SAT MATH TESTS

Test 1

Section 1

Questions: 20
Time: 25 minutes

1. If n is an odd integer, which one of the following is an even integer?

   (A) n^3
   (B) $n/4$
   (C) $2n + 3$
   (D) $n(n + 3)$
   (E) $\sqrt{n}$

USE THIS SPACE FOR SCRATCHWORK.

2. Define $x\nabla y$ by the equation $x\nabla y = xy - y$. Then $2\nabla 3 =$

   (A) 1
   (B) 3
   (C) 12
   (D) 15
   (E) 18

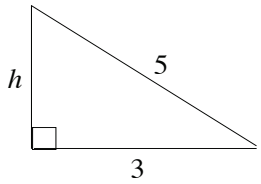
USE THIS SPACE FOR SCRATCHWORK.

3. he graph of $x = -y^2 + 2$ and the graph of the line k intersect at $(0, p)$ and $(1, q)$. Which one of the following is the smallest possible slope of line k ?

   (A) $-\sqrt{2} - 1$
   (B) $-\sqrt{2} + 1$
   (C) $\sqrt{2} - 1$
   (D) $\sqrt{2} + 1$
   (E) $\sqrt{2} + 2$

USE THIS SPACE FOR SCRATCHWORK.

4. What is the area of the triangle shown?



(A) 6
(B) 7.5
(C) 8
(D) 11
(E) 15

USE THIS SPACE FOR SCRATCHWORK.

5. When the integer n is divided by 2, the quotient is u and the remainder is 1. When the integer n is divided by 5, the quotient is v and the remainder is 3. Which one of the following must be true?

(A) $2u + 5v = 4$
(B) $2u - 5v = 2$
(C) $4u + 5v = 2$
(D) $4u - 5v = 2$
(E) $3u - 5v = 2$

USE THIS SPACE FOR SCRATCHWORK.

6. If $xy^2z < 0$, then which one of the following statements must also be true?

I. $xz < 0$
II. $z < 0$
III. $xyz < 0$

(A) None
(B) I only
(C) III only
(D) I and II
(E) II and III

7. Which of the following fractions is the largest in the group?

(A) 10/11
(B) 9/10
(C) 8/9
(D) 7/8
(E) 6/7

8. If $a + 3a$ is 4 less than $b + 3b$, then $a - b =$

(A) –4
(B) –1
(C) 1/5
(D) 1/3
(E) 2

9. What is the average of x, $2x$, and 6?

(A) $x/2$
(B) $2x$
(C) $(x + 2)/6$
(D) $x + 2$
(E) $(x + 2)/3$

10. What is the ratio of 2 feet to 4 yards?

(A) 1 : 9
(B) 1 : 8
(C) 1 : 7
(D) 1 : 6
(E) 1 : 5

11. If $x \neq 0$, $\dfrac{x\left(x^5\right)^2}{x^4} =$

(A) x^5
(B) x^6
(C) x^7
(D) x^8
(E) x^9

12. If $x - y = 9$, then $\left(x - \frac{y}{3}\right) - \left(y - \frac{x}{3}\right) =$

(A) –4
(B) –3
(C) 0
(D) 12
(E) 27

USE THIS SPACE FOR SCRATCHWORK.

13. $2 - \left(5 - 3^3\left[4 \div 2 + 1\right]\right) =$

(A) –21
(B) 32
(C) 45
(D) 60
(E) 78

USE THIS SPACE FOR SCRATCHWORK.

14. What percent of 25 is 5?

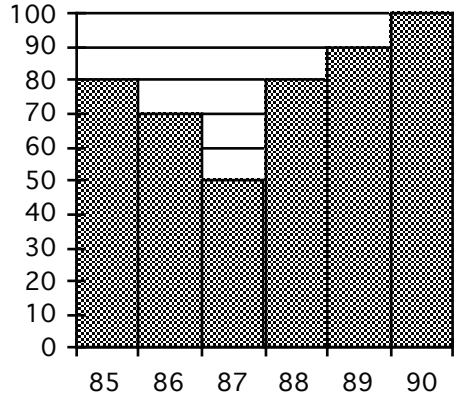
(A) 10%
(B) 20%
(C) 30%
(D) 35%
(E) 40%

USE THIS SPACE FOR SCRATCHWORK.

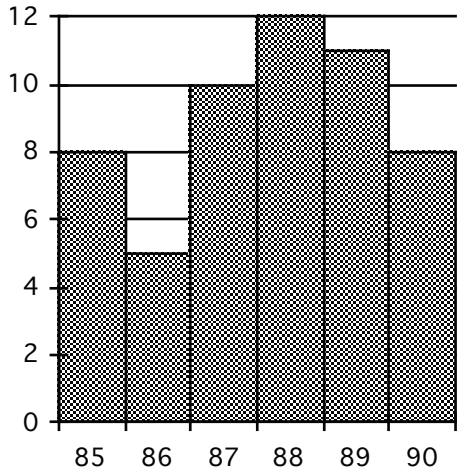
Questions 15-18 refer to the following graphs.

SALES AND EARNINGS OF CONSOLIDATED CONGLOMERATE

Sales
(in millions of dollars)



Earnings
(in millions of dollars)



Note: Figure drawn to scale.

15. During which year was the company's earnings 10 percent of its sales?

(A) 85
(B) 86
(C) 87
(D) 88
(E) 90

USE THIS SPACE FOR SCRATCHWORK.

16. During the years 1986 through 1988, what were the average earnings per year?

(A) 6 million
(B) 7.5 million
(C) 9 million
(D) 10 million
(E) 27 million

USE THIS SPACE FOR SCRATCHWORK.

17. In which year did sales increase by the greatest percentage over the previous year?

(A) 86
(B) 87
(C) 88
(D) 89
(E) 90

USE THIS SPACE FOR SCRATCHWORK.

18. If Consolidated Conglomerate's earnings are less than or equal to 10 percent of sales during a year, then the stockholders must take a dividend cut at the end of the year. In how many years did the stockholders of Consolidated Conglomerate suffer a dividend cut?

(A) None
(B) One
(C) Two
(D) Three
(E) Four

USE THIS SPACE FOR SCRATCHWORK.

19. Scott starts jogging from point X to point Y. A half-hour later his friend Garrett who jogs 1 mile per hour slower than twice Scott's rate starts from the same point and follows the same path. If Garrett overtakes Scott in 2 hours, how many miles will Garrett have covered?

(A) 2 1/5
(B) 3 1/3
(C) 4
(D) 6
(E) 6 2/3

USE THIS SPACE FOR SCRATCHWORK.

20. In sequence S, the 3rd term is 4, the 2nd term is three times the 1st, and the 3rd term is four times the 2nd. What is the 1st term in sequence S?

(A) 0
(B) 1/3
(C) 1
(D) 3/2
(E) 4

USE THIS SPACE FOR SCRATCHWORK.

Section 2

Questions: 18
Time: 25 minutes

1. If n is an integer, which of the following CANNOT be an even integer?

(A) $2n + 2$
(B) $n - 5$
(C) $2n$
(D) $2n + 3$
(E) $5n + 2$

USE THIS SPACE FOR SCRATCHWORK.

2. If x is a positive integer, define:

$(x)^* = \sqrt{x}$, if x is even;
$(x)^* = 4x$, if x is odd.

If k is a positive integer, which one of the following equals $(2k - 1)^*$?

(A) $\sqrt{2k-1}$
(B) $k - 1$
(C) $8k - 4$
(D) $\sqrt{8k-4}$
(E) $8k - 1$

USE THIS SPACE FOR SCRATCHWORK.

3. Suppose p is even and q is odd. Then which of the following CANNOT be an integer?

I. $(p + q)/p$
II. $pq/3$
III. q/p^2

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) I and III only

USE THIS SPACE FOR SCRATCHWORK.

4. If $x = -|x|$, then which one of the following statements could be true?

I. $x = 0$
II. $x < 0$
III. $x > 0$

(A) None
(B) I only
(C) III only
(D) I and II
(E) II and III

USE THIS SPACE FOR SCRATCHWORK.

5. If $w \neq 0$ and $w = 2x = \sqrt{2}y$, what is the value of $w - x$ in terms of y ?

(A) $2y$
(B) $\frac{\sqrt{2}}{2}y$
(C) $\sqrt{2y}$
(D) $\frac{4}{\sqrt{2}}y$
(E) y

USE THIS SPACE FOR SCRATCHWORK.

6. $\frac{3 \cdot 3 \cdot 3 \cdot 3}{9 \cdot 9 \cdot 9 \cdot 9} =$

(A) $\left(\frac{1}{3}\right)^4$
(B) $\left(\frac{1}{3}\right)^3$
(C) 1/3
(D) 4/9
(E) 4/3

USE THIS SPACE FOR SCRATCHWORK.

7. $\dfrac{2^{20} - 2^{19}}{2^{11}} =$

(A) $2^9 - 2^{19}$
(B) $\dfrac{1}{2^{11}}$
(C) 2^8
(D) 2^{10}
(E) 2^{28}

8. Except for the first two numbers, every number in the sequence –1, 3, –3, . . . is the product of the two immediately preceding numbers. How many numbers of this sequence are odd?

(A) one
(B) two
(C) three
(D) four
(E) more than four

[Grid-in Problem]
9. How many integers are there between 49 and 101, inclusive?

[Grid-in Problem]

10. Bowl S contains only marbles. If 1/4 of the marbles were removed, the bowl would be filled to 1/2 of its capacity. If 100 marbles were added, the bowl would be full. How many marbles are in bowl S?

[Grid-in Problem]

11. If in a certain school 20 students are taking math and 10 are taking history and 7 are taking both, how many students are taking either math or history?

[Grid-in Problem]

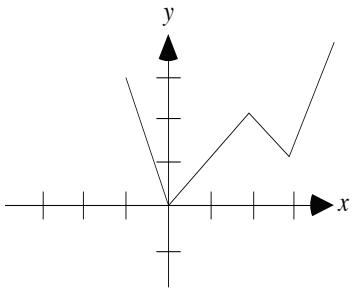
12. A hat contains 15 marbles, and each marble is numbered with one and only one of the numbers 1, 2, 3. From a group of 15 people, each person selects exactly 1 marble from the hat.

Numbered Marble	Number of People Who Selected The Marble
1	4
2	5
3	6

What is the probability that a person selected at random picked a marble numbered 2 or greater?

[Grid-in Problem]

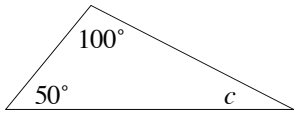
13. The graph of $y = f(x)$ is shown. If $f(-1) = v$, then what is the value of $f(v)$?



USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

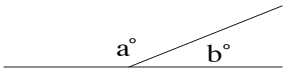
14. In the triangle shown, what is the degree measure of angle c ?



USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

15. In the figure, if the quotient of a and b is 7/2, then b =



[Grid-in Problem]

16. If $x \neq -1$, then $\dfrac{2x^2 + 4x + 2}{(x+1)^2} =$

[Grid-in Problem]

17. If on a test three people answered 90% of the questions correctly and two people answered 80% correctly, then the average for the group of five people is

[Grid-in Problem]

18. If the ratio of y to x is equal to 3 and the sum of y and x is 80, what is the value of y?

Section 3

Questions: 16
Time: 20 minutes

1. If x/y is a fraction greater than 1, then which of the following must be less than 1?

(A) $3y/x$
(B) $x/3y$
(C) $\sqrt{\frac{x}{y}}$
(D) y/x
(E) y

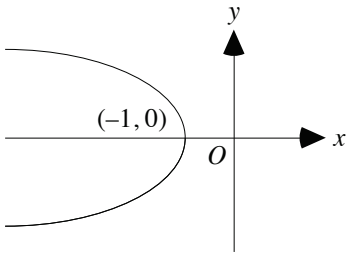
USE THIS SPACE FOR SCRATCHWORK.

2. Define x^* by the equation $x^* = \pi - x$. Then $((-\pi)^*)^* =$

(A) -2π
(B) -1
(C) $-\pi$
(D) 2π
(E) 4π

USE THIS SPACE FOR SCRATCHWORK.

3. The graph shows a parabola that is symmetric about the x-axis. Which one of the following could be the equation of the graph?



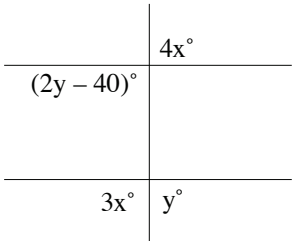
(A) $x = -y^2 - 1$
(B) $x = -y^2$
(C) $x = -y^2 + 1$
(D) $x = y^2 - 1$
(E) $x = (y + 1)^2$

4. If a, b, and c are consecutive integers and $a < b < c$, which of the following must be true?

I. $b - c = 1$
II. $abc/3$ is an integer.
III. $a + b + c$ is even.

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) II and III only

5. In the figure, what is the measure of angle y ?



(A) 80
(B) 84
(C) 85
(D) 87
(E) 90

USE THIS SPACE FOR SCRATCHWORK.

6. If $1/Q > 1$, which of the following must be true?

(A) $1 < Q^2$
(B) $\frac{1}{Q^2} > 2$
(C) $1 > Q^2$
(D) $\frac{1}{Q^2} < 1$
(E) $Q < Q^2$

USE THIS SPACE FOR SCRATCHWORK.

7. If $\frac{x+3}{x-3} = y$, what is the value of x in terms of y?

(A) $3 - y$
(B) $3/y$
(C) $\sqrt{y+12}$
(D) $\frac{-3y-3}{1-y}$
(E) $3y^2$

USE THIS SPACE FOR SCRATCHWORK.

8. If p and q are positive, $p^2 + q^2 = 16$, and $p^2 - q^2 = 8$, then $q =$

(A) 2
(B) 4
(C) 8
(D) $2\sqrt{2}$
(E) $2\sqrt{6}$

USE THIS SPACE FOR SCRATCHWORK.

9. If the average of five numbers is -10, and the sum of three of the numbers is 16, then what is the average of the other two numbers?

(A) –33
(B) –1
(C) 5
(D) 20
(E) 25

USE THIS SPACE FOR SCRATCHWORK.

10. If Biff can shape 3 surfboards in 50 minutes, how many surfboards can he shape in 5 hours?

(A) 16
(B) 17
(C) 18
(D) 19
(E) 20

11. $\frac{6^4}{3^2} =$

(A) 2^4
(B) $2^3 \cdot 3$
(C) 6^2
(D) $2^4 \cdot 3^2$
(E) $2^2 \cdot 3^4$

12. Given the system $\begin{matrix} x^2 = 4 \\ y^3 = -8 \end{matrix}$, which of the following is NOT necessarily true?

(A) $y < 0$
(B) $x < 5$
(C) y is an integer
(D) $x > y$
(E) x/y is an integer

13. If $x \neq -2$, then $\dfrac{8x^2 - 32}{4x + 8} =$

(A) $2(x - 2)$
(B) $2(x - 4)$
(C) $8(x + 2)$
(D) $x - 2$
(E) $x + 4$

USE THIS SPACE FOR SCRATCHWORK.

14. What percent of a is $3a$?

(A) 100%
(B) 150%
(C) 200%
(D) 300%
(E) 350%

USE THIS SPACE FOR SCRATCHWORK.

15. A cyclist travels 20 miles at a speed of 15 miles per hour. If he returns along the same path and the entire trip takes 2 hours, at what speed did he return?

(A) 15 mph
(B) 20 mph
(C) 22 mph
(D) 30 mph
(E) 34 mph

USE THIS SPACE FOR SCRATCHWORK.

16. The seventh number in a sequence of numbers is 31 and each number after the first number in the sequence is 4 less than the number immediately preceding it. What is the fourth number in the sequence?

(A) 15
(B) 19
(C) 35
(D) 43
(E) 51

Test 2

Section 1

Questions: 20
Time: 25 minutes

1. If n is an odd integer, which of the following must be an even integer?

(A) $n/2$
(B) $4n + 3$
(C) $2n$
(D) n^4
(E) $\sqrt{n}$

USE THIS SPACE FOR SCRATCHWORK.

2. If x is an integer, define:

$/x\ = 5$, if x is odd;
$/x\ = 10$, if x is even.

If u and v are integers, and both $3u$ and $7 - v$ are odd, then $/u\ - /v\ =$

(A) –5
(B) 0
(C) 5
(D) 10
(E) 15

USE THIS SPACE FOR SCRATCHWORK.

3. Let the function h be defined by $h(x) = \sqrt{x} + 2$. If $3h(v) = 18$, then which one of the following is the value of $h\left(\frac{v}{4}\right)$?

(A) –4
(B) –1
(C) 0
(D) 2
(E) 4

USE THIS SPACE FOR SCRATCHWORK.

4. Which one of the following numbers is smallest?

(A) $\left(\frac{7}{8}\right)^2$
(B) $\sqrt{\frac{7}{8}}$
(C) $\sqrt{\frac{8}{7}}$
(D) $\left(\frac{8}{7}\right)^2$
(E) 8/7

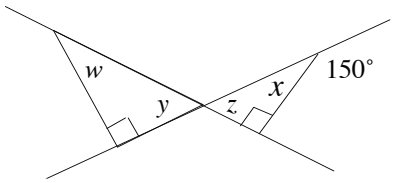
USE THIS SPACE FOR SCRATCHWORK.

