

**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 top surface of a rectangular table has an area of 100 square feet and a width of 5 feet. What is the length, in feet, of the surface?

- A. 10
- B. 15
- C. 20
- D. 95
- E. 500

2. A wallet containing 2 five-dollar bills, 9 ten-dollar bills, and 5 twenty-dollar bills is found and returned to its owner. The wallet's owner will reward the finder with 1 bill drawn randomly from the wallet. What is the probability that the bill drawn will be a twenty-dollar bill?

- F.  $\frac{1}{16}$
- G.  $\frac{1}{10}$
- H.  $\frac{1}{5}$
- J.  $\frac{5}{16}$
- K.  $\frac{5}{11}$

3. In his costume supplies, Elmo the clown has 4 noses, 3 pairs of lips, and 2 wigs. A clown costume consists of 1 nose, 1 pair of lips, and 1 wig. How many different clown costumes can Elmo make?

- A. 3
- B. 9
- C. 12
- D. 14
- E. 24

**DO YOUR FIGURING HERE.**

**DO YOUR FIGURING HERE.**

4. Esteban and his family are making care packages to send to children at summer camp. Each complete care package contains 5 pens, 2 notebooks, 3 envelopes, 12 cookies, and 5 candy bars. Esteban and his family have already made 7 complete care packages and the following materials remain:

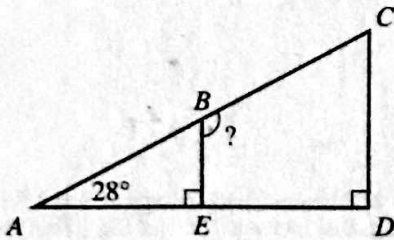
- 3 boxes of pens (10 pens per box)
- 4 boxes of notebooks (5 notebooks per box)
- 2 boxes of envelopes (12 envelopes per box)
- 84 cookies
- $4\frac{1}{2}$  boxes of candy bars (10 candy bars per box)

How many additional complete care packages can Esteban and his family make with the remaining materials?

- F. 6
  - G. 7
  - H. 8
  - J. 10
  - K. 15
5. A formula for the volume of a right circular cone is  $V = \frac{1}{3}\pi r^2 h$ , where  $r$  is the radius of the base and  $h$  is the height of the cone. Using  $\frac{22}{7}$  as an approximate value for  $\pi$ , which of the following values is closest to the volume, in cubic inches, of a cone with height 28 inches and radius 6 inches?

- A. 264
- B. 352
- C. 1,056
- D. 4,224
- E. 4,928

6. In  $\triangle ACD$  below,  $B$  is on  $\overline{AC}$ ,  $E$  is on  $\overline{AD}$ , the measure of  $\angle CAD$  is  $28^\circ$ , and  $\overline{BE}$  is perpendicular to both  $\overline{BE}$  and  $\overline{CD}$ . What is the measure of  $\angle CBE$ ?



- F.  $104^\circ$
- G.  $118^\circ$
- H.  $124^\circ$
- J.  $146^\circ$
- K.  $152^\circ$



DO YOUR FIGURING HERE.

7. What is the sum of  $0.1x^2 + 3x + 80$  and  $0.5x^2 - 2x + 60$  for all  $x$ ?
- A.  $-0.4x^2 + 5x + 20$   
 B.  $0.6x^2 + x + 140$   
 C.  $0.6x^2 + 5x + 140$   
 D.  $x^2 + 5x + 140$   
 E.  $5.6x^2 + 140$

8. 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.

