



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.

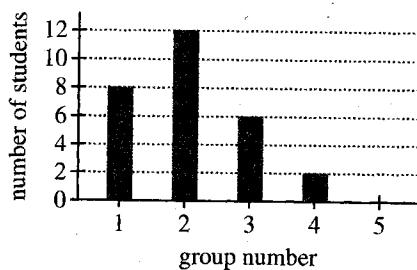
1. A marble will be randomly selected from a bag of solid-colored marbles. The probability of selecting a red marble is $\frac{5}{19}$. The probability of selecting a blue marble is $\frac{4}{19}$. What is the probability of selecting a red marble *or* a blue marble?

- A. $\frac{1}{19}$
 B. $\frac{9}{19}$
 C. $\frac{9}{38}$
 D. $\frac{20}{38}$
 E. $\frac{20}{361}$

DO YOUR FIGURING HERE.

2. The graph below shows the number of students who were present on Thursday from each of the 5 groups in Ms. Meagan's class. What is the probability that a student selected at random from the class on Thursday is in Group 4?

- F. $\frac{1}{28}$
 G. $\frac{1}{14}$
 H. $\frac{1}{5}$
 J. $\frac{1}{4}$
 K. $\frac{1}{2}$

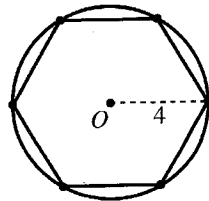




3. Consider the equation $k = \frac{7}{5}j + 54$. For what value of j is the value of k equal to 40?

DO YOUR FIGURING HERE.

- A. -10
 B. $-\frac{98}{5}$
 C. $\frac{178}{7}$
 D. $\frac{200}{7}$
 E. 56
4. What is $|3 - x|$ when $x = 8$?
- F. -11
 G. -5
 H. 5
 J. 8
 K. 11
5. When Tyrese fell asleep one night, the temperature was 24°F . When Tyrese awoke the next morning, the temperature was -16°F . Letting $+$ denote a rise in temperature and $-$ denote a drop in temperature, what was the change in temperature from the time Tyrese fell asleep until the time he awoke?
- A. -40°F
 B. -8°F
 C. $+4^\circ\text{F}$
 D. $+8^\circ\text{F}$
 E. $+40^\circ\text{F}$
6. Ming purchased a car that had a purchase price of \$5,400, which included all other costs and tax. She paid \$1,000 as a down payment and got a loan for the rest of the purchase price. Ming paid off the loan by making 28 payments of \$200 each. The total of all her payments, including the down payment, was how much more than the car's purchase price?
- F. \$ 200
 G. \$1,200
 H. \$4,400
 J. \$5,600
 K. \$6,600
7. Shown below is a regular hexagon inscribed in a circle whose radius is 4 inches. What is the perimeter, in inches, of the hexagon?

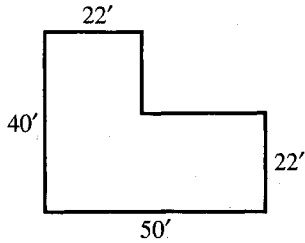


- A. 8π
 B. $12\sqrt{3}$
 C. 18
 D. 20
 E. 24



8. The floor plan for an L-shaped storage building is shown below with distances marked in feet. What is the floor area of the building, in square feet?

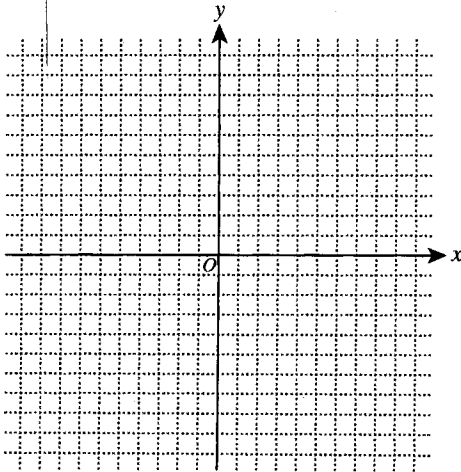
(Note: Walls in this building meet only at right angles.)



- F. 190
G. 504
H. 1,232
J. 1,496
K. 1,980

DO YOUR FIGURING HERE.

9. Quadrilateral $ABCD$ with vertices $A(-2,0)$, $B(0,4)$, $C(5,5)$, and $D(8,2)$ will be graphed in the standard (x,y) coordinate plane below.