5. If both x and y are prime numbers, which of the following CANNOT be the difference of x and y?

(A) 1
(B) 3
(C) 9
(D) 15
(E) 23

USE THIS SPACE FOR SCRATCHWORK.

6. In the figure, $w =$



(A) 30
(B) 32
(C) 40
(D) 52
(E) 60

USE THIS SPACE FOR SCRATCHWORK.

7. If $2 < x < 5$ and $3 < y < 5$, which of the following best describes $x - y$?

(A) $-3 < x - y < 2$
(B) $-3 < x - y < 5$
(C) $0 < x - y < 2$
(D) $3 < x - y < 5$
(E) $2 < x - y < 5$

USE THIS SPACE FOR SCRATCHWORK.

8. $\dfrac{1-\dfrac{1}{2}}{3} =$

(A) 6
(B) 3
(C) 1/3
(D) 1/6
(E) 1/8

USE THIS SPACE FOR SCRATCHWORK.

9. If $a > 0$ and $6a = 5b$, which of the following must be true?

(A) $a = 6b/5$
(B) $ab < 0$
(C) $a > b$
(D) $b = 5a/6$
(E) $b > a$

10. In traveling from city A to city B, John drove for 1 hour at 50 mph and for 3 hours at 60 mph. What was his average speed for the whole trip?

(A) 50
(B) 53½
(C) 55
(D) 56
(E) 57½

11. On a map, 1 inch represents 150 miles. What is the actual distance between two cities if they are 3½ inches apart on the map?

(A) 225
(B) 300
(C) 450
(D) 525
(E) 600

12. If $x < 0$ and y is 5 more than the square of x, which one of the following expresses x in terms of y?

(A) $x = \sqrt{y-5}$
(B) $x = -\sqrt{y-5}$
(C) $x = \sqrt{y+5}$
(D) $x = \sqrt{y^2-5}$
(E) $x = -\sqrt{y^2-5}$

13. If $r^2 - 2rs + s^2 = 4$, then $(r-s)^6 =$

(A) –4
(B) 4
(C) 8
(D) 16
(E) 64

14. $\dfrac{x^2 - 2x + 1}{x - 1} =$

(A) $x + 1$
(B) $-x - 1$
(C) $-x + 1$
(D) $x - 1$
(E) $x - 2$

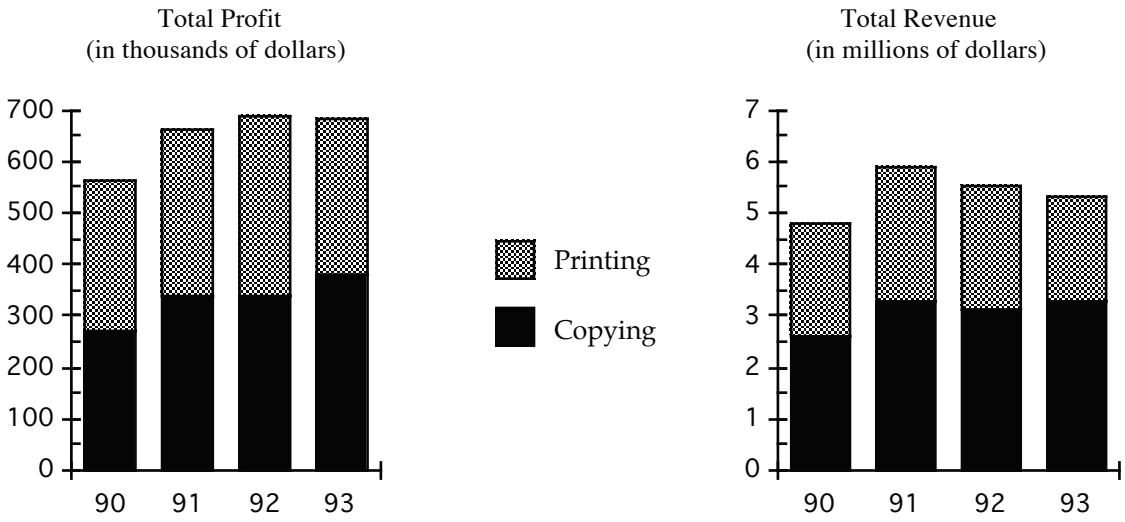
15. 2 is 10% of what number?

(A) 10
(B) 12
(C) 20
(D) 24
(E) 32

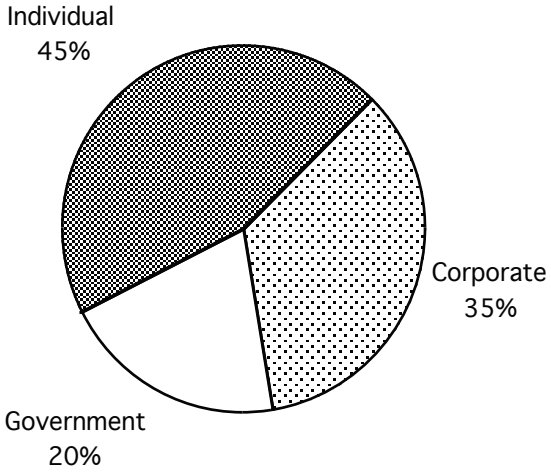
USE THIS SPACE FOR SCRATCHWORK.

Questions 16–20 refer to the following graphs.

Profit And Revenue Distribution For Zippy Printing, 1990–1993, Copying And Printing.



Distribution of Profit from Copying, 1992
(in thousands of dollars)



16. In 1993, the total profit was approximately how much greater than the total profit in 1990?

(A) 50 thousand
(B) 75 thousand
(C) 120 thousand
(D) 200 thousand
(E) 350 thousand

USE THIS SPACE FOR SCRATCHWORK.

17. In 1990, the profit from copying was approximately what percent of the revenue from copying?

(A) 2%
(B) 10%
(C) 20%
(D) 35%
(E) 50%

USE THIS SPACE FOR SCRATCHWORK.

18. In 1992, the profit from copying for corporate customers was approximately how much greater than the profit from copying for government customers?

(A) 50 thousand
(B) 80 thousand
(C) 105 thousand
(D) 190 thousand
(E) 260 thousand

USE THIS SPACE FOR SCRATCHWORK.

19. During the two years in which total profit was most nearly equal, the combined revenue from printing was closest to

(A) 1 million
(B) 2 million
(C) 4.5 million
(D) 6 million
(E) 6.5 million

20. The amount of profit made from government copy sales in 1992 was

(A) 70 thousand
(B) 100 thousand
(C) 150 thousand
(D) 200 thousand
(E) 350 thousand

Section 2

Questions: 18
Time: 25 minutes

1. What is the sixth term of the sequence 90, –30, 10, –10/3, . . . ?

   (A) 1/3
   (B) 0
   (C) –10/27
   (D) –3
   (E) –100/3

2. A drum contains 3 to 5 jars each of which contains 30 to 40 marbles. If 10 percent of the marbles are flawed, what is the greatest possible number of flawed marbles in the drum?

   (A) 51
   (B) 40
   (C) 30
   (D) 20
   (E) 12

3. Sarah cannot completely remember her four-digit ATM pin number. She does remember the first two digits, and she knows that each of the last two digits is greater than 5. The ATM will allow her three tries before it blocks further access. If she randomly guesses the last two digits, what is the probability that she will get access to her account?

   (A) 1/2
   (B) 1/4
   (C) 3/16
   (D) 3/18
   (E) 1/32

4. If x and y are perfect squares, then which of the following is NOT necessarily a perfect square?

(A) x^2
(B) xy
(C) $4x$
(D) $x + y$
(E) x^5

5. The digits of a three-digit number add up to 18. If the ten's digit is twice the hundred's digit and the hundred's digit is 1/3 the unit's digit, what is the number?

(A) 246
(B) 369
(C) 531
(D) 855
(E) 893

6. In the function shown, for what values of x is $g(x)$ a real number?

$$g(x) = (2x - 3)^{1/4} + 1$$

(A) $x \geq 0$
(B) $x \geq 1/2$
(C) $x \geq 3/2$
(D) $x \geq 2$
(E) $x \geq 3$

7. If $x \neq 0$, then which one of the following must be true?

(A) $2x^2 = (2x)^2$
(B) $2x^2 < (2x)^2$
(C) $2x^2 \leq (2x)^2$
(D) $2x^2 > (2x)^2$
(E) $2x^2 \geq (2x)^2$

USE THIS SPACE FOR SCRATCHWORK.

8. If $-x = -|-(-2 + 5)|$, then $x =$

(A) –7
(B) –3
(C) 3
(D) 7
(E) 9

USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

9. The population of a town was 12,000, and ten years later it was 16,000. What was the percent increase in the population of the town during this period?

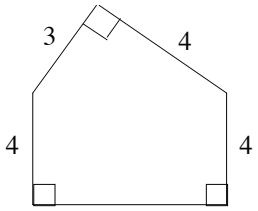
USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

10. Two people start jogging at the same point and time but in opposite directions. If the rate of one jogger is 2 mph faster than the other and after 3 hours they are 30 miles apart, what is the rate of the faster jogger?

[Grid-in Problem]

11. In the figure, what is the perimeter of the pentagon?



[Grid-in Problem]

12. If x is an integer and $y = -2x - 8$, what is the least value of x for which y is less than 9?

[Grid-in Problem]

13. $\frac{1}{2} - \frac{3}{4} =$

[Grid-in Problem]

14. If $p - q + r = 4$ and $p + q + r = 8$, then what is the value of $p + r$.

[Grid-in Problem]

15. How many ounces of a solution that is 30 percent salt must be added to a 50-ounce solution that is 10 percent salt so that the resulting solution is 20 percent salt?

[Grid-in Problem]

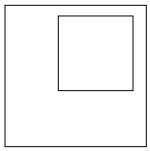
16. The sum of the squares of the first n positive integers $1^2 + 2^2 + 3^2 + \ldots + n^2$ is $\frac{n(n+1)(2n+1)}{6}$. What is the sum of the squares of the first 9 positive integers?

[Grid-in Problem]

17. In a legislative body of 200 people, the number of Democrats is 50 less than 4 times the number of Republicans. If one fifth of the legislators are neither Republican nor Democrat, how many of the legislators are Republicans?

[Grid-in Problem]

18. In the figure, the smaller square has sides of length 2 and the larger square has sides of length 4. If a point is chosen at random from the large square, what is the probability that it will be from the small square?



Section 3

Questions: 16
Time: 20 minutes

1. If y is an even integer and x is an odd integer, which of the following expressions could be an even integer?

   (A) $3x + y/2$
   (B) $(x + y)/2$
   (C) $x + y$
   (D) $x/4 - y/2$
   (E) $x^2 + y^2$

USE THIS SPACE FOR SCRATCHWORK.

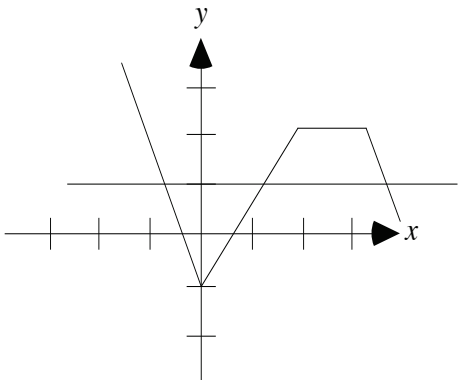
2. For all real numbers a and b, where $a \cdot b \neq 0$, let $a \lozenge b = a^b$. Then which of the following must be true?

   I. $a \lozenge b = b \lozenge a$
   II. $(-a) \lozenge (-a) = \dfrac{(-1)^{-a}}{a^a}$
   III. $(a \lozenge b) \lozenge c = a \lozenge (b \lozenge c)$

   (A) I only
   (B) II only
   (C) III only
   (D) I and II only
   (E) II and III only

USE THIS SPACE FOR SCRATCHWORK.

3. The graphs of $y = f(x)$ and $y = 1$ are shown. For how many x values does $f(x)$ equal 1?



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

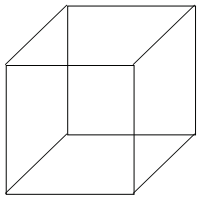
USE THIS SPACE FOR SCRATCHWORK.

4. If the remainder is 1 when m is divided by 2 and the remainder is 3 when n is divided by 4, which of the following must be true?

(A) m is even.
(B) n is even.
(C) $m + n$ is even.
(D) mn is even.
(E) m/n is even.

USE THIS SPACE FOR SCRATCHWORK.

5. The volume of the cube shown is x and its surface area is x. What is the length of an edge of the cube?



(A) 6
(B) 10
(C) 18
(D) 36
(E) 48

USE THIS SPACE FOR SCRATCHWORK.

6. If $1 < x < y$, which of the following must be true?

(A) $-x^2 < -y^2$
(B) $\frac{x}{y} < \frac{y}{x}$
(C) $\frac{y}{x} < \frac{x}{y}$
(D) $\frac{-x}{y} < \frac{-y}{x}$
(E) $x^2 > y^2$

USE THIS SPACE FOR SCRATCHWORK.

7. Which one of the following equals the average of x and $\frac{1}{x}$?

(A) $\frac{x+2}{x}$

(B) $\frac{x^2+1}{2x}$

(C) $\frac{x+1}{x^2}$

(D) $\frac{2x^2+1}{x}$

(E) $\frac{x+1}{x}$

USE THIS SPACE FOR SCRATCHWORK.

8. Suppose $x = y - 2 = \frac{y+5}{2}$. Then x equals

(A) 1/3
(B) 1
(C) 7/6
(D) 2
(E) 7

USE THIS SPACE FOR SCRATCHWORK.

9. If the average of p and $4p$ is 10, then $p =$

(A) 1
(B) 3
(C) 4
(D) 10
(E) 18

USE THIS SPACE FOR SCRATCHWORK.

10. If 7 workers can assemble a car in 8 hours, how long would it take 12 workers to assemble the same car?

(A) 3 hrs.
(B) 3 1/2 hrs.
(C) 4 2/3 hrs.
(D) 5 hrs.
(E) 6 1/3 hrs.

11. If $x \neq 0$, $\left(\frac{2y^3}{x^2}\right)^4 \cdot x^{10} =$

(A) $16y^{12}x^2$
(B) $8y^7x^2$
(C) $16\frac{y^{12}}{x^8}$
(D) $8\frac{y^{12}}{x^8}$
(E) $\frac{y^{12}}{16x^8}$

12. Which of the following could be a solution of the equation $x^2 - 7x - 18 = 0$?

(A) –1
(B) 0
(C) 2
(D) 7
(E) 9

13. $\left(x^2+2\right)\left(x-x^3\right) =$

(A) $x^4 - x^2 + 2$
(B) $-x^5 - x^3 + 2x$
(C) $x^5 - 2x$
(D) $3x^3 + 2x$
(E) $x^5 + x^3 + 2x$

USE THIS SPACE FOR SCRATCHWORK.

14. If there are 15 boys and 25 girls in a class, what percent of the class is boys?

(A) 10%
(B) 15%
(C) 18%
(D) 25%
(E) 37.5%

USE THIS SPACE FOR SCRATCHWORK.

15. At 1 PM, Ship A leaves port heading due west at x miles per hour. Two hours later, Ship B is 100 miles due south of the same port and heading due north at y miles per hour. At 5 PM, how far apart are the ships?

(A) $\sqrt{(4x)^2 + (100 + 2y)^2}$
(B) $x + y$
(C) $\sqrt{x^2 + y^2}$
(D) $\sqrt{(4x)^2 + (2y)^2}$
(E) $\sqrt{(4x)^2 + (100 - 2y)^2}$

USE THIS SPACE FOR SCRATCHWORK.

16. For all integers $x > 1$, $\langle x \rangle = 2x + (2x - 1) + (2x - 2) + \ldots + 2 + 1$. What is the value of $\langle 3 \rangle \cdot \langle 2 \rangle$?

(A) 60
(B) 116
(C) 210
(D) 263
(E) 478

USE THIS SPACE FOR SCRATCHWORK.

Test 3

Section 1

Questions: 20
Time: 25 minutes

1. If $0 < k < 1$, then which of the following must be less than k?

   (A) $3k/2$
   (B) $1/k$
   (C) $|k|$
   (D) $\sqrt{k}$
   (E) k^2

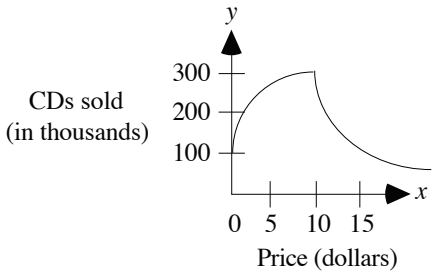
USE THIS SPACE FOR SCRATCHWORK.

2. The operation @ is defined for all non-zero x and y by the equation $x@y = x^y$. Then the expression $(x @ y) @ z$ is equal to

   (A) x^{y^z}
   (B) xyz
   (C) $(xy)^z$
   (D) $x^y z$
   (E) $(x^y)^z$

USE THIS SPACE FOR SCRATCHWORK.

3. The graph shows the number of music CDs sold at various prices. At what price should the CDs be marked to sell the maximum number of CDs?



