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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. Given $3x - 7 = 5x - 13$ is true, $x = ?$

   A. -10

   B. -3

   C. $-\frac{5}{2}$

   D. $\frac{5}{2}$

   E. 3

2. Aleka earns her regular pay of $14 per hour for up to 40 hours of work per week. For each hour over 40 hours of work per week, Aleka earns $1\frac{1}{2}$ times her regular pay. How much does Aleka earn in a week in which she works 48 hours?

   F. $ 576
   G. $ 672
   H. $ 728
   J. $ 744
   K. $1,008

3. A water tank that initially contained 200 gallons of water is leaking water at a constant rate of 4 gallons per minute. For the amount of time the tank has water, which of the following function models gives the number of gallons, G, in the tank t minutes after the leak started?

   A. $G(t) = 196 - t$

   B. $G(t) = 200 - 4t$

   C. $G(t) = 200t - 4$

   D. $G(t) = 200t - 4t^2$

   E. $G(t) = 200\left(\frac{3}{4}\right)^t$

DO YOUR FIGURING HERE.

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

4. Which of the following expressions is equivalent to $(x^5y^3z^2)(x^4y^3z^6)$ for all real values of x, y, and z ?

F. $x^9y^6z^8$
G. $x^9y^9z^8$
H. $x^{20}y^6z^8$
J. $x^{20}y^9z^{12}$
K. $x^{21}y^6z^{12}$

5. The 1st term in the geometric sequence below is -12. If it can be determined, what is the 6th term?

$$-12, 24, -48, 96, -192, \cdots$$

A. -384
B. -288
C. 288
D. 384
E. Cannot be determined from the given information

6. How many *minutes* would it take a car to travel 120 miles at a constant speed of 50 miles per hour?

(Note: There are 60 minutes in 1 hour.)

F. 25
G. 42
H. 70
J. 100
K. 144

7. Patrick and Ayako are painting a room in the city hall. They started with 6 gallons of paint. On the first day, Patrick used $\frac{1}{2}$ gallon of paint and Ayako used $1\frac{3}{4}$ gallons of paint. How many gallons of paint were left when they completed their first day of painting?

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

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

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

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

E. $5\frac{1}{2}$

8. The length of the hypotenuse of a certain right triangle is 50 inches, and the length of one of its legs is 40 inches. What is the length, in inches, of the other leg of the triangle?

F. 10
G. 30
H. 45
J. 64
K. 90

ACT-B04

15

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

9. Of the 450 parking spaces in a parking lot, 8% of the spaces are reserved for handicapped parking. Of those parking spaces NOT reserved for handicapped parking, 18 are suitable for compact cars only. How many spaces that are NOT reserved for handicapped parking are suitable for noncompact cars?

 A. 432
 B. 424
 C. 414
 D. 396
 E. 369

10. A gardener is planting 7 rows of trees in a triangular plot. The first row contains 1 tree. Each successive row contains 2 more trees than the previous row. How many trees will the gardener plant in the triangular plot?

 F. 14
 G. 15
 H. 48
 J. 49
 K. 64

11. Let $a = 3$, $b = 5$, and $c = 8$. What is $\frac{a}{b^2} + \frac{c}{2}$?

 A. $\frac{43}{10}$

 B. $\frac{7}{25}$

 C. $\frac{103}{25}$

 D. $\frac{109}{25}$

 E. $\frac{11}{27}$

12. What is the least common denominator of the fractions $\frac{4}{21}$, $\frac{1}{12}$, and $\frac{3}{8}$?

 F. 56
 G. 168
 H. 252
 J. 672
 K. 2,016

13. The relationship between the sum of the measures of the interior angles of a polygon, S, and the number of sides of the polygon, n, is given by the equation $S = 180(n - 2)$. The sum of the interior angle measures of a certain polygon is 1,440°. How many sides does this polygon have?

