



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.

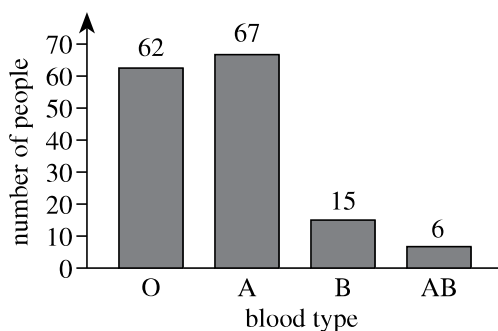
You are permitted to use a calculator on this test. You may use your calculator for any problems you choose,

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. The blood types of 150 people were determined for a study as shown in the figure below.



If 1 person from this study is randomly selected, what is the probability that this person has either Type A or Type AB blood?

- A. $\frac{62}{150}$
 B. $\frac{66}{150}$
 C. $\frac{68}{150}$
 D. $\frac{73}{150}$
 E. $\frac{84}{150}$
2. The monthly fees for single rooms at 5 colleges are \$370, \$310, \$380, \$340, and \$310, respectively. What is the mean of these monthly fees?
- F. \$310
 G. \$340
 H. \$342
 J. \$350
 K. \$380

3. On a particular road map, $\frac{1}{2}$ inch represents 18 miles. About how many miles apart are 2 towns that are $2\frac{1}{2}$ inches apart on this map?

- A. 18
 B. $22\frac{1}{2}$
 C. 36
 D. 45
 E. 90

4. Given $f = cd^3$, $f = 450$, and $d = 10$, what is c ?

- F. 0.45
 G. 4.5
 H. 15
 J. 45
 K. 150

5. If $f(x) = (3x + 7)^2$, then $f(1) = ?$

- A. 10
 B. 16
 C. 58
 D. 79
 E. 100

6. Jorge's current hourly wage for working at Denti Smiles is \$12.00. Jorge was told that at the beginning of next month, his new hourly wage will be an increase of 6% of his current hourly wage. What will be Jorge's new hourly wage?

- F. \$12.06
 G. \$12.60
 H. \$12.72
 J. \$18.00
 K. \$19.20



7. The first term is 1 in the geometric sequence $1, -3, 9, -27, \dots$. What is the SEVENTH term of the geometric sequence?

A. -243
B. -30
C. 81
D. 189
E. 729

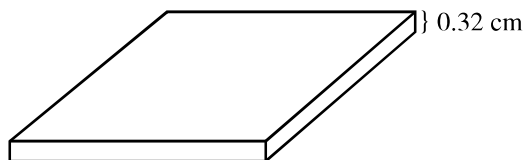
8. The shipping rate for customers of Ship Quick consists of a fee per box and a price per pound for each box. The table below gives the fee and the price per pound for customers shipping boxes of various weights.

Weight of box (pounds)	Fee	Price per pound
Less than 10	\$ 5.00	\$1.00
10–25	\$10.00	\$0.65
More than 25	\$20.00	\$0.30

Gregg wants Ship Quick to ship 1 box that weighs 15 pounds. What is the shipping rate for this box?

F. \$ 9.75
G. \$16.50
H. \$19.75
J. \$20.00
K. \$24.50

9. A computer chip 0.32 cm thick is made up of layers of silicon. If the top and bottom layers are each 0.03 cm thick and the inner layers are each 0.02 cm thick, how many inner layers are there?



A. 13
B. 15
C. 16
D. 52
E. 64

10. The table below shows the number of cars Jing sold each month last year. What is the median of the data in the table?

Month	Number of cars sold
January	25
February	15
March	22
April	19
May	16
June	13
July	19
August	25
September	26
October	27
November	28
December	29

F. 13
G. 16
H. 19
J. 20.5
K. 23.5

11. Students studying motion observed a cart rolling at a constant rate along a straight line. The table below gives the distance, d feet, the cart was from a reference point at 1-second intervals from $t = 0$ seconds to $t = 5$ seconds.

t	0	1	2	3	4	5
d	14	20	26	32	38	44

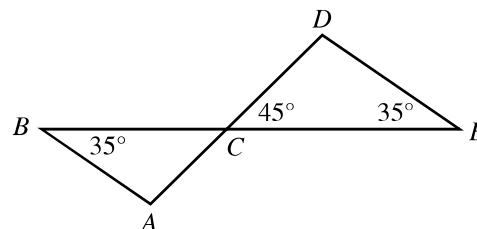
Which of the following equations represents this relationship between d and t ?

