29. Paula is planning a course for a bike race. The course is in the shape of a right triangle, as shown below. Participants will begin at  $A$ , ride directly to  $B$ , then directly to  $C$ , and directly back to  $A$ . Paula wants to put a rest stop at the halfway point on the course. How many miles past  $B$  will the rest stop be?



- A. 3  
 B.  $6\frac{1}{2}$   
 C. 8  
 D. 10  
 E. 13





30. Adams High School has 120 students, and  $\frac{1}{3}$  of the students are taking Literature. Of the students NOT taking Literature,  $\frac{1}{4}$  are taking Composition. No students are taking both Literature and Composition. How many students are taking Composition?

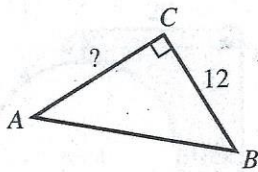
F. 10  
G. 20  
H. 30  
J. 40  
K. 80

31. For what value of  $x$  is the equation  $\sqrt{x} + \sqrt{9} = \sqrt{36}$  true?

A. 2  
B. 3  
C. 4  
D. 9  
E. 27

32. In the right triangle  $\triangle ABC$  shown below, the length of  $\overline{BC}$  is 12 feet and  $\sin A = \frac{3}{4}$ . What is the length, in feet, of  $\overline{AC}$ ?

F. 2  
G. 4  
H.  $4\sqrt{7}$   
J. 16  
K. 20



33. What integer does  $3(\log_2 16)$  equal?

A. 12  
B. 24  
C. 64  
D. 96  
E. 768

34. A bag contains several marbles. On 3 successive draws with replacement, a red marble is drawn from the bag each time. Which of the following statements *must* be true about the marbles in the bag?

F. At least 1 marble is red.  
G. Exactly 1 marble is red.  
H. Exactly 3 marbles are red.  
J. All the marbles are red.  
K. The bag contains more red marbles than marbles of other colors.

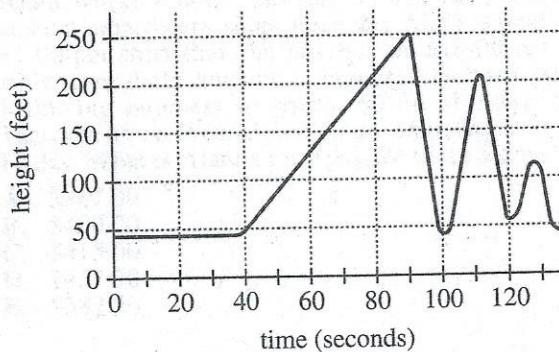
### DO YOUR FIGURING HERE.





Use the following information to answer questions 35–37.

Students and adults from Western High School visited an amusement park on a field trip. The amusement park charged \$25 for each adult ticket and \$20 for each student ticket. Before the trip, the students were given this information about the Happy Dragon roller coaster: the average speed of the roller coaster is 50 miles per hour, and 1 ride on the roller coaster track is completed in 2.25 minutes. A graph showing the height above level ground, in feet, with respect to the time into the ride, in seconds, is given below.



35. Which of the following values is closest to the total distance traveled, in miles, during 1 complete ride on the roller coaster track?
- A. 0.8  
B. 1.9  
C. 2.3  
D. 2.7  
E. 9.4
36. The roller coaster is at a height of at least 235 feet for a total of 5 seconds during each complete ride. Which of the following is closest to the percent of the time during a complete ride that the roller coaster is at a height of at least 235 feet?
- F. 1%  
G. 4%  
H. 19%  
J. 33%  
K. 45%
37. Which of the following values is closest to the average slope, in feet per second, of the graph on the interval between 40 seconds and 90 seconds?
- A.  $\frac{1}{4}$   
B.  $\frac{7}{9}$   
C.  $2\frac{1}{4}$   
D.  $2\frac{7}{9}$   
E. 4

DO YOUR FIGURING HERE.



DO YOUR FIGURING HERE.

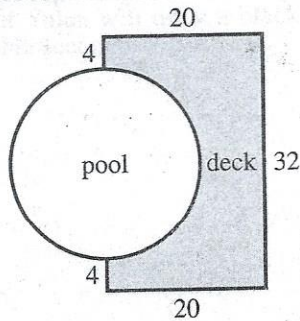
38. The value of  $x^5(0.5x^2 + 2.5x + 6)$  is between which of the following numbers when  $x = 10$ ?

