



MATHEMATICS TEST

50 Minutes—45 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.

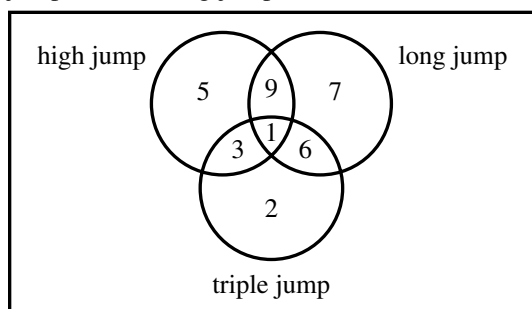
You are permitted to use a calculator on this test. You may use your calculator for any problems you choose,

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. At a college track meet, there are 3 jumping events: high jump, long jump, and triple jump. The Venn diagram below shows the distribution of the number of athletes competing in each jumping event. How many athletes are competing in both high jump and triple jump but **not** long jump?



- A. 3
B. 4
C. 10
D. 19
2. A function, f , is defined by the equation $f(x) = x^2 + 5$. What is $f(3) + 1$?
- F. 9
G. 11
H. 12
J. 15
3. Given $b = 40$ and $c = -16$, $b + c$ is equal to the product of -4 and what number?
- A. -14
B. -6
C. 6
D. 14

DO YOUR FIGURING HERE.

GO ON TO THE NEXT PAGE.



4. It takes Collin 24 minutes to walk to school in the morning. What fraction of his 24-hour day is spent walking to school in the morning?

F. $\frac{1}{1,440}$

G. $\frac{1}{60}$

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

J. $\frac{1}{12}$

DO YOUR FIGURING HERE.

5. A certain triangle has interior angle measures of $(6x)^\circ$, $(2x)^\circ$, and x° . What is the value of x ?

A. 9

B. 12

C. 20

D. 57

6. Which of the following matrices is equal to $6\begin{bmatrix} -5 & 3 \\ 0 & -4 \end{bmatrix}$?

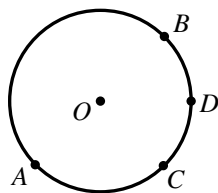
F. $\begin{bmatrix} -30 & -6 \end{bmatrix}$

G. $\begin{bmatrix} 1 & 9 \\ 6 & 2 \end{bmatrix}$

H. $\begin{bmatrix} -\frac{5}{6} & \frac{1}{2} \\ 0 & -\frac{2}{3} \end{bmatrix}$

J. $\begin{bmatrix} -30 & 18 \\ 0 & -24 \end{bmatrix}$

7. For circle O shown, A , B , C , and D are on circle O ; A and B are as far apart as possible; C is halfway between A and B along circle O ; and D is halfway between C and B along circle O . What percent of the area enclosed by circle O is enclosed by $\overline{OC}$, $\overline{OD}$, and minor arc $\widehat{CD}$?



A. 12.5%

B. 25%

C. 50%

D. 100%

GO ON TO THE NEXT PAGE.



8. An object is launched vertically at 30 meters per second from a 55-meter-tall platform. The height, $h(t)$ meters, of the object t seconds after launch is modeled by $h(t) = -4.9t^2 + 30t + 55$. What will be the height, in meters, of the object 3 seconds after launch?

F. 44.1
G. 100.9
H. 145
J. 189.1

DO YOUR FIGURING HERE.

9. Given the function $f(x) = 4x^2 - 14x + 12$, which of the following expressions is equivalent to $f(x)$?

A. $(-2x + 4)(2x + 3)$
B. $(2x - 4)(2x - 3)$
C. $(2x - 4)(2x + 3)$
D. $(2x - 3)(2x + 4)$

10. Which of the following is equivalent to $(6x + 3y) - (y - 2x)$?

F. $4x + 2y$
G. $5x + y$
H. $5x + 5y$
J. $8x + 2y$

11. Bryce owns an apartment building. He charges \$325 per month for each 1-bedroom apartment and \$410 per month for each 2-bedroom apartment. Bryce charged a total of \$4,905 in rent for 13 apartments this month. How many 1-bedroom apartments did Bryce charge for this month?

A. 5
B. 6
C. 7
D. 8

GO ON TO THE NEXT PAGE.



12. A restaurant surveyed its customers to determine whether or not they like hamburgers and whether or not they like turkey burgers. The table shows the results of the survey.

	Like hamburgers	Do not like hamburgers	Total
Like turkey burgers	97	39	136
Do not like turkey burgers	98	78	176
Total	195	117	312

To the nearest 1%, what percent of the customers who responded to the survey like hamburgers?

- F. 31%
- G. 50%
- H. 63%
- J. 71%

DO YOUR FIGURING HERE.