 A. 6
 B. 8
 C. 10
 D. 12
 E. 16

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

14. In the figure shown below, $\overline{CG} \cong \overline{AE}$, and rectangle $ABCD$ has a length of 6 inches and a width of 4 inches. The area of rectangle $EFGD$ is 2 times the area of rectangle $ABCD$. What is the length, in inches, of $\overline{CG}$?
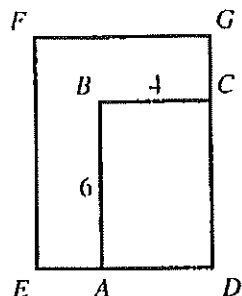
F. 2
G. 2.4
H. 3.5
J. 4
K. 4.8

15. Point A is located at $(3,8)$ in the standard (x,y) coordinate plane. What are the coordinates of A', the image of A after it is reflected across the y-axis?

A. $(\ 3,-8)$
B. $(-3,-8)$
C. $(-3,\ 8)$
D. $(\ 8,\ 3)$
E. $(-8,\ 3)$

16. What is the sum of the 2 solutions of the equation $x^2 + 3x - 54 = 0$?

F. -54
G. -9
H. -3
J. 0
K. 6

17. The area of a certain square is 36 square inches. What is the perimeter of this square, in inches?

A. 6
B. 9
C. 12
D. 18
E. 24

18. $\dfrac{1}{4} \cdot \dfrac{2}{5} \cdot \dfrac{3}{6} \cdot \dfrac{4}{7} \cdot \dfrac{5}{8} \cdot \dfrac{6}{9} \cdot \dfrac{7}{n} = ?$

F. 1

G. $\dfrac{1}{n}$
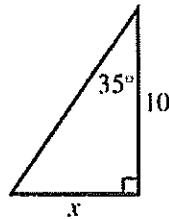
H. $\dfrac{1}{12n}$

J. $\dfrac{2}{9n}$

K. $\dfrac{6}{17n}$

17

GO ON TO THE NEXT PAGE.

19. What is 3% of 5.13×10^5 ?

A.   15,390
B.   17,100
C.   171,000
D.   153,900
E.   1,539,000

**20.** The triangle below has side lengths given in meters.

Which of the following expressions is equal to x ?

F. $\sin 35^\circ$

G. $\cos 35^\circ$

H. $\frac{1}{10} \sin 35^\circ$

J. $\frac{1}{10} \cos 35^\circ$

K. $10 \tan 35^\circ$

21. Mr. Evans is going to buy new markers for his students to use for a project. He will buy n packs of markers, and each pack will contain 40 markers. He will distribute the markers so that each of his 24 students will have the same number of markers with none left over. Which of the following integers could NOT be the value of n ?

A.   3
B.   8
C.   12
D.   15
E.   24

22. Points A, B, D, and E lie on the circle shown below. Secants $\overleftrightarrow{AC}$ and $\overleftrightarrow{CE}$ intersect at C. The chords $\overline{AB}$ and $\overline{DE}$ are congruent. Minor arc $\overarc{AE}$ measures 106°. Minor arc $\overarc{BD}$ measures 64°. What is the measure of minor arc $\overarc{DE}$?