(A) 0
(B) 5
(C) 10
(D) 15
(E) 20

USE THIS SPACE FOR SCRATCHWORK.

4. Which one of the following fractions is greatest?

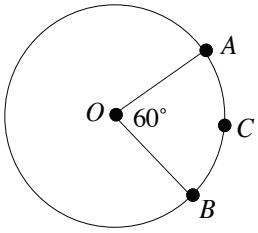
(A) 15/16
(B) 7/9
(C) 13/15
(D) 8/9
(E) 10/11

USE THIS SPACE FOR SCRATCHWORK.

5. If x and y are both prime and greater than 2, then which of the following CANNOT be a divisor of xy?

(A) 2
(B) 3
(C) 11
(D) 15
(E) 17

6. In the figure, the circle has center O and its radius is 2. What is the length of arc ACB ?



(A) $\pi/3$
(B) $2\pi/3$
(C) π
(D) $4\pi/3$
(E) $7\pi/3$

7. If $-3 < x < -1$ and $3 < y < 7$, which one of the following best describes $\frac{x-y}{2}$?

(A) $-5 < \frac{x-y}{2} < -2$

(B) $-3 < \frac{x-y}{2} < -1$

(C) $-2 < \frac{x-y}{2} < 0$

(D) $2 < \frac{x-y}{2} < 5$

(E) $3 < \frac{x-y}{2} < 7$

8. 1/5 of .1 percent equals:

(A) 2
(B) .2
(C) .02
(D) .002
(E) .0002

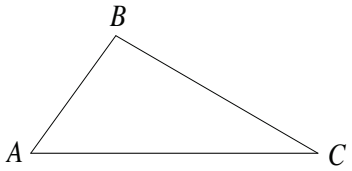
9. Let $p = 3^{q+1}$ and $q = 2r$. Then $\frac{p}{3^2} =$

(A) 3^{2r-1}
(B) 3^{2r}
(C) 3
(D) r
(E) 3^{2r+1}

10. The average of six consecutive integers in increasing order of size is 9½. What is the average of the last three integers?

(A) 8
(B) 9½
(C) 10
(D) 11
(E) 19

11. In the figure, the angles A, B, C of the triangle are in the ratio 5:12:13. What is the measure of angle A?



(A) 15
(B) 27
(C) 30
(D) 34
(E) 40

12. $\sqrt{(31-6)(16+9)} =$

(A) 5
(B) 10
(C) 25
(D) 50
(E) 625

13. If $3y + 5 = 7x$, then $21y - 49x =$

(A) –40
(B) –35
(C) –10
(D) 0
(E) 15

14. $-2\left(3 - x\left[\frac{5 + y - 2}{x}\right] - 7 + 2 \cdot 3^2\right) =$

(A) $2y - 11$
(B) $2y + 1$
(C) $x - 2$
(D) $x + 22$
(E) $2y - 22$

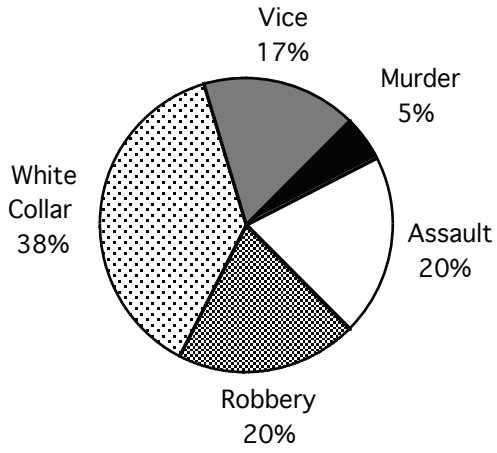
15. John spent $25, which is 15 percent of his monthly wage. What is his monthly wage?

(A) $80
(B) $166 2/3
(C) $225
(D) $312.5
(E) $375

Questions 6–10 refer to the following graphs.

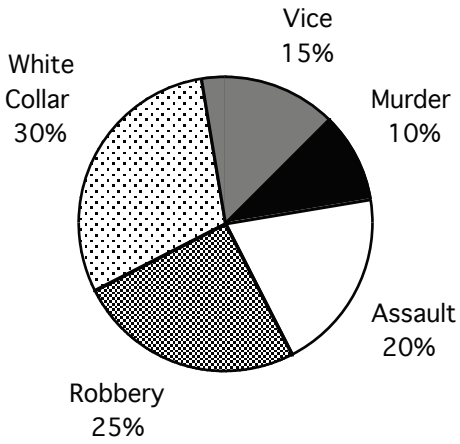
DISTRIBUTION OF CRIMINAL ACTIVITY BY CATEGORY OF CRIME FOR COUNTRY X IN 2010 AND PROJECTED FOR 2020.

Criminal Population: 10 million



2010

Criminal Population: 20 million



2020 (Projected)

16. What is the projected number of white-collar criminals in 2020?

(A) 1 million
(B) 3.8 million
(C) 6 million
(D) 8 million
(E) 10 million

USE THIS SPACE FOR SCRATCHWORK.

17. The ratio of the number of robbers in 2010 to the number of projected robbers in 2020 is

(A) 2/5
(B) 3/5
(C) 1
(D) 3/2
(E) 5/2

USE THIS SPACE FOR SCRATCHWORK.

18. From 2010 to 2020, there is a projected decrease in the number of criminals for which of the following categories?

(A) None
(B) I only
(C) II only
(D) II and III only
(E) I, II, and III

19. What is the approximate projected percent increase between 2010 and 2020 in the number of criminals involved in vice?

(A) 25%
(B) 40%
(C) 60%
(D) 75%
(E) 85%

20. The projected number of Robbers in 2020 will exceed the number of white-collar criminals in 2010 by

(A) 1.2 million
(B) 2.3 million
(C) 3.4 million
(D) 5.8 million
(E) 7.2 million

Section 2

Questions: 18
Time: 25 minutes

1. Suppose you begin reading a book on page h and end on page k. If you read each page completely and the pages are numbered and read consecutively, then how many pages have you read?

(A) $h + k$
(B) $h - k$
(C) $k - h + 2$
(D) $k - h - 1$
(E) $k - h + 1$

USE THIS SPACE FOR SCRATCHWORK.

2. For all real numbers x and y, let $x \# y = (xy)^2 - x + y^2$. What is the value of y that makes $x \# y$ equal to $-x$ for all values of x ?

(A) 0
(B) 2
(C) 5
(D) 7
(E) 10

USE THIS SPACE FOR SCRATCHWORK.

3. The table shows the values of the quadratic function f for several values of x. Which one of the following functions best represents f?

x	–1	0	1	2
$f(x)$	1	3	1	–5

(A) $f(x) = -2x^2$
(B) $f(x) = x^2 + 3$
(C) $f(x) = -x^2 + 3$
(D) $f(x) = -2x^2 - 3$
(E) $f(x) = -2x^2 + 3$

USE THIS SPACE FOR SCRATCHWORK.

4. $1 + \dfrac{1}{1 - \dfrac{1}{2}} =$

(A) 3
(B) 5
(C) 7
(D) 9
(E) 11

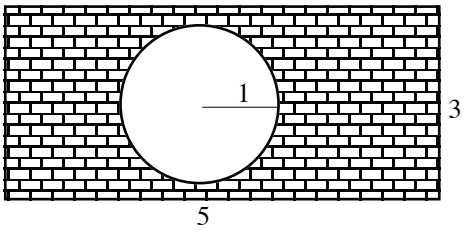
USE THIS SPACE FOR SCRATCHWORK.

5. If 2 is the greatest number that will divide evenly into both x and y, what is the greatest number that will divide evenly into both $5x$ and $5y$?

(A) 2
(B) 4
(C) 6
(D) 8
(E) 10

USE THIS SPACE FOR SCRATCHWORK.

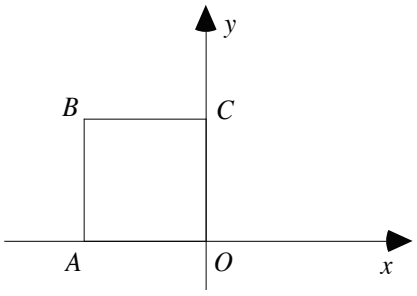
6. What is the area of the shaded region formed by the circle and the rectangle in the figure?



(A) $15 - 2\pi$
(B) $15 - \pi$
(C) 14
(D) $16 - \pi$
(E) 15π

USE THIS SPACE FOR SCRATCHWORK.

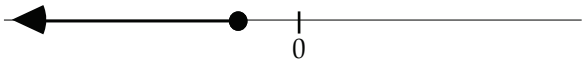
7. In the figure, polygon *ABCO* is a square. If the coordinates of *B* are $(h, 4)$, what is the value of h ?

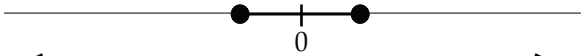


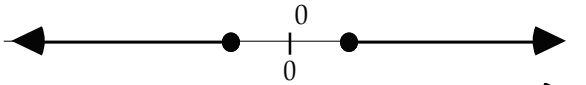
(A) 4
(B) $4\sqrt{2}$
(C) $-4\sqrt{2}$
(D) –4
(E) not enough information

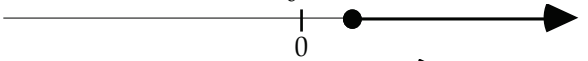
USE THIS SPACE FOR SCRATCHWORK.

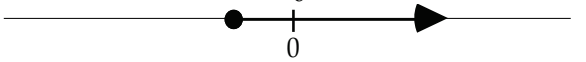
8. Which one of the following could be the graph of $3 - 6x \leq \frac{4x + 2}{-2}$?

(A)


(B)


(C)


(D)


(E)


USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

9. $\frac{2}{\frac{4}{3}} =$

USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

10. k is a constant in the equation $\frac{u - v}{k} = 8$. If $u = 18$ when $v = 2$, then what is the value of u when $v = 4$?

USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

11. The average of five numbers is 6.9. If one of the numbers is deleted, the average of the remaining numbers is 4.4. What is the value of the number deleted?

[Grid-in Problem]

12. What is the ratio of 2 ft. 3 in. to 2 yds?

[Grid-in Problem]

13. What is the largest integer n such that 2^n is a factor of 20^8?

[Grid-in Problem]

14. If $x \neq -2$, then $\dfrac{7x^2 + 28x + 28}{(x+2)^2} =$

[Grid-in Problem]

15. A town has a population growth rate of 10% per year. The population in 2010 was 2000. What was the population in 2012?

[Grid-in Problem]

16. If Johnny can mow the lawn in 30 minutes and with the help of his brother, Bobby, they can mow the lawn 20 minutes, how long would it take Bobby working alone to mow the lawn?

[Grid-in Problem]

17. By dividing 21 into 1, the fraction 1/21 can be written as a repeating decimal: 0.476190476190 . . . where the block of digits 476190 repeats. What is the 54th digit following the decimal point?

[Grid-in Problem]

18. If $x < y < z$, $z = ky$, $x = 0$, and the average of the numbers x, y, and z is 3 times the median, what is the value of k?

Section 3

Questions: 16
Time: 20 minutes

1. Which one of the following is a solution to the equation $x^4 - 2x^2 = -1$?

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

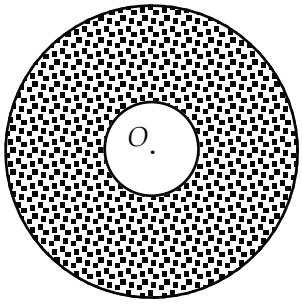
2. If the ratio of 1/5 to 1/4 is equal to the ratio of 1/4 to x, then what is the value of x ?

   (A) 5/16
   (B) 4/11
   (C) 1
   (D) 4
   (E) 5

3. The smallest prime number greater than 53 is

   (A) 54
   (B) 55
   (C) 57
   (D) 59
   (E) 67

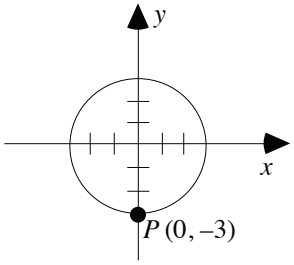
4. In the figure, the radius of the larger circle is three times that of the smaller circle. If the circles are concentric, what is the ratio of the shaded region's area to the area of the smaller circle?



(A) 10 : 1
(B) 9 : 1
(C) 8 : 1
(D) 3 : 1
(E) 5 : 2

USE THIS SPACE FOR SCRATCHWORK.

5. In the figure, the circle is centered at the origin and passes through point P. Which one of the following points does it also pass through?



(A) (3, 3)
(B) $\left(-2\sqrt{2}, -1\right)$
(C) (2, 6)
(D) $\left(-\sqrt{3}, \sqrt{3}\right)$
(E) (–3, 4)

USE THIS SPACE FOR SCRATCHWORK.

6. If $x < y < -1$, which of the following must be true?

(A) $\frac{x}{y} > xy$

(B) $\frac{y}{x} > x + y$

(C) $\frac{y}{x} > xy$

(D) $\frac{y}{x} < x + y$

(E) $\frac{y}{x} > \frac{x}{y}$

USE THIS SPACE FOR SCRATCHWORK.

7. The decimal .1 is how many times greater than the decimal $(.001)^3$?

(A) 10
(B) 10^2
(C) 10^5
(D) 10^8
(E) 10^{10}

USE THIS SPACE FOR SCRATCHWORK.

8. If $x = 3y = 4z$, which of the following must equal $6x$?

I. $18y$
II. $3y + 20z$
III. $\frac{4y+10z}{3}$

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) I and III only

9. If S denotes the sum and A the average of the consecutive positive integers 1 through n, then which of the following must be true?

I. $A = S/n$
II. $S = A/n$
III. $A - S = n$

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) I, II, and III

10. The ratio of two numbers is 10 and their difference is 18. What is the value of the smaller number?

(A) 2
(B) 5
(C) 10
(D) 21
(E) 27

USE THIS SPACE FOR SCRATCHWORK.

11. $\frac{55^5}{5^{55}}$ =

(A) $\frac{11}{5^{50}}$
(B) $\frac{11}{5^{55}}$
(C) $\frac{11^5}{5^{50}}$
(D) $\frac{11^5}{5^5}$
(E) $\frac{11^5}{5}$

USE THIS SPACE FOR SCRATCHWORK.

12. If $x - y = p$, then $2x^2 - 4xy + 2y^2 =$

(A) p
(B) $2p$
(C) $4p$
(D) p^2
(E) $2p^2$

USE THIS SPACE FOR SCRATCHWORK.

13. For all real numbers a and b, where $a \cdot b \neq 0$, let $a \lozenge b = ab - 1$, which of the following must be true?

I. $a \lozenge b = b \lozenge a$
II. $\frac{a \lozenge a}{a} = 1 \lozenge 1$
III. $(a \lozenge b) \lozenge c = a \lozenge (b \lozenge c)$

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) I and III only

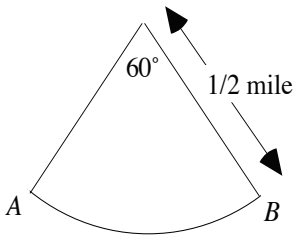
USE THIS SPACE FOR SCRATCHWORK.

14. If $a = 4b$, what percent of $2a$ is $2b$?

(A) 10%
(B) 20%
(C) 25%
(D) 26%
(E) 40%

USE THIS SPACE FOR SCRATCHWORK.

15. The figure shows the path of a car moving around a circular racetrack. How many miles does the car travel in going from point *A* to point *B* ?



(A) $\pi/6$
(B) $\pi/3$
(C) π
(D) 30
(E) 60

USE THIS SPACE FOR SCRATCHWORK.

16. The positive integers *P*, *Q*, *R*, *S*, and *T* increase in order of size such that the value of each successive integer is one more than the preceding integer and the value of *T* is 6. What is the value of *R*?

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

USE THIS SPACE FOR SCRATCHWORK.

Test 4

Section 1

Questions: 20
Time: 25 minutes

1. If $x + 3y = 5$ and $3x + y = 7$, then $x + y =$

   (A) 1
   (B) 2
   (C) 3
   (D) 4
   (E) 5

USE THIS SPACE FOR SCRATCHWORK.

2. The number of integers between 29 and 69, inclusive is

   (A) 39
   (B) 40
   (C) 41
   (D) 42
   (E) 43

USE THIS SPACE FOR SCRATCHWORK.

3. If $\frac{x^6 - 5x^3 - 16}{8} = 1$, then x could be

(A) 1
(B) 2
(C) 3
(D) 5
(E) 8

USE THIS SPACE FOR SCRATCHWORK.

4. $\frac{1}{1-(.2)^2} =$

(A) 25/24
(B) 25/23
(C) 24/15
(D) 23/11
(E) 21/9

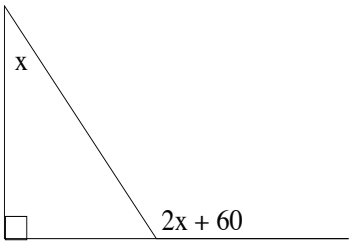
USE THIS SPACE FOR SCRATCHWORK.

5. If $-x - 2 = -|-(6 - 2)|$, then $x =$

(A) –5
(B) –2
(C) 0
(D) 2
(E) 5

USE THIS SPACE FOR SCRATCHWORK.