13. For what value of n does the quadratic equation $x^2 - 4x + n = 0$ have solutions of $x = 7$ and $x = -3$?

- A. -21
- B. -4
- C. 4
- D. 10

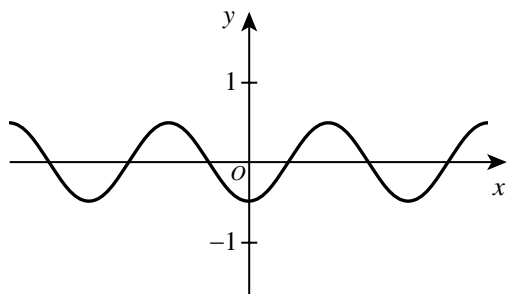
14. The lengths of corresponding sides of 2 similar right triangles are in the ratio 4:5. The hypotenuse of the smaller triangle is 20 inches long. How many inches long is the hypotenuse of the larger triangle?

- F. 9
- G. 20
- H. 21
- J. 25

GO ON TO THE NEXT PAGE.



15. What is the amplitude of the graph of function $f(x) = \frac{1}{2}\cos(3x + \pi)$, shown in the standard (x,y) coordinate plane?



DO YOUR FIGURING HERE.

- A. $\frac{1}{3}$
 B. $\frac{1}{2}$
 C. 2
 D. 3
16. A circle in the standard (x,y) coordinate plane has its center at $(3,-4)$ and passes through $(0,0)$. Which of the following is an equation for that circle?
- F. $x^2 + y^2 = 5$
 G. $(x - 3)^2 + (y + 4)^2 = 25$
 H. $(x + 3)^2 + (y - 4)^2 = 7$
 J. $(x + 3)^2 + (y - 4)^2 = 25$
17. $\sqrt{112} + \sqrt{63} + \sqrt{175} = ?$
- A. $7\sqrt{12}$
 B. $7\sqrt{50}$
 C. $12\sqrt{7}$
 D. $60\sqrt{7}$
18. The sum of 3 positive integers is 180, and the ratio of the integers is 5:3:2. What is the value of the smallest of the integers?
- F. 18
 G. 36
 H. 54
 J. 90

GO ON TO THE NEXT PAGE.



19. Jeremy reaches into a box in the closet. The box contains 10 gloves that make up 5 matching pairs. He picks 1 glove at random and puts it on. Then he picks another glove at random. What is the probability that he has picked a matching pair?

A. $\frac{1}{9}$
B. $\frac{1}{5}$
C. $\frac{4}{9}$
D. $\frac{1}{2}$

DO YOUR FIGURING HERE.

20. During an event, a store gave a free T-shirt to every 24th customer that entered the store and a free gift certificate to every 60th customer that entered the store. Given that 500 customers entered the store during the event, how many customers received both a free T-shirt **and** a free gift certificate?

F. 2
G. 4
H. 12
J. 24

21. Cameron's bookshelf has 3 books with a rating of 10, 5 books with a rating of 100, and 2 books with a rating of 70. There are no other books on the bookshelf. What is the expected value, to the nearest whole number, of the rating of a book randomly selected from Cameron's bookshelf?

A. 18
B. 60
C. 67
D. 85

22. The 1st term of a certain sequence is -10 , and the 2nd term is 1. Each subsequent term is obtained by adding the 2 immediately preceding terms. What is the 5th term of this sequence?

F. -23
G. -17
H. 19
J. 34

GO ON TO THE NEXT PAGE.



23. Which of the following values is the y -value of the solution to the given system of equations?

$$\begin{aligned} -4y - 3 &= x \\ 2x - 22 &= 6y \end{aligned}$$

- A. $y = -2\frac{1}{2}$
 B. $y = -2$
 C. $y = -\frac{3}{4}$
 D. $y = 5$

DO YOUR FIGURING HERE.

24. Some values of the function g are given in the table. One of the following equations defines g . Which one?

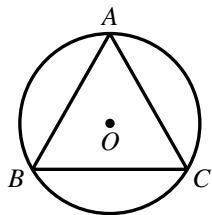
x	-2	0	1	2	3
$g(x)$	0	-8	-6	0	10

- F. $g(x) = -2x - 8$
 G. $g(x) = -x - 8$
 H. $g(x) = x^2 + 2$
 J. $g(x) = 2x^2 - 8$

25. The vertex angle of an isosceles triangle is 40° . What is the measure of a base angle?

- A. 40°
 B. 70°
 C. 100°
 D. 140°

26. Equilateral triangle $\triangle ABC$ is inscribed in circle O , as shown. What is the degree measure of minor arc $\widehat{BC}$?



- F. 60°
 G. 90°
 H. 120°
 J. 180°

GO ON TO THE NEXT PAGE.