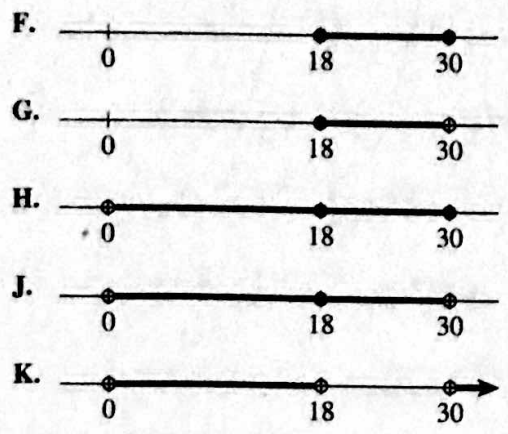
$t$	0	1	2	3	4	5
$d$	15	18	21	24	27	30

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

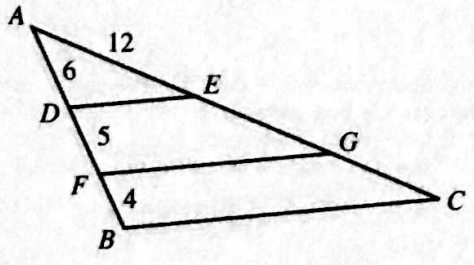
- F.  $d = t + 15$   
 G.  $d = 3t + 12$   
 H.  $d = 3t + 15$   
 J.  $d = 15t + 3$   
 K.  $d = 33t$
9. Dmitry bought a pair of pants at the discounted price of \$30. The original price of the pants was \$40. What was the percent of the discount?
- A. 4%  
 B. 10%  
 C. 25%  
 D.  $33\frac{1}{3}\%$   
 E. 75%
10. What is the value of  $|-6| - |7 - 41|$ ?
- F. -40  
 G. -28  
 H. 28  
 J. 40  
 K. 54
11. Samantha, Nyla, and Jerry own shares of stock in the Triumph Hotels company. The shares of stock that they own have a combined value of \$6,880. Samantha owns 70 shares, Nyla owns 50 shares, and Jerry owns 40 shares. What is the value of the shares Samantha owns?
- A. \$ 98  
 B. \$ 301  
 C. \$3,010  
 D. \$4,816  
 E. \$5,351

DO YOUR FIGURING HERE.

12. A new club wants to attract customers who are at least 18 but less than 30 years of age. One of the number lines below illustrates the range of ages, in years, of the customers the club wants to attract. Which number line is it?



13. In the figure shown below,  $E$  and  $G$  lie on  $\overline{AC}$ ,  $D$  and  $F$  lie on  $\overline{AB}$ ,  $\overline{DE}$  and  $\overline{FG}$  are parallel to  $\overline{BC}$ , and the given lengths are in feet. What is the length of  $\overline{AC}$ , in feet?



- A. 9
- B. 18
- C. 21
- D. 30
- E. 36

14. Which of the following integers is closest to  $\frac{\sqrt{50}}{2}$  ?

- F. 3
- G. 4
- H. 5
- J. 13
- K. 14

15. The ratio of Jane's age to her daughter's age is 9:2. The sum of their ages is 44. How old is Jane?

- A. 22
- B. 33
- C. 35
- D. 36
- E. 40



16. For the next school year, a college will use  $\frac{1}{9}$  of the money in its operating budget for library books and  $\frac{1}{6}$  of the money in its operating budget for scholarships. What fraction of the operating budget remains for other uses?

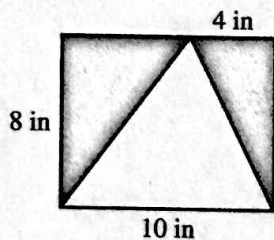
- F.  $\frac{1}{18}$   
 G.  $\frac{5}{18}$   
 H.  $\frac{13}{18}$   
 J.  $\frac{20}{27}$   
 K.  $\frac{8}{9}$

17. What value of  $x$  makes the proportion below true?

$$\frac{10}{10+x} = \frac{35}{42}$$

- A. 2  
 B. 7  
 C. 12  
 D. 17  
 E. 32

18. The rectangle shown in the figure below is partitioned into 3 triangles, 2 of which are shaded. What is the total area, in square inches, of the 2 shaded regions?



- F. 20  
 G. 24  
 H. 32  
 J. 40  
 K. 80

19. Which of the following ordered pairs in the standard  $(x,y)$  coordinate plane satisfies the system of inequalities below?

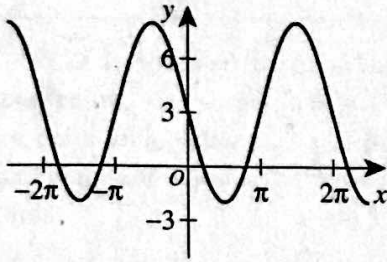
$$\begin{aligned} x &> 2 \\ y &> 0 \\ x + y &< 5 \end{aligned}$$

- A. (1,3)  
 B. (2,2)  
 C. (3,1)  
 D. (3,2)  
 E. (4,0)

DO YOUR FIGURING HERE.