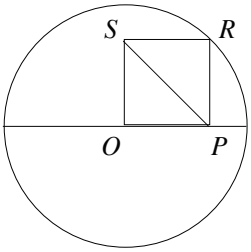
6. In the figure, what is the value of x ?



(A) 30
(B) 32
(C) 35
(D) 40
(E) 47

USE THIS SPACE FOR SCRATCHWORK.

7. In the figure, O is both the center of the circle with radius 2 and a vertex of the square $OPRS$. What is the length of diagonal PS ?



(A) 1/2
(B) $\frac{\sqrt{2}}{2}$
(C) 4
(D) 2
(E) $2\sqrt{5}$

USE THIS SPACE FOR SCRATCHWORK.

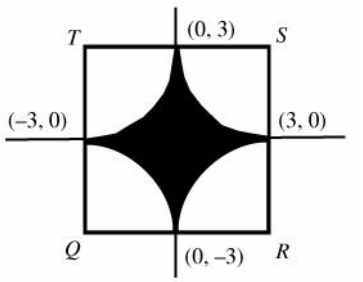
8. Which of the following represents all solutions of the inequality $x^2 < 2x$?

(A) $-1 < x < 1$
(B) $0 < x < 2$
(C) $1 < x < 3$
(D) $2 < x < 4$
(E) $4 < x < 6$

9. Let $x = .99$, $y = \sqrt{.99}$, and $z = (.99)^2$. Then which one of the following is true?

(A) $x < z < y$
(B) $z < y < x$
(C) $z < x < y$
(D) $y < x < z$
(E) $y < z < x$

10. In the figure, $QRST$ is a square. If the shaded region is bounded by arcs of circles with centers at Q, R, S, and T, then the area of the shaded region is



(A) 9
(B) 36
(C) $36 - 9\pi$
(D) $36 - \pi$
(E) $9 - 3\pi$

USE THIS SPACE FOR SCRATCHWORK.

11. If $x^4y < 0$ and $xy^4 > 0$, which of the following must be true?

(A) $x > y$
(B) $y > x$
(C) $x = y$
(D) $x < 0$
(E) $y > 0$

USE THIS SPACE FOR SCRATCHWORK.

12. If $x \neq \pm 3$, then $\dfrac{x^2+6x+9}{x+3} \cdot \dfrac{x^2-9}{x-3} =$

(A) $\dfrac{x+3}{x-3}$

(B) -1

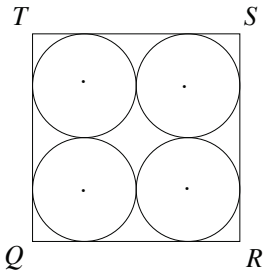
(C) $(x+3)^2$

(D) $\left(\dfrac{x+3}{x-3}\right)^2$

(E) 1

USE THIS SPACE FOR SCRATCHWORK.

13. In the figure, *QRST* is a square. If the area of each circle is 2π, then the area of square *QRST* is



(A) $\sqrt{2}$

(B) 4

(C) $\sqrt{2}\pi$

(D) $4\sqrt{2}$

(E) 32

USE THIS SPACE FOR SCRATCHWORK.

14. $\left(x+\frac{1}{2}\right)^2-(2x-4)^2=$

(A) $-3x^2-15x+\frac{65}{4}$

(B) $3x^2+16x$

(C) $-3x^2+17x-\frac{63}{4}$

(D) $5x^2+\frac{65}{4}$

(E) $3x^2$

USE THIS SPACE FOR SCRATCHWORK.

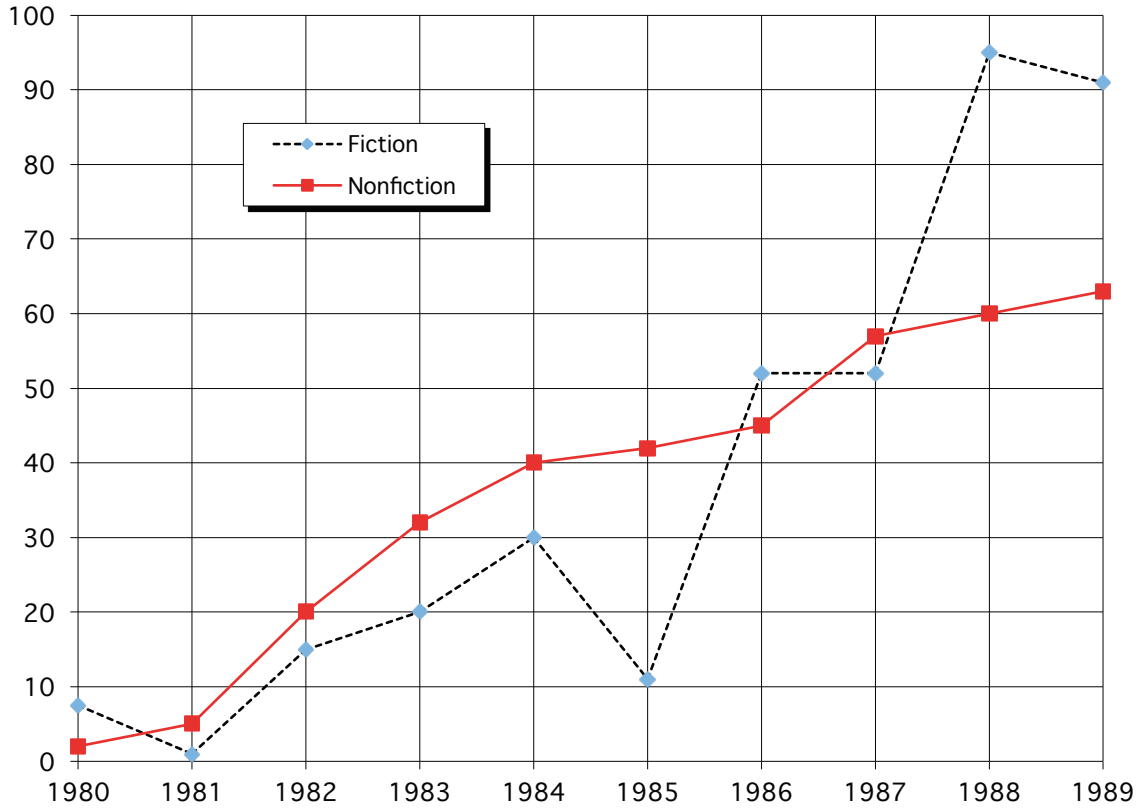
15. If $p = 5q > 0$, then 40 percent of $3p$ equals

(A) $6q$
(B) $5.52q$
(C) $13.3q$
(D) $9q$
(E) $20.1q$

USE THIS SPACE FOR SCRATCHWORK.

Questions 16–20 refer to the following graph.

SALES BY CATEGORY FOR GRAMMERCY PRESS, 1980–1989
(in thousands of books)



16. In how many years did the sales of nonfiction titles exceed the sales of fiction titles ?

(A) 2
(B) 3
(C) 4
(D) 5
(E) 6

USE THIS SPACE FOR SCRATCHWORK.

17. Which of the following best approximates the amount by which the increase in sales of fiction titles from 1985 to 1986 exceeded the increase in sales of fiction titles from 1983 to 1984?

(A) 31.5 thousand
(B) 40 thousand
(C) 49.3 thousand
(D) 50.9 thousand
(E) 68 thousand

18. Which of the following periods showed a continual increase in the sales of fiction titles?

(A) 1980–1982
(B) 1982–1984
(C) 1984–1986
(D) 1986–1988
(E) 1987–1989

19. What was the approximate average number of sales of fiction titles from 1984 to 1988?

(A) 15 thousand
(B) 30 thousand
(C) 40 thousand
(D) 48 thousand
(E) 60 thousand

20. By approximately what percent did the sale of nonfiction titles increase from 1984 to 1987?

(A) 42%
(B) 50%
(C) 70%
(D) 90%
(E) 110%

USE THIS SPACE FOR SCRATCHWORK.

Section 2

Questions: 18
Time: 25 minutes

1. $\dfrac{1}{\frac{4}{3}-1}$ =

(A) –1/3
(B) –1/4
(C) 3/4
(D) 3
(E) 9/2

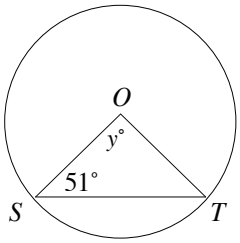
USE THIS SPACE FOR SCRATCHWORK.

2. If $7x - y = 23$ and $7y - x = 31$, then $x + y$ =

(A) 4
(B) 6
(C) 7
(D) 8
(E) 9

USE THIS SPACE FOR SCRATCHWORK.

3. In the figure, if O is the center of the circle, then $y =$



(A) 75
(B) 76
(C) 77
(D) 78
(E) 79

USE THIS SPACE FOR SCRATCHWORK.

4. If $5x = 6y$, then the ratio of x to y is

(A) 5 : 11
(B) 5 : 6
(C) 1 : 1
(D) 6 : 5
(E) 11 : 6

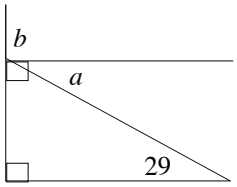
USE THIS SPACE FOR SCRATCHWORK.

5. If $x = 1/9$, then $\sqrt{x} - x^2 =$

(A) 0
(B) 1/9
(C) 26/81
(D) 1/3
(E) 1

USE THIS SPACE FOR SCRATCHWORK.

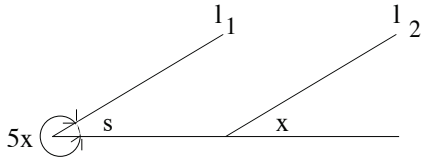
6. In the figure, the value of $a + b$ is



(A) 118
(B) 119
(C) 120
(D) 121
(E) 122

USE THIS SPACE FOR SCRATCHWORK.

7. If $l_1 \| l_2$ in the figure, what is the value of x?



(A) 30
(B) 45
(C) 60
(D) 72
(E) 90

USE THIS SPACE FOR SCRATCHWORK.

8. If m is an even integer, then which of the following is the sum of the next two even integers greater than $4m + 1$?

(A) $8m + 2$
(B) $8m + 4$
(C) $8m + 6$
(D) $8m + 8$
(E) $8m + 10$

USE THIS SPACE FOR SCRATCHWORK.

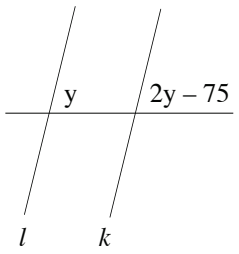
[Grid-in Problem]

9. For all $p \neq 2$ define p^* by the equation $p^* = \dfrac{p+5}{p-2}$. If $p = 3$, then $p^* =$

USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

10. In the figure, if $l \parallel k$, then what is the value of y ?



USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

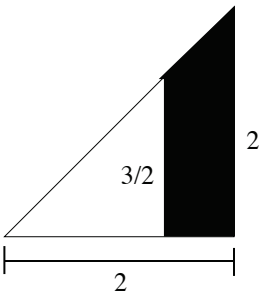
11. A jar contains 24 blue balls and 40 red balls. Which one of the following is 50% of the blue balls?

[Grid-in Problem]

12. Laura has 20 coins consisting of quarters and dimes. If she has a total of $3.05, how many dimes does she have?

[Grid-in Problem]

13. In the figure, both triangles are right triangles. The area of the shaded region is



[Grid-in Problem]

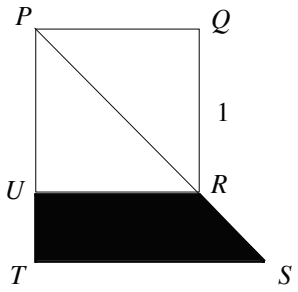
14. Let u represent the sum of the integers from 1 through 20, and let v represent the sum of the integers from 21 through 40. What is the value of $v - u$?

[Grid-in Problem]

15. Speed bumps are being placed at 20 foot intervals along a road 1015 feet long. If the first speed bump is placed at one end of the road, how many speed bumps are needed?

[Grid-in Problem]

16. In the figure, ΔPST is an isosceles right triangle, with the right angle at T, $PQRU$ is a square, and $PS = 2$. What is the area of the shaded region $URST$?

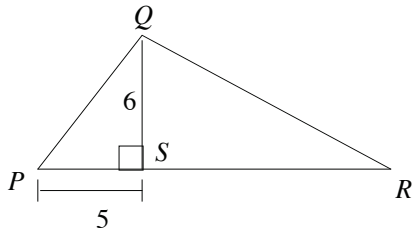


[Grid-in Problem]

17. Three positive numbers x, y, and z have the following relationships $y = x + 2$ and $z = y + 2$. When the median of x, y, and z is subtracted from the product of the smallest number and the median, the result is 0. What is the value of the largest number?

[Grid-in Problem]

18. In the figure, the area of ΔPQR is 40. What is the area of ΔQRS ?



Section 3

Questions: 16
Time: 20 minutes

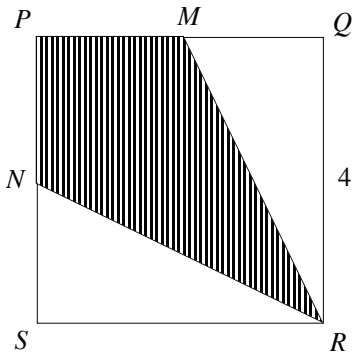
1. $x(x - y) - z(x - y) =$

   (A) $x - y$
   (B) $x - z$
   (C) $(x - y)(x - z)$
   (D) $(x - y)(x + z)$
   (E) $(x - y)(z - x)$

2. Suppose x is divisible by 8 but not by 3. Then which of the following CANNOT be an integer?

   (A) $x/2$
   (B) $x/4$
   (C) $x/6$
   (D) $x/8$
   (E) x

3. In the figure, *PQRS* is a square and *M* and *N* are midpoints of their respective sides. What is the area of quadrilateral *PMRN* ?



(A) 8
(B) 10
(C) 12
(D) 14
(E) 16

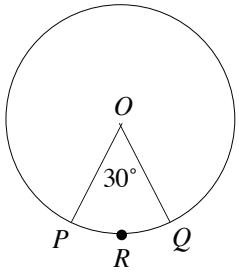
USE THIS SPACE FOR SCRATCHWORK.

4. If [*x*] denotes the area of a square with sides of length *x*, then which one of the following is equal to [9] ÷ [3] ?

(A) [2]
(B) [3]
(C) [16]
(D) [27]
(E) [81]

USE THIS SPACE FOR SCRATCHWORK.

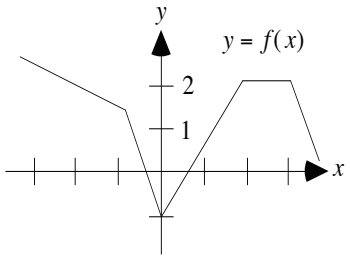
5. In the figure, O is the center of the circle. If the area of the circle is 9π, then the perimeter of the sector $PRQO$ is



(A) $\pi/2 - 6$
(B) $\pi/2 + 6$
(C) $3\pi/4 + 6$
(D) $\pi/2 + 18$
(E) $3\pi/4 + 18$

USE THIS SPACE FOR SCRATCHWORK.

6. In the function shown, if $f(k) = 2$, then which one of the following could be a value of k ?



(A) –1
(B) 0
(C) 0.5
(D) 2.5
(E) 4

USE THIS SPACE FOR SCRATCHWORK.

7. Let $a \# b$ be denoted by the expression $a \# b = -b^4$. Then $x \# (-y) =$

(A) $-y^2$
(B) y^4
(C) $-y^4$
(D) y^2
(E) $|y|$

USE THIS SPACE FOR SCRATCHWORK.

8. If the average of the consecutive even integers a, b, and c is less than $a/3$, which of the following best describes the value of a?

(A) a is prime.
(B) a is odd.
(C) a is zero.
(D) a is positive.
(E) a is negative.

USE THIS SPACE FOR SCRATCHWORK.

9. If n is an integer, what is the least value of n such that $\frac{1}{3^n} < 0.01$?

(A) 2
(B) 3
(C) 4
(D) 5
(E) 6

USE THIS SPACE FOR SCRATCHWORK.

10. Let A denote the area of a circular region. Which of the following denotes the circumference of that circular region?

(A) $\sqrt{\frac{A}{\pi}}$

(B) $2\frac{A}{\sqrt{\pi}}$

(C) $2\pi\sqrt{A}$

(D) $2\sqrt{\frac{A}{\pi}}$

(E) $2\pi\sqrt{\frac{A}{\pi}}$

USE THIS SPACE FOR SCRATCHWORK.

11. If $0 < x < 1$, which of the following must be true?

I. $x^2 < x$

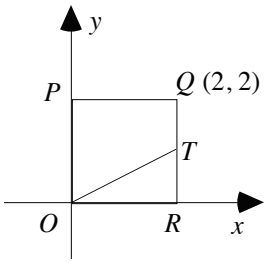
II. $x < \frac{1}{x^2}$

III. $\sqrt{x} < x$

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) I, II, and III

USE THIS SPACE FOR SCRATCHWORK.