F.  $5 \times 10^4$  and  $6 \times 10^4$   
 G.  $8 \times 10^4$  and  $9 \times 10^4$   
 H.  $5 \times 10^6$  and  $6 \times 10^6$   
 J.  $8 \times 10^6$  and  $9 \times 10^6$   
 K.  $1 \times 10^7$  and  $1 \times 10^8$

39. For which of the following data sets is the difference between the mean and the median the greatest?

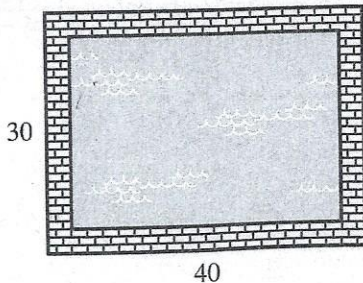
A. {10, 10, 10, 10}  
 B. {10, 10, 15, 20}  
 C. {10, 15, 15, 15}  
 D. {10, 15, 15, 100}  
 E. {10, 20, 90, 100}

40. Pablo has a deck and pool in his backyard. The deck's shape is a rectangle with a semicircle removed and is shown shaded in the figure below. The lengths of the straight sides of the deck are given in feet. Pablo plans to cover the top of the deck with stain. To decide how much stain to purchase, he needs to find the area of the top of the deck. To the nearest square foot, what is the area of the top of the deck?



F. 110  
 G. 226  
 H. 238  
 J. 332  
 K. 414

41. A 3-foot-wide brick sidewalk is laid around a rectangular swimming pool. The outside edge of the sidewalk measures 30 feet by 40 feet, as shown in the figure below. What is the perimeter, in feet, of the swimming pool?



A. 70  
 B. 116  
 C. 140  
 D. 816  
 E. 1,200





42. Given the functions  $f(x) = x^2$  and  $g(x) = \frac{1}{4-x}$ , what is  $g(f(x))$ ?

F.  $\frac{1}{4-x^2}$

G.  $\frac{1}{(4-x)^2}$

H.  $\frac{1}{16-x^2}$

J.  $\frac{x^2}{4-x}$

K.  $\frac{x^2}{4-x^2}$

43. A circle has a circumference of  $2\pi\sqrt{2}$  feet. What is the area, in square feet, of the circle?

A.  $\pi\sqrt{2}$

B.  $2\pi\sqrt{2}$

C.  $2\pi$

D.  $4\pi$

E.  $8\pi$

44. In the standard  $(x,y)$  coordinate plane, the coordinates of the  $y$ -intercept of the graph of the function  $y = f(x)$  are  $(0,-2)$ . What are the coordinates of the  $y$ -intercept of the graph of the function  $y = f(x) - 3$ ?

F.  $(0,-5)$

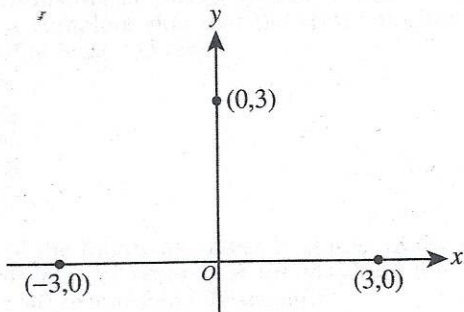
G.  $(0,-3)$

H.  $(0,-2)$

J.  $(0, 1)$

K.  $(0, 6)$

45. Which of the following is an equation of a parabola that passes through the 3 points labeled in the standard  $(x,y)$  coordinate plane below?



A.  $y = -\frac{1}{3}(x-3)(x+3)$

B.  $y = -(x-3)^2(x+3)$

C.  $y = -(x-3)(x+3)^2$

D.  $y = (x-3)^2(x+3)$

E.  $y = \frac{1}{3}(x-3)(x+3)$

DO YOUR FIGURING HERE.



DO YOUR FIGURING HERE.

