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.

DO YOUR FIGURING HERE.

1. The table below gives the heart rates, in beats per minute (bpm), for 8 participants in a fitness study after each participant completed 45 minutes of aerobic exercise. What is the mean heart rate of the 8 participants, to the nearest 0.1 bpm ?

Participant	Heart rate (bpm)
1	130
2	155
3	162
4	148
5	177
6	162
7	170
8	156
Sum	1,260

A. 137.3
B. 153.5
C. 157.5
D. 162.0
E. 162.5

2. The top surface of a rectangular table has an area of 144 square feet and a width of 4 feet. What is the length, in feet, of the surface?

F. 12
G. 32
H. 36
J. 140
K. 576

3. The price of a coat decreased from $50 to $40. The price decreased by what percent?

A. 10%
B. 14%
C. 15%
D. 20%
E. 25%

DO YOUR FIGURING HERE.

4. Chang, a store employee, asked each of 50 customers which 1 of 4 shirt colors the customer preferred. The number of customers who preferred each color is given in the table below.

Color	Number of customers
Red	15
White	22
Blue	5
Gray	8
Total	50

Chang will order 500 shirts in the proportions, by color, in the table. How many gray shirts will he order?

F. 8
G. 16
H. 40
J. 80
K. 125

5. Belinda plans to use landscaping timbers to build a border for her 8-foot-by-12-foot rectangular garden. To determine the number of timbers she needs, she must calculate the perimeter of the garden. What is the perimeter, in feet, of the garden?

A. 20
B. 24
C. 40
D. 48
E. 96

6. At Nikki's Necklaces, the total production cost to produce necklaces consists of an operational cost of $300 per day, plus a material cost of $10 per necklace produced. For a day in which n necklaces are produced, which of the following expressions gives that day's total production cost, in dollars, to produce necklaces?

F. $-10n + 300$
G. $10n - 300$
H. $10n + 300$
J. $300n - 10$
K. $300n + 10$

7. The first question on a 2-question quiz offers 2 answers, and exactly 1 answer must be chosen. The second question offers 5 answers, and exactly 1 answer must be chosen. The quiz has how many possible combinations of answers?

A. 5
B. 10
C. 20
D. 25
E. 100

DO YOUR FIGURING HERE.

8. For what value of x is the equation $2(x - 6) + x = 36$ true?

F. 8
G. 10
H. 14
J. 16
K. 24

9. What value of a will make the equation $\frac{4+a}{9+a} = \frac{2}{3}$ true?

A. −19
B. 3
C. 5
D. 6
E. 30

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

$$-6, 12, -24, 48, -96, \cdots$$

F. 192
G. 144
H. −144
J. −192
K. Cannot be determined from the given information

11. In the standard (x,y) coordinate plane, A has coordinates (−4,−9). Point A is translated 4 units to the right and 9 units up and labeled A'. What are the coordinates of A' ?

A. (−13,−13)
B. (−8,−18)
C. (−4,−18)
D. (0, 0)
E. (8, 18)

12. A formula used to compute the volume, V, of a rectangular prism is $V = lwh$, where l is the length of the base, w is the width of the base, and h is the height of the prism. What is the height, in centimeters, of a rectangular prism that has a volume of 510 cubic centimeters and a base that measures 5 centimeters by 12 centimeters?

F. 8.5
G. 30
H. 42.5
J. 102
K. 450

DO YOUR FIGURING HERE.

13. Solar panels that produce 150 amps of electric current each are needed for a proposed space station. If the solar panels are manufactured to produce 0.75 amps per square meter of surface area, the surface area of each solar panel needs to be how many square meters?

A. 20
B. 75
C. 112.5
D. 150
E. 200

14. If cantaloupes sell at \$1.49 each or 3 for \$3.90, how much is saved, to the nearest cent, on each cantaloupe by buying them 3 at a time?