12. In the figure, polygon *PQRO* is a square and *T* is the midpoint of side *QR*. What are the coordinates of *T* ?



(A) (1, 1)
(B) (1, 2)
(C) (1.5, 1.5)
(D) (2, 1)
(E) (2, 3)

USE THIS SPACE FOR SCRATCHWORK.

13. Let $P = (x + y)k$. If $P = 10$ and $k = 3$, what is the average of x and y?

(A) 0
(B) 1/2
(C) 5/3
(D) 10/3
(E) 7/2

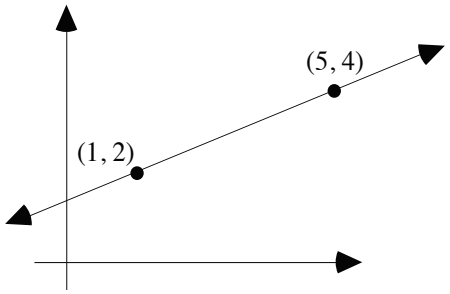
USE THIS SPACE FOR SCRATCHWORK.

14. If $p + q = r$, what is the average of p, q, and r ?

(A) $r/3$
(B) $(p + q)/3$
(C) $2r/3$
(D) $r/2$
(E) $(p + q)/2$

USE THIS SPACE FOR SCRATCHWORK.

15. In the figure, what is the slope of the line passing through the two points?



(A) 1/4
(B) 1
(C) 1/2
(D) 3/2
(E) 2

USE THIS SPACE FOR SCRATCHWORK.

16. The language Q has the following properties:

(1) ABC is the base word.
(2) If C immediately follows B, then C can be moved to the front of the code word to generate another word.

Which one of the following is a code word in language Q?

(A) CAB
(B) BCA
(C) AAA
(D) ABA
(E) CCC

USE THIS SPACE FOR SCRATCHWORK.

Test 5

Section 1

Questions: 20
Time: 25 minutes

1. Callers 49 through 91 to a radio show won a prize. How many callers won a prize?

(A) 42
(B) 43
(C) 44
(D) 45
(E) 46

USE THIS SPACE FOR SCRATCHWORK.

2. If $x + y = 10$ and $x - y = 5$, then $x^2 - y^2 =$

(A) $x - y$
(B) $x - z$
(C) $(x - y)(x - z)$
(D) $(x - y)(x + z)$
(E) $(x - y)(z - x)$

USE THIS SPACE FOR SCRATCHWORK.

3. Ship *X* and ship *Y* are 5 miles apart and are on a collision course. Ship *X* is sailing directly north, and ship *Y* is sailing directly east. If the point of impact is 1 mile closer to the current position of ship *X* than to the current position of ship *Y*, how many miles away from the point of impact is ship *Y* at this time?

(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

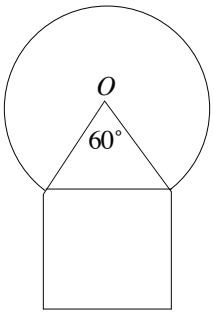
4. If $3x + y < 4$ and $x > 3$, which of the following must be true?

(A) $y < -5$
(B) $y < -10$
(C) $x = y$
(D) $x < 3$
(E) $y > 0$

5. $\dfrac{6^4 - 6^3}{5} =$

(A) 1/5
(B) 63
(C) 6/5
(D) 64
(E) $\dfrac{6^3}{5}$

6. The figure represents a square with sides of length 4 surmounted by a circle with center O. What is the outer perimeter of the figure?



(A) $5\pi/6 + 12$
(B) $\pi + 12$
(C) $49\pi/9 + 12$
(D) $20\pi/3 + 12$
(E) $9\pi + 12$

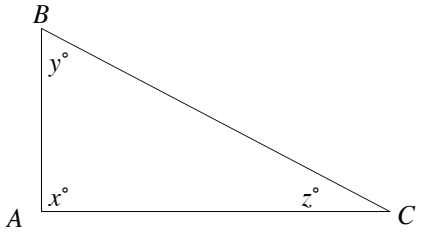
USE THIS SPACE FOR SCRATCHWORK.

7. $4(xy)^3 + (x^3 - y^3)^2 =$

(A) $x^3 - y^3$
(B) $(x^2 + y^2)^3$
(C) $(x^3 + y^3)^3$
(D) $(x^3 - y^3)^2$
(E) $(x^3 + y^3)^2$

USE THIS SPACE FOR SCRATCHWORK.

8. In ΔABC, $AB = AC$ and $x = 30$. What is the value of y ?



(A) 30
(B) 40
(C) 50
(D) 65
(E) 75

USE THIS SPACE FOR SCRATCHWORK.

9. If $\frac{x+5}{y}$ is a prime integer, which of the following must be true?

I. $y = 5x$
II. y is a prime integer.
III. $\frac{x+5}{y}$ is odd.

(A) None
(B) I only
(C) II only
(D) I and II only
(E) II and III only

USE THIS SPACE FOR SCRATCHWORK.

10. In a company with 180 employees, 108 of the employees are female. What percent of the employees are male?

(A) 5%
(B) 25%
(C) 35%
(D) 40%
(E) 60%

11. If the total surface area of cube S is 22, what is the volume of S ?

(A) $\frac{1}{3}\sqrt{\frac{11}{3}}$
(B) $\frac{\sqrt{11}}{3}$
(C) 11/3
(D) $\frac{11}{3}\sqrt{\frac{11}{3}}$
(E) 121/9

12. If x is an integer and x^2 is even, which of the following must be true?

I. x is odd.
II. x is even.
III. x^3 is odd.

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) II and III only

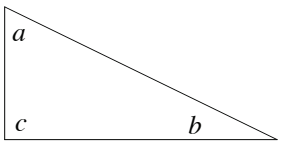
USE THIS SPACE FOR SCRATCHWORK.

13. John is 20 years older than Steve. In 10 years, Steve's age will be half that of John's. What is Steve's age?

(A) 2
(B) 8
(C) 10
(D) 20
(E) 25

USE THIS SPACE FOR SCRATCHWORK.

14. In the figure, what is the area of the triangle?

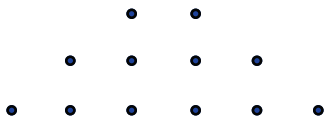


$a = x$, $b = 2x$, and $c = 3x$.

(A) 5
(B) 9
(C) 10
(D) 15
(E) It cannot be determined from the information given

USE THIS SPACE FOR SCRATCHWORK.

15. In the pattern of dots shown, each row after the first row has two more dots than the row immediately above it. Row 6 contains how many dots?



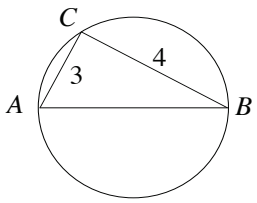
(A) 6
(B) 8
(C) 10
(D) 11
(E) 12

USE THIS SPACE FOR SCRATCHWORK.

16. A school has a total enrollment of 150 students. There are 63 students taking French, 48 taking chemistry, and 21 taking both. How many students are taking neither French nor chemistry?

(A) 60
(B) 65
(C) 71
(D) 75
(E) 97

17. In the figure, ΔABC is inscribed in the circle and AB is a diameter of the circle. What is the radius of the circle?



(A) 3/2
(B) 2
(C) 5/2
(D) 5
(E) 6

18. Of the following symbols, which one can be substituted for the question mark in the expression below to make a true statement for all values of x such that $-1 < x \leq 2$?

$$2 - 3x \ ? \ 5$$

(A) =
(B) <
(C) ≥
(D) >
(E) ≤

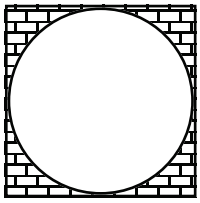
USE THIS SPACE FOR SCRATCHWORK.

19. A jar contains only three types of objects: red, blue, and silver paper clips. The probability of selecting a red paper clip is 1/4, and the probability of selecting a blue paper clip is 1/6. What is the probability of selecting a silver paper clip?

(A) 5/12
(B) 1/2
(C) 7/12
(D) 3/4
(E) 11/12

USE THIS SPACE FOR SCRATCHWORK.

20. In the figure, the circle is inscribed in the square. If the area of the square is 16 square feet, what is the area of the shaded region?



(A) $16 - 16\pi$
(B) $16 - 4.4\pi$
(C) $16 - 4\pi$
(D) 2π
(E) 4π

USE THIS SPACE FOR SCRATCHWORK.

Section 2

Questions: 18
Time: 25 minutes

1. If $x = 2$ and $y = -3$, then $y^2 - \left(x - \left[y + \frac{1}{2} \right] \right) - 2 \cdot 3 =$

(A) –39/2
(B) –3/2
(C) 0
(D) 31
(E) 43

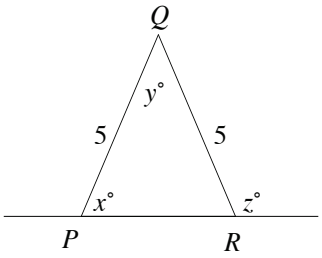
USE THIS SPACE FOR SCRATCHWORK.

2. If $0 < x < 1$, which of the following expressions is greatest?

(A) $\frac{1}{\sqrt{x}}$
(B) $\sqrt{x}$
(C) x/π
(D) x^3
(E) x^4

USE THIS SPACE FOR SCRATCHWORK.

3. In ΔPQR, $x = 60$. What is the value of y?



(A) 60
(B) 55
(C) 50
(D) 45
(E) 40

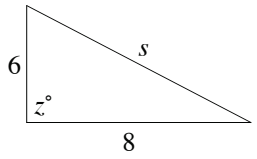
USE THIS SPACE FOR SCRATCHWORK.

4. If $x > 0$ and $|x| = \frac{1}{x}$, then $x =$

(A) –1
(B) 0
(C) 1
(D) 2
(E) 3

USE THIS SPACE FOR SCRATCHWORK.

5. In the figure, what is the area of the triangle?



$z < 90$

(A) 5
(B) 9
(C) 10
(D) 15
(E) It cannot be determined from the information given

USE THIS SPACE FOR SCRATCHWORK.

6. In sequence S, all odd numbered terms are equal and all even numbered terms are equal. The first term in the sequence is $\sqrt{2}$ and the second term is –2. What is approximately the sum of two consecutive terms of the sequence?

(A) –2
(B) –0.6
(C) 0
(D) 2
(E) 0.8

USE THIS SPACE FOR SCRATCHWORK.

7. A web press prints 5 pages every 2 seconds. At this rate, how many pages will the press print in 7 minutes?

(A) 350
(B) 540
(C) 700
(D) 950
(E) 1050

USE THIS SPACE FOR SCRATCHWORK.

8. A bowl contains one marble labeled 0, one marble labeled 1, one marble labeled 2, and one marble labeled 3. The bowl contains no other objects. If two marbles are drawn randomly without replacement, what is the probability that they will add up to 3?

(A) 1/12
(B) 1/8
(C) 1/6
(D) 1/4
(E) 1/3

USE THIS SPACE FOR SCRATCHWORK.

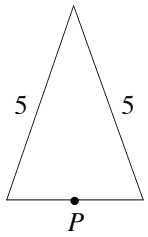
[Grid-in Problem]

9. If x is both the cube and the square of an integer and x is between 2 and 200, what is the value of x?

USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

10. If point *P* in the figure makes one complete revolution around the triangle which has height 4, what is the length of the path traveled by *P*?



USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

11. Four letters—a, b, c, and d—represent one number each from one through four. No two letters represent the same number. It is known that $c > a$ and $a > d$. If b = 2, then a =

USE THIS SPACE FOR SCRATCHWORK.

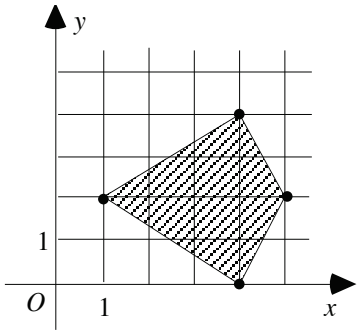
[Grid-in Problem]

12. If $x \neq \pm 1$, then $\dfrac{\dfrac{2x^2 - 2}{x - 1}}{2(x + 1)} =$

USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

13. What is the area of the quadrilateral in the coordinate system shown?



USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

14. In the two-digit number x, both the sum and the difference of its digits is 4. What is the value of x?

USE THIS SPACE FOR SCRATCHWORK.

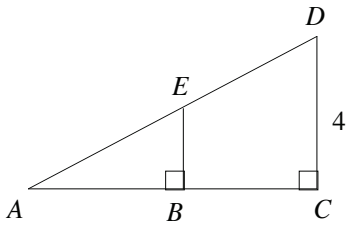
[Grid-in Problem]

15. A certain brand of computer can be bought with or without a hard drive. The computer with the hard drive costs 2,900 dollars. The computer without the hard drive costs 1,950 dollars more than the hard drive alone. What is the cost of the hard drive?

USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

16. In the figure, E is the midpoint of AD. What is the length of EB?



USE THIS SPACE FOR SCRATCHWORK.

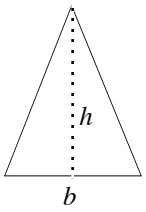
[Grid-in Problem]

17. If 4 percent of $(p + q)$ is 8 and p is a positive integer, what is the greatest possible value of q?

USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

18. In the figure, h denotes the height and b the base of the triangle. If $(bh)^2 = 16$, what is the area of the triangle?



USE THIS SPACE FOR SCRATCHWORK.

Section 3

Questions: 16
Time: 20 minutes

1. $(2 + x)(2 + y) - (2 + x) - (2 + y) =$

   (A) $2y$
   (B) xy
   (C) $x + y$
   (D) $x - y$
   (E) $x + y + xy$

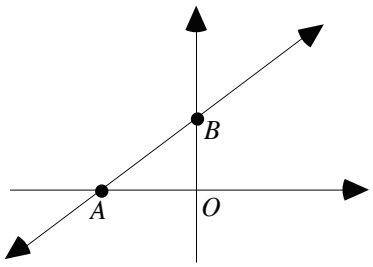
USE THIS SPACE FOR SCRATCHWORK.

2. If $x + y = 4a/5$, $y + z = 7a/5$ and $z + x = 9a/5$, then $x + y + z =$

   (A) $7a/15$
   (B) a
   (C) $2a$
   (D) $3a$
   (E) $4a$

USE THIS SPACE FOR SCRATCHWORK.

3. In the figure, the equation of the line is $y = \frac{9}{10}x + k$. Which one of the following must be true about line segments *AO* and *BO* ?



(A) $AO > BO$
(B) $AO < BO$
(C) $AO \leq BO$
(D) $AO = BO$
(E) $AO = BO/2$

USE THIS SPACE FOR SCRATCHWORK.

4. Let x, y, z be three different positive integers each less than 20. What is the smallest possible value of expression $\frac{x - y}{-z}$?

(A) –18
(B) –17
(C) –14
(D) –11
(E) –9

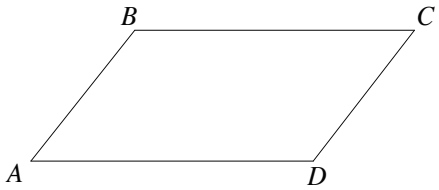
USE THIS SPACE FOR SCRATCHWORK.

5. $\dfrac{1}{1-\dfrac{1}{1-\dfrac{1}{2}}} =$

(A) –2
(B) –1
(C) 3/2
(D) 2
(E) 4

USE THIS SPACE FOR SCRATCHWORK.

6. In the parallelogram, $\angle BAD + \angle BCD = 140$. What is the measure of $\angle ABC$?



(A) 100
(B) 110
(C) 120
(D) 125
(E) 142

USE THIS SPACE FOR SCRATCHWORK.

7. The average of four numbers is 20. If one of the numbers is removed, the average of the remaining numbers is 15. What number was removed?

(A) 10
(B) 15
(C) 30
(D) 35
(E) 45

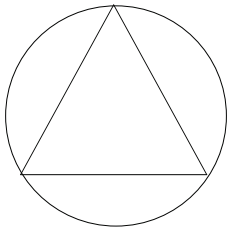
USE THIS SPACE FOR SCRATCHWORK.

8. A jet uses 80 gallons of fuel to fly 320 miles. At this rate, how many gallons of fuel are needed for a 700-mile flight?

(A) 150
(B) 155
(C) 160
(D) 170
(E) 175

USE THIS SPACE FOR SCRATCHWORK.

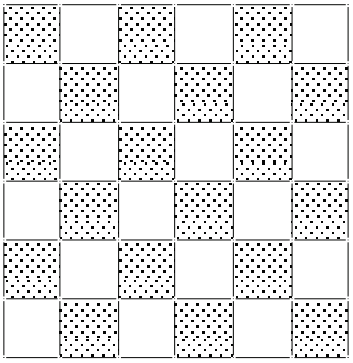
9. An equilateral triangle is inscribed in a circle, as shown. If the radius of the circle is 2, what is the area of the triangle?



(A) $\frac{\sqrt{2}}{2}$
(B) $\sqrt{2}$
(C) $\sqrt{3}$
(D) $3\sqrt{3}$
(E) $10\sqrt{3}$

USE THIS SPACE FOR SCRATCHWORK.