46. As  $x$  continually increases in value without bound, the value of  $\frac{x}{x+3}$  most closely approaches:

F. 0  
 G.  $\frac{1}{3}$   
 H. 1  
 J. 3  
 K.  $\infty$

47. Yulan will use a bag of 30 solid-colored marbles for a game in which each player randomly draws marbles from the bag. The number of marbles of each color is shown in the table below.

Color	Number
Blue	10
Red	8
Black	6
White	4
Green	2

Yulan will randomly draw 2 marbles from the bag, one after the other, without replacing the first marble. What is the probability that Yulan will draw a black marble first and a green marble second?

- A.  $\frac{1}{75}$   
 B.  $\frac{2}{145}$   
 C.  $\frac{4}{15}$   
 D.  $\frac{39}{145}$   
 E.  $\frac{2}{5}$
48. The expression  $\frac{2b+c}{b-2c}$  is undefined whenever  $b = ?$
- F.  $-2c$   
 G.  $-\frac{1}{2}c$   
 H. 0  
 J.  $\frac{1}{2}c$   
 K.  $2c$





49. What number is halfway between  $\frac{2}{5}$  and  $\frac{8}{7}$ ?

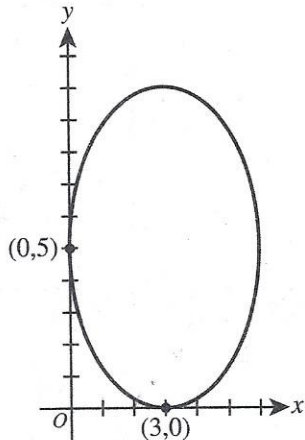
- A.  $\frac{6}{2}$
- B.  $\frac{5}{6}$
- C.  $\frac{5}{12}$
- D.  $\frac{26}{35}$
- E.  $\frac{27}{35}$

DO YOUR FIGURING HERE.

50. A function  $f(x)$  is defined as  $f(x) = 3^{x^2 - x - 2}$ . What 2 real numbers satisfy  $f(x) = 1$ ?

- F. -2 and 2
- G. -2 and 0
- H. -1 and 2
- J. -1 and 0
- K. 0 and 2

51. The ellipse shown in the standard  $(x,y)$  coordinate plane below has equation  $\frac{(x-3)^2}{9} + \frac{(y-5)^2}{25} = 1$ . Which of the following ordered pairs are the foci of the ellipse?



- A. (0,5) and (3, 5)
- B. (3,0) and (3, 9)
- C. (3,0) and (3,10)
- D. (3,1) and (3, 9)
- E. (3,5) and (6, 5)

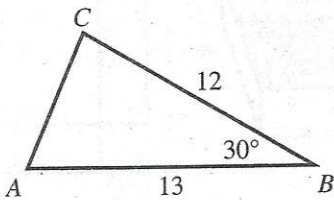


## DO YOUR FIGURING HERE.

52. A basket contains 10 solid-colored balls—2 blue, 3 red, and 5 green. Each ball has a single number printed on it. The blue balls are numbered 1 and 2 (each number is used once), the red balls are numbered 1–3 (each number is used once), and the green balls are numbered 1–5 (each number is used once). A ball will be drawn at random from the basket. What is the probability that the ball that is drawn will be red *or* have a 3 printed on it?

- F.  $\frac{1}{10}$   
 G.  $\frac{2}{10}$   
 H.  $\frac{3}{10}$   
 J.  $\frac{4}{10}$   
 K.  $\frac{5}{10}$

53. In the figure below, the given side lengths of  $\triangle ABC$  are in inches. What is the area, in square inches, of  $\triangle ABC$ ?



- A. 30  
 B. 39  
 C.  $39\sqrt{3}$   
 D. 60  
 E. 78

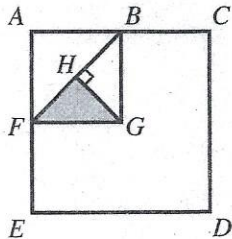
54. There are 66 calories in 15 grams of grated Parmesan cheese, and 59% of those calories are from fat. When measuring Parmesan cheese, 5 grams is equal to 1 tablespoon. Which of the following is closest to the number of calories from fat per tablespoon of grated Parmesan cheese?