F. 12¢
G. 19¢
H. 31¢
J. 47¢
K. 92¢

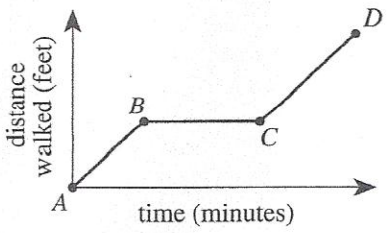
15. Which of the following expressions is equivalent to $(4ab^2)(3a^4b^3)$?

A. $7a^4b^6$
B. $7a^5b^5$
C. $12a^4b^5$
D. $12a^4b^6$
E. $12a^5b^5$

16. In the standard (x,y) coordinate plane, the coordinates of the endpoints of $\overline{DM}$ are (11,3) and (17,15). What is the y-coordinate of the midpoint of $\overline{DM}$?

F. 7
G. 9
H. 14
J. 16
K. 18

17. The distance-versus-time graph below represents Barbara Jean's walk to school on Friday.

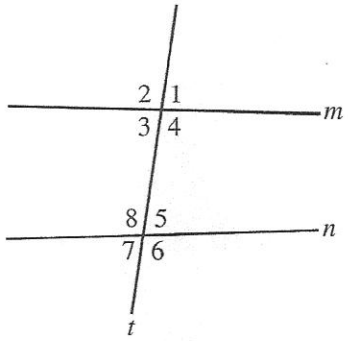


Which of the following statements could describe what Barbara Jean did during the time interval covered by the horizontal line segment $\overline{BC}$?

A. She walked due east.
B. She walked up some steps.
C. She walked on level ground.
D. She walked at a faster speed.
E. She stopped to talk to friends.

DO YOUR FIGURING HERE.

18. In the diagram below, lines m and n are cut by transversal t. Lines m and n are NOT parallel. Which of the following statements *must* be true?



F. $\angle 1 \cong \angle 2$
G. $\angle 1 \cong \angle 3$
H. $\angle 1 \cong \angle 5$
J. $\angle 2 \cong \angle 6$
K. $\angle 3 \cong \angle 5$

19. The expression $5 - 3(2x - 1)$ is equivalent to:

A. $-2 + 4x$
B. $2 - 6x$
C. $8 - 6x$
D. $8 - 5x$
E. $9 - 6x$

20. Which of the following angle measures CANNOT be the measure of any angle in an obtuse triangle?

(Note: An obtuse triangle is a triangle that has 1 angle with a measure greater than 90° but less than 180°.)

F. 30°
G. 37°
H. 60°
J. 90°
K. 126°

21. What is the value of $f(-5)$ when $f(x) = \frac{-3(x^2 + 3x + 2)}{15x + 15}$?

A. $-\frac{19}{10}$

B. $-\frac{3}{5}$

C. $\frac{3}{5}$

D. $\frac{12}{25}$

E. $\frac{19}{10}$

DO YOUR FIGURING HERE.

22. In the standard (x,y) coordinate plane, what is the slope of the line with equation $3x + 2y = 6$?

F. -3

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

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

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

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

23. Which of the following is a simplified form of $\sqrt{20} - \sqrt{45}$?

A. $-\sqrt{5}$
B. -5
C. 5
D. $5\sqrt{5}$
E. $\sqrt{65}$

24. A formula for simple interest is $I = Prt$, where I is the interest in dollars, P is the principal in dollars, r is the annual interest rate expressed as a decimal, and t is the time in years the money is invested. Which of the following expressions gives t when the annual interest rate is 5% ?

F. $\frac{I}{0.05P}$

G. $\frac{I}{0.5P}$

H. $\frac{I}{5P}$

J. $\frac{0.5I}{P}$

K. $0.05IP$

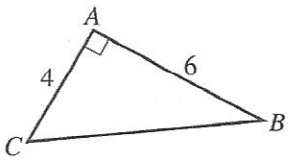
25. When $t = 2{,}005$, the value of the function $f(t)$ is 100 more than twice the value of $f(t)$ when $t = 1{,}998$. Which of the following equations expresses this relationship?