F. 42°
G. 84°
H. 85°
J. 90°
K. 95°
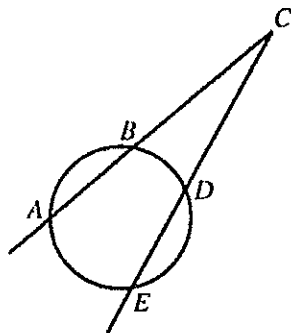
DO YOUR FIGURING HERE.

23. Jayla plotted the data from her science project as a scatterplot in the standard (*x,y*) coordinate plane. She found the line containing 2 of the points to be $y = 0.28x + 6$. The scatterplot and the line are shown below.
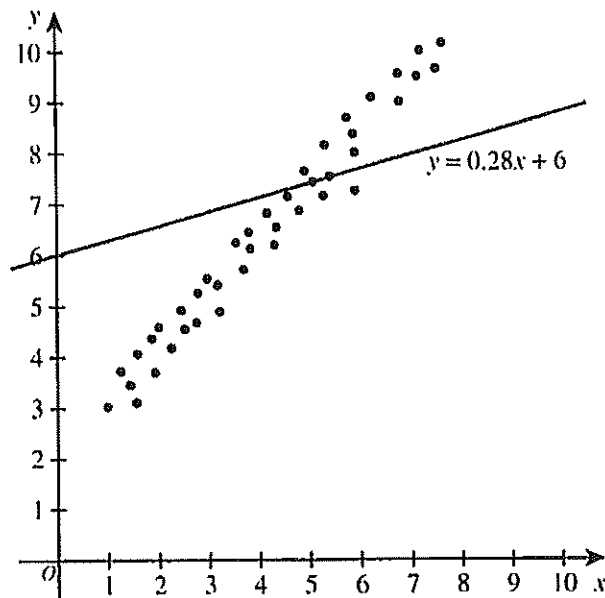
Jayla decided that this line was not a good fit for her data. To transform her line into the regression line for her data, Jayla *must*:

A. increase both the slope and the *y*-intercept.
B. increase the slope and decrease the *y*-intercept.
C. decrease both the slope and the *y*-intercept.
D. decrease the slope and increase the *y*-intercept.
E. use either a horizontal or vertical line.

24. The probability that Event A will occur is 0.2. The probability that Event B will occur is 0.6. Given that Events A and B are mutually exclusive, what is the probability that Event A *or* Event B will occur?

F. 0.12
G. 0.2
H. 0.3
J. 0.4
K. 0.8

25. Given that $\sin A = \frac{15}{17}$ and that $0 < A < \frac{\pi}{2}$, then what is the value of $\cos A$?

A. $-\frac{17}{15}$

B. $-\frac{8}{17}$

C. $\frac{8}{17}$

D. $\frac{17}{15}$

E. $\frac{17}{8}$

GO ON TO THE NEXT PAGE.

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DO YOUR FIGURING HERE.

Use the following information to answer questions 26–29.

Widely considered one of the greatest film directors, Alfred Hitchcock directed over 60 films. The table below gives some information about Hitchcock's last 12 films.

Title	Year of release	Length (minutes)
The Trouble with Harry	1955	99
The Man Who Knew Too Much	1956	120
The Wrong Man	1956	105
Vertigo	1958	128
North by Northwest	1959	136
Psycho	1960	109
The Birds	1963	119
Marnie	1964	130
Torn Curtain	1966	128
Topaz	1969	143
Frenzy	1972	?
Family Plot	1976	?

26. What is the median of the given lengths, in minutes, of the 10 Hitchcock films released before 1972 ?

   F. 120.0
   G. 121.7
   H. 122.5
   J. 124.0
   K. 128.0

27. Hector owns all 12 films listed. He will randomly select 1 of them to view this weekend. What is the probability that he will choose a film that has only 1 word in its title, given that the film he chooses will have a release date after 1965 ?

   A. $\frac{2}{4}$

   B. $\frac{2}{5}$

   C. $\frac{4}{5}$

   D. $\frac{2}{12}$

   E. $\frac{7}{12}$

28. Recently, a director made a new version of *Vertigo*. The new version is 20% shorter in length than Hitchcock's version. Which of the following values is closest to the length, in minutes, of the new version?

   F. 64
   G. 102
   H. 105
   J. 108
   K. 125

ACT B04

20

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

29. At a Hitchcock film festival, Lelei watched *Topaz* and *Frenzy* once each and *Family Plot* twice, for a total of 501 minutes. *Family Plot* is 5 minutes longer than *Frenzy*. What is the sum of the lengths, in minutes, of *Frenzy* and *Family Plot* ?