- F. 3  
 G. 8  
 H. 9  
 J. 13  
 K. 22





55. In the diagram below,  $B$ ,  $F$ , and  $H$  are on  $\overline{AC}$ ,  $\overline{AE}$ , and  $\overline{BF}$ , respectively, and  $\overline{GH} \perp \overline{BF}$ . The area of square  $ABGF$  is  $\frac{1}{4}$  the area of square  $ACDE$ . What percent of the area of  $ACDE$  does the shaded portion represent?



- A. 0.0625%  
 B. 0.125%  
 C. 0.25%  
 D. 6.25%  
 E. 12.5%
56. In a data set of 10 distinct values, the single largest value is replaced with a much greater value to form a new data set. Which of the following statements is true about the values of the mean and median for the new data set as compared to the mean and median of the original data set?
- F. The mean will increase; the median will stay the same.  
 G. The mean will stay the same; the median will increase.  
 H. The mean and median will both stay the same.  
 J. The mean and median will both increase.  
 K. Using the given information, the means and medians of the 2 data sets cannot be compared.

57. Valley High School and Mountain High School have decided that selected students will attend a daytime theatrical performance that costs \$5 for each teacher and \$3 for each student. One teacher and 10 students from Valley High will attend, and 2 teachers and 25 students from Mountain High will attend. Which of the following matrix products represents the ticket costs, in dollars, for each high school?

- A.  $[5 \ 3] \begin{bmatrix} 1 & 2 \\ 10 & 25 \end{bmatrix}$   
 B.  $[5 \ 3] \begin{bmatrix} 1 & 10 \\ 25 & 2 \end{bmatrix}$   
 C.  $[5 \ 3] \begin{bmatrix} 1 & 25 \\ 2 & 10 \end{bmatrix}$   
 D.  $\begin{bmatrix} 5 \\ 3 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 10 & 25 \end{bmatrix}$   
 E.  $\begin{bmatrix} 5 \\ 3 \end{bmatrix} \begin{bmatrix} 1 & 10 \\ 2 & 25 \end{bmatrix}$

DO YOUR FIGURING HERE.



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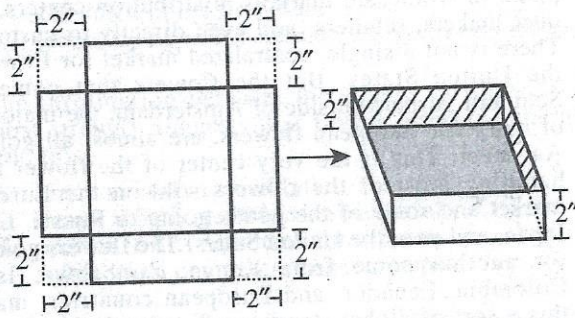
58. Karie is inventing a new notation in math. She has decided to use  $n\downarrow$  to denote the sum of the first  $n$  positive integers. For example,  $5\downarrow$  means  $5 + 4 + 3 + 2 + 1$ . Karie has written 3 statements that she is investigating as possible properties of  $n\downarrow$ .

- I.  $n\downarrow + (n + 1) = (n + 1)\downarrow$
- II.  $n\downarrow + n\downarrow = (2n)\downarrow$
- III.  $(n^2)\downarrow = (n\downarrow)^2$

Which of these statements, if any, is(are) true for all positive integers  $n$ ?

- F. I only
- G. II only
- H. III only
- J. I, II, and III
- K. None

59. Rey wants to make an open box as shown below, using a square piece of cardboard. He intends to cut a 2-inch square from each corner of the cardboard and fold the cardboard along the lines shown to form the sides. The resulting box will have a volume of 72 cubic inches. What are the dimensions, in inches, of the original piece of cardboard?



- A.  $6 \times 6$
- B.  $7 \times 7$
- C.  $8 \times 8$
- D.  $9 \times 9$
- E.  $10 \times 10$

60. Which of the following quadratic equations has the complex number  $(1 + \sqrt{-1})$  as a solution?

- F.  $x^2 + 1 = 0$
- G.  $x^2 + x + 1 = 0$
- H.  $x^2 - x + 1 = 0$
- J.  $x^2 + 2x - 2 = 0$
- K.  $x^2 - 2x + 2 = 0$

**END OF TEST 2**

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

**DO NOT RETURN TO THE PREVIOUS TEST.**