A. $f(2{,}005) = 2f(1{,}998) + 100$
B. $f(1{,}998) = 2f(2{,}005) + 100$
C. $f(t) = 2f(t) + 100$
D. $f(t + 2{,}005) = 2f(t + 1{,}998) + 100$
E. $f(2{,}005) + 100 = 2f(1{,}998)$

DO YOUR FIGURING HERE.

Use the following information to answer questions 26–28.

Shown below is right triangle $\triangle ABC$ with the given dimensions in meters.



26. What is the length, in meters, of $\overline{BC}$?

F. 8
G. 10
H. $\sqrt{10}$
J. $\sqrt{20}$
K. $\sqrt{52}$

27. Which of the following statements about the measures of the interior angles in $\triangle ABC$ is true?

(Note: $m\angle A$ represents the degree measure of $\angle A$.)

A. $m\angle A = m\angle B$
B. $m\angle B = m\angle C$
C. $m\angle A = m\angle B + m\angle C$
D. $m\angle B + m\angle C = 180°$
E. $m\angle A + m\angle B + m\angle C = 360°$

28. Which of the following expressions represents $\cos B$?

F. $\frac{AB}{AC}$
G. $\frac{AB}{BC}$
H. $\frac{AC}{BC}$
J. $\frac{AC}{AB}$
K. $\frac{BC}{AB}$

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29. Given the functions f and g defined by $f(x) = x + 3$ and $g(x) = x^2 + 1$, what is the value of $f(g(1))$?

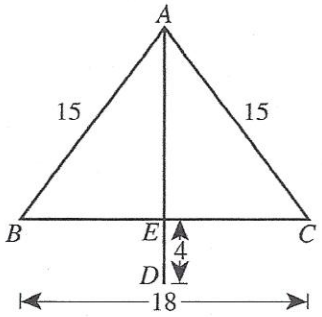
A. 2
B. 5
C. 6
D. 8
E. 17

DO YOUR FIGURING HERE.

30. Which of the following expressions is equivalent to $(3x^2)^3$?

F. $3x^5$
G. $3x^6$
H. $9x^5$
J. $9x^6$
K. $27x^6$

31. Marsha is making a sail for a model boat. In the figure below, the sail is represented by $\triangle ABC$. Base $\overline{BC}$ is 18 inches long, and legs $\overline{AB}$ and $\overline{AC}$ are each 15 inches long. The mast, represented by $\overline{AD}$, is perpendicular to the base and extends 4 inches below the bottom of the sail. How many inches long is the mast?



A. 12
B. 16
C. 33
D. $3\sqrt{11}$
E. $3\sqrt{11} + 4$

32. Which of the following inequalities orders the numbers below from least to greatest?

$$3\tfrac{3}{7},\ -(-3.5),\ 3\tfrac{2}{5}$$

F. $-(-3.5) < 3\frac{2}{5} < 3\frac{3}{7}$
G. $-(-3.5) < 3\frac{3}{7} < 3\frac{2}{5}$
H. $3\frac{3}{7} < 3\frac{2}{5} < -(-3.5)$
J. $3\frac{2}{5} < -(-3.5) < 3\frac{3}{7}$
K. $3\frac{2}{5} < 3\frac{3}{7} < -(-3.5)$

DO YOUR FIGURING HERE.

Use the following information to answer questions 33–35.

The table below gives the prices for dog grooming at Pretty Pooches.

Size of dog	Shampoo	Haircut
Small	$20	$30
Large	$35	$55

33. Hoakoa brought 10 dogs to Pretty Pooches and paid $260 to have all 10 shampooed. How many large dogs did Hoakoa have shampooed?

A. 2
B. 4
C. 5
D. 6
E. 7

34. Jim took his large dog to Pretty Pooches for a haircut 3 times. Jim paid full price for the first 2 haircuts, and had a coupon for the 3rd haircut, giving him a 15% discount on the 3rd haircut. How much did Jim pay for the 3 haircuts?