27. A scale model, where 1 coordinate unit represents 1 mile, is drawn in the standard (x,y) coordinate plane. Angelo's house is at $(4,-3)$, Ella's house is at $(4,7)$, Troy's house is at $(-2,7)$, and Yoko's house is at $(-2,-3)$. Which of the following is closest to the area, in square miles, of the rectangle whose vertices are the **real** locations of the 4 houses?

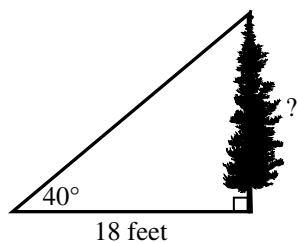
A. 32
B. 36
C. 60
D. 100

DO YOUR FIGURING HERE.

28. Let the function f be defined as $f(x) = -9x^2$. In the standard (x,y) coordinate plane, the graph of $y = f(x)$ undergoes a transformation such that the result is the graph of $y = f(x) - 4$. Under this transformation the graph of $y = f(x)$ is:

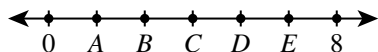
F. shifted downward 4 coordinate units.
G. shifted left 4 coordinate units.
H. stretched horizontally by a factor of 4.
J. stretched vertically by a factor of 4.

29. Which of the following expressions equals the height, in feet, of the tree shown?



A. $18 \tan 40^\circ$
B. $18 \sin 40^\circ$
C. $18 \cos 40^\circ$
D. $\frac{\tan 40^\circ}{18}$

30. As shown, the number line between 0 and 8 is divided into 6 segments of equal length by points A through E . Which of the following statements about $\sqrt{8}$ is true?



F. $\sqrt{8}$ is at C .
G. $\sqrt{8}$ is at D .
H. $\sqrt{8}$ is between A and B .
J. $\sqrt{8}$ is between B and C .

GO ON TO THE NEXT PAGE.



31. Deon often flies his kite. He can only fly his kite on days with wind. He does not fly his kite on every day with wind. For any given day, let Event A be that there is wind and let Event B be that Deon flies his kite. Which of the following values can $P(A \text{ and } B)$ be?

A. 0
B. 0.5
C. 1
D. 1.5

DO YOUR FIGURING HERE.

32. Whenever $\frac{-3x^3 + 12x}{x^3 - x^2 - 6x}$ is defined, it is equivalent to:

F. -2
G. $\frac{1}{x+3}$
H. $\frac{6-3x}{x+3}$
J. $\frac{6-3x}{x-3}$

33. The roots of a polynomial equation are 0, 2, and -5 . Which of the following is a factored form of the equation?

A. $(x-2)(x+5) = 0$
B. $x(x-2)(x+5) = 0$
C. $x(x+2)(x-5) = 0$
D. $(x-2)(x+5) = x$

34. If $\frac{3x-y}{x+y} = \frac{5}{8}$, then $\frac{x}{y} = ?$

F. $\frac{2}{19}$
G. $\frac{13}{19}$
H. $\frac{5}{8}$
J. $\frac{13}{7}$

GO ON TO THE NEXT PAGE.



35. Let the slope of $3x + 2y = 5$ be m_1 , and the slope of $6x + 4y = 7$ be m_2 . Which of the following is true?

A. $m_1 = m_2$
 B. $m_1 = 2m_2$
 C. $2m_1 = m_2$
 D. $7m_1 = 5m_2$

DO YOUR FIGURING HERE.

36. The piecewise functions f and g are given.

$$f(x) = \begin{cases} -x^2 & \text{for } x < 0 \\ 1 - x & \text{for } x \geq 0 \end{cases}$$

$$g(x) = \begin{cases} |x| + 7 & \text{for } x \leq -1 \\ x - 3 & \text{for } x > -1 \end{cases}$$

What is the value of $f(g(-1))$?

F. -16
 G. -7
 H. -5
 J. -1

37. Let f be defined by $f(x) = 4x + 7$. Let g be defined by $g(x) = -2x^2 + 11x + 1$. The graphs of $y = f(x)$ and $y = g(x)$ intersect at one of the following (x,y) points. Which one?

A. $(-2, -1)$
 B. $(1\frac{1}{2}, 13)$
 C. $(2, 1\frac{1}{2})$
 D. $(13, -1)$

38. A tourism organization randomly selected 100 tourists finishing their summer visit to Spain. The organization asked them how many cities they had toured in the country. The table shows the results. Based on these data, for the population of tourists that visited Spain during the summer, what is the best estimate of the mean number of cities toured?

Number of cities	1	2	3
Number of tourists	10	40	50

F. 0.8
 G. 2
 H. 2.4
 J. 3

GO ON TO THE NEXT PAGE.



39. Given that i is the imaginary unit, which of the following numbers is equal to $(7 + 4i)^2$?

A. 33
 B. 65
 C. $14 + 8i$
 D. $33 + 56i$

DO YOUR FIGURING HERE.