A. $d = t + 14$
B. $d = 6t + 8$
C. $d = 6t + 14$
D. $d = 14t + 6$
E. $d = 34t$

12. The length of a rectangle with area 54 square centimeters is 9 centimeters. What is the perimeter of the rectangle, in centimeters?

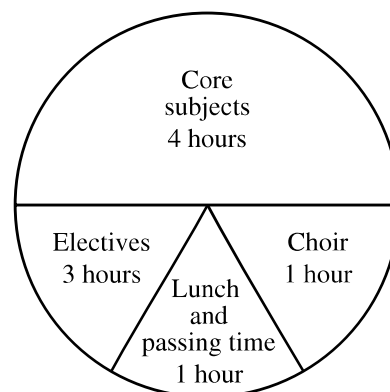
F. 6
G. 12
H. 15
J. 24
K. 30

13. In the figure below, C is the intersection of \overline{AD} and \overline{BE} . If it can be determined, what is the measure of $\angle BAC$?



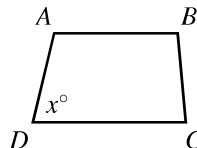
A. 80°
B. 100°
C. 110°
D. 115°
E. Cannot be determined from the given information

14. Antwan drew the circle graph below describing his time spent at school in 1 day. His teacher said that the numbers of hours listed were correct, but that the central angle measures for the sectors were not correct. What should be the central angle measure for the Core subjects sector?



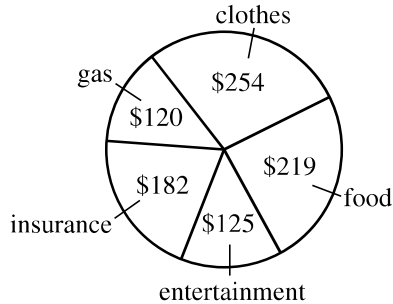
F. 72°
G. 80°
H. 160°
J. 200°
K. 288°



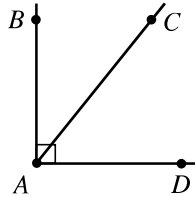
15. This month, Kami sold 70 figurines in 2 sizes. The large figurines sold for \$12 each, and the small figurines sold for \$8 each. The amount of money he received from the sales of the large figurines was equal to the amount of money he received from the sales of the small figurines. How many large figurines did Kami sell this month?
- A. 20
B. 28
C. 35
D. 42
E. 50
16. A car accelerated from 88 feet per second (fps) to 220 fps in exactly 3 seconds. Assuming the acceleration was constant, what was the car's acceleration, in feet per second per second, from 88 fps to 220 fps ?
- F. $\frac{1}{44}$
G. $29\frac{1}{3}$
H. 44
J. $75\frac{1}{3}$
K. $102\frac{2}{3}$
17. In a plane, the distinct lines \overleftrightarrow{AB} and \overleftrightarrow{CD} intersect at A , where A is between C and D . The measure of $\angle BAC$ is 47° . What is the measure of $\angle BAD$?
- A. 43°
B. 47°
C. 94°
D. 133°
E. 137°
18. In which of the following are $\frac{1}{2}$, $\frac{5}{6}$, and $\frac{5}{8}$ arranged in ascending order?
- F. $\frac{1}{2} < \frac{5}{8} < \frac{5}{6}$
G. $\frac{5}{6} < \frac{1}{2} < \frac{5}{8}$
H. $\frac{5}{6} < \frac{5}{8} < \frac{1}{2}$
J. $\frac{5}{8} < \frac{1}{2} < \frac{5}{6}$
K. $\frac{5}{8} < \frac{5}{6} < \frac{1}{2}$
19. In scientific notation, $670,000,000 + 700,000,000 = ?$
- A. 1.37×10^{-9}
B. 1.37×10^7
C. 1.37×10^8
D. 1.37×10^9
E. 137×10^{15}
20. For trapezoid $ABCD$ shown below, $\overline{AB} \parallel \overline{DC}$, the measures of the interior angles are distinct, and the measure of $\angle D$ is x° . What is the degree measure of $\angle A$ in terms of x ?
- F. $(180 - x)^\circ$
G. $(180 - 0.5x)^\circ$
H. $(180 + 0.5x)^\circ$
J. $(180 + x)^\circ$
K. x°
- 
21. To get a driver's license, an applicant must pass a written test and a driving test. Past records show that 80% of the applicants pass the written test and 60% of those who have passed the written test pass the driving test. Based on these figures, how many applicants in a random group of 1,000 applicants would you expect to get driver's licenses?
- A. 200
B. 480
C. 600
D. 750
E. 800
22. If a , b , and c are positive integers such that $a^b = x$ and $c^b = y$, then $xy = ?$
- F. ac^b
G. ac^{2b}
H. $(ac)^b$
J. $(ac)^{2b}$
K. $(ac)^{b^2}$
23. Which of the following expressions is equivalent to $\frac{1}{2}y^2(6x + 2y + 12x - 2y)$?
- A. $9xy^2$
B. $18xy$
C. $3xy^2 + 12x$
D. $9xy^2 - 2y^3$
E. $3xy^2 + 12x - y^3 - 2y$
24. An artist makes a profit of $(500p - p^2)$ dollars from selling p paintings. What is the fewest number of paintings the artist can sell to make a profit of at least \$60,000 ?
- F. 100
G. 150
H. 200
J. 300
K. 600