20. The graph of  $y = 3 - 5 \sin(x - \pi)$  is shown in the standard  $(x, y)$  coordinate plane below. What is the range of  $y$ ?

DO YOUR FIGURING HERE.



- F.  $-5 \leq y \leq 5$
  - G.  $-2 \leq y \leq 2$
  - H.  $-2 \leq y \leq 8$
  - J.  $3 \leq y \leq 8$
  - K.  $3 \leq y \leq 10$
21. Given functions  $f(x) = 2x + 1$  and  $g(x) = x^2 - 4$ , what is the value of  $f(g(-3))$ ?
- A. -29
  - B. -25
  - C. -19
  - D. 11
  - E. 21
22. A fabric store sells flannel and calico fabrics. Joan pays \$25 for 3 yards of flannel and 4 yards of calico. Chris pays \$11 for 1 yard of flannel and 2 yards of calico. What is the price of 1 yard of calico?
- F. \$3
  - G. \$4
  - H. \$5
  - J. \$6
  - K. \$7
23. The scores given below were earned by 10 students on a recent biology test. What is the median score?
- 71, 94, 86, 77, 88, 94, 88, 80, 78, 94
- A. 85
  - B. 86
  - C. 87
  - D. 88
  - E. 91
24. A parallelogram has a perimeter of 84 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?
- F. 16, 16, 36
  - G. 16, 18, 18
  - H. 16, 26, 26
  - J. 16, 34, 34
  - K. Cannot be determined from the given information



DO YOUR FIGURING HERE.

25. In the figure below, all of the small squares are equal in area, and the area of rectangle  $ABCD$  is 1 square unit. Which of the following expressions represents the area, in square units, of the shaded region?

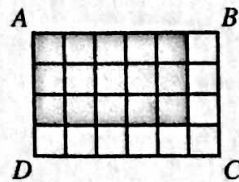
A.  $\frac{1}{6} \cdot \frac{1}{4}$

B.  $\frac{1}{6} \cdot \frac{3}{4}$

C.  $\frac{1}{6} \cdot \frac{5}{6}$

D.  $\frac{5}{6} \cdot \frac{1}{4}$

E.  $\frac{5}{6} \cdot \frac{3}{4}$



26. A bag contains 16 red marbles, 7 yellow marbles, and 19 green marbles. How many additional red marbles must be added to the 42 marbles already in the bag so that the probability of randomly drawing a red marble is  $\frac{3}{5}$ ?

F. 18

G. 23

H. 37

J. 42

K. 52

27. For all  $a > 0$ , which of the following expressions is equal to  $a^{-2}$ ?

A.  $-2a$

B.  $-a^2$

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

D.  $\frac{1}{\sqrt{a}}$

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

28. Jamie claims, "If a triangle is in Set A, then it is not isosceles." Later, Jamie discovers that  $\triangle MNP$  is a counterexample proving this claim false. Which of the following statements *must* be true about  $\triangle MNP$ ?

F. It is isosceles and in Set A.

G. It is scalene and in Set A.

H. It is obtuse and not in Set A.

J. It is scalene and not in Set A.

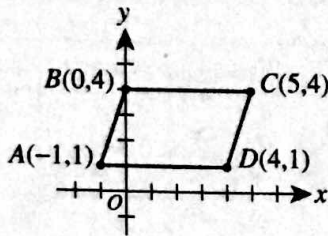
K. It is isosceles and not in Set A.



Use the following information to answer questions 29–32.

DO YOUR FIGURING HERE.

Parallelogram  $ABCD$  is graphed in the standard  $(x,y)$  coordinate plane below. Sides  $\overline{AB}$  and  $\overline{CD}$  are each  $\sqrt{10}$  coordinate units long. Sides  $\overline{AD}$  and  $\overline{BC}$  are each 5 coordinate units long. The distance between  $\overline{AD}$  and  $\overline{BC}$  is 3 coordinate units.



