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. Xuan sold 9 used books for \$9.80 each. With the money from these sales, she bought 4 new books and had \$37.80 left over. What was the average amount Xuan paid for each new book?
 - **A.** \$ 5.60 **B.** \$ 9.45

 - C. \$10.08
 - **D.** \$12.60
 - E. \$22.05

DO YOUR FIGURING HERE.

- 2. A point at (-5,7) in the standard (x,y) coordinate plane is translated right 7 coordinate units and down 5 coordinate units. What are the coordinates of the point after the translation?
 - (-12,12)
 - 0, 0)
 - (2, 2)
 - 2,12)
 - (12,12)
- 3. Shantiel left her home at 9:00 a.m. on Tuesday and traveled 648 miles. When she arrived at her destination it was 3:00 a.m. the next day. Given that her home and her destination are in the same time zone, which of the following is closest to her average speed, in miles per hour, for this trip?
 - **A.** 72
 - **B.** 54
 - C. 36
 - **D.** 31
 - 18

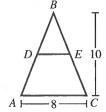
- 4. The text message component of each of Juan's monthly phone bills consists of \$10.00 for the first 300 text messages sent that month, plus \$0.10 for each additional text message sent that month. On Juan's most recent phone bill he was charged a total of \$16.50 for text messages. For how many text messages in total was Juan charged on this bill?
 - F. 235
 - G. 285 H. 315

 - J. 365 K. 465
- 5. Which of the following matrices is equal to

$$\begin{bmatrix} 9 & 8 \\ -4 & 7 \end{bmatrix} + \begin{bmatrix} -6 & 6 \\ 5 & 4 \end{bmatrix}$$

- **6.** A function, f, is defined by $f(x,y) = 3x^2 4y$. What is the value of f(4,3)?
 - F. 11
 - G. 24
 - H. 36
 - 65 132
- 7. A certain group consists of 5 children, 3 of whom are age 10 and 2 of whom are age 5. What is the mean age of the children in the group?
 - A. В.
 - C. 7.5
 - D. 8
 - 10
- **8.** In the figure shown below, $\overline{AC} \parallel \overline{DE}$; BD = AD; D and Eare on \overline{AB} and \overline{BC} , respectively; AC = 8 feet; and the height of $\triangle ABC$ is 10 feet. What is DE, in feet?



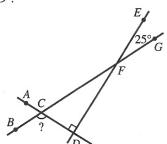


- 9. In a poll of 500 registered voters, 337 voters favored a proposal to increase funding for local schools. Suppose the poll is indicative of how the 22,000 registered voters will vote on the proposal. Which of the following values is closest to how many of the 22,000 registered voters will be expected to vote in favor of the proposal?
 - **A.** 13,200
 - **B.** 14,830

 - C. 21,840 D. 22,000
 - E. 32,640
- 10. Diego purchased a car that had a purchase price of \$13,400, which included all other costs and tax. He paid \$400 as a down payment and got a loan for the rest of the purchase price. Diego paid off the loan by making 48 payments of \$300 each. The total of all his payments, including the down payment, was how much more than the car's purchase price?

 - **G.** \$ 1,400 **H.** \$13,000
 - \$14,400
 - **K.** \$14,800
- 11. In the standard (x,y) coordinate plane, what is the slope of the line 4x + 7y = 9?

 - C.
 - D. 4
 - E.
- 12. In the figure below, \overrightarrow{AD} intersects \overrightarrow{BG} at C and is perpendicular to \overrightarrow{DE} . Line \overrightarrow{DE} intersects \overrightarrow{BG} at F. Given that the measure of $\angle EFG$ is 25°, what is the measure of $\angle BCD$?



65° 115° H. 120° **J.** 130° K. 155°

- 13. What is the sum of the 2 solutions of the equation $x^2 + x - 30 = 0$?
- DO YOUR FIGURING HERE.

- -30
- -6
- B. C. D. E. 0
- 14. The volume of a sphere is $\frac{4\pi r^3}{3}$, where r is the radius of the sphere. What is the volume, in cubic yards, of a sphere with a diameter of 4 yards?