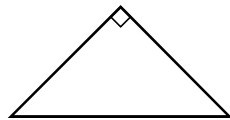
25. Last month, Lucie had total expenditures of \$900. The pie chart below breaks down these expenditures by category. The category in which Lucie's expenditures were greatest is what percent of her total expenditures, to the nearest 1%?



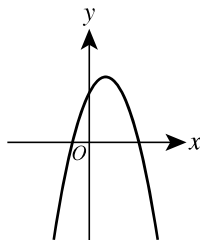
- A. 24%
B. 28%
C. 32%
D. 34%
E. 39%
26. In the figure shown below, the measure of $\angle BAC$ is $(x + 20)^\circ$ and the measure of $\angle BAD$ is 90° . What is the measure of $\angle CAD$?



- F. $(x - 70)^\circ$
G. $(70 - x)^\circ$
H. $(70 + x)^\circ$
J. $(160 - x)^\circ$
K. $(160 + x)^\circ$
27. What is the perimeter, in inches, of the isosceles right triangle shown below, whose hypotenuse is $8\sqrt{2}$ inches long?



- A. 8
B. $8 + 8\sqrt{2}$
C. $8 + 16\sqrt{2}$
D. 16
E. $16 + 8\sqrt{2}$
28. The equation $y = ax^2 + bx + c$ is graphed in the standard (x, y) coordinate plane below for real values of a , b , and c . When $y = 0$, which of the following best describes the solutions for x ?

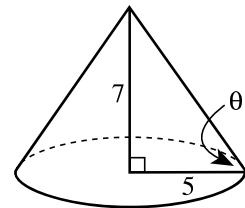


- F. 2 distinct positive real solutions
G. 2 distinct negative real solutions
H. 1 positive real solution and 1 negative real solution
J. 2 real solutions that are not distinct
K. 2 distinct solutions that are not real

29. What is the product of the complex numbers $(-3i + 4)$ and $(3i + 4)$?

- A. 1
B. 7
C. 25
D. $-7 + 24i$
E. $7 + 24i$

30. The radius of the base of the right circular cone shown below is 5 inches, and the height of the cone is 7 inches. Solving which of the following equations gives the measure, θ , of the angle formed by a slant height of the cone and a radius?