29. What is the area, in square coordinate units, of  $ABCD$  ?

- A. 5
- B. 7.5
- C. 10
- D. 15
- E. 20

30. What is the distance, in coordinate units, from  $B$  to  $D$  ?

- F. 3
- G. 4
- H. 5
- J. 7
- K. 8

31. What is the slope of  $\overleftrightarrow{BC}$  ?

- A. 0
- B. 1
- C. 4
- D. 5
- E. Undefined

32. Parallelogram  $ABCD$  will be reflected over the  $y$ -axis. What will be the coordinates of the image of  $A$  ?

- F.  $(-4, 1)$
- G.  $(-1, -1)$
- H.  $(1, -1)$
- J.  $(1, 1)$
- K.  $(4, -1)$

33. Which of the following is equivalent to  $8^2 \cdot 4^{0.5}$  ?

- A.  $2^7$
- B.  $4^{4.5}$
- C.  $8^{2.5}$
- D.  $16^2$
- E. 32





DO YOUR FIGURING HERE.

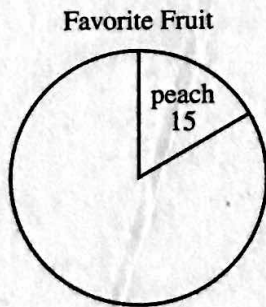
34. A school admissions office accepts 2 out of every 7 applicants. Given that the school accepted 630 students, how many applicants were NOT accepted?

F. 140  
 G. 180  
 H. 490  
 J. 1,260  
 K. 1,575

35. What is the value of  $\log_2 \sqrt{8}$  ?

A.  $\frac{1}{2}$   
 B.  $\frac{3}{2}$   
 C.  $\sqrt{2}$   
 D. 1  
 E. 3

36. Jie asked 90 students to choose 1 favorite fruit from 4 options. Jie has begun to represent the results in the circle graph below. Peaches were chosen as the favorite of 15 students. Apples, bananas, and strawberries were each chosen as favorites by an equal number of the remaining students. What must be the measure of the central angle in the circle graph for bananas?



F.  $100^\circ$   
 G.  $102^\circ$   
 H.  $105^\circ$   
 J.  $112.5^\circ$   
 K.  $115^\circ$

37. For all real numbers  $x$  such that  $x \neq 0$ ,  $\frac{4}{5} + \frac{7}{x} = ?$

A.  $\frac{11}{5x}$   
 B.  $\frac{28}{5x}$   
 C.  $\frac{11}{5+x}$   
 D.  $\frac{7x+20}{5+x}$   
 E.  $\frac{4x+35}{5x}$

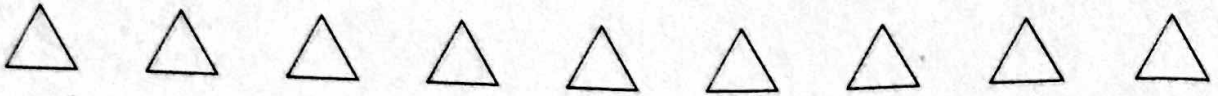
Use the following information to answer questions 38–40.

DO YOUR FIGURING HERE.

The Harrisburg Recreation Center recently changed its hours to open 1 hour later and close 3 hours later than it had previously. Residents of Harrisburg age 16 or older were given a survey, and 560 residents replied. The survey asked each resident his or her student status (high school, college, or nonstudent) and what he or she thought about the change in hours (approve, disapprove, or no opinion). The results are summarized in the table below.

Student status	Approve	Disapprove	No opinion
High school	30	4	11
College	14	10	6
Nonstudent	85	353	47
Total	129	367	64

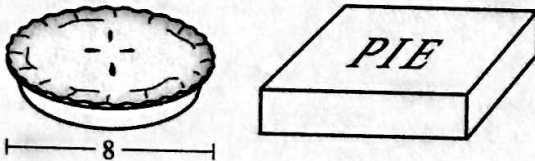
38. What fraction of these nonstudent residents replied that they disapproved of the change in hours?
- F.  $\frac{1}{3}$
- G.  $\frac{4}{45}$
- H.  $\frac{14}{75}$
- J.  $\frac{353}{367}$
- K.  $\frac{353}{485}$
39. Suppose a person will be chosen at random from these 560 residents. Which of the following values is closest to the probability that the person chosen will NOT be a high school student and will NOT have replied with no opinion?
- A. 0.06
- B. 0.09
- C. 0.44
- D. 0.83
- E. 0.98
40. After constructing the table, it was discovered that the student status of 15 residents who replied that they approved had been incorrectly classified as nonstudents. After correcting the errors, exactly 60% of the college students had replied that they approved. To the nearest 1%, what percent of high school students replied that they approved?
- F. 60%
- G. 67%
- H. 70%
- J. 75%
- K. 82%



DO YOUR FIGURING HERE.