 - 32π
 - J. 48π
- 15. What is the smallest integer greater than $\sqrt{85}$?
 - A.
 - B. 9
 - C. 10
 - **D.** 12
 - E. 43
- 16. The 3 statements below are true for the elements of sets A, B, C, and D.
 - I. All elements of A are elements of B.
 - II. All elements of C are elements of D.
 - III. No elements of D are elements of B.

Which of the following statements must be true?

- All elements of A are elements of C.
- G. All elements of B are elements of D.
- All elements of C are elements of B.
- No elements of A are elements of B.
- No elements of A are elements of C.
- 17. In the standard (x,y) coordinate plane, the midpoint of \overline{AB} is at (2,1), and A is at (8,10). What is the x-coordinate of B?

 - **B.** -6
 - C. -8 D. 3 E. 5

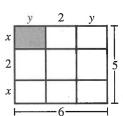
18. Lena will pick 1 card at random from a pack of 25 baseball cards. Each card features the fielding position for 1 of 25 different baseball players. Each player in the pack has only 1 fielding position. The table below lists the frequency of fielding positions in the pack. What is the probability that the card Lena picks will feature an outfielder or a pitcher?

-		
	Fielding position	Frequency
	Catcher Infielder Pitcher Outfielder	4 6 8 7

- 9% **G.** 28%
- H. 32% 56%
- 60%
- 19. According to a soil analysis, a certain lawn requires an application of 40.0 kg of nitrogen phosphate when the average temperature is 75.0°F. To avoid burning the grass, the required application amount decreases 1.2 kg for each 1.0°F that the average temperature is above 75.0°F. To the nearest 0.1 kg, what is the required application amount of nitrogen phosphate when the average temperature is 83.0°F?

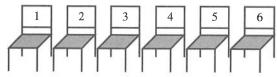
 - **B.** 30.8 C. 33.3
 - D. 38.4
 - E. 38.8
- 20. In the figure below, all segments that meet do so at right angles. What is the area, in square units, of the shaded region?
 - **F.** $2\frac{1}{4}$
 - **G.** 3
 - **H.** $3\frac{1}{3}$

 - **K.** 7



- 21. The perimeter of a certain scalene triangle is 100 inches. The side lengths of the triangle are represented by 5x, 3x + 30, and 2x + 10, respectively. What is the length, in inches, of the longest side of the triangle?
 - **B.** 22
 - **C.** 30
 - D. 48

22. The mayor of Westbrook is deciding how to assign the 6 council members to the row of seats below.



From how many different arrangements can she choose?

- F. G. 36 H. 64 720 **K.** 6,000,000
- 23. The sum of 2 and 200% of 1 has the same value as which of the following calculations?
 - **A.** 100% of 2 150% of 2
 - C. 300% of 2
 - **D.** 300% of 1
 - E. 400% of 1
- **24.** The graph in the standard (x,y) coordinate plane below is represented by one of the following equations. Which equation?

(0,2)

(3,0)

F.
$$y = -\frac{3}{2}x + 2$$

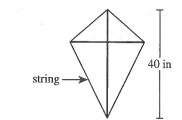
G.
$$y = -\frac{3}{2}x + 3$$

H.
$$y = -\frac{2}{3}x + 2$$

J.
$$y = -\frac{2}{3}x + 3$$

K.
$$y = \frac{2}{3}x + 2$$

25. Kamini is constructing the kite shown below. The kite includes 2 perpendicular supports, one of length 40 inches and the other of length 28 inches. The ends of the supports are connected with string to form a 4-sided figure that is symmetric with respect to the longer support. A layer of paper will cover the interior of the 4-sided figure. Which of the following is closest to the area, in square inches, that Kamini will cover



28 in -



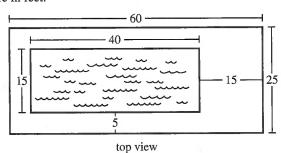
with paper?