- F. $\tan \theta = \frac{5}{7}$
G. $\tan \theta = \frac{7}{5}$
H. $\sin \theta = \frac{5}{7}$
J. $\sin \theta = \frac{7}{5}$
K. $\cos \theta = \frac{7}{5}$

31. To make a 750-piece jigsaw puzzle more challenging, a puzzle company includes 5 extra pieces in the box along with the 750 pieces, and those 5 extra pieces do not fit anywhere in the puzzle. If you buy such a puzzle box, break the seal on the box, and immediately select 1 piece at random, what is the probability that it will be 1 of the extra pieces?

- A. $\frac{1}{5}$
B. $\frac{1}{755}$
C. $\frac{1}{750}$
D. $\frac{5}{755}$
E. $\frac{5}{750}$

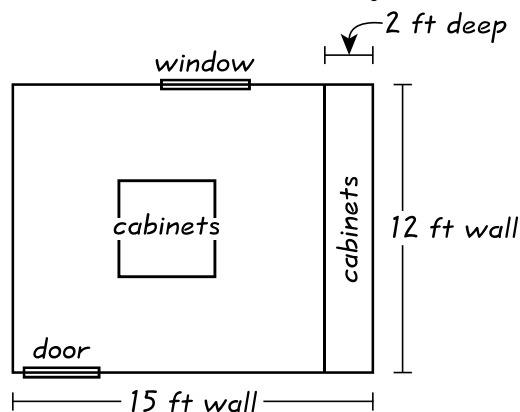
32. What fraction lies exactly halfway between $\frac{2}{3}$ and $\frac{3}{4}$?

- F. $\frac{3}{5}$
G. $\frac{5}{6}$
H. $\frac{7}{12}$
J. $\frac{9}{16}$
K. $\frac{17}{24}$



Use the following information to answer questions 33–35.

Gianna is converting a 12-foot-by-15-foot room in her house to a craft room. Gianna will install tile herself but will have CC Installations build and install the cabinets. The scale drawing shown below displays the location of the cabinets in the craft room (0.25 inch represents 2 feet).

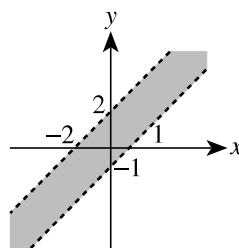


Cabinets will be installed along one of the 12-foot walls from floor to ceiling, and 4 cabinets that are each 3 feet tall will be installed in the middle of the room. These are the only cabinets that will be installed, and each of them will be 2 feet wide and 2 feet deep. CC Installations has given Gianna an estimate of \$2,150.00 for building and installing the cabinets.

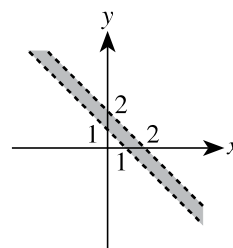
33. A 15-foot wall is how many inches long in the scale drawing?
- A. 1.5
B. 1.875
C. 3
D. 3.375
E. 3.75
34. Gianna will install tile on the portion of the floor that will NOT be covered by cabinets. What is the area, in square feet, of the portion of the floor that will NOT be covered by cabinets?
- F. 72
G. 90
H. 140
J. 156
K. 164
35. CC Installations' estimate consists of a \$650.00 charge for labor, plus a fixed charge per cabinet. The labor charge and the charge per cabinet remain the same for any number of cabinets built and installed. CC Installations would give Gianna what estimate if the craft room were to have twice as many cabinets as Gianna is planning to have?
- A. \$2,800.00
B. \$3,000.00
C. \$3,450.00
D. \$3,650.00
E. \$4,300.00

36. Which of the following is the graph of the region $1 < x + y < 2$ in the standard (x,y) coordinate plane?

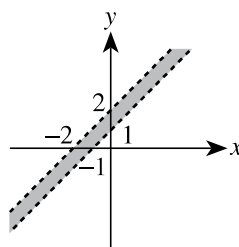
F.



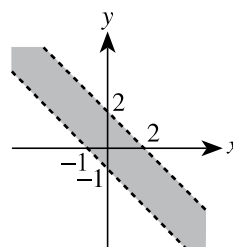
J.



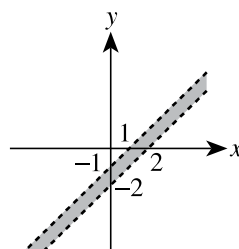
G.