10. What is the maximum number of 3 x 3 squares that can be formed from the squares in the 6 x 6 checkerboard?



(A) 4
(B) 6
(C) 12
(D) 16
(E) 24

USE THIS SPACE FOR SCRATCHWORK.

11. If the average of 10, 14, and n is greater than or equal to 8 and less than or equal to 12, what is the least possible value of n ?

(A) –12
(B) –6
(C) 0
(D) 6
(E) 12

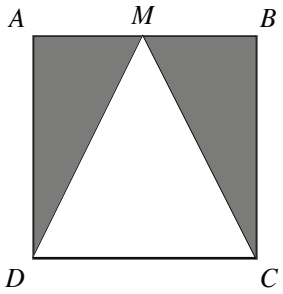
12. If $\left(x^2 - 4\right)\left(\frac{4}{x} - 5\right) = 0$, then $x =$

(A) –4
(B) –1
(C) –4/5
(D) 4/5
(E) 4

13. Which one of the following numbers is the greatest positive integer x such that 3^x is a factor of 27^5 ?

(A) 5
(B) 8
(C) 10
(D) 15
(E) 19

14. The triangle shown has side *DC* of the square as its base. If *DM* = 5 and *M* is the midpoint of side *AB*, what is the area of the shaded region?

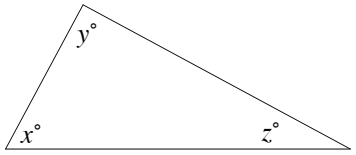


(A) 5/2
(B) $\sqrt{10}$
(C) $\sqrt{15}$
(D) 4
(E) 10

15. Let *C* and *K* be constants. If $x^2 + Kx + 5$ factors into $(x + 1)(x + C)$, the value of *K* is

(A) 0
(B) 5
(C) 6
(D) 8
(E) not enough information

16. In the triangle what is the value of $\frac{x+y+z}{15}$?



(A) 9
(B) 10
(C) 11
(D) 12
(E) 13

USE THIS SPACE FOR SCRATCHWORK.

Test 6

Section 1

Questions: 20
Time: 25 minutes

1. The number of minutes in 1 1/3 hours is

   (A) 60
   (B) 65
   (C) 71
   (D) 80
   (E) 97

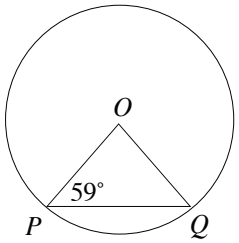
USE THIS SPACE FOR SCRATCHWORK.

2. The ten's digit of a two-digit number is twice the unit's digit. Reversing the digits yields a new number that is 27 less than the original number. Which one of the following is the original number?

   (A) 12
   (B) 21
   (C) 43
   (D) 63
   (E) 83

USE THIS SPACE FOR SCRATCHWORK.

3. In the figure, O is the center of the circle. Which one of the following must be true?



(A) $PQ > OQ$
(B) $OP \geq OQ$
(C) $PQ = OQ$
(D) $OQ < OP$
(E) $PQ \leq OP$

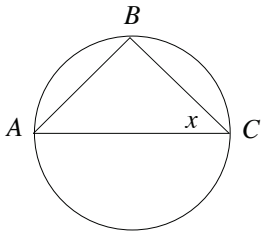
USE THIS SPACE FOR SCRATCHWORK.

4. Let $[x]$ be defined by the equation $[x] = \frac{x^2}{2}$. Then which one of the following equals 2?

(A) [2]
(B) [4]
(C) [6]
(D) [8]
(E) [10]

USE THIS SPACE FOR SCRATCHWORK.

5. In the figure, what is the value of angle x ?



AC is a chord.
B is a point on the circle.

(A) $x > 45^\circ$
(B) $x < 45^\circ$
(C) $x = 45^\circ$
(D) $x \geq 45^\circ$
(E) It cannot be determined from the information given

USE THIS SPACE FOR SCRATCHWORK.

6. A housing subdivision contains only two types of homes: ranch-style homes and townhomes. There are twice as many townhomes as ranch-style homes. There are 3 times as many townhomes with pools than without pools. What is the probability that a home selected at random from the subdivision will be a townhome with a pool?

(A) 1/6
(B) 1/5
(C) 1/4
(D) 1/3
(E) 1/2

USE THIS SPACE FOR SCRATCHWORK.

7. If $x^5 = 4$ and $x^4 = 7/y$, then what is the value of x in terms of y?

(A) $7y/4$
(B) $4y/7$
(C) $y/7$
(D) $7y$
(E) $7 + 5/y$

8. Let P stand for the product of the first 5 positive integers. What is the greatest possible value of m if $\frac{P}{10^m}$ is an integer?

(A) 1
(B) 2
(C) 3
(D) 5
(E) 10

9. The average of two numbers is $\pi/2$, and one of the numbers is x. What is the other number in terms of x ?

(A) $\pi/2 - x$
(B) $\pi/2 + x$
(C) $\pi - x$
(D) $\pi + x$
(E) $2\pi + x$

10. The distance between cities A and B is 120 miles. A car travels from A to B at 60 miles per hour and returns from B to A along the same route at 40 miles per hour. What is the average speed for the round trip?

    (A) 48
    (B) 50
    (C) 52
    (D) 56
    (E) 58

11. How many different ways can 3 cubes be painted if each cube is painted one color and only the 3 colors red, blue, and green are available? (Order is not considered, for example, green, green, blue is considered the same as green, blue, green.)

    (A) 2
    (B) 3
    (C) 9
    (D) 10
    (E) 27

12. If a square has an area of a^2 and a right-angled isosceles triangle also has area a^2, then which one of the following must be true?

    (A) The perimeter of the square is greater than the perimeter of the triangle.
    (B) The perimeter of the square is less than the perimeter of the triangle.
    (C) The perimeter of the square is equal to the perimeter of the triangle.
    (D) The perimeter of the square is greater than or equal to the perimeter of the triangle.
    (E) It cannot be determined which perimeter is greater from the information given

13. If the sum of two prime numbers x and y is odd, then the product of x and y must be divisible by

(A) 2
(B) 3
(C) 4
(D) 5
(E) 8

14. Two boys can mow a lawn in 2 hours and 30 minutes. If they are joined by three other boys, how many hours will it take to mow the lawn?

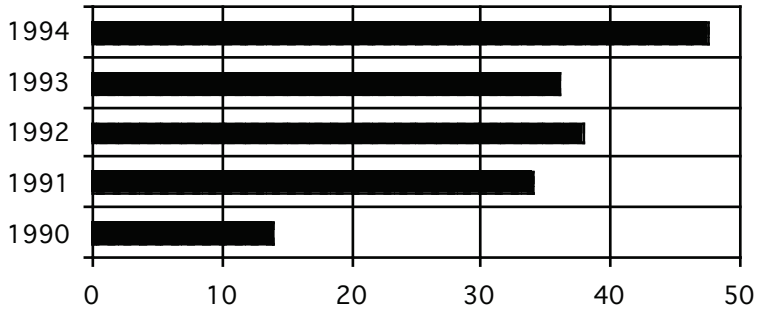
(A) 1 hr.
(B) 1 1/4 hrs.
(C) 1 1/2 hrs.
(D) 1 3/4 hrs.
(E) 2 hrs.

15. The perimeter of a square is equal to the perimeter of a rectangle whose length and width are $6m$ and $4m$, respectively. The side of the square is

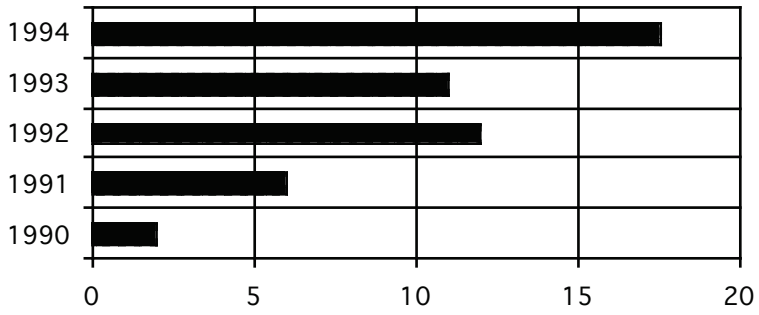
(A) $3m$
(B) $4m$
(C) $5m$
(D) $6m$
(E) $7m$

Questions 16–20 refer to the following graph.

AUTOMOBILE ACCIDENTS IN COUNTRY X: 1990 TO 1994
(in ten thousands)



CARS IN COUNTRY X
(in millions)



16. Approximately how many millions of cars were in Country X in 1994?

(A) 1.0
(B) 4.7
(C) 9.0
(D) 15.5
(E) 17.5

USE THIS SPACE FOR SCRATCHWORK.

17. The amount by which the number of cars in 1990 exceeded the number of accidents in 1991 was approximately

(A) 0.3 million
(B) 0.7 million
(C) 1.0 million
(D) 1.7 million
(E) 2.5 million

18. The number of accidents in 1993 was approximately what percentage of the number of cars?

(A) 1%
(B) 1.5%
(C) 3%
(D) 5%
(E) 10%

19. In which of the following years will the number of accidents exceed 500 thousand?

(A) 1994
(B) 1995
(C) 1998
(D) 2000
(E) It cannot be determined from the information given.

20. If no car in 1993 was involved in more than four accidents, what is the minimum number of cars that could have been in accidents in 1993?

(A) 50 thousand
(B) 60 thousand
(C) 70 thousand
(D) 80 thousand
(E) 90 thousand

USE THIS SPACE FOR SCRATCHWORK.

Section 2

Questions: 18
Time: 25 minutes

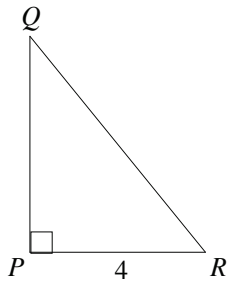
1. Which one of the following fractions is greatest?

(A) 5/6
(B) 4/5
(C) 1/2
(D) 2/3
(E) 3/4

2. If $p > 2$, then which one of the following inequalities must be false?

(A) $2p > 7$
(B) $3p < 7$
(C) $p < 3$
(D) $p > 4$
(E) $3p < 6$

3. The area of Triangle PQR is 6. If $PR = 4$, then the length of the hypotenuse QR is



(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

USE THIS SPACE FOR SCRATCHWORK.

4. In the two-digit number x, both the sum and the difference of its digits is 4. What is the value of x?

(A) 13
(B) 31
(C) 40
(D) 48
(E) 59

USE THIS SPACE FOR SCRATCHWORK.

5. At Peabody Tech, 72 students are enrolled in History, and 40 students are enrolled in both History and Math. How many students are enrolled in Math, but not History?

(A) 30
(B) 31
(C) 32
(D) 33
(E) not enough information to decide

6. If the circumference of a circle is $4m$, then the ratio of circumference of the circle to the diameter of the circle is

(A) π
(B) 4
(C) 2π
(D) 4π
(E) 16

7. The buyer of a particular car must choose 2 of 3 optional colors and 3 of 4 optional luxury features. In how many different ways can the buyer select the colors and luxury features?

(A) 3
(B) 6
(C) 9
(D) 12
(E) 20

8. If $\frac{x+y}{x-y} = 3$ and x and y are integers, then which one of the following must be true?

(A) x is divisible by 4
(B) y is an odd number
(C) y is an even integer
(D) x is an even number
(E) x is an irreducible fraction

USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

9. In Triangle ABC, $\angle A$ is 10 degrees greater than $\angle B$, and $\angle B$ is 10 degrees greater than $\angle C$. The value of Angle B is

USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

10. If n is an odd number greater than 5 and a multiple of 5, then what is the remainder when n is divided by 10?

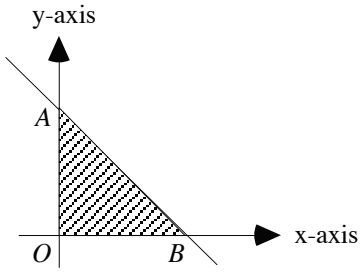
USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

11. A rancher is constructing a fence by stringing wire between posts 20 feet apart. If the fence is 400 feet long, how many posts must the rancher use?

[Grid-in Problem]

12. In the figure, the equation of line *AB* is $y = -\frac{5}{3}x + 10$. The area of the shaded portion is



[Grid-in Problem]

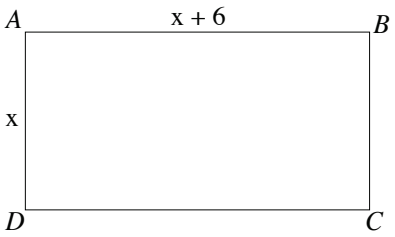
13. Let $x \otimes y = x\sqrt{y} - y - 2x$. For what value of x does $x \otimes y = -y$ for all values of y?

[Grid-in Problem]

14. The sum of the first n even, positive integers is $2 + 4 + 6 + \cdots + 2n$ is $n(n + 1)$. What is the sum of the first 20 even, positive integers?

[Grid-in Problem]

15. If one of the sides of the rectangle shown in the figure has a length of 3, then the area of the rectangle is



[Grid-in Problem]

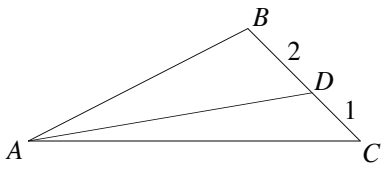
16. If n is a number such that $(-8)^{2n} = 2^{8+2n}$, then $n =$

[Grid-in Problem]

17. If a sprinter takes 30 steps in 9 seconds, how many steps does he take in 54 seconds?

[Grid-in Problem]

18. The area of the Triangle *ABC* shown in the figure is 30. The area of Triangle *ADC* is



Section 3

Questions: 16
Time: 20 minutes

1. What is 0.12345 rounded to the nearest thousandth?

   (A) 0.12
   (B) 0.123
   (C) 0.1235
   (D) 0.1234
   (E) 0.12346

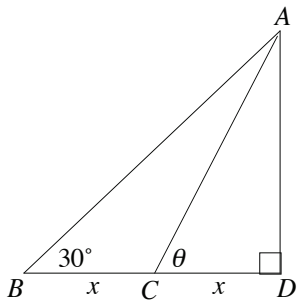
USE THIS SPACE FOR SCRATCHWORK.

2. Stella paid $1,500 for a computer after receiving a 20 percent discount. What was the price of the computer before the discount?

   (A) $300
   (B) $1,500
   (C) $1,875
   (D) $2,000
   (E) $3,000

USE THIS SPACE FOR SCRATCHWORK.

3. In the figure, which one of the following must be true about the angle θ?



(A) $\theta = 60^\circ$
(B) $\theta < 60^\circ$
(C) $\theta > 60^\circ$
(D) $\theta > 70^\circ$
(E) It cannot be determined from the information given

4. If $r > t$ and $r < 1$ and $rt = 1$, then which one of the following must be true?

(A) $r > 0$ and $t < -1$
(B) $r > -1$ and $t < -1$
(C) $r < -1$ and $t > -1$
(D) $r < 1$ and $t > 1$
(E) $r > 1$ and $t < 0$

5. Three rays emanate from a common point and form three angles with measures p, q, r. Which one of the following is the measure of angle $q + r$?

(A) $q + r > 180^\circ$
(B) $q + r < 180^\circ$
(C) $q + r = 180^\circ$
(D) $q + r \leq 180^\circ$
(E) It cannot be determined from the information given

6. If **w** is 10 percent less than **x,** and **y** is 30 percent less than **z**, then **wy** is what percent less than **xz**?

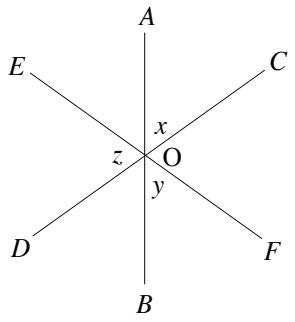
(A) 10%
(B) 20%
(C) 37%
(D) 40%
(E) 100%

7. p and q are integers. If p is divided by 2, the remainder is 1; and if q is divided by 6, the remainder is 1. Which of the following must be true.

I. $pq + 1$ is even.
II. $pq/2$ is an integer.
III. pq is a multiple of 12.

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) I and III only

8. In the figure, if $x = 54^\circ$ and $y = 72^\circ$, then $z =$



O is the point of intersection
of the three lines in the figure.

(A) 54°
(B) 56°
(C) 72°
(D) 76°
(E) 98°

USE THIS SPACE FOR SCRATCHWORK.

9. Let $\frac{x}{y} + \frac{w}{z} = 2$. Then the value of $\frac{y}{x} + \frac{z}{w}$ is

(A) 1/2
(B) 3/4
(C) 1
(D) 5
(E) It cannot be determined from the information given.

USE THIS SPACE FOR SCRATCHWORK.

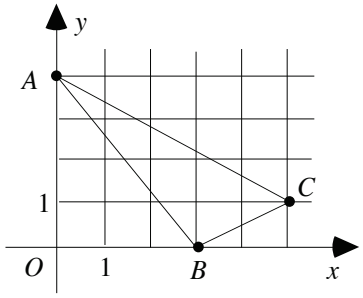
10. Cars X and Y leave City A at the same time and travel the same route to City B. Car X takes 30 minutes to complete the trip and car Y takes 20 minutes. Which of the following must be true?