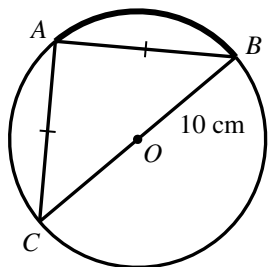
40. The product of 2 complex numbers, x and y , is a real number that is irrational. Which of the following statements **cannot** be true?

F. Both x and y are rational.
 G. Both x and y are imaginary.
 H. The product of x and y is $\sqrt{2}$.
 J. The product of x and y is negative.

41. The real solution of the equation $3e^x = 12$ is:

A. $\ln 4$
 B. $3 \ln 12$
 C. 4^e
 D. $\frac{\ln 12}{3}$

42. The figure shows $\triangle ABC$, a right isosceles triangle, inscribed in a circle with center O and radius 10 cm. What is the length, in centimeters, of arc $\widehat{AB}$ shown as the thick curved line?



F. 20π
 G. 15π
 H. 10π
 J. 5π

43. It took Sam x minutes to bike the d miles from home to work. Returning home on the same route, it took Sam y minutes. On the way home his average speed was 2 times his average speed on the way to work. Which of the following equations gives y in terms of x ?

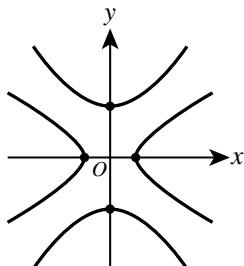
A. $y = \frac{x}{2}$
 B. $y = x - 2$
 C. $y = x + 2$
 D. $y = 2x$

GO ON TO THE NEXT PAGE.



44. The hyperbolas $\frac{x^2}{9} - \frac{y^2}{4} = 1$ and $\frac{y^2}{36} - \frac{x^2}{25} = 1$ are graphed in the standard (x,y) coordinate plane. Which of the following equations is an ellipse that intersects all 4 vertices of the hyperbolas?

DO YOUR FIGURING HERE.



- F. $\frac{x^2}{9} + \frac{y^2}{36} = 1$
 G. $\frac{x^2}{25} + \frac{y^2}{4} = 1$
 H. $\frac{x^2}{25} + \frac{y^2}{9} = 1$
 J. $(x - 9)^2 + (y - 36)^2 = 1$
45. Given that $f(x) = \sqrt[3]{2x-1}$, which of the following expressions is the inverse function, $f^{-1}(x)$?
- A. $\frac{1}{\sqrt[3]{2x-1}}$
 B. $\sqrt[3]{\frac{x+1}{2}}$
 C. $\frac{x^3+1}{2}$
 D. $(2x-1)^3$

END OF TEST 2

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

DO NOT RETURN TO THE PREVIOUS TEST.

Mathematics Scoring Key

Math Number	Correct Answer	Correct (Mark 1)	Reporting Categories
1	A		S
2	J		F
3	B		IES
4	G		N
5	C		IES
6	J		N
7	A		G
8	G	Not Scored	___
9	B		F
10	J		A
11	A		A
12	H		S
13	A		A
14	J		G
15	B		F
16	G		G
17	C		N
18	G	Not Scored	___
19	A		S
20	G		IES
21	C		S
22	G		F
23	B		IES
24	J		F
25	B		G
26	H		G
27	C		IES
28	F	Not Scored	___
29	A		G
30	J		IES
31	B		S
32	J		A
33	B		A
34	G		A
35	A		IES
36	C		F
37	B		A
38	H	Not Scored	___
39	D		N
40	F		N
41	A		F
42	J		G
43	A		IES
44	F		G
45	C		F

Mathematics Reporting Categories

(Capture raw scores/correct answers.)

Preparing for Higher Math (PHM)

(A + F + G + N + S) = ___ of 33

A = Algebra

F = Functions

G = Geometry

N = Number & Quantity

S = Statistics & Probability

Integrating Essential Skills (IES) = ___ of 8

Total Mathematics Raw Score

(PHM + IES) = ___ of 41

Mathematics Scale Score Conversion Table

Use the Total Mathematics Raw Score from the previous table to find the scale score you could expect if you got that number correct on test day.

Math Raw Score	Math Scale Score	Math Raw Score	Math Scale Score
41	36	20	18
40	36	19	17
39	35	18	17
38	34	17	17
37	33	16	16
36	31	15	16
35	30	14	16
34	29	13	15
33	28	12	15
32	27	11	14
31	27	10	14
30	26	9	14
29	25	8	14
28	25	7	13
27	24	6	12
26	23	5	11
25	22	4	10
24	21	3	9
23	20	2	7
22	19	1	4
21	18	0	1

Mathematics Scale Score = ___