F. $ 99.75
G. $118.25
H. $137.50
J. $150.00
K. $156.75

35. When the owner of Pretty Pooches increases the price to have a small dog shampooed, the number of small dogs shampooed per day decreases. The expression $ax + b$ represents the number of small dogs shampooed in 1 day whenever the price is x dollars per dog. The number of small dogs shampooed per day was 12 when the price in the table was in effect. The number of small dogs shampooed per day decreases by 2 for every $5 increase in price. What are the values of a and b ?

	a	b
A.	$-\frac{5}{2}$	62
B.	$-\frac{2}{5}$	20
C.	$\frac{2}{5}$	4
D.	2	200
E.	5	2

DO YOUR FIGURING HERE.

36. $\dfrac{1}{1+\dfrac{1}{1+\frac{1}{2}}} = ?$

F. $\frac{5}{3}$

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

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

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

K. $\frac{3}{5}$

37. In the standard (x,y) coordinate plane, what is the x-intercept of the line represented by $y = -2x + 8$?

A. -4
B. -2
C. 2
D. 4
E. 6

38. A toy rocket is launched from the ground. Its height, h feet above the ground, t seconds after it is launched, is given by $h = -16t^2 + 48t$. During the rocket's ascent, at what value of t is the rocket 32 feet above the ground?

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

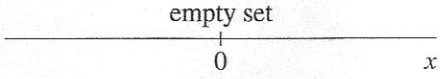
G. $\frac{2}{3}$

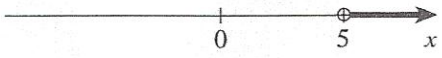
H. 1

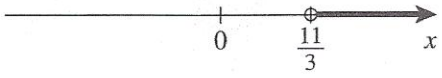
J. 2

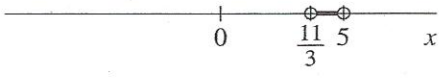
K. 3

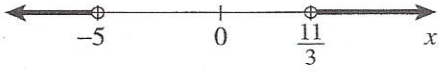
39. Which of the following graphs illustrates the solution set for the system of inequalities $3x - 2 > 9$ and $-2x > -10$?

A.


B.


C.


D.


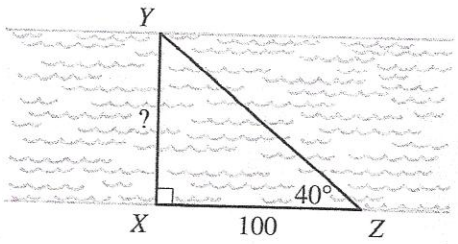
E.


DO YOUR FIGURING HERE.

40. A cab picks up a passenger at a point that is designated on the map as (7,–3) and is 7 miles east and 3 miles south of the cab company's headquarters. From (7,–3), the cab travels 4 miles due north, 5 miles due east, and then 2 miles due west, where the passenger is dropped off. Which of the following is closest to the straight-line distance, in miles, the cab is from the cab company's headquarters?

F. 21
G. 17
H. 14
J. 10
K. 8

41. During a competition, a swimmer will be swimming the width of a river, from X to Y in the figure below. The swimmer wants to know how wide the river is. The right triangle shows the measurements the swimmer obtained by walking 100 feet from X to Z, sighting to Y from both points. From this sighting, it is determined that the measure of $\angle Z$ is 40°. How wide, in feet, is the river?



A. $\frac{100}{\sin 40°}$

B. $\frac{100}{\tan 40°}$

C. $100 \sin 40°$

D. $100 \cos 40°$

E. $100 \tan 40°$

42. The figure below shows a support wire for a television transmission tower. The wire, which is fastened to the tower at a point 125 feet above the level ground, has an angle of elevation of 65°. Which of the following expressions gives the length, in feet, of the wire?