Which of the following is a type of quadrilateral determined by these vertices?

- A. Kite
B. Parallelogram
C. Trapezoid
D. Rectangle
E. Square
10. Given that $f(x) = 3x + 7$ and $g(x) = \frac{x^2}{2}$, what is the value of $f(g(4))$?

- F. 8
G. 19
H. 31
J. 152
K. 180.5



11. At her hot dog stand, Julie sells hot dogs for \$2 each. Purchasing hot dogs and other supplies costs \$200 per month. The solution of which of the following inequalities models the numbers of hot dogs, h , Julie can sell per month and make a profit?

A. $h - 200 > 0$
 B. $h - 200 < 0$
 C. $h + 200 > 0$
 D. $2h - 200 < 0$
 E. $2h - 200 > 0$

DO YOUR FIGURING HERE.

12. In the standard (x,y) coordinate plane, what is the slope of the line $3x + 8y = 5$?

F. -3
 G. $-\frac{3}{8}$
 H. $\frac{3}{5}$
 J. 3
 K. 5

13. Which of the following (x,y) pairs is the solution for the system of equations $x + 2y = 2$ and $-2x + y = 16$?

A. $(-6,4)$
 B. $(-1,1.5)$
 C. $(1,0.5)$
 D. $(0,1)$
 E. $(2,0)$

14. On a map, $\frac{1}{4}$ inch represents 16 actual miles. Two towns that are $2\frac{3}{4}$ inches apart on this map are how many actual miles apart?

F. 11
 G. 16
 H. 44
 J. 64
 K. 176

15. Which of the following matrices is equal to $4\begin{bmatrix} -1 & 2 \\ 0 & -4 \end{bmatrix}$?

A. $[-4 \ -8]$
 B. $\begin{bmatrix} 4 \\ -16 \end{bmatrix}$
 C. $\begin{bmatrix} 3 & 6 \\ 4 & 0 \end{bmatrix}$
 D. $\begin{bmatrix} -\frac{1}{4} & \frac{1}{2} \\ 0 & -1 \end{bmatrix}$
 E. $\begin{bmatrix} -4 & 8 \\ 0 & -16 \end{bmatrix}$



16. What is the value of $\tan A$ in right triangle $\triangle ABC$ below?

DO YOUR FIGURING HERE.

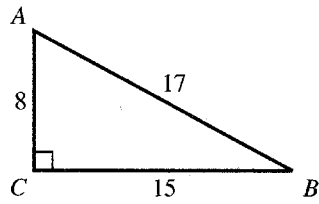
F. $\frac{8}{17}$

G. $\frac{8}{15}$

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

J. $\frac{15}{8}$

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



17. Tina runs at a rate of 8 miles per hour. At that rate, how many miles will she run in 12 minutes?

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

B. $\frac{2}{3}$

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

D. $1\frac{3}{5}$

E. 2

18. A function $f(x)$ is defined as $f(x) = -6x^2$. What is $f(-3)$?

F. -324

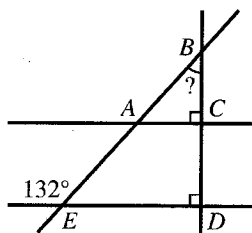
G. -54

H. 54

J. 108

K. 324

19. In the figure below, A is on \overleftrightarrow{BE} and C is on \overleftrightarrow{BD} . What is the measure of $\angle ABC$?



A. 24°

B. 42°

C. 45°

D. 48°

E. 66°



DO YOUR FIGURING HERE.

20. Marcos programs his calculator to evaluate a linear function, but he doesn't say what the function is. When 5 is entered, the calculator displays the value 2. When 15 is entered, the calculator displays the value 6. Which of the following expressions explains what the calculator will display when any number, n , is entered?

F. $\frac{2}{5}n$

G. $\frac{5}{2}n$

H. $n - 3$

J. $n - 9$

K. $\frac{5}{2}n - \frac{21}{2}$

21. On Friday, the temperature at 8:00 a.m. was 49°F and rose at a constant rate of $\frac{1}{2}$ °F per hour until noon. A cold front passed through at noon, and the temperature then fell at a constant rate of 1°F per hour. The temperature first fell below 49°F between:

- A. noon and 1 p.m.
 B. 1 p.m. and 2 p.m.
 C. 2 p.m. and 3 p.m.
 D. 3 p.m. and 4 p.m.
 E. 4 p.m. and 5 p.m.