A. 237
B. 243
C. 244
D. 286
E. 358

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30. Matrices A and B are given below.

$$A = \begin{bmatrix} 3 & -5 \\ -2 & 9 \end{bmatrix} \qquad B = \begin{bmatrix} -7 & 6 \\ 4 & 5 \end{bmatrix}$$

Which of the following matrices is $A - B$?

F. $\begin{bmatrix} -10 & 11 \\ 6 & -4 \end{bmatrix}$

G. $\begin{bmatrix} -4 & 2 \\ 1 & 14 \end{bmatrix}$

H. $\begin{bmatrix} -4 & 1 \\ 2 & 14 \end{bmatrix}$

J. $\begin{bmatrix} 10 & -6 \\ -11 & 4 \end{bmatrix}$

K. $\begin{bmatrix} 10 & -11 \\ -6 & 4 \end{bmatrix}$

31. In 2001, the U.S. Mint in Philadelphia produced 10,334,590,000 1-cent pieces, commonly called pennies. These pennies were then bagged, with $50 in pennies per bag. This process resulted in how many bags of pennies?

A. 2,066,918
B. 206,691,800
C. 5,167,295,000
D. 20,669,180,000
E. 51,672,950,000,000

32. Given that the equation $\frac{3x - y}{x + y} = \frac{4}{7}$ is true, what is the value of $\frac{x}{y}$?

F. $\frac{2}{17}$
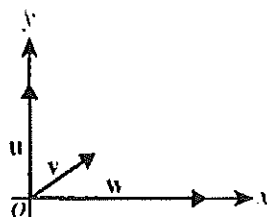
G. $\frac{4}{7}$

H. $\frac{11}{17}$

J. $\frac{11}{4}$

K. $\frac{11}{5}$

ACT-B04

21

GO ON TO THE NEXT PAGE.

33. The vectors **u**, **v**, and **w** are represented in the standard (x,y) coordinate plane below.

In what general direction will the vector **u** − **v** + **w** point?

A. Up and to the right
B. Up and to the left
C. Down and to the right
D. Down and to the left
E. To the right but neither up nor down

34. Shown below, a board 11 feet 4 inches long is cut into 2 equal parts. What is the length, to the nearest inch, of each part?
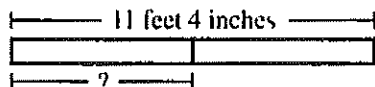
F. 5 feet 5 inches
G. 5 feet 7 inches
H. 5 feet 8 inches
J. 6 feet 5 inches
K. 6 feet 6 inches

35. Which of the following are linear factors of $krx^2 + (kn + rm)x + mn$, a general quadratic expression in x ?

A. $(kx - m)$ and $(rx - n)$
B. $(kx - m)$ and $(rx + n)$
C. $(kx + m)$ and $(rx - n)$
D. $(kx + m)$ and $(rx + n)$
E. $(kn - n)$ and $(rx - m)$

36. Which of the following numbers has the greatest value?

F. $\dfrac{15}{101}$

G. $\dfrac{150}{999}$

H. 0.15

J. $0.\overline{15}$

K. $0.\overline{151}$

DO YOUR FIGURING HERE.

37. Diane traveled to 3 locations during a workday. Diane remained at each location a whole number of hours. The graph below shows the relationship between time, in hours, into her workday and total distance, in miles, traveled. Which of the following values is closest to Diane's average speed, in miles per hour, for the parts of the workday when she was traveling?
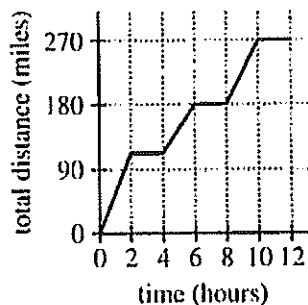
A. 27
B. 34
C. 36
D. 45
E. 56