I. The average miles per hour at which car X traveled was greater than the average miles per hour at which car Y traveled.
II. The distance between the cities is 30 miles.
III. The average miles per hour at which car Y traveled was greater than the average miles per hour at which car X traveled.

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) I and III only

USE THIS SPACE FOR SCRATCHWORK.

11. What is the perimeter of Triangle *ABC* in the figure?



(A) $5+\sqrt{5}+\sqrt{34}$
(B) $10+\sqrt{34}$
(C) $5+\sqrt{5}+\sqrt{28}$
(D) $2\sqrt{5}+\sqrt{34}$
(E) $\sqrt{5}+\sqrt{28}$

USE THIS SPACE FOR SCRATCHWORK.

12. What is the greatest prime factor of $\left(2^4\right)^2 - 1$?

(A) 3
(B) 5
(C) 11
(D) 17
(E) 19

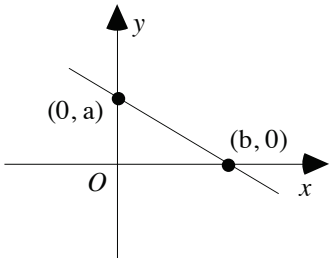
USE THIS SPACE FOR SCRATCHWORK.

13. A recipe requires 1/2 lb. of shortening and 14 oz. of flour. If the chef accidentally pours in 21 oz. of flour, how many ounces of shortening should be added?

(A) 9
(B) 10
(C) 11
(D) 12
(E) 13

USE THIS SPACE FOR SCRATCHWORK.

14. In the figure, the equation of the line is $y = px + a$. Which one of the following is the value of p ?



(A) $p = -1/2$
(B) $p = a/b$
(C) $p = -a/b$
(D) $p = b/a$
(E) $p = -b/a$

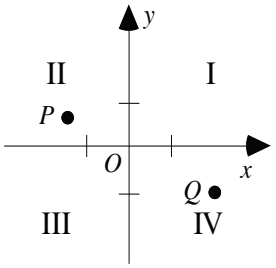
USE THIS SPACE FOR SCRATCHWORK.

15. $\left(9^x\right)^3 =$

(A) 3^{3x}
(B) 3^{2+3x}
(C) 3^{6x}
(D) $729x^3$
(E) 9^{x^3}

USE THIS SPACE FOR SCRATCHWORK.

16. In the figure, a is the x-coordinate of point P and b is the y-coordinate of point Q. In which quadrant is the point (a, b) ?



(A) I
(B) II
(C) III
(D) IV
(E) cannot be determined from the information given

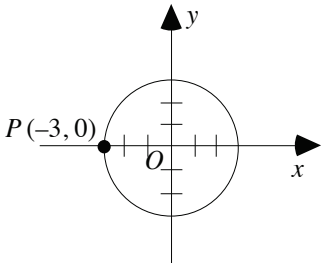
USE THIS SPACE FOR SCRATCHWORK.

Test 7

Section 1

Questions: 20
Time: 25 minutes

1. In the figure, O is the center of the circle. What is the area of the circle?



(A) 2π
(B) 3π
(C) 5.5π
(D) 7π
(E) 9π

USE THIS SPACE FOR SCRATCHWORK.

2. If p and q are positive integers, how many integers are larger than pq and smaller than $p(q + 2)$?

(A) 3
(B) $p + 2$
(C) $p - 2$
(D) $2p - 1$
(E) $2p + 1$

USE THIS SPACE FOR SCRATCHWORK.

3. For all a and b, define $a \# b$ to be $-\sqrt{(a+b)^2}$. Then $2 \# 3 =$

(A) –10
(B) –5
(C) –3
(D) –1
(E) 0

4. A pottery store owner determines that the revenue for sales of a particular item can be modeled by the function $r(x) = 50\sqrt{x} - 40$, where x is the number of the items sold. How many of the items must be sold to generate $110 in revenue?

(A) 5
(B) 6
(C) 7
(D) 8
(E) 9

5. Which of the following are true?

I. $\dfrac{\sqrt{\frac{5}{6}}}{\left(\frac{5}{6}\right)^2} > 1$

II. $\dfrac{\sqrt{\frac{5}{6}}}{\left(\frac{6}{5}\right)^2} > 1$

III. $\sqrt{\dfrac{\frac{5}{6}}{\sqrt{\frac{5}{6}}}} > 1$

(A) I only
(B) II only
(C) I and II only
(D) I and III only
(E) I, II, and III

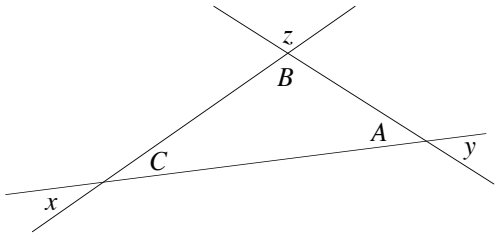
USE THIS SPACE FOR SCRATCHWORK.

6. A two-digit even number is such that reversing its digits creates an odd number greater than the original number. Which one of the following cannot be the first digit of the original number?

(A) 1
(B) 3
(C) 5
(D) 7
(E) 9

USE THIS SPACE FOR SCRATCHWORK.

7. The value of $x + y + z =$



(A) 120˚
(B) 160˚
(C) 180˚
(D) 270˚
(E) 360˚

USE THIS SPACE FOR SCRATCHWORK.

8. After being marked down 20 percent, a calculator sells for $10. The original selling price was

(A) $20
(B) $12.5
(C) $12
(D) $9
(E) $7

USE THIS SPACE FOR SCRATCHWORK.

9. If $x > y > 0$ and $p > q > 0$, then which one of the following expressions must be greater than 1?

(A) $\frac{x + p}{y + q}$

(B) $\frac{x + q}{y + p}$

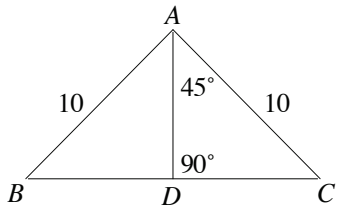
(C) $\frac{x}{p}$

(D) $\frac{xq}{yp}$

(E) $\frac{yq}{xp}$

USE THIS SPACE FOR SCRATCHWORK.

10. In the figure, what is the area of Triangle *ABC* ?



(A) 25

(B) 50

(C) $100/\sqrt{2}$

(D) 100

(E) $100\sqrt{2}$

USE THIS SPACE FOR SCRATCHWORK.

11. In the following pairs of numbers, which are reciprocals of each other?

I. 1 and 1

II. 1/11 and –11

III. $\sqrt{5}$ and $\frac{\sqrt{5}}{5}$

(A) I only
(B) II only
(C) I and II only
(D) I and III only
(E) II and III only

USE THIS SPACE FOR SCRATCHWORK.

12. How many solutions does the following system of equations have?

$$2x + y = 3$$
$$3y = 9 - 6x$$

(A) None
(B) One
(C) Two
(D) Four
(E) An infinite number

USE THIS SPACE FOR SCRATCHWORK.

13. Suppose a train travels x miles in y hours and 15 minutes. Its average speed in miles per hour is

(A) $\dfrac{y+15}{x}$

(B) $x\left(y-\dfrac{1}{4}\right)$

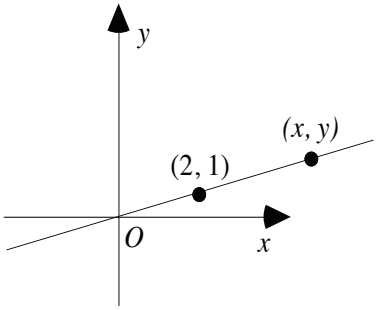
(C) $\dfrac{x}{y+\dfrac{1}{4}}$

(D) $\dfrac{x}{y+15}$

(E) $\dfrac{y+\dfrac{1}{4}}{x}$

USE THIS SPACE FOR SCRATCHWORK.

14. In the figure, if $x = 4$, then $y =$



(A) 1
(B) 2
(C) 3
(D) 4
(E) 5.1

USE THIS SPACE FOR SCRATCHWORK.

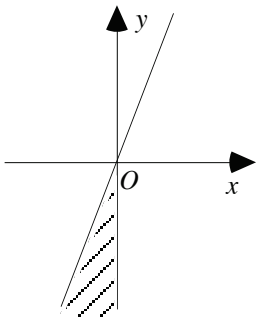
15. If w widgets cost d dollars, then at this rate how many dollars will 2000 widgets cost?

(A) $\frac{wd}{2000}$
(B) $\frac{2000w}{d}$
(C) $\frac{2000d}{w}$
(D) $\frac{d}{2000w}$
(E) $\frac{2000}{wd}$

16. If $x = 4$, then $-2^{2\sqrt{x}} + 2 =$

(A) –14
(B) –8
(C) –2
(D) 0
(E) 18

17. In the figure, which of the following could be the coordinates of a point in the shaded region?



(A) (1, 2)
(B) (–2, 3)
(C) (3, –5)
(D) (–5, 1)
(E) (–1, –6)

18. If $p \neq 0$ and $p = \sqrt{2pq - q^2}$, then in terms of q, p =

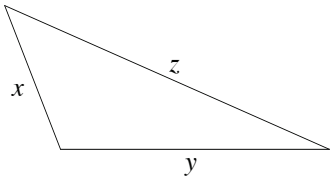
(A) q
(B) q^2
(C) $2q$
(D) $-2q$
(E) $q/4$

19. If $\frac{a}{b} = -\frac{2}{3}$, then $\frac{b-a}{a} =$

(A) –5/2
(B) –5/3
(C) –1/3
(D) 0
(E) 7

USE THIS SPACE FOR SCRATCHWORK.

20. In the triangle, $y/x = 3$. Which one of the following must be true?



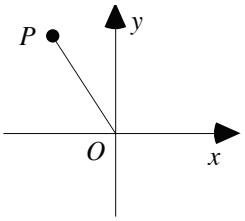
(A) $4x > z$
(B) $4x < z$
(C) $4x \leq z$
(D) $4x = z$
(E) It cannot be determined from the information given

USE THIS SPACE FOR SCRATCHWORK.

Section 2

Questions: 18
Time: 25 minutes

1. In the figure, which one of the following must be true about the value of the y-coordinate of point P ?



P is a point in the coordinate system and $OP = 6$.

(A) $y < 6$
(B) $y > 6$
(C) $y > 5$
(D) $y = 6$
(E) $y < 5$

USE THIS SPACE FOR SCRATCHWORK.

2. A total of \$1200 is deposited in two savings accounts for one year, part at 5% and the remainder at 7%. If \$72 was earned in interest, how much was deposited at 5%?

(A) 410
(B) 520
(C) 600
(D) 650
(E) 760

USE THIS SPACE FOR SCRATCHWORK.

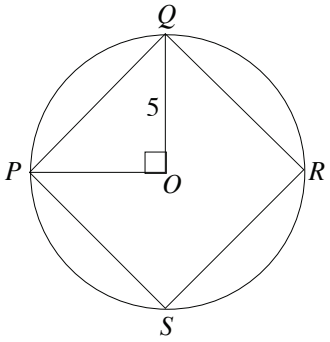
3. In the array of numbers shown, each number above the bottom row is equal to three times the number immediately below it. What is value of $x + y$?

27	x	81	–108
9	–18	27	–36
3	–6	y	–12
1	–2	3	–4

(A) –45
(B) –15
(C) –2
(D) 20
(E) 77

USE THIS SPACE FOR SCRATCHWORK.

4. In the figure, *w*hich one of the following statements about the circumference C of the circle and the perimeter P of Square $PQRS$ must be true?



O is the center of the circle, and the radius of the circle is 5.

(A) $C > P$
(B) $C < P$
(C) $C \leq P$
(D) $C = P$
(E) It cannot be determined from the information given

USE THIS SPACE FOR SCRATCHWORK.

5. If a wheel is spinning at 1200 revolutions per minute, how many revolutions will it make in t seconds?

(A) $2t$
(B) $10t$
(C) $20t$
(D) $48t$
(E) $72t$

6. A school has a total enrollment of 90 students. There are 30 students taking physics, 25 taking English, and 13 taking both. What percentage of the students are taking either physics or English?

(A) 30%
(B) 36%
(C) 47%
(D) 51%
(E) 58%

7. The median is larger than the average for which one of the following sets of integers?

(A) {8, 9, 10, 11, 12}
(B) {8, 9, 10, 11, 13}
(C) {8, 10, 10, 10, 12}
(D) {10, 10, 10, 10, 10}
(E) {7, 9, 10, 11, 12}

8. If x, y, and z are consecutive integers in that order, which of the following must be true?

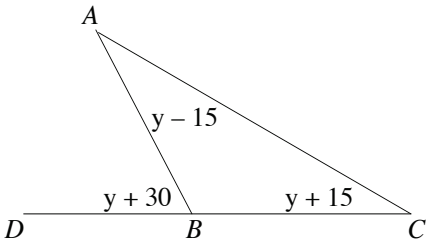
I. xy is even.
II. $x - z$ is even.
III. x^z is even.

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) I and III only

USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

9. In the figure, what is the value of y ?



USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

10. A dress was initially listed at a price that would have given the store a profit of 20 percent of the wholesale cost. After reducing the asking price by 10 percent, the dress sold for a net profit of 10 dollars. What was the wholesale cost of the dress?

[Grid-in Problem]

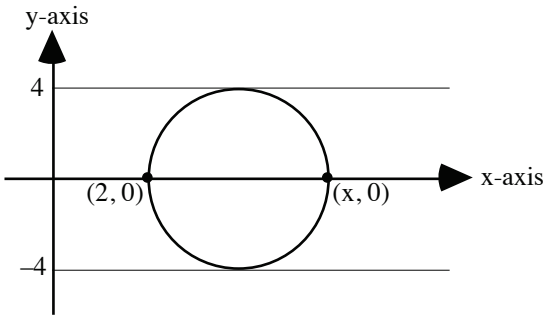
11. The number of integers from 2 to 10^3, inclusive is

[Grid-in Problem]

12. The capacity of glass X is 80 percent of the capacity of glass Y. Further, glass X contains 6 ounces of punch and is half-full, while glass Y is full. Glass Y contains how many more ounces of punch than glass X?

[Grid-in Problem]

13. A circle is depicted in the rectangular coordinate system as shown. The value of x is



USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

14. Which one of the following could be the difference between two numbers both of which are divisible by 2, 3 and 4?

USE THIS SPACE FOR SCRATCHWORK.

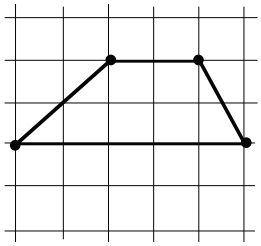
[Grid-in Problem]

15. Steve bought some apples at a cost of $.60 each and some oranges at a cost of $.50 each. If he paid a total of $4.10 for a total of 8 apples and oranges, how many apples did Steve buy?

USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

16. In the figure, the grid consists of unit squares. What is the area of the polygon?



USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

17. Cyclist M leaves point P at 12 noon and travels in a straight path at a constant velocity of 20 miles per hour. Cyclist N leaves point P at 2 PM, travels the same path at a constant velocity, and overtakes M at 4 PM. What was the average speed of N?

USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

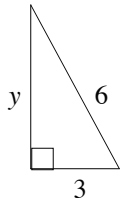
18. In a small town, 16 people own Fords and 11 people own Toyotas. If exactly 15 people own only one of the two types of cars, how many people own both types of cars.

USE THIS SPACE FOR SCRATCHWORK.

Section 3

Questions: 16
Time: 20 minutes

1. In the figure, what is the value of y ?



(A) $\sqrt{23}$
(B) $\sqrt{27}$
(C) $\sqrt{29}$
(D) $\sqrt{33}$
(E) $\sqrt{35}$

USE THIS SPACE FOR SCRATCHWORK.

2. A pair of pants and matching shirt cost $52.50. The pants cost two and a half times as much as the shirt. What is the cost of the shirt alone?

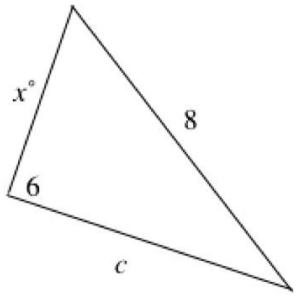
(A) 10
(B) 15
(C) 20
(D) 27
(E) 30

USE THIS SPACE FOR SCRATCHWORK.

3. Let a, b, and c be three integers, and let a be a perfect square. If $a/b = b/c$, then which one of the following statements must be true?

(A) c must be an even number
(B) c must be an odd number
(C) c must be a perfect square
(D) c must not be a perfect square
(E) c must be a prime number

4. In the figure, $c^2 = 6^2 + 8^2$. What is the area of the triangle?



(A) 12
(B) 18
(C) 24
(D) 30
(E) 36

5. The first term of a sequence is 2. All subsequent terms are found by adding 3 to the immediately preceding term and then multiplying the sum by 2. Which of the following describes the terms of the sequence?

(A) Each term is odd
(B) Each term is even
(C) The terms are: even, odd, even, odd, etc.
(D) The terms are: even, odd, odd, odd, etc.
(E) The terms are: even, odd, odd, even, odd, odd, etc.