22. Letter grades in Hugo's math class are based on the percent of the total possible points on 4 unit exams (each worth 100 points) and the final exam (worth 200 points) and are assigned according to the chart below.

Range	Course grade
At least 90%	A
80%–89%	B
70%–79%	C
60%–69%	D
Less than 60%	F

The number of points Hugo scored on the unit exams this term were 82, 88, 91, and 83. When course grades were posted, Hugo's course grade was listed as a B. Which of the following could NOT have been the number of points he scored on the final exam?

- F. 136
 G. 156
 H. 166
 J. 176
 K. 196

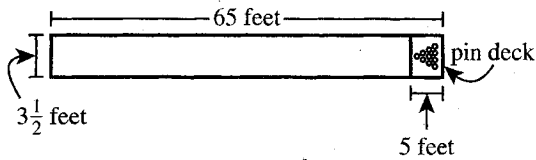


Use the following information to answer questions 23–25.

DO YOUR FIGURING HERE.

Halle is bowling a series of 3 games. She has bowled 2 of 3 games with scores of 148 and 176. The figure below is a top view of the bowling lane. The dimensions for the bowling lane are given in the figure. The *pin deck* is the rectangular area within the bowling lane where the 10 bowling pins are set up.

(Note: The figure is not drawn to scale.)



23. The diameter of each pin at its base is 2.25 in. When all of the pins are set up, which of the following values is closest to the area, in square inches, that is covered by the bases of the pins?
- A. 40
B. 71
C. 111
D. 125
E. 159
24. What is the ratio of the total area of the bowling lane to the area of the pin deck?
- F. 12:1
G. 13:1
H. 13:12
J. 127:17
K. 137:17
25. What score will Halle need to earn in her 3rd game to have an average score of 172 for the 3 games?
- A. 165
B. 172
C. 182
D. 192
E. 200
-
26. The area of a rectangle is 300 square meters, and its length is 3 times its width. How many meters wide is the rectangle?
- F. 10
G. 30
H. 50
J. 100
K. 150



DO YOUR FIGURING HERE.

27. A parallelogram has a perimeter of 96 inches, and 1 of its sides measures 16 inches. If it can be determined, what are the lengths, in inches, of the other 3 sides?

- A. 16, 16, 48
- B. 16, 24, 24
- C. 16, 32, 32
- D. 16, 40, 40
- E. Cannot be determined from the given information

28. Elmhurst Street is a two-way street. In each direction, it has one 12-foot-wide lane for car traffic, one 6-foot-wide bike lane, and one 8-foot-wide parking lane. How many feet wide is Elmhurst Street?

- F. 26
- G. 38
- H. 52
- J. 60
- K. 80

29. At Central High School, 4 out of every 10 students ride the bus to and from school, and 3 out of every 8 who ride the bus are freshmen. If there are 2,500 students at Central, how many of the students are freshmen who ride the bus?

- A. 375
- B. 412
- C. 428
- D. 561
- E. 705

30. If $90^\circ < \theta < 180^\circ$ and $\sin \theta = \frac{20}{29}$, then $\cos \theta = ?$

- F. $\frac{29}{20}$
- G. $\frac{20}{21}$
- H. $-\frac{21}{29}$
- J. $-\frac{29}{21}$
- K. $-\frac{29}{20}$

31. Given $f(x) = \frac{2}{x+1}$, what is(are) the real value(s) of t for which $f(t) = t$?

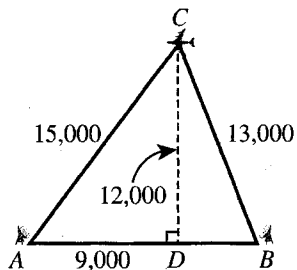
- A. -1 only
- B. 2 only
- C. -2 and 1 only
- D. -1 and 2 only
- E. 1 and 2 only



Use the following information to answer questions 32–35.

DO YOUR FIGURING HERE.

In the figure below, a highway rest area (at D) and radar stations (at A and B) lie on a level east-west line; A is 9,000 feet due west of D . An airplane (at C) is shown directly above the rest area, flying due west at a constant speed of 300 feet per second and at a constant altitude of 12,000 feet. The airplane is located at a straight-line distance of 15,000 feet from the radar station at A and 13,000 feet from the radar station at B .