38. Let $f(x) = x^2 + 2$ and $g(x) = x + 3$. For all values of x, which of the following expressions gives $f(g(x))$?

F. $x^2 + 11$
G. $x^2 + x + 5$
H. $x^2 + 6x + 11$
J. $x^3 + 6$
K. $x^3 + 3x^2 + 2x + 6$

39. In $\triangle ABC$ below, the measure of $\angle ABD$ is $70°$, the measure of $\angle ACB$ is $32°$, D is on $\overline{BC}$, and $\overline{AD}$ is a bisector of $\angle BAC$. What is the measure of $\angle ADB$?
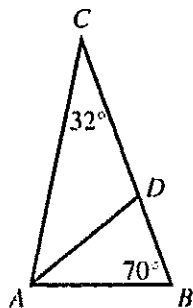
A. $64°$
B. $70°$
C. $71°$
D. $78°$
E. $102°$

40. Given the function below, what is $f(4)$?

$$f(x) = \begin{cases} 2x + 1; & x < 4 \\ -\frac{1}{2}x - 3; & x \geq 4 \end{cases}$$

F. -5
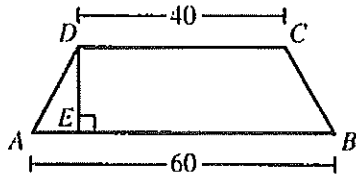G. $\frac{1}{2}$
H. 4
J. 9
K. 14

41. The base lengths of isosceles trapezoid $ABCD$ shown below are in centimeters, and E is on $\overline{AB}$. What is the ratio of the area of $ABCD$ to the area of $\triangle AED$?
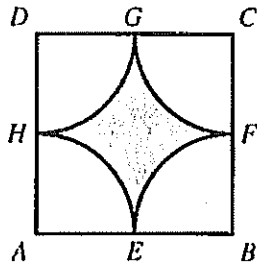
A. 2:1
B. 4:1
C. 5:1
D. 10:1
E. 20:1

42. What real value of x satisfies the equation $\log_5(25^2) = 2x$?

F. 2
G. 4
H. 8
J. 25
K. 125

43. In the figure below, points E, F, G, and H are on the sides of square $ABCD$. Arc $\overset{\frown}{EH}$ has center at A, $\overset{\frown}{EF}$ at B, $\overset{\frown}{FG}$ at C, and $\overset{\frown}{GH}$ at D. All of the arcs have a radius of 3 feet. What is the area, in square feet, of the shaded region?

A. $24 - 6\pi$

B. $24 - 9\pi$

C. $36 - \frac{9}{2}\pi$

D. $36 - 3\pi$

E. $36 - 9\pi$

44. For all real values of x such that $0 < x < \frac{\pi}{2}$, which of the following expressions is NOT equivalent to $\tan x$?
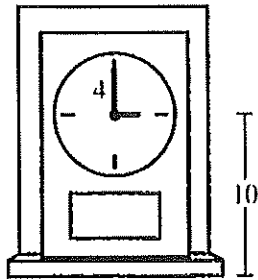
F. $\dfrac{1}{\cot x}$

G. $\dfrac{\sec x}{\csc x}$

H. $\dfrac{\sin x}{\cos x}$

J. $(\cos x)(\csc x)$

K. $(\sin x)(\sec x)$

45. A shirt has a sale price of $30.40, which is 20% off the original price. How much less than the original price is the sale price?

A. $ 0.38
B. $ 1.52
C. $ 6.08
D. $ 7.60
E. $10.40

46. The clock shown below has a minute hand that is 4 inches long, and the center of the clock face is 10 inches above the bottom surface of the clock.

Let x be the time in minutes after the clock strikes 3:00. Let y be the height in inches that the end of the minute hand is above the bottom surface of the clock. One of the following graphs in the standard (x,y) coordinate plane shows the height, y, as a function of time, x. Which graph shows this relationship?

F.

J.

G.

K.