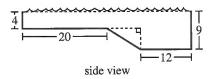
980



Use the following information to answer questions 26-29.

The top view and side view of a 40-foot-long swimming pool are shown in the figure below. All dimensions given are in feet.





The top view shows the top rectangular surface of the pool and the surrounding rectangular patio. All 4 walls of the pool are vertical and perpendicular to the top surface. The side view shows a cross section along the length of the pool. All cross sections parallel to the side view are congruent. The shallow end has a constant depth of 4 ft. The deep end has a constant depth of 9 ft. A rectangular surface connects the shallow and deep ends.

- 26. What is the area, in square feet, of the patio surrounding the pool?
 - F. 500
 - G. 600
 - 900 H.
 - 1,100 1,350
- 27. Johann put up a fence along the outer edge of the patio. Given that the materials for the fence cost \$12 per foot, what was the total cost of the materials for the fence?
 - **A.** \$1,020

 - **B.** \$1,320 **C.** \$1,800
 - **D.** \$2,040
 - **E.** \$3,360

- 28. A full lap is 2 times the length of the pool. Johann swam 5 full laps of the pool in $4\frac{1}{2}$ minutes. Which of the following values is closest to Johann's average swimming speed, in feet per minute?
 - 45 G. H. 60
 - **J.** 90 **K.** 120
- **29.** The side view of the pool is placed in the standard (x,y)coordinate plane, keeping the same orientation and scale, such that both vertical segments showing depth are parallel to the y-axis. Which of the following values is closest to the slope of the line segment connecting the shallow end to the deep end?
 - A. -0.44 **B.** −0.63 **C.** −0.75
 - D. -1.33
 - **E.** −1.60

30. A construction company builds 3 different models of houses (A, B, and C). They order all the bathtubs, shower stalls, and sinks for the houses from a certain manufacturer. Each model of house contains different numbers of these bathroom fixtures. The tables below give the number of each kind of these fixtures required for each model and the cost to the company, in dollars, of each type of fixture.

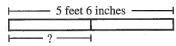
	Model		
Fixture	A	В	C
Bathtubs Shower stalls Sinks	1 0 1	1 1 2	2 1 4

Fixture	Cost
Bathtub	\$250
Shower stall	\$150
Sink	\$120

The company plans to build 3 A's, 4 B's, and 6 C's. What will be the cost to the company of exactly enough of these bathroom fixtures to put the required number in all of these houses?

- \$ 1,940
- \$ 2,070 G. **H.** \$ 8,940
- \$ 9,180
- \$10,450

31. Shown below, a board 5 feet 6 inches long is cut into 2 equal parts. What is the length, to the nearest inch, of each part?



- A. 2 feet 5 inchesB. 2 feet 8 inchesC. 2 feet 9 inches

- D. 3 feet 0 inches
- E. 3 feet 5 inches

- 32. A company that builds bridges used a pile driver to drive a post into the ground. The post was driven 18 feet into the ground by the first hit of the pile driver. On each hit after the first hit, the post was driven into the ground an additional distance that was $\frac{2}{3}$ the distance the post was driven in the previous hit. After a total of 4 hits, the post was driven how many feet into the ground?
 - **F.** $28\frac{8}{9}$
 - **G.** 30
 - **H.** $43\frac{1}{3}$
 - J. 48
 - K. 54

- 33. In the standard (x,y) coordinate plane, A' is the image resulting from the reflection of the point A(2,-3) across the y-axis. What are the coordinates of A'?

 - B. C. (-2, -3)

 - D.



- 34. To increase the mean of 4 numbers by 3, by how much would the sum of the 4 numbers have to increase?
- DO YOUR FIGURING HERE.