32. Which of the following values is closest to the distance, in feet, between the 2 radar stations?
- F. 5,000
 - G. 10,000
 - H. 10,500
 - J. 14,000
 - K. 15,000
33. Let A , C , and D lie in the standard (x,y) coordinate plane such that A is at $(0,0)$ and D is at $(9,000, 0)$. Which of the following equations represents the line along which the airplane is flying?
- A. $x = 9,000$
 - B. $x = 15,000$
 - C. $y = 12,000$
 - D. $y = 13,000$
 - E. $y = 15,000$
34. Which of the following values is closest to the number of seconds it will take for the airplane to fly from C to the point directly above the radar station at A ?
- F. 17
 - G. 30
 - H. 40
 - J. 43
 - K. 50



35. When considering the changing triangle formed by A , B , and the moving airplane (C), which of the angles below increases in measure as the airplane flies due west beyond the point directly above A ?

- I. $\angle A$
- II. $\angle B$
- III. $\angle C$

- A. I only
- B. II only
- C. I and II only
- D. I and III only
- E. II and III only

DO YOUR FIGURING HERE.

36. Troy made a rectangular poster that is 4 feet long and 2 feet wide. The poster is too large to fit in the available display space, so Troy is going to make a new poster that will have an area that is 50% of the area of the original poster. The length of Troy's new poster will be $\frac{3}{4}$ the length of the original poster. How many feet wide will the new poster be?

- F. $\frac{3}{4}$
- G. $1\frac{1}{3}$
- H. $1\frac{1}{2}$
- J. 3
- K. 6

37. What is the solution set of the equation $x + 6 = 2(x + 3) - x$?

- A. The empty set (no solution)
- B. $\{0\}$
- C. $\{2\}$
- D. $\{3\}$
- E. The set of all real numbers

38. Steve plans to use 28 feet of fencing to enclose a region of his yard for a pen for his pet rabbit. What is the area, in square feet, of the largest rectangular region Steve can enclose?

- F. 40
- G. 45
- H. 48
- J. 49
- K. 196



DO YOUR FIGURING HERE.

39. There are exactly 5 people in a bookstore at 12:00 p.m. Each person earns an annual income that is between \$30,000 and \$35,000. No one enters or leaves the bookstore until 12:15 p.m., when a professional athlete with an annual income of more than \$1,000,000 enters the bookstore and joins the other 5 people. The mean, median, range, and standard deviation of the annual incomes of the 5 people in the bookstore at 12:00 p.m. are calculated and compared to the same 4 statistics of the annual incomes of the 6 people in the bookstore at 12:15 p.m. If it can be determined, which of the 4 statistics changed the least?

- A. Range
- B. Mean
- C. Median
- D. Standard deviation
- E. Cannot be determined from the given information

40. Ana and Amy started a landscaping job together. When Ana stopped, she had completed $\frac{2}{5}$ of the job. When Amy stopped, she had completed $\frac{1}{3}$ of the job. Then Ruben completed the rest of the job in 2 hours. Assume that Ana, Amy, and Ruben all worked at the same rate. Which of the following values is closest to the number of hours it would have taken 1 of them to complete the entire job alone?

- F. 0.37
- G. 1.27
- H. 2.73
- J. 5.00
- K. 7.50

41. If a and b are positive real numbers, which of the following is equivalent to $\frac{(2a^{-1}\sqrt{b})^4}{ab^{-3}}$?

- A. $8a^2b^4$
- B. $\frac{8b^6}{a^4}$
- C. $\frac{16b^5}{a^5}$
- D. $\frac{16b^4}{a^5}$
- E. $\frac{16b}{a^3}$



42. To become a contestant on a quiz show, a person must correctly order 4 rock stars by age, from youngest to oldest. The contestant knows which one is the oldest rock star, but randomly guesses at the order of the other 3 rock stars. What is the probability the contestant will get all 4 in the correct order?

DO YOUR FIGURING HERE.