41. Set A and Set B each consist of 5 distinct numbers. The 2 sets contain identical numbers with the exception of the number with the least value in each set. The number with the least value in Set B is greater than the number with the least value in Set A. The value of which of the following measures *must* be greater for Set B than for Set A?
- A. Mean only  
 B. Median only  
 C. Mode only  
 D. Mean and median only  
 E. Mean, median, and mode
42. For all  $x$  such that  $0 \leq x \leq 90$ , which of the following expressions is NOT equal to  $\sin x^\circ$ ?
- F.  $-\sin(-x^\circ)$   
 G.  $\sin(-x^\circ)$   
 H.  $\cos(90 - x)^\circ$   
 J.  $\cos(x - 90)^\circ$   
 K.  $\sqrt{1 - (\cos x^\circ)^2}$

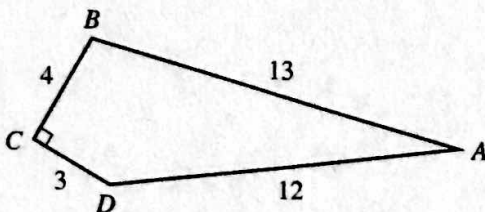
43. A 3-inch-tall rectangular box with a square base is constructed to hold a circular pie that has a diameter of 8 inches. Both are shown below. What is the volume, in cubic inches, of the smallest such box that can hold this pie?



- A. 24  
 B. 64  
 C. 72  
 D. 192  
 E. 512

44. Quadrilateral  $ABCD$  is shown in the figure below with the lengths of the 4 sides given in meters. The measure of  $\angle C$  is  $90^\circ$ . What is  $\tan A$ ?

- F.  $\frac{4}{12}$   
 G.  $\frac{5}{12}$   
 H.  $\frac{4}{13}$   
 J.  $\frac{5}{13}$   
 K.  $\frac{12}{13}$



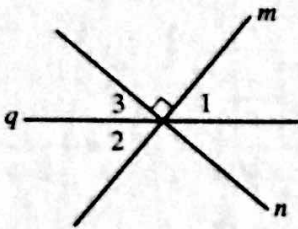


DO YOUR FIGURING HERE.

45. Given today is Tuesday, what day of the week was it 200 days ago?

A. Monday  
 B. Tuesday  
 C. Wednesday  
 D. Friday  
 E. Saturday

46. In the figure below, line  $m$  is perpendicular to line  $n$ , and both lines intersect line  $q$  at the same point. The measure of  $\angle 1$  is  $(3x - 10)^\circ$ , and the measure of  $\angle 2$  is  $(2x + 10)^\circ$ . What is the measure of  $\angle 3$ ?



- F.  $36^\circ$   
 G.  $40^\circ$   
 H.  $44^\circ$   
 J.  $45^\circ$   
 K.  $54^\circ$
47. The greatest common factor of 2 whole numbers is 10. The least common multiple of these same 2 numbers is 120. What are the 2 numbers?
- A. 6 and 20  
 B. 10 and 12  
 C. 10 and 20  
 D. 20 and 60  
 E. 30 and 40
48. The side lengths of a certain triangle are 4, 5, and 7 centimeters. Which of the following descriptions best classifies this triangle?
- F. Scalene acute  
 G. Scalene right  
 H. Scalene obtuse  
 J. Isosceles obtuse  
 K. Isosceles right
49. A professional baseball team will play 1 game Saturday and 1 game Sunday. A sportswriter estimates the team has a 60% chance of winning on Saturday but only a 35% chance of winning on Sunday. Using the sportswriter's estimates, what is the probability that the team will *lose* both games?

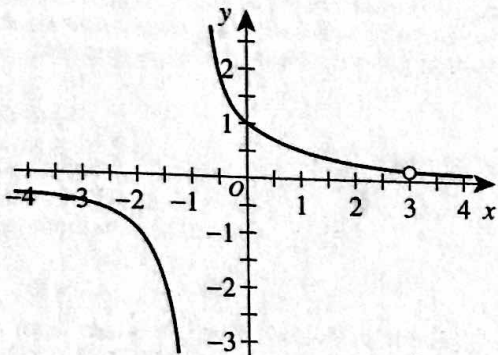
(Note: Neither game can result in a tie.)

