

**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.

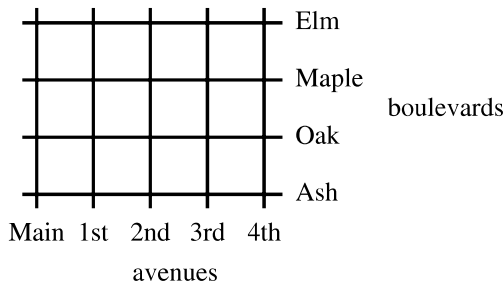
You are permitted to use a calculator on this test. You may use your calculator for any problems you choose,

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. In the section of Middleton shown on the given map, the avenues and boulevards form a uniform square grid. At the annual Middleton Scavenger Hunt, the winners receive wonderful prizes. Clue 1 states that Clue 2 will be found exactly halfway between the corner of Main and Oak and the corner of 4th and Elm along the straight line between the two corners. On which avenue is Clue 2 located?



- A. 1st
B. 2nd
C. 3rd
D. 4th
2. The mean of 4 numbers is 45. The first 3 numbers are 26, 39, and 58. What is the value of the last number?
- F. 12
G. 32
H. 42
J. 57
3. When $a = 7$, $b = -4$, and $c = 5$, $abc - ac^2 - ab = ?$
- A. -343
B. -287
C. -63
D. 7

DO YOUR FIGURING HERE.**GO ON TO THE NEXT PAGE.**



4. In the standard (x,y) coordinate plane, the vertices of a rectangle are $A(1,1)$, $B(5,1)$, $C(5,3)$, and $D(1,3)$. The rectangle is translated to the right 2 units and then down 5 units. What are the new coordinates of point B after these translations are performed on the rectangle?

F. $(0,3)$
 G. $(3,-1)$
 H. $(7,-4)$
 J. $(10,-1)$

DO YOUR FIGURING HERE.

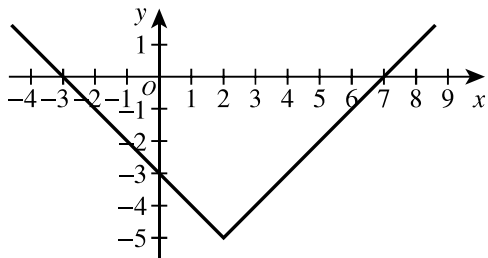
5. A certain garden has 8 rows of pumpkins with 7 pumpkins in each row. One afternoon the gardener harvested 4 of the rows of pumpkins. That night a tree branch fell and damaged half of the remaining pumpkins. How many pumpkins were damaged by the branch?

A. 2
 B. 14
 C. 26
 D. 28

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

F. 9
 G. 12
 H. 20
 J. 57

7. An absolute value function is shown in the standard (x,y) coordinate plane. Which of the following lists all the x -intercepts of the graph?



A. $(0,-3)$ only
 B. $(2,-5)$ only
 C. $(-3,0)$ and $(7,0)$
 D. $(-3,0)$, $(0,-3)$, and $(7,0)$

8. Given $i = \sqrt{-1}$, what is $\sqrt{9} + \sqrt{-144}$?

F. $3\sqrt{15}$
 G. $3\sqrt{15}i$
 H. $3 - 12i$
 J. $3 + 12i$

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9. The table gives observed data values for variables x and y . Among all equations of the form $y = kx$ such that k is an integer, there is 1 equation that best fits the data in the table. Based on that equation, which of the following values is closest to the predicted y -value for an x -value of 66.00?

x	y
2.99	36
9.70	116
14.99	180
22.90	275
29.00	348

- A. 231
B. 385
C. 550
D. 792
10. If $|4x - 3| = 7$, which of the following is a possible value for x ?
- F. -3
G. -1
H. 1
J. 3
11. The fairness of a particular coin is being investigated by flipping the coin. Which of the following experiment results provides the **most** evidence that the coin is **not** fair?
- A. 1 out of 170,000 flips is a tail.
B. 17 out of 17,000 flips are tails.
C. 170 out of 1,700 flips are heads.
D. 1,700 out of 17,000 flips are heads.
12. Which of the following is equivalent to the given expression?
- $$3xy^2 - 4x^2y + 12x^2y - 7xy^2$$
- F. $-8x^2y + 4xy^2$
G. $-x^2y + 5xy^2$
H. $x^2y - 5xy^2$
J. $8x^2y - 4xy^2$

DO YOUR FIGURING HERE.