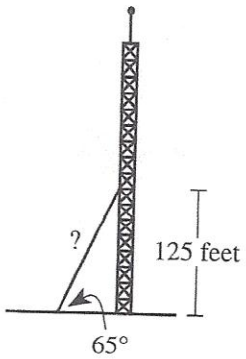
F. $\frac{125}{\sin 65°}$

G. $\frac{125}{\cos 65°}$

H. $\frac{125}{\tan 65°}$

J. $125 \sin 65°$

K. $125 \tan 65°$

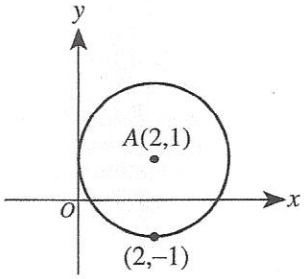


DO YOUR FIGURING HERE.

43. A circle is inside a rectangle 6 inches wide and 8 inches long and is tangent to 3 sides of the rectangle. What is the area, in square inches, of the circle?

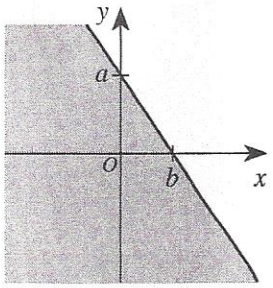
A. 6π
B. 8π
C. 9π
D. 16π
E. 36π

44. Which of the following equations represents the circle with center (2,1) shown in the standard (x,y) coordinate plane below?



F. $(x-2)^2+(y-1)^2=2$
G. $(x-2)^2+(y-1)^2=4$
H. $(x-2)^2+(y+1)^2=4$
J. $(x+2)^2+(y+1)^2=2$
K. $(x+2)^2+(y+1)^2=4$

45. One of the following inequalities, where both constants a and b are positive real numbers, is graphed in the standard (x,y) coordinate plane below. Which inequality is it?



A. $y \geq -\frac{a}{b}x + a$

B. $y \leq -\frac{a}{b}x + a$

C. $y \leq -\frac{b}{a}x + a$

D. $y \leq \frac{b}{a}x$

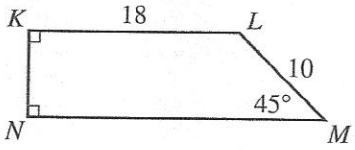
E. $y \leq \frac{a}{b}x + a$

DO YOUR FIGURING HERE.

46. Circles A, B, and C have diameters of x inches, $2x$ inches, and $4x$ inches, respectively. What is the ratio of the *radius* of Circle B to the *diameter* of Circle A ?

F. 1:1
G. 1:2
H. 1:4
J. 2:1
K. 4:1

47. In trapezoid $KLMN$ shown below, $\angle M$ measures 45° and $\angle K$ and $\angle N$ are both right angles. The given side lengths are in feet. Which of the following values is closest to the area, in square feet, of $KLMN$?



A. 4
B. 7
C. 43
D. 127
E. 152

48. For the 2 o'clock hour on Milena's grandfather clock (shown below), the bell is struck 2 times. For the 3 o'clock hour, the bell is struck 3 times. For every hour, 2 seconds elapse between consecutive strikes of the bell. For the 9 o'clock hour, how many seconds elapse between the 1st strike of the bell and the 9th strike of the bell?

F. 8
G. 9
H. 11
J. 16
K. 18

49. For positive real numbers a, b, and c such that $2a = 3b$ and $\frac{1}{4}b = \frac{1}{2}c$, which of the following inequalities is true?

A. $c < b < a$
B. $c < a < b$
C. $b < c < a$
D. $b < a < c$
E. $a < b < c$

DO YOUR FIGURING HERE.