A. 14%  
 B. 21%  
 C. 25%  
 D. 26%  
 E. 39%



50. The graph of  $f(x) = \frac{x-3}{x^2-2x-3}$  is shown below. What is the domain of  $f(x)$ ?

DO YOUR FIGURING HERE.

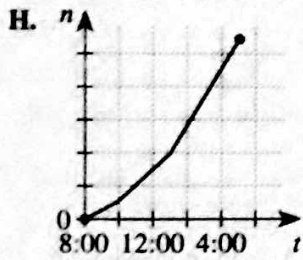
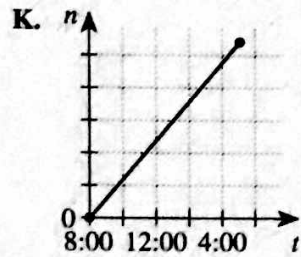
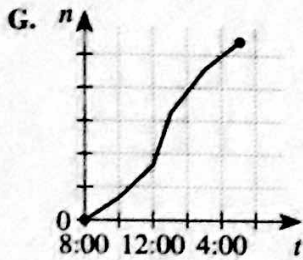
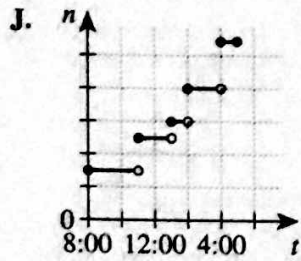
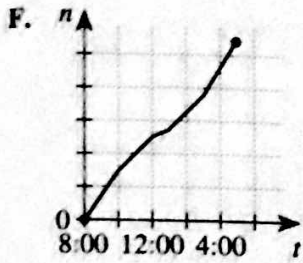


- F.  $\{x|x \neq -1\}$   
 G.  $\{x|x \neq 2\}$   
 H.  $\{x|x \neq 3\}$   
 J.  $\{x|x \neq -1 \text{ and } x \neq 3\}$   
 K.  $\{x|x \neq 0 \text{ and } x \neq 2\}$
51. Get-A-Great-Read Books is adding a new phone line. The phone company says that the first 3 digits of the phone number must be 555, but the remaining 4 digits, where each digit is a digit from 0 through 9, can be chosen by Get-A-Great-Read Books. How many phone numbers are possible?
- A.  $5(9^4)$   
 B.  $5^3(9^4)$   
 C.  $5^3(10^4)$   
 D.  $9^4$   
 E.  $10^4$
52. In the standard  $(x,y)$  coordinate plane, the circle centered at  $(1,3)$  that passes through  $(4,7)$  is the set of all points that are:
- F. 5 coordinate units from  $(1,3)$ .  
 G. 5 coordinate units from both  $(1,3)$  and  $(4,7)$ .  
 H. 5 coordinate units from the line segment with endpoints  $(1,3)$  and  $(4,7)$ .  
 J. equidistant from  $(1,3)$  and  $(4,7)$ .  
 K. equidistant from the line segment with endpoints  $(1,3)$  and  $(4,7)$ .
53. Which of the following values is the  $x$ -coordinate of the point in the standard  $(x,y)$  coordinate plane where the graph of the line  $y = 7$  intersects the graph of the function  $y = \ln(x-2) + 3$ ?
- A. 6  
 B.  $e^4 + 2$   
 C.  $4e + 2$   
 D.  $\ln(4) + 2$   
 E.  $\ln(5) + 3$



DO YOUR FIGURING HERE.

54. Three copy machines—A, B, and C—copy at the same rate and will all be used to make copies of a report. At 8:00 a.m., all 3 machines begin copying. Machine A breaks down at 10:00 a.m. and is back in service at 1:00 p.m. Machine B breaks down at 12:00 p.m. (noon) and begins copying again at 3:00 p.m. All 3 machines finish copying at 5:00 p.m. when the copying of the report is complete. One of the following graphs shows  $n$ , the number of copies made, as a function of  $t$ , the time at any given point during the copying. Which graph is it?



55. A sporting-goods store sells baseball caps for \$22 each. At this price, 40 caps are sold per week. For every \$1 decrease in price, the store will sell 4 more caps per week. The store will adjust the price to maximize revenue. What will be the maximum possible revenue for 1 week?