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13. A restaurant conducted a survey to determine whether or not its customers like white cake and chocolate cake. The table below shows the results of the survey.

	Like white cake	Do not like white cake	Total
Like chocolate cake	64	75	139
Do not like chocolate cake	37	53	90
Total	101	128	229

To the nearest whole number, what percent of the customers surveyed like white cake?

- A. 28%
 B. 44%
 C. 63%
 D. 77%
14. The 1st through 5th terms, in order, of an infinite arithmetic sequence are -3 , -7 , -11 , -15 , and -19 . What is the 21st term of the sequence?
- F. -63
 G. -77
 H. -79
 J. -83
15. All students in a middle school responded either “Yes,” “No,” or “I don’t know” to the question “Do you plan to attend a 4-year college?” The table gives the number of students in each grade who responded. Two numbers are represented by x and y .

	6th	7th	8th
Yes	28	x	49
No	20	y	12
I don’t know	80	71	73

The probability that a randomly selected student from this middle school responded “Yes” given that the student is in 7th grade is $\frac{49}{139}$. One of the following is the value of y . Which one?

- A. 16
 B. 19
 C. 22
 D. 58
16. If $(x + k)^2 = x^2 + 94x + k^2$, then $k = ?$
- F. 47
 G. 94
 H. 188
 J. 376

DO YOUR FIGURING HERE.

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17. Given that $f(x) = -10 + x$ and $g(x) = 2$, it must be true that $\frac{f}{g}(x) = ?$

A. $-10 + \frac{x}{2}$
 B. $-10 + 2x$
 C. $-5 + \frac{x}{2}$
 D. $-5 + 2x$

DO YOUR FIGURING HERE.

18. 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?

F. 0
 G. 0.5
 H. 1
 J. 1.5

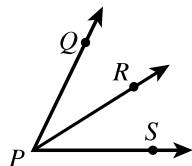
19. To determine the number of frogs in a swamp, a biologist catches a random sample of 400 frogs, tags them, and releases them back into the swamp. Four weeks later, the biologist catches a random sample of 140 frogs from this swamp, and 70 of them have tags. Based on these samples, which of the following is the best estimate of the number of frogs in the swamp?

A. 800
 B. 1,080
 C. 3,086
 D. 3,920

20. The inequality $7(x + 4) > 8(x - 2)$ is equivalent to which of the following inequalities?

F. $x < 2$
 G. $x < 6$
 H. $x < 12$
 J. $x < 44$

21. In the figure shown, $\overrightarrow{PR}$ bisects $\angle QPR$, $m\angle QPR = 64^\circ$, and $m\angle RPS = (2x + 10)^\circ$. What is the value of x ?



A. 11
 B. 21
 C. 27
 D. 53

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22. Given that $\sin \theta = \frac{1}{3}$ and $\cos \theta = \frac{2\sqrt{2}}{3}$, what is $\tan \theta$?

F. $\frac{1}{2\sqrt{2}}$

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

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

J. $2\sqrt{2}$

DO YOUR FIGURING HERE.

23. The graph of $4(x+1)^2 - 5(y+9)^2 = 100$ is a hyperbola in the standard (x,y) coordinate plane. What is the point of intersection of the hyperbola's asymptotes?

A. $(-4,5)$

B. $(-1,-9)$

C. $(1,9)$

D. $(4,-5)$

24. $(\sqrt{3} + \sqrt{7})^2 = ?$

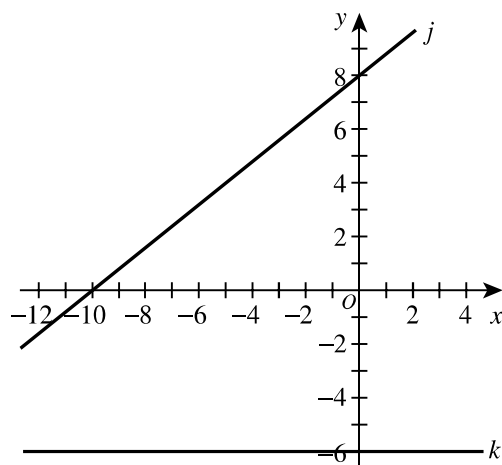
F. 10

G. $10 + \sqrt{42}$

H. $10 + 2\sqrt{21}$

J. $2\sqrt{3} + 2\sqrt{7}$

25. Lines j and k are graphed in the given standard (x,y) coordinate plane. The coordinates at each of the intercepts are integers. Line k is horizontal.