- 1 G.
- H.
- 7
- **K.** 12
- 35. Which of the following expressions is equivalent to $(3+x)^{-100}$?
 - **A.** $-3^{100} x^{100}$
 - **B.** -300 100x
- **36.** Consider the graph of the equation $y = \frac{3x 12}{2x 6}$ in the standard (x,y) coordinate plane. Which of the following equations represents the vertical asymptote of the graph?
 - **F.** x = 2 **G.** x = 3

 - **H.** x = 4

 - J. x = 6K. x = 12
- 37. For every pair of real numbers x and y such that xy = 0and $\frac{x}{y} = 0$, which of the following statements is true?
 - **A.** x = 0 and y = 0 **B.** $x \ne 0$ and y = 0

 - C. x = 0 and $y \neq 0$
 - **D.** $x \neq 0$ and $y \neq 0$
 - None of the statements is true for every such pair of real numbers x and y.

Use the following information to answer questions 38-40.

Walter recently vacationed in Paris. While there, he visited the Louvre, a famous art museum. Afterward, he took a 3.7-kilometer cab ride from the Louvre to the Eiffel Tower. A tour guide named Amélie informed him that 2.5 million rivets were used to build the tower, which stands 320 meters tall.

38. Walter's cab ride lasted 15 minutes. Which of the following values is closest to the average speed, in miles per hour, of the cab?

(Note: 1 mile ≈ 1.6 kilometers)

- **G.** 15
- **H.** 21
- 24
- **J.** 24 **K.** 35
- 39. When written in scientific notation, the number of rivets used to build the Eiffel Tower is equal to which of the following expressions?
 - 2.5×10^{6}
 - 2.5×10^{7} B.
 - 2.5×10^{8}
 - **D.** 25 $\times 10^6$
 - **E.** 25 $\times 10^7$
- 40. At a certain point, the angle of elevation formed by the level ground and the line from that point to the top of the Eiffel Tower is 70°. Which of the following expressions is equal to the distance, in meters, between that point and the center of the base of the tower?
 - F. 320 cos 70°
 - G. 320 sin 70°
 - H. 320 tan 70°
- **41.** When the vector $a\mathbf{i} + 3\mathbf{j}$ is added to the vector $-2\mathbf{i} + b\mathbf{j}$, the sum is $6\mathbf{i} - 6\mathbf{j}$. What are the values of a and b?
 - **A.** a = -9 and b = 8
 - **B.** a = -8 and b = 9
 - **C.** a = -4 and b = 3
 - **D.** a = 4 and b = -3**E.** a = 8 and b = -9



















42. Given $c = 10b^3 + 50$, which of the following is an expression for b in terms of c?

$$\mathbf{F}_{\bullet} \quad \left(\frac{c}{10} - 5\right)^{\frac{1}{3}}$$

G.
$$\left(\frac{c}{10} + 5\right)^{\frac{1}{3}}$$

H.
$$\frac{1}{10}(c-50)^{\frac{1}{3}}$$

J.
$$c^3 + 5$$

K.
$$10c^3 + 50$$

43. Given $f(x) = x^2 + 3x$ and g(x) = x + 1, what is f(g(x))?

A.
$$x^2 + 5x + 4$$

B.
$$x^2 + 3x + 1$$

C.
$$x^3 + 5x^2 + 4x$$

D.
$$x^3 + 4x^2 + 3x$$

E.
$$x^4 + 4x^3 + 3x^2$$

44. The diameter of one circle is 12 inches long. The diameter of a second circle is 25% longer than the diameter of the first circle. To the nearest square inch, how much larger is the area of the second circle than the area of the first circle?

- 28
- G.
- H. 44 64
- 254

45. What is the product of the mean and the median of the first 6 prime numbers?

(Note: 2 is the first prime number.)

- A. 27B. 37C. 39

- **D.** 41
- E. 42

46. For all real values of x, which of the following equations is true?

$$\mathbf{F.} \quad \sin(7x) + \cos(7x) = 7$$

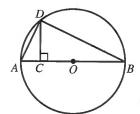
G.
$$\sin(7x) + \cos(7x) = 1$$

H.
$$7 \sin(7x) + 7 \cos(7x) = 14$$

J.
$$\sin^2(7x) + \cos^2(7x) = 7$$

K.
$$\sin^2(7x) + \cos^2(7x) = 1$$

47. In the figure shown below, A, B, and D lie on a circle whose center is O, a diameter is \overline{AB} , \overline{CD} is perpendicular to \overline{AB} at C, the length of \overline{AD} is 5 m, and the length of \overline{BD} is 12 m. What is the length, in meters, of \overline{CD} ?