H.
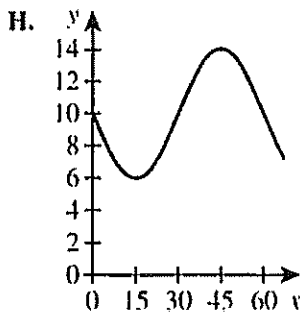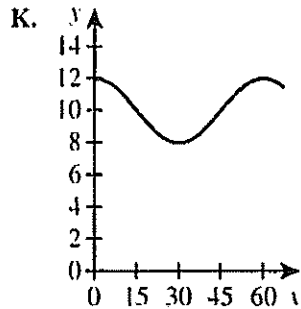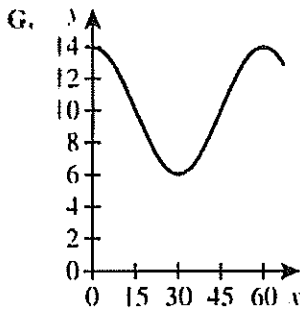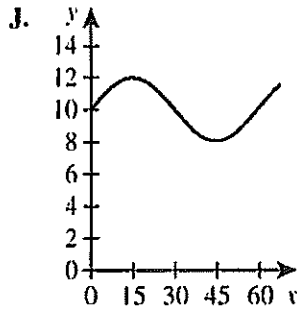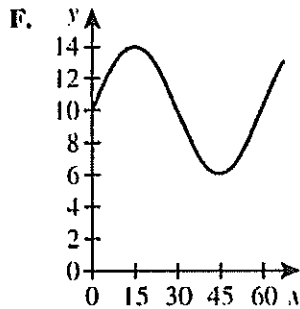
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DO YOUR FIGURING HERE.

Use the following information to answer questions 47–49.

A *regular icosahedron* is a solid that has 20 congruent faces, each of which is an equilateral triangle. Each vertex is shared by 5 faces, and each edge is shared by 2 faces.

A specialty die used in a certain board game is in the shape of a regular icosahedron with a certain number of dots on each of the 20 faces. In the image below, 10 faces of the die are visible.
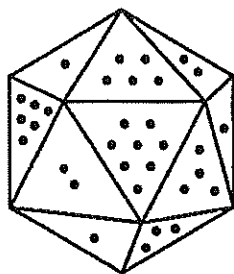
The table below lists the total number of faces on this die that have the given number of dots.

Number of dots	Number of faces
1	6
2	4
3	3
4	2
5	1
6	1
7	1
8	1
9	1

47. How many *edges* does the specialty die have?

A. 10
B. 18
C. 20
D. 30
E. 36

48. What is the area, in square centimeters, of 1 face of the specialty die, given that the length of each of its edges is 2 centimeters?

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

G. $\sqrt{3}$

H. 2

J. $2\sqrt{3}$

K. 4

ACT-B04

26

GO ON TO THE NEXT PAG

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49. When the specialty die is rolled, only 1 face will land on top. Each of its faces has the same probability of landing on top. Which of the following values is closest to the probability that the face that lands on top will have 3 dots?

A. 0.05
B. 0.14
C. 0.15
D. 0.18
E. 0.45

50. Tom is in Ms. Zhu's class. To choose 4 students from her class of 24 students to answer questions, Ms. Zhu will put 24 cards, each with the name of a different student from her class on it, in a box. Next, Ms. Zhu will randomly draw 4 cards from the box without replacing any of the cards. What is the probability that Tom's card will NOT be drawn?

F. $\frac{1}{24}$

G. $\frac{1}{6}$

H. $\frac{19}{24}$

J. $\frac{5}{6}$

K. $\frac{23}{24}$

51. There are 2 sections of Algebra I taught at the local high school. The average score on the final exam for the 20 students in the first section was 74. The average score on the final exam for the 25 students in the second section was 92. What was the average of the final exam scores of students in Algebra I ?