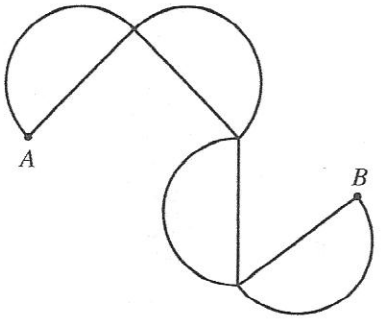
50. This month, Malcolm has \$100 saved, and his goal is to have a total of \$310 saved 12 months from now. After adding to his savings next month, each month he will add \$1 more than what he added the previous month. For the next 12 months, Malcolm will not remove any money from what he has already saved. What is the minimum amount of money Malcolm must add to his savings next month so that he reaches his goal?

F. \$12
G. \$17
H. \$18
J. \$26
K. \$34

51. For all pairs of nonzero real numbers a and b, the product of the complex number $a + bi$ and which of the following complex numbers is a real number?

A. abi
B. $a + bi$
C. $a - bi$
D. $b + ai$
E. $b - ai$

52. Four congruent semicircles touch only at their corners, as shown in the figure below. If the path from A to B along the diameters of the semicircles is 100 centimeters long, how many centimeters long is the path from B back to A along the arcs of these semicircles?



F. 25π
G. 50π
H. 100π
J. 150π
K. 230π

53. For all $a > 1$, which of the following statements describes the function g defined by $g(x) = a^{-x}$?

A. g is constant for all x
B. g is increasing for $x \geq 0$
C. g is decreasing for $x \geq 0$
D. g is increasing for $0 \leq x < 1$ and decreasing for $x \geq 1$
E. g is decreasing for $0 \leq x < 1$ and increasing for $x \geq 1$

DO YOUR FIGURING HERE.

54. A magnet attracts a nail with a force that varies inversely with the square of the distance between them. The nail is 12 inches from the magnet. How many inches from the magnet would the nail need to be to have twice as much attractive force on it as it currently has?

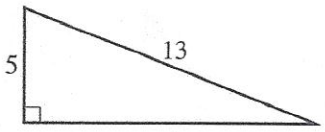
F. $\sqrt{2}$
G. 3
H. 6
J. $6\sqrt{2}$
K. $12\sqrt{2}$

55. What is the area, in square meters, of a rhombus (a parallelogram having 4 congruent sides) with side length 4 meters and 2 angles that each measure 60° ?

A. $8\sqrt{3}$
B. $16\sqrt{3}$
C. 8
D. 24
E. 48

56. The right triangle shown below with hypotenuse 13 inches long and vertical leg 5 inches long is rotated 360° around the vertical leg to form a right circular cone. What is the volume of this cone, in cubic inches?

(Note: $V = \frac{1}{3}\pi r^2 h$, where V is the volume, r is the radius, and h is the height.)



F. $\frac{80}{3}\pi$
G. 40π
H. $\frac{320}{3}\pi$
J. 240π
K. 960π

57. Which of the following fractions is equal to $\frac{1}{11^{20}} - \frac{1}{11^{21}}$?

A. $\frac{1}{11^{21}}$
B. $\frac{1}{11^{22}}$
C. $\frac{1}{11^{40}}$
D. $\frac{10}{11^{21}}$
E. $\frac{10}{11^{41}}$

58. Which of the following is equal to $\tan\theta \cos\theta$ when $\sin\theta = \frac{2}{3}$ and $0 < \theta < \frac{\pi}{2}$?

DO YOUR FIGURING HERE.

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

G. $\frac{2\sqrt{5}}{9}$

H. $\frac{\sqrt{5}}{3}$

J. $\frac{2\sqrt{5}}{5}$

K. 1

59. An equilateral triangle is partitioned into 4 smaller congruent equilateral triangles. What is the ratio of the perimeter of 1 of the smaller triangles to the perimeter of the original triangle?

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

B. $\frac{1}{5}$

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

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

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

60. If $|x| = -x$, which of the following statements *must* be true?

F. $x \leq 0$
G. $x \geq 0$
H. $x = 0$
J. $x \neq 0$
K. x is not a real number.

END OF TEST 2

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

DO NOT RETURN TO THE PREVIOUS TEST.