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

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

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

J. $\frac{1}{3}$

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

43. Which of the following expressions is equivalent to

$$\frac{\frac{x}{3} + \frac{1}{2}}{\frac{2}{3} - \frac{1}{4}} ?$$

A. $\frac{-x-1}{5}$

B. $\frac{2x+6}{5}$

C. $\frac{4x+3}{5}$

D. $\frac{4x+6}{5}$

E. $4x+6$

44. An automobile license plate number issued by a certain state has 6 character positions. Each of the first 3 positions contains a single digit from 0 through 9. Each of the last 3 positions contains 1 of the 26 letters of the alphabet. Digits and letters of the alphabet can be repeated on a license plate. How many different such license plate numbers can be made?

F. 36

G. 46,656

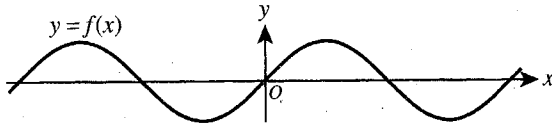
H. 1,000,000

J. 12,812,904

K. 17,576,000



45. The function $y = f(x)$ is graphed in the standard (x, y) coordinate plane below.



The points on the graph of the function $y = 3 + f(x - 1)$ can be obtained from the points on $y = f(x)$ by a shift of:

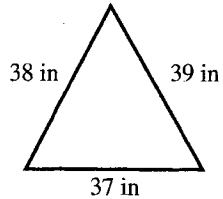
- A. 1 unit to the right and 3 units up.
 B. 1 unit to the right and 3 units down.
 C. 3 units to the right and 1 unit up.
 D. 3 units to the right and 1 unit down.
 E. 3 units to the left and 1 unit down.
46. When $\log_5 x = -2$, what is x ?
- F. -32
 G. -25
 H. -10
 J. $\frac{1}{10}$
 K. $\frac{1}{25}$
47. Which of the following lists those integer values of D for which the fraction $\frac{2}{D}$ lies between $\frac{1}{5}$ and $\frac{1}{3}$?
- A. 4 only
 B. 3, 4, and 5
 C. 8 only
 D. 7, 8, and 9
 E. 16 only
48. For all real numbers a , b , and c such that $a > b$ and $c < 0$, which of the following inequalities *must* be true?
- F. $\frac{a}{c} < \frac{b}{c}$
 G. $\frac{a}{c} > \frac{b}{c}$
 H. $ac > bc$
 J. $a + c < b + c$
 K. $a < b - c$

DO YOUR FIGURING HERE.



49. The triangle shown below has side lengths 37, 38, and 39 inches. Which of the following expressions gives the measure of the largest angle of the triangle?

(Note: For every triangle with sides of length a , b , and c that are opposite $\angle A$, $\angle B$, and $\angle C$, respectively, $c^2 = a^2 + b^2 - 2ab \cos C$.)



DO YOUR FIGURING HERE.

- A. $\cos^{-1}\left(-\frac{37^2 - 38^2 - 39^2}{2(38)(39)}\right)$
- B. $\cos^{-1}\left(-\frac{39^2 - 37^2 - 38^2}{2(37)(38)}\right)$
- C. $\cos^{-1}(37^2 - 38^2 - 39^2 + 2(38)(39))$
- D. $\cos^{-1}(38^2 - 37^2 - 39^2 + 2(37)(39))$
- E. $\cos^{-1}(39^2 - 37^2 - 38^2 + 2(37)(38))$
50. Pete has an average score of exactly x points on 4 equally weighted tests. How many points higher than x must Pete score on the 5th equally weighted test to raise his average score after the 5th test to $x + 2$ points?
- F. 2
- G. 4
- H. 5
- J. 8
- K. 10
51. The intersection of lines l and m forms the 4 angles $\angle A$, $\angle B$, $\angle C$, and $\angle D$. The measure of $\angle B$ is $3\frac{1}{2}$ times the measure of $\angle A$. Which of the following values is closest to the measure of $\angle A$?
- A. 20°
- B. 26°
- C. 35°
- D. 40°
- E. 51°
52. A sequence is defined for all positive integers by $s_n = 2s_{(n-1)} + n + 1$ and $s_1 = 3$. What is s_4 ?
- F. 9
- G. 18
- H. 22
- J. 49
- K. 111



53. If a is an integer less than -1 , which of the following orders the expressions $|a|$, $-a^2$, and $-\frac{1}{a}$ from least value to greatest value?