(Note: The revenue equals the number of caps sold times the price per cap.)

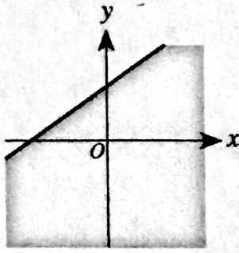
- A. \$ 880
- B. \$ 882
- C. \$ 924
- D. \$ 960
- E. \$1,024



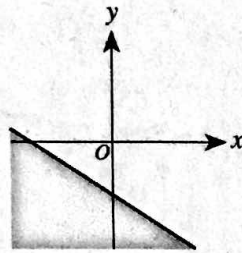
56. Each of the following graphs in the standard  $(x,y)$  coordinate plane has the same scale on both axes. One graph is the graph of  $ax + by \leq c$ , where  $0 < a < b < c$ . Which one is it?

DO YOUR FIGURING HERE.

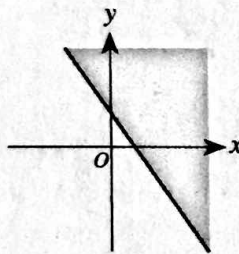
F.



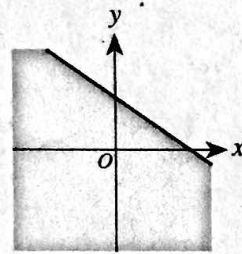
J.



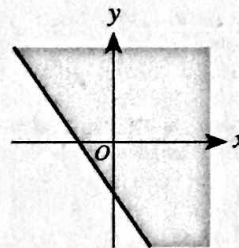
G.



K.



H.



57. The art club designed and made banners of the school colors, blue and white, for their fund-raiser. Each banner required  $\frac{1}{4}$  yard of blue material and  $\frac{3}{8}$  yard of white material. The club originally planned to purchase exactly enough material to make 500 banners, but found the material to be cheaper if purchased in full bolts—the blue material in 10-yard bolts and the white material in 12-yard bolts. How many extra banners was the club able to make if they purchased enough full bolts to make at least 500 banners?

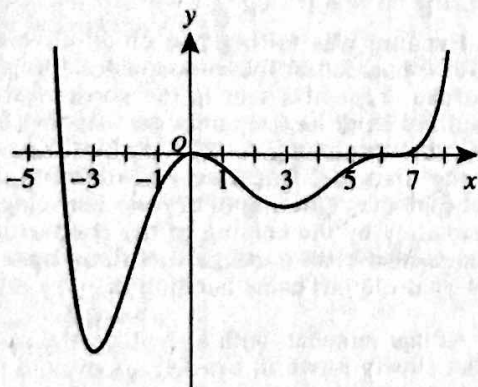
- A. 12  
 B. 13  
 C. 15  
 D. 16  
 E. 20



58. For all real numbers  $x$  and the imaginary number  $i$ , which of the following expressions is equivalent to  $(x - 3i)^3$ ?

**DO YOUR FIGURING HERE.**

- F.  $x^3 - 9x^2i - 27x + 27i$   
 G.  $x^3 + 9x^2i - 27x - 27i$   
 H.  $x^3 + 3x^2i - 9x - 27i$   
 J.  $x^3 - 3x^2i - 9x + 27i$   
 K.  $x^3 + 27i$
59. The graph in the standard  $(x,y)$  coordinate plane below is the graph of one of the following functions. Which one?



- A.  $g(x) = x(x - 6)(x + 4)$   
 B.  $h(x) = x^2(x + 6)(x - 4)$   
 C.  $n(x) = x^2(x + 6)^3(x - 4)$   
 D.  $p(x) = x^2(x - 6)^3(x + 4)$   
 E.  $q(x) = x^3(x - 6)^2(x + 4)$
60. The table below shows the numbers of rows and columns in each of 5 matrices.

Matrix	Number of rows	Number of columns
A	$m$	$n$
B	$m$	$m$
C	$k$	$n$
D	$m$	$k$
E	$n$	$m$

For distinct values of  $k$ ,  $m$ , and  $n$ , which of the following matrix products is NOT possible?

- F. ED  
 G. DC  
 H. CE  
 J. AE  
 K. AC

**END OF TEST 2**

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

**DO NOT RETURN TO THE PREVIOUS TEST.**