6. The number of marbles in x jars, each containing 15 marbles, plus the number of marbles in $3x$ jars, each containing 20 marbles is

(A) 65x
(B) 70x
(C) 75x
(D) 80x
(E) 85x

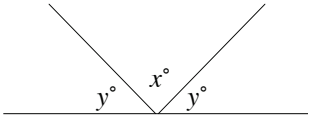
7. If x and y are prime numbers, then which one of the following cannot equal $x - y$?

(A) 1
(B) 2
(C) 13
(D) 14
(E) 20

8. If <*d*> denotes the area of a circle with diameter *d*, then which one of the following is equal to <4> · <6> ?

   (A) <10>
   (B) <12>
   (C) <24>
   (D) $\pi \cdot$ <12>
   (E) $\pi \cdot$ <24>

9. In the figure, the ratio of *x* to *y* is 2. What is the value of *y* ?



   (A) 108
   (B) 90
   (C) 68
   (D) 45
   (E) 36

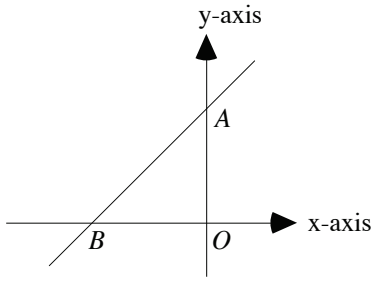
10. Jennifer and Alice are 4 miles apart. If Jennifer starts walking toward Alice at 3 miles per hour and at the same time Alice starts walking toward Jennifer at 2 miles per hour, how much time will pass before they meet?

   (A) 20 minutes
   (B) 28 minutes
   (C) 43 minutes
   (D) 48 minutes
   (E) 60 minutes

11. A number, when divided by 12, gives a remainder of 7. If the same number is divided by 6, then the remainder must be

(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

12. In the figure, the equation of line AB is $y = x + 2$. The difference of the x- and y-coordinates of any point on the line is equal to:



(A) –4
(B) –2
(C) 0
(D) 2
(E) 4

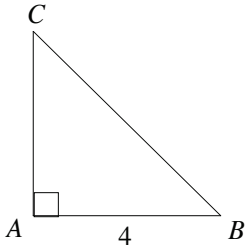
13. Let x be a two-digit number. If the sum of the digits of x is 9, then the sum of the digits of the number $(x + 10)$ is

    (A) 1
    (B) 8
    (C) 10
    (D) either 8 or 10
    (E) either 1 or 10

14. If Robert can assemble a model car in 30 minutes and Craig can assemble the same model car in 20 minutes, how long would it take them, working together, to assemble the model car?

    (A) 12 minutes
    (B) 13 minutes
    (C) 14 minutes
    (D) 15 minutes
    (E) 16 minutes

15. In the figure, what is the area of ΔABC ?



(A) 6
(B) 7
(C) 8
(D) 9
(E) It cannot be determined from the information given

USE THIS SPACE FOR SCRATCHWORK.

16. Except for the first two numbers, every number in the sequence –1, 3, 2, . . . is the sum of the two immediately preceding numbers. How many numbers of this sequence are even?

(A) none
(B) one
(C) two
(D) three
(E) more than three

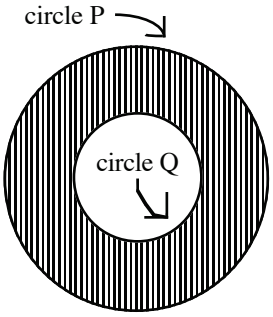
USE THIS SPACE FOR SCRATCHWORK.

Test 8

Section 1

Questions: 20
Time: 25 minutes

1. In the figure, circle P has diameter 2 and circle Q has diameter 1. What is the area of the shaded region?



(A) $3\pi/4$
(B) 3π
(C) $7\pi/2$
(D) 5π
(E) 6π

USE THIS SPACE FOR SCRATCHWORK.

2. If $2x + y > m$ and $2y + x < n$, then $x - y$ must be greater than

(A) $m + n$
(B) $m - n$
(C) mn
(D) $2m + n$
(E) $n - m$

USE THIS SPACE FOR SCRATCHWORK.

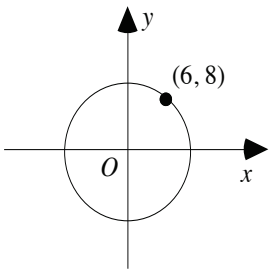
3. $\frac{39693}{3} =$

(A) 33231
(B) 13231
(C) 12331
(D) 23123
(E) 12321

4. $\frac{1}{10^9} - \frac{1}{10^{10}} =$

(A) $-\frac{1}{10}$
(B) $-\frac{1}{10^9}$
(C) $-\frac{1}{10^{19}}$
(D) $\frac{9}{10^{10}}$
(E) $\frac{9}{10}$

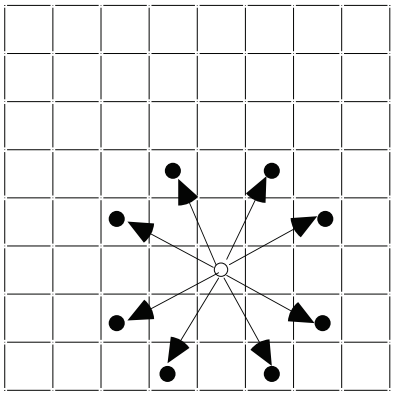
5. In the figure, which of the following points lies within the circle?



(A) (3.5, 9.5)
(B) (–7, 7)
(C) (–10, 1)
(D) (0, 11)
(E) (5.5, 8.5)

USE THIS SPACE FOR SCRATCHWORK.

6. In the game of chess, the Knight can make any of the moves displayed in the diagram. If a Knight is the only piece on the board, what is the greatest number of spaces from which not all 8 moves are possible?



(A) 8
(B) 24
(C) 38
(D) 48
(E) 56

USE THIS SPACE FOR SCRATCHWORK.

7. If x is an integer, then which of the following is the product of the next two integers greater than $2(x + 1)$?

(A) $4x^2 + 14x + 12$
(B) $4x^2 + 12$
(C) $x^2 + 14x + 12$
(D) $x^2 + x + 12$
(E) $4x^2 + 14x$

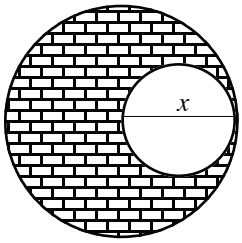
8. For all real numbers x, y, and z, let $\overleftrightarrow{x, y, z} = (x - y)z$. For what values of a does $\overleftrightarrow{0, 1, a} = \overleftrightarrow{1, a, 0}$?

(A) 3
(B) –1
(C) 0
(D) 3
(E) 4

9. The number of positive integers less than 1000 that are divisible by 3 is

(A) 332
(B) 333
(C) 334
(D) 335
(E) 336

10. In the figure, x is both the radius of the larger circle and the diameter of the smaller circle. The area of the shaded region is



(A) $\frac{3}{4}\pi x^2$
(B) $\pi/3$
(C) $\frac{4}{3}\pi x^2$
(D) $\frac{3}{5}\pi x^2$
(E) πx^2

USE THIS SPACE FOR SCRATCHWORK.

11. If $n > 2$, then the sum, S, of the integers from 1 through n can be calculated by the following formula: $S = n(n + 1)/2$. Which one of the following statements about S must be true?

(A) S is always odd.
(B) S is always even.
(C) S must be a prime number.
(D) S must not be a prime number.
(E) S must be a perfect square.

USE THIS SPACE FOR SCRATCHWORK.

12. Let $[x] = x^2 - 2$. If $[2] - [x] = x^2$, then $x =$

(A) $\sqrt{2}$
(B) $\sqrt{3}$
(C) 2
(D) 4
(E) 8

13. Car X traveled from city A to city B in 30 minutes. The first half of the distance was covered at 50 miles per hour, and the second half of the distance was covered at 60 miles per hour. What was the average speed of car X?

(A) 200/11
(B) 400/11
(C) 500/11
(D) 600/11
(E) 700/11

14. In triangle ABC, $AB = 5$ and $AC = 3$. Which one of the following is the measure of the length of side BC ?

(A) $BC < 7$
(B) $BC = 7$
(C) $BC > 7$
(D) $BC \leq 7$
(E) It cannot be determined from the information given

15. If n^3 is an odd integer, which one of the following expressions is an even integer?

(A) $2n^2 + 1$
(B) n^4
(C) $n^2 + 1$
(D) $n(n + 2)$
(E) n

16. For all real numbers a and b, where $a \cdot b \neq 0$, let $a \lozenge b = ab - \frac{a}{b}$. Then which of the following must be true?

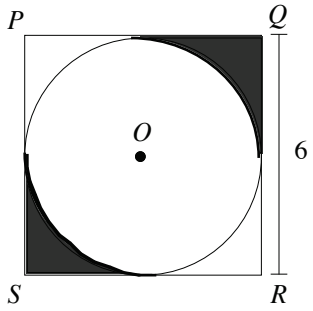
I. $a \lozenge b = b \lozenge a$
II. $a \lozenge a = (a + 1)(a - 1)$
III. $(a \lozenge b) \lozenge c = a \lozenge (b \lozenge c)$

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) I, II, and III

17. If the product of two integers is odd, then the sum of those two integers must be

(A) odd
(B) even
(C) prime
(D) divisible by the difference of the two numbers
(E) a perfect square

18. In the figure, the circle with center O is inscribed in the square $PQRS$. The combined area of the shaded regions is



(A) $36 - 9\pi$
(B) $36 - 9\pi/2$
(C) $\dfrac{36 - 9\pi}{2}$
(D) $18 - 9\pi$
(E) $9 - 9\pi/4$

USE THIS SPACE FOR SCRATCHWORK.

19. Seven years ago, Scott was 3 times as old as Kathy was at that time. If Scott is now 5 years older than Kathy, how old is Scott?

(A) 12½
(B) 13
(C) 13½
(D) 14
(E) 14½

USE THIS SPACE FOR SCRATCHWORK.

20. In the sequence $w, x, y, 30$, adding any one of the first three terms to the term immediately following it yields $w/2$. What is the value of w ?

(A) –60
(B) –30
(C) 0
(D) 5
(E) 25

USE THIS SPACE FOR SCRATCHWORK.

Section 2

Questions: 18
Time: 25 minutes

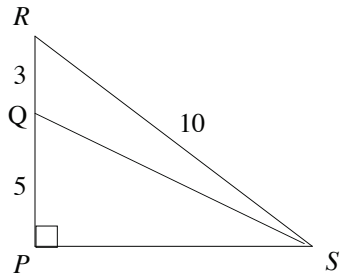
1. If the integer x is divisible by 3 but not by 2, then which one of the following expressions is NEVER an integer?

   (A) $(x + 1)/2$
   (B) $x/7$
   (C) $x^2/3$
   (D) $x^3/3$
   (E) $x/24$

2. The operation * is defined for all non-zero x and y by the equation $x * y = x/y$. Then the expression $(x * y) * z$ is equal to

   (A) z/xy
   (B) y/xz
   (C) xyz
   (D) xz/y
   (E) x/yz

3. In the figure, the length of QS is



(A) $\sqrt{51}$
(B) $\sqrt{61}$
(C) $\sqrt{69}$
(D) $\sqrt{77}$
(E) $\sqrt{89}$

USE THIS SPACE FOR SCRATCHWORK.

4. Suppose five circles, each 4 inches in diameter, are cut from a rectangular strip of paper 12 inches long. If the least amount of paper is to be wasted, what is the width of the paper strip?

(A) 5
(B) $4 + 2\sqrt{3}$
(C) 8
(D) $4\left(1 + \sqrt{3}\right)$
(E) not enough information

USE THIS SPACE FOR SCRATCHWORK.

5. If $m = 3^{n-1} = 3^{3n+1}$, what is the value of m/n ?

(A) 0
(B) –1/20
(C) –1/10
(D) –1/9
(E) –2

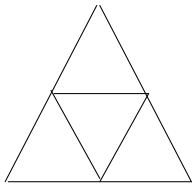
6. How many ounces of nuts costing 80 cents a pound must be mixed with nuts costing 60 cents a pound to make a 10-ounce mixture costing 70 cents a pound?

(A) 3
(B) 4
(C) 5
(D) 7
(E) 8

7. If the sum of three consecutive integers is odd, then the first and the last integers must be

(A) odd, even
(B) odd, odd
(C) even, odd
(D) even, even
(E) none of the above

8. The figure shows a small equilateral triangle inscribed in the large equilateral triangle. If a point is chosen at random from the large triangle, what is the probability that it will be from the small triangle?

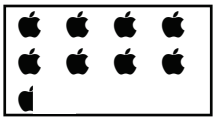


(A) 1/8
(B) 1/5
(C) 1/4
(D) 1/3
(E) 1/2

USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

9. The picture shown represents 4,250 apples. How many apples does each stand for?



USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

10. If l, m, and n are positive integers such that $l < m < n$ and $n < 4$, then $m =$

USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

11. For all positive numbers n, $n^* = \dfrac{\sqrt{n}}{2}$. What is the value of $\left(64^*\right)^*$?

[Grid-in Problem]

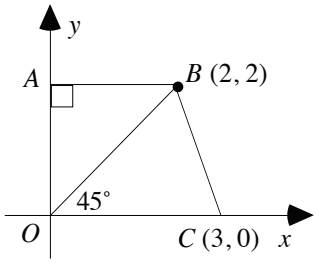
12. At time $t = 0$, a projectile was fired upward from an initial height of 10 feet. Its height after t seconds is given by the function $h(t) = p - 10(q - t)^2$, where p and q are positive constants. If the projectile reached a maximum height of 100 feet when $t = 3$, then what was the height, in feet, of the projectile when $t = 4$?

[Grid-in Problem]

13. If line segment AD has midpoint M_1 and line segment M_1D has midpoint M_2, what is the value of $\dfrac{M_1D}{AM_2}$?

[Grid-in Problem]

14. In the figure, what is the area of quadrilateral *ABCO* ?



[Grid-in Problem]

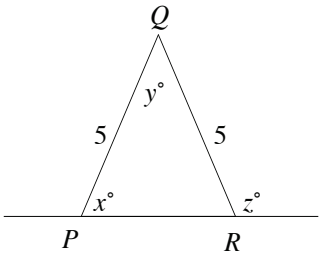
15. Tom is 10 years older than Carrie. However, 5 years ago Tom was twice as old as Carrie. How old is Carrie?

[Grid-in Problem]

16. Let $x@y = \sqrt{xy}$ for all positive x and y. Then (2@8) – (3@3) =

[Grid-in Problem]

17. In ΔPQR, $y + z = 150$. What is the value of y?



USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

18. Define the symbol * by the following equation: $x^* = 2 - x$, for all non-negative x. If $(2 - x)^* = (x - 2)^*$, then $x =$

USE THIS SPACE FOR SCRATCHWORK.

Section 3

Questions: 16
Time: 20 minutes

1. Which one of the following is a solution to the equation $x^4 - 2x^2 = -1$?

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

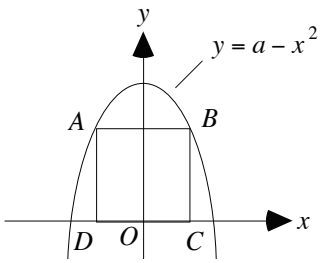
USE THIS SPACE FOR SCRATCHWORK.

2. If $\langle x \rangle = (x + 2)x$, for all x, what is the value of $\langle x + 2 \rangle - \langle x - 2 \rangle$?

(A) -2
(B) $x + 4$
(C) 0
(D) x^2
(E) $8(x + 1)$

USE THIS SPACE FOR SCRATCHWORK.

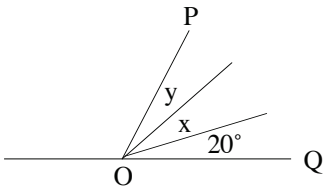
3. Shown is the graph of $y = a - x^2$ for some constant a. If the square $ABCD$ intersects the graph at points A and B and the area of the square is 16, what is the value of a ?



(A) 2
(B) 4
(C) 6
(D) 8
(E) 10

USE THIS SPACE FOR SCRATCHWORK.

4. In the figure, which one of the following must be true about y ?



$\angle$ POQ = 70° and x > 15

(A) $y > 37$
(B) $y < 35$
(C) $y > 40$
(D) $y > 42$
(E) $y > 45$

USE THIS SPACE FOR SCRATCHWORK.

5. If $p/19$ is 1 less than 3 times $q/19$, then p equals which of the following expressions?

(A) $3q + 19$
(B) $3q + 38$
(C) 19/2
(D) $3q - 38$
(E) $3q - 19$

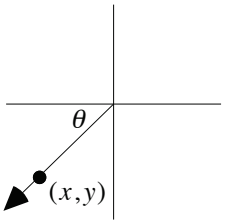
6. A shopper spends \$25 to purchase CDs at 50¢ each. The next day, the disks go on sale for 30¢ each and the shopper spends \$45 to purchase more disks. What was the average price per disk purchased?

(A) 25¢
(B) 30¢
(C) 35¢
(D) 40¢
(E) 45¢

7. If the degree measures of two angles of an isosceles triangle are in the ratio 1:3, what is