- A. $-\frac{1}{a} < -a^2 < |a|$
 B. $-\frac{1}{a} < |a| < -a^2$
 C. $|a| < -\frac{1}{a} < -a^2$
 D. $-a^2 < |a| < -\frac{1}{a}$
 E. $-a^2 < -\frac{1}{a} < |a|$

54. At the school carnival, Ann is playing a game involving a stack of 10 index cards. Each card has a single number written on it: 1 card has a 1, 2 cards have a 2, 3 cards have a 3, and 4 cards have a 4. Ann will choose 1 card at random, and she will be awarded the number of points equal to the number written on the card. Let the random variable X represent the number of points Ann receives on any 1 draw. What is the expected value of X ?

- F. 0.4
 G. 1
 H. 2.5
 J. 3
 K. 4

55. Which of the following is equivalent to the sum of any 3 consecutive odd integers, x , y , and z , such that $x < y < z$?

- A. $3z$
 B. $3y$
 C. $3x$
 D. $3x + 2$
 E. $\frac{x+y+z}{3}$

56. The mean of the set of 5 numbers $\{42, 3, 11, 27, x\}$ is 24, and the median of the set of 4 numbers $\{53, 8, 29, y\}$ is 38. If it can be determined, which of the following values is equal to $x - y$?

- F. -38
 G. -10
 H. 10
 J. 38
 K. Cannot be determined from the given information

DO YOUR FIGURING HERE.



57. Consider all rectangles such that the rectangle's length is greater than the rectangle's width and the length and width are whole numbers of inches. Which of the following perimeters, in inches, is NOT possible for such a rectangle with an area of 144 square inches?

A. 48
 B. 60
 C. 80
 D. 102
 E. 148

DO YOUR FIGURING HERE.

58. The equation $(x - 7)^2 + (y - 8)^2 = 10$ is that of a circle that lies in the standard (x, y) coordinate plane. One endpoint of a diameter of the circle has y -coordinate 11. What is the y -coordinate of the other endpoint of that diameter?

F. 1
 G. 3
 H. 4
 J. 5
 K. 8

59. The plans for a diving pool call for a rectangular prism that has a length of 30 meters, a width of 25 meters, and a depth of 5 meters. If the plans are changed to increase both the length and the width of the pool by 10%, what will be the increase, to the nearest 1%, in the volume of the pool?

A. 10%
 B. 17%
 C. 20%
 D. 21%
 E. 33%

60. One solution of the equation $4x^3 - 2x^2 + x + 7 = 0$ is $x = -1$. Which of the following describes the other 2 solutions?

F. Both are negative real numbers.
 G. One is a negative real number, and the other is a positive real number.
 H. Both are positive real numbers.
 J. One is a positive real number, and the other is a complex number that is not real.
 K. Both are complex numbers that are not real.

END OF TEST 2

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

DO NOT RETURN TO THE PREVIOUS TEST.

Test 2: Mathematics—Scoring Key

Key	Reporting Category*						
	PHM					IES	MDL
	N	A	F	G	S		
1. B							
2. G							
3. A							
4. H							
5. A							
6. G							
7. E							
8. J							
9. C							
10. H							
11. E							
12. G							
13. A							
14. K							
15. E							
16. J							
17. D							
18. G							
19. B							
20. F							
21. C							
22. K							
23. A							
24. G							
25. D							
26. F							
27. C							
28. H							
29. A							
30. H							

Key	Reporting Category*						
	PHM					IES	MDL
	N	A	F	G	S		
31. C							
32. J							
33. C							
34. G							
35. A							
36. G							
37. E							
38. J							
39. C							
40. K							
41. C							
42. G							
43. D							
44. K							
45. A							
46. K							
47. D							
48. F							
49. B							
50. K							
51. D							
52. J							
53. E							
54. J							
55. B							
56. G							
57. A							
58. J							
59. D							
60. K							

Combine the totals of these columns and put in the blank for PHM in the box below.

***Reporting Categories**

PHM = Preparing for Higher Math

N = Number & Quantity

A = Algebra

F = Functions

G = Geometry

S = Statistics & Probability

IES = Integrating Essential Skills

MDL = Modeling

Number Correct (Raw Score) for:	
Preparing for Higher Math (PHM) (N + A + F + G + S)	(35)
Integrating Essential Skills (IES)	(25)
Total Number Correct for Mathematics Test (PHM + IES)	(60)
Modeling (MDL) (Not included in total number correct for mathematics test raw score)	(26)