One of the following ordered pairs is the point of intersection of lines j and k . Which one?

A. $(-\frac{35}{2}, -6)$

B. $(-\frac{56}{5}, -6)$

C. $(-\frac{74}{5}, -6)$

D. $(-6, -\frac{74}{5})$

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26. Each of a doctor's 70 patients is insured by 1 of 4 companies. For each company, the table lists the number of her patients that have and do **not** have a flexible savings account (FSA). One of her patients will be randomly selected. What is the probability that the selected patient does **not** have an FSA, given that the patient is insured by Company A?

DO YOUR FIGURING HERE.

Company	Has an FSA	Does not have an FSA
A	28	20
B	2	6
C	7	3
D	0	4

- F. $\frac{1}{20}$
- G. $\frac{5}{7}$
- H. $\frac{5}{12}$
- J. $\frac{20}{33}$
27. Rectangle R has vertices $(-4,3)$, $(2,3)$, $(2,-2)$, and $(-4,-2)$ in the standard (x,y) coordinate plane. Reflecting R across the x -axis will result in rectangle R' . Reflecting R' across the y -axis will result in rectangle R'' . Which of the following clockwise ($\curvearrowright$) rotations about the origin on R'' will result in R ?
- A. 90°
- B. 180°
- C. 270°
- D. 360°
28. Let $f(x) = -x + 5$ and $g(x) = 4x^2 + 8x - 4$. One of the following points is a point of intersection of the graphs of $y = f(x)$ and $y = g(x)$ in the standard (x,y) coordinate plane. Which one?
- F. $(-3, \frac{3}{4})$
- G. $(-3, 8)$
- H. $(\frac{3}{4}, -3)$
- J. $(\frac{3}{4}, \frac{23}{4})$

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29. In a particular cleaning solution, the ratio of concentrated solution to water is 3:40. How many **cups** of concentrated solution should be added to 5 gallons of water to make the cleaning solution in the given ratio?

(Note: 4 cups = 1 quart; 4 quarts = 1 gallon)

A. 12

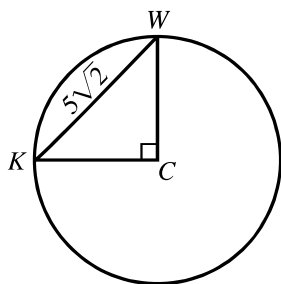
B. 6

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

D. $\frac{3}{8}$

DO YOUR FIGURING HERE.

30. Points K and W are on the given circle with center C such that $WK = 5\sqrt{2}$ inches and the measure of $\angle WCK$ is 90° . What is the area, to the nearest 0.1 inch, of the circle?



- F. 31.4
G. 39.3
H. 78.5
J. 157.1

31. A formula was evaluated with the nonzero real numbers a , b , m , and d . The resulting equation $a = bmd$ is **not** true, but it becomes a true equation when m is increased by n . Which of the following equations gives n in terms of a , b , m , and d ?

A. $n = \frac{a}{d} - bm$

B. $n = \frac{a}{bd} - m$

C. $n = \frac{a-d}{b} - m$

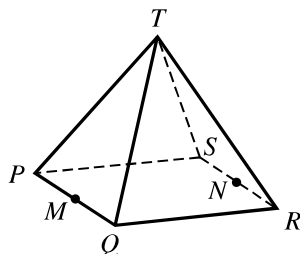
D. $n = \frac{a-bm}{d}$

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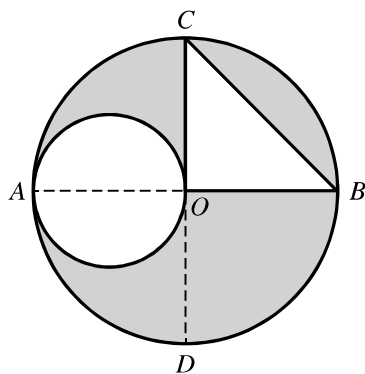


32. As given, a right pyramid has a square base, $PQRS$, and a vertex, T . Points M and N are the midpoints of $\overline{PQ}$ and $\overline{RS}$. The height of the pyramid is 12 cm, and each side length of the base is 5 cm. Among the following cross sections, which one has the greatest area?

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



- F. $\triangle PRT$
 G. $\triangle QRT$
 H. $\triangle MNT$
 J. square $PQRS$
33. In the given figure, $\overline{AB}$ and $\overline{CD}$ are perpendicular diameters of the circle centered at O . The unshaded areas are made up of a circle, with $\overline{OA}$ as a diameter, and a triangle with vertices at O , B , and C . Given that $\overline{OA}$ is 12 centimeters long, which of the following values is closest to the area, in square centimeters, of the **shaded** region inside the circle centered at O ?