K.



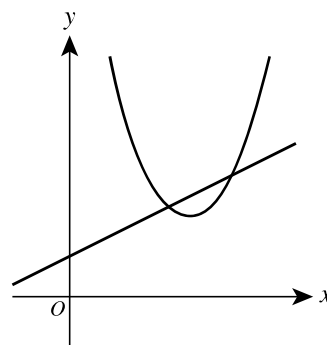
H.



37. What is the difference between the mean and the median of the set $\{3, 8, 10, 15\}$?

A. 0
B. 1
C. 4
D. 9
E. 12

38. Which of the following describes a true relationship between the functions $f(x) = (x - 3)^2 + 2$ and $g(x) = \frac{1}{2}x + 1$ graphed below in the standard (x,y) coordinate plane?



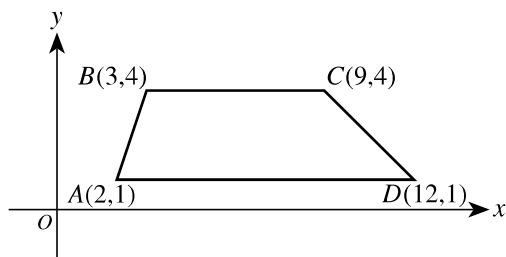
- F. $f(x) = g(x)$ for exactly 2 values of x
G. $f(x) = g(x)$ for exactly 1 value of x
H. $f(x) < g(x)$ for all x
J. $f(x) > g(x)$ for all x
K. $f(x)$ is the inverse of $g(x)$

GO ON TO THE NEXT PAGE.



Use the following information to answer questions 39–41.

Trapezoid $ABCD$ is graphed in the standard (x,y) coordinate plane below.



39. What is the slope of \overline{CD} ?

- A. -3
- B. -1
- C. 1
- D. $\frac{5}{21}$
- E. $\frac{3}{2}$

40. When $ABCD$ is reflected over the y -axis to $A'B'C'D'$, what are the coordinates of D' ?

- F. $(-12, 1)$
- G. $(-12, -1)$
- H. $(12, -1)$
- J. $(1, 12)$
- K. $(1, -12)$

41. Which of the following vertical lines cuts $ABCD$ into 2 trapezoids with equal areas?

- A. $x = 2.5$
- B. $x = 3.5$
- C. $x = 4.5$
- D. $x = 5.5$
- E. $x = 6.5$

42. Given $f(x) = x - \frac{1}{x}$ and $g(x) = \frac{1}{x}$, what is $f\left(g\left(\frac{1}{2}\right)\right)$?

- F. -3
- G. $-\frac{3}{2}$
- H. $-\frac{2}{3}$
- J. 0
- K. $\frac{3}{2}$

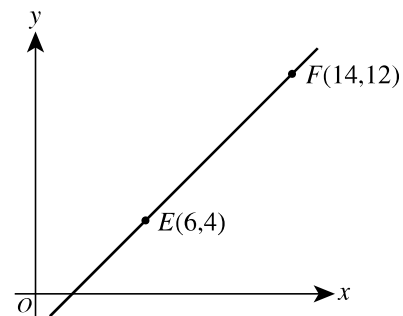
43. A formula to estimate the monthly payment, p dollars, on a short-term loan is

$$p = \frac{\frac{1}{2}ary + a}{12y}$$

where a dollars is the amount of the loan, r is the annual interest rate expressed as a decimal, and y years is the length of the loan. When a is multiplied by 2, what is the effect on p ?

- A. p is divided by 6
- B. p is divided by 2
- C. p does not change
- D. p is multiplied by 2
- E. p is multiplied by 4

44. The points $E(6,4)$ and $F(14,12)$ lie in the standard (x,y) coordinate plane shown below. Point D lies on \overline{EF} between E and F such that the length of \overline{EF} is 4 times the length of \overline{DE} . What are the coordinates of D ?



- F. $(7, 5)$
- G. $(8, 6)$
- H. $(8, 8)$
- J. $(10, 8)$
- K. $(12, 10)$

45. Given that $a \begin{bmatrix} 2 & 6 \\ 1 & 4 \end{bmatrix} = \begin{bmatrix} x & 27 \\ y & z \end{bmatrix}$ for some real number a , what is $x + z$?