A. 74
B. 78
C. 83
D. 84
E. 92

52. The table below gives some statistics based on the points Veronica earned on each of her first 3 math exams.

Statistic	Points
Median	80
Range	11
Maximum	90

If it can be determined, what is the mean number of points Veronica earned on her first 3 math exams?

F. 79
G. 80
H. 83
J. 85
K. Cannot be determined from the given information

53. A club has 30 members. The positions of president, vice president, and treasurer will be assigned to 3 distinct members. Which of the following expressions gives the maximum number of distinct assignments that can be made?

A. 30^3

B. $30(3)$

C. $30(29)(28)$

D. $30(29)(28)(3)(2)(1)$

E. $\dfrac{30(29)(28)}{3(2)(1)}$

54. Jane and Margaret moved to Newcity at the same time several years ago and have lived there ever since. Jane has lived there $\frac{1}{2}$ of her life, while Margaret has lived there $\frac{3}{5}$ of her life. If j represents Jane's present age, which of the following expressions represents Margaret's present age?

F. $\dfrac{3j}{10}$

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

H. $\dfrac{5j}{6}$

J. $\dfrac{6j}{5}$

K. $2j$

55. When 7^{126} is multiplied out, what is the digit in the ones place?

A. 1
B. 2
C. 3
D. 7
E. 9

56. Shown below is quadrilateral $ABCD$ inscribed in an ellipse. The figure will be placed in the standard (x,y) coordinate plane, and the ellipse will be described by the equation $\dfrac{x^2}{9} + \dfrac{(y-5)^2}{16} = 1$. Given that $\overline{AC}$ is the minor axis and $\overline{BD}$ is the major axis of the ellipse, what will be the coordinates of points A and B ?

	point A	point B
F.	(−9,0)	(0,16)
G.	(−9,5)	(0,21)
H.	(−3,0)	(0, 4)
J.	(−3,5)	(0, 9)
K.	(−3,5)	(4, 5)
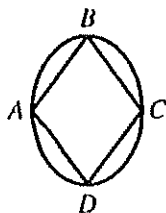
57. There are 90 equally spaced dots marked on a circle. Shannon chooses an integer, n. Beginning at a randomly chosen dot, Shannon goes around the circle clockwise and colors in every nth dot. He continues going around and around the circle coloring in every nth dot, counting each dot whether it is colored in or not, until he has colored in every dot. Which of the following could have been Shannon's integer n ?

A. 3
B. 4
C. 5
D. 6
E. 7

58. There are 100 file folders, each 0.45 inches thick, that will be placed in drawers. Each drawer can hold file folders with a combined thickness of no more than 7.5 inches. No folder is split between 2 drawers. All but one drawer will hold the maximum number of folders. What is the combined thickness, in inches, of the folders that are in the partially filled drawer?

F. 1.8
G. 2.0
H. 2.7
J. 4.0
K. 6.0

59. Which of the following expressions is equivalent to the sum $\dfrac{3}{x^2-9} + \dfrac{6}{x^2+3x-18}$?

A. $\dfrac{3x+12}{(x-1)(x+1)(x+2)}$

B. $\dfrac{9}{(x-3)(x+3)(x+6)}$

C. $\dfrac{9}{2x^2+3x-27}$

D. $\dfrac{9x}{(x-3)^2(x+6)}$

E. $\dfrac{9x+36}{(x-3)(x+3)(x+6)}$

60. For all positive x and y, $x^{\frac{1}{3}}y^{\frac{3}{4}}$ can be written in which of the following radical forms?

F. $\sqrt[12]{xy^5}$

G. $\sqrt[12]{x^4y^3}$

H. $\sqrt[12]{x^5y^5}$

J. $y\sqrt[12]{x^4y^3}$

K. $xy\sqrt[12]{x^3y^7}$

DO YOUR FIGURING HERE.

END OF TEST 2

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

DO NOT RETURN TO THE PREVIOUS TEST.