- A. 154
 B. 195
 C. 226
 D. 267
34. The function p is defined by $p(x) = -4x^2$. The function r is defined by $r(x) = p(x + 6)$. The graph of $y = r(x)$ in the standard (x, y) coordinate plane is the graph of $y = p(x)$:
- F. shifted in the negative x -direction 6 coordinate units.
 G. shifted in the negative y -direction 6 coordinate units.
 H. shifted in the positive y -direction 6 coordinate units.
 J. stretched in the x -direction by a factor of 6.

DO YOUR FIGURING HERE.

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35. The equation $a \begin{bmatrix} 5 & b \\ 1 & bc \end{bmatrix} = \begin{bmatrix} 10 & 2 \\ c & d \end{bmatrix}$ is true for the fixed real numbers a , b , c , and d . What is the value of d ?

A. 1
B. 2
C. 4
D. 8

DO YOUR FIGURING HERE.

36. Let a and b represent positive real numbers with the property $|a - b - 1| > 0$. Which of the following statements about a and b **cannot** be true?
- F. $a = b$
G. $a > b$
H. $a - b < 1$
J. $a - b = 1$
37. Haruka is a long-distance runner who competes both in 10,000-meter races and in marathons, which are run over a distance of 26.2 miles. Given that 1.0 mile is approximately 1.6 kilometers, which of the following distances, in kilometers, is closest to the difference between the distances Haruka runs in a marathon and in a 10,000-meter race?
- A. 16.2
B. 16.4
C. 31.9
D. 41.9
38. What is the value of $\cos\left(\text{Arcsin}\left(\frac{8}{17}\right)\right)$?
- F. $\frac{8}{17}$
G. $\frac{15}{17}$
H. $\frac{8}{15}$
J. $\frac{17}{8}$
39. An object is launched vertically at 44.1 meters per second from a 931-meter-tall platform. The function $s = -4.9t^2 + 44.1t + 931$ gives the object's height, s meters, at the time t seconds after launch. What is the greatest height, to the nearest 0.1 meters, the object can reach?
- A. 198.5
B. 935.5
C. 1,030.2
D. 1,129.5

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40. The table gives values of $f(x)$, $g(x)$, and $h(x)$ for all positive integers $x \leq 5$. Given $h(f(g(a))) = 1$ where a is a positive integer less than or equal to 5, what is the value of a ?

x	$f(x)$	$g(x)$	$h(x)$
1	2	4	3
2	1	5	1
3	4	2	5
4	5	3	4
5	3	1	2

- F. 2
G. 3
H. 4
J. 5
41. For all x and y such that $y = \log_{10}(2x)$, which of the following expressions is equal to x ?
- A. $\left(\frac{1}{2}\right)10^y$
B. 10^{y-2}
C. $10^{\sqrt{y}}$
D. 10^{2y}
42. What is the binomial expansion of $(x - 5)^4$?
- F. $x^4 + 625$
G. $x^4 - 20x^2 + 625$
H. $x^4 - 5x^3 + 25x^2 - 125x + 625$
J. $x^4 - 20x^3 + 150x^2 - 500x + 625$
43. Triangle A has an area of $16\sqrt{3}$ square feet. Triangle B is the result of a dilation on Triangle A and has sides that are $\frac{1}{2}$ as long as the corresponding sides of Triangle A. What is the area, in square feet, of Triangle B?
- A. $4\sqrt{3}$
B. $4\sqrt{6}$
C. $8\sqrt{3}$
D. $8\sqrt{6}$

DO YOUR FIGURING HERE.



44. The probability distribution for the random variable X is given in the table. What is the expected value of X ?

X	$P(X)$
8	0.1
9	0.3
10	0.4
11	0.2

- F. 0.3
 G. 9.5
 H. 9.7
 J. 10.0
45. A skater's speed increased over a 6-second interval. His initial speed was 4 meters per second, and his speed 6 seconds later was 6 meters per second. Which of the following was the average rate of change of the skater's speed over this 6-second interval?
- A. 2 meters per second
 B. 12 meters per second per second
 C. $\frac{1}{3}$ meter per second
 D. $\frac{1}{3}$ meter per second per second

DO YOUR FIGURING HERE.

END OF TEST 2

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

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