- A. $\frac{4}{3}$
- B. $\frac{27}{2}$
- C. 26
- D. 27
- E. 48

46. A container is $\frac{1}{8}$ full of water. After 10 cups of water are added, the container is $\frac{3}{4}$ full. What is the volume of the container, in cups?

- F. $13\frac{1}{3}$
- G. $13\frac{1}{2}$
- H. 15
- J. 16
- K. 40



47. Only tenth-, eleventh-, and twelfth-grade students attend Washington High School. The ratio of tenth graders to the school's total student population is 86:255, and the ratio of eleventh graders to the school's total student population is 18:51. If 1 student is chosen at random from the entire school, which grade is that student most likely to be in?

A. Tenth
 B. Eleventh
 C. Twelfth
 D. All grades are equally likely.
 E. Cannot be determined from the given information

48. $\frac{4}{\sqrt{2}} + \frac{2}{\sqrt{3}} = ?$

F. $\frac{4\sqrt{3} + 2\sqrt{2}}{\sqrt{5}}$

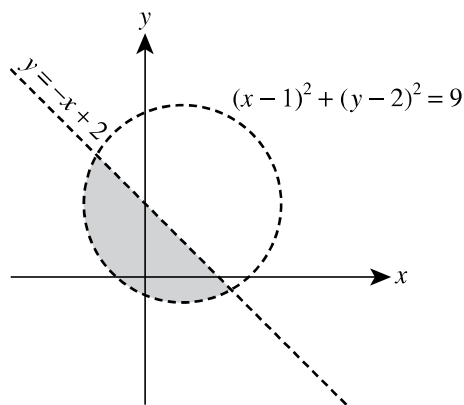
G. $\frac{4\sqrt{3} + 2\sqrt{2}}{\sqrt{6}}$

H. $\frac{6}{\sqrt{2} + \sqrt{3}}$

J. $\frac{6}{\sqrt{5}}$

K. $\frac{8}{\sqrt{6}}$

49. The shaded region in the graph below represents the solution set to which of the following systems of inequalities?



A. $\begin{cases} y < -x + 2 \\ (x - 1)^2 + (y - 2)^2 < 9 \end{cases}$

B. $\begin{cases} y > -x + 2 \\ (x - 1)^2 + (y - 2)^2 < 9 \end{cases}$

C. $\begin{cases} y > -x + 2 \\ (x - 1)^2 + (y - 2)^2 > 9 \end{cases}$

D. $\begin{cases} y < -x + 2 \\ (x - 1)^2 + (y - 2)^2 > 9 \end{cases}$

E. $\begin{cases} (y - 2) < 3 \\ (x - 1) > 3 \end{cases}$

50. You can find the volume of an irregularly shaped solid object by completely submerging it in water and calculating the volume of water the object displaces. You completely submerge a solid object in a rectangular tank that has a base 40 centimeters by 30 centimeters and is filled with water to a depth of 20 centimeters. The object sinks to the bottom, and the water level goes up 0.25 centimeters. What is the volume, in cubic centimeters, of the object?

F. 300
 G. 240
 H. 200
 J. 150
 K. 75

51. If $x:y = 5:2$ and $y:z = 3:2$, what is the ratio of $x:z$?

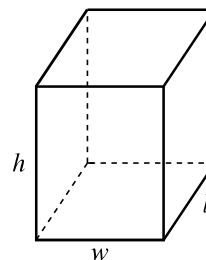
A. 3:1
 B. 3:5
 C. 5:3
 D. 8:4
 E. 15:4

52. Which of the following is the solution statement for the inequality shown below?

$$-5 < 1 - 3x < 10$$

F. $-5 < x < 10$
 G. $-3 < x$
 H. $-3 < x < 2$
 J. $-2 < x < 3$
 K. $x < -3$ or $x > 2$

53. A formula for the surface area (A) of the rectangular solid shown below is $A = 2lw + 2lh + 2wh$ where l represents length; w , width; and h , height. By doubling each of the dimensions (l , w , and h), the surface area will be multiplied by what factor?