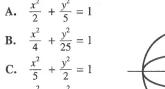


- 13
- C. 13
- E. 60
- **48.** If a and b are real numbers such that a > 0 and b < 0, then which of the following is equivalent to |a| - |b|?
 - **F.** |a-b|
 - G. |a+b|
 - **H.** |a| + |b|
 - **J.** a-b
 - $\mathbf{K}. \ a+b$
- **49.** If x < y and y < 4, then what is the greatest possible integer value of x + y?
 - **A.** 0
 - **B.** 3

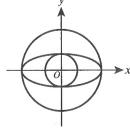
 - C. 4 D. 7 E. 8
- **50.** Given that y varies directly as the square of x, if y = 20when x = 2, what is y when x = 3?
 - **F.** 75
 - G. 45
 - **H.** 30

 - J. 21 K. 15

51. Shown below in the standard (x,y) coordinate plane are 2 circles and 1 ellipse, each centered at (0,0). The larger circle has equation $x^2 + y^2 = 25$ and intersects the ellipse at exactly 2 points, both on the x-axis. The smaller circle has equation $x^2 + y^2 = 4$ and intersects the ellipse at exactly 2 points, both on the y-axis. Which of the following equations represents the ellipse?







52. The mean of 5 integers is 52. The median of these 5 integers is 82. Three of the integers are 0, 12, and 82. Which of the following could be one of the other integers?

- F. 52 G. 66
- H. 84
- J. 86 K. 105

53. An integer is abundant if its positive integer factors, excluding the integer itself, have a sum that is greater than the integer. How many of the integers 6, 8, 10, and 12 are abundant?

- **A.** 0 В. 1
- C. 2
- D. 3 4

54. Vanna walked at a rate of 2 miles per hour for 10 minutes and then walked at a rate of 3 miles per hour for 5 minutes. Which of the following gives the average rate, in miles per hour, at which she walked over this 15-minute period?

- $\frac{1}{3}$ F.
- G.
- H.

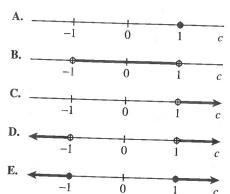
- 55. The ratio of Alani's height to Baahir's height is 5:7. The ratio of Baahir's height to Connor's height is 4:3. What is the ratio of Alani's height to Connor's height?

 - 8:11
 - C. 15:28
 - **D.** 20:21
 - E. 28:15
- **56.** For all x > 0, which of the following expressions is NOT equivalent to $\sqrt[4]{x^2}$?
 - **F.** $\sqrt[3]{x}$
 - **G.** $\sqrt[6]{x^2}$
- 57. If the length of a rectangle is increased by 25% and the width is decreased by 10%, the area of the resulting rectangle is larger than the area of the original rectangle by what percent?
 - A. 2.5%B. 12.5%C. 15%

 - **D.** 22.5%
 - E. 35%
- 58. Five balls, numbered 1, 2, 3, 4, and 5, are placed in a bin. Two balls are drawn at random without replacement. What is the probability that the sum of the numbers on the balls drawn is 7?
 - F.
 - G.
 - H.

 - K.

59. Consider the family of functions $y = f(x) = \sin x + c$, where c is a real number. Which of the following number lines represents the graph of all and only the possible values of c for which the graph of y has no *x*-intercepts?



- 60. Tameka calculates that she needs 360 square feet of new carpet. But the type of carpet that she wants is priced by the square yard. How many square yards of carpet does she need?
 - 15 G. H. 40 60 J. 90 K. 120

END OF TEST 2 STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO. DO NOT RETURN TO THE PREVIOUS TEST.