A. 2
 B. 4
 C. 6
 D. 8
 E. 12

54. A dog eats 7 cans of food in 3 days. At this rate, how many cans of food does the dog eat in $3 + d$ days?

F. $\frac{7}{3} + d$
 G. $\frac{7}{3} + \frac{d}{3}$
 H. $\frac{7}{3} + \frac{7d}{3d}$
 J. $7 + \frac{d}{3}$
 K. $7 + \frac{7d}{3}$



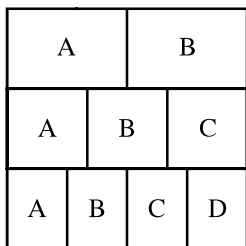
55. Kelly asked 120 students questions about skiing. The results of the poll are shown in the table below.

Question	Yes	No
1. Have you skied either cross-country or downhill?	65	55
2. If you answered Yes to Question 1, did you ski downhill?	28	37
3. If you answered Yes to Question 1, did you ski cross-country?	45	20

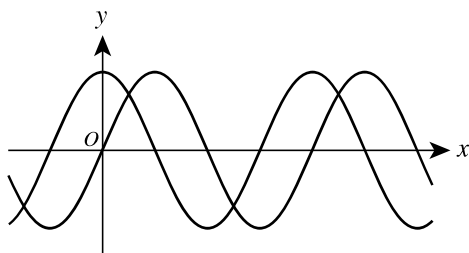
After completing the poll, Kelly wondered how many of the students polled had skied both cross-country *and* downhill. How many of the students polled indicated that they had skied both cross-country and downhill?

- A. 73
B. 65
C. 47
D. 18
E. 8
56. The square below is divided into 3 rows of equal area. In the top row, the region labeled A has the same area as the region labeled B. In the middle row, the 3 regions have equal areas. In the bottom row, the 4 regions have equal areas. What fraction of the square's area is in a region labeled A ?

- F. $\frac{1}{9}$
G. $\frac{3}{9}$
H. $\frac{6}{9}$
J. $\frac{13}{12}$
K. $\frac{13}{36}$

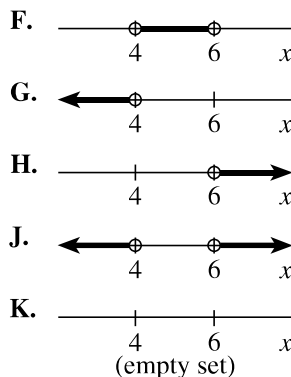


57. The functions $y = \sin x$ and $y = \sin(x + a) + b$, for constants a and b , are graphed in the standard (x, y) coordinate plane below. The functions have the same maximum value. One of the following statements about the values of a and b is true. Which statement is it?



- A. $a < 0$ and $b = 0$
B. $a < 0$ and $b > 0$
C. $a = 0$ and $b > 0$
D. $a > 0$ and $b < 0$
E. $a > 0$ and $b > 0$

58. Which of the following number line graphs shows the solution set to the inequality $|x - 5| < -1$?



59. As part of a probability experiment, Elliott is to answer 4 multiple-choice questions. For each question, there are 3 possible answers, only 1 of which is correct. If Elliott randomly and independently answers each question, what is the probability that he will answer the 4 questions correctly?

- A. $\frac{27}{81}$
B. $\frac{12}{81}$
C. $\frac{4}{81}$
D. $\frac{3}{81}$
E. $\frac{1}{81}$

60. The sides of an acute triangle measure 14 cm, 18 cm, and 20 cm, respectively. Which of the following equations, when solved for θ , gives the measure of the smallest angle of the triangle?

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

- F. $\frac{\sin \theta}{14} = \frac{1}{18}$
G. $\frac{\sin \theta}{14} = \frac{1}{20}$
H. $\frac{\sin \theta}{20} = \frac{1}{14}$
J. $14^2 = 18^2 + 20^2 - 2(18)(20)\cos \theta$
K. $20^2 = 14^2 + 18^2 - 2(14)(18)\cos \theta$

END OF TEST 2

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

DO NOT RETURN TO THE PREVIOUS TEST.