READING TEST

35 Minutes - 40 Questions

DIRECTIONS: There are several passages in this test. Each passage is accompanied by several questions. After reading a passage, choose the best answer to each question and fill in the corresponding oval on your answer document. You may refer to the passages as often as necessary.

Passage I

LITERARY NARRATIVE: This passage is adapted from the novel The Cat's Table by Michael Ondaatje (©2011 by Michael Ondaatie).

The ship Oronsay is departing from Colombo, Ceylon (a city in what is today Sri Lanka), in the early 1950s.

Michael was eleven years old that night when, green as he could be about the world, he climbed aboard the first and only ship of his life. It felt as if a city had been added to the coast, better lit than any 5 town or village. He went up the gangplank, watching only the path of his feet—nothing ahead of him existed—and continued till he faced the dark harbour and sea. There were outlines of other ships farther out, beginning to turn on lights. He stood alone, smelling 10 everything, then came back through the noise and the crowd to the side that faced land. A yellow glow over the city. Already it felt there was a wall between him and what took place there. Stewards began handing out food and cordials. He ate several sandwiches, and after 15 that he made his way down to his cabin, undressed, and slipped into the narrow bunk. He'd never slept under a blanket before, save once in Nuwara Eliya. He was wide awake. The cabin was below the level of the waves, so there was no porthole. He found a switch 20 beside the bed and when he pressed it his head and pillow were suddenly lit by a cone of light.

He did not go back up on deck for a last look, or to wave at his relatives who had brought him to the harbour. He could hear singing and imagined the slow and 25 then eager parting of families taking place in the thrilling night air. I do not know, even now, why he chose this solitude. Had whoever brought him onto the Oronsay already left? In films people tear themselves away from one another weeping, and the ship separates 30 from land while the departed hold on to those disappearing faces until all distinction is lost.

I try to imagine who the boy on the ship was. Perhaps a sense of self is not even there in his nervous stillness in the narrow bunk, in this green grasshopper 35 or little cricket, as if he has been smuggled away accidentally, with no knowledge of the act, into the future.

What had there been before such a ship in my life? A dugout canoe on a river journey? A launch in Trincomalee harbour? There were always fishing boats on our 40 horizon. But I could never have imagined the grandeur of this castle that was to cross the sea. The longest journeys I had made were car rides to Nuwara Eliya and Horton Plains, or the train to Jaffna, which we boarded at seven a.m. and disembarked from in the late after-45 noon. We made that journey with our egg sandwiches, a pack of cards, and a small Boy's Own adventure.

But now it had been arranged I would be travelling to England by ship, and that I would be making the journey alone. No mention was made that this might be 50 an unusual experience or that it could be exciting or dangerous, so I did not approach it with any joy or fear. I was not forewarned that the ship would have seven levels, hold more than six hundred people including a captain, nine cooks, engineers, a veterinarian, and that 55 it would contain a small jail and chlorinated pools that would actually sail with us over two oceans. The departure date was marked casually on the calendar by my aunt, who had notified the school that I would be leaving at the end of the term. The fact of my being at sea 60 for twenty-one days was spoken of as having not much significance, so I was surprised my relatives were even bothering to accompany me to the harbour. I had assumed I would be taking a bus by myself and then change onto another at Borella Junction.

There had been just one attempt to introduce me to the situation of the journey. A lady named Flavia Prins, whose husband knew my uncle, turned out to be making the same journey and was invited to tea one afternoon to meet with me. She would be travelling in First Class 70 but promised to keep an eye on me. I shook her hand carefully, as it was covered with rings and bangles, and she then turned away to continue the conversation I had interrupted. I spent most of the hour listening to a few uncles and counting how many of the trimmed sand-75 wiches they ate.

On my last day, I found an empty school examination booklet, a pencil, a pencil sharpener, a traced map of the world, and put them into my small suitcase.

As I got into the car, it was explained to me that 80 after I'd crossed the Indian Ocean and the Arabian Sea and the Red Sea, and gone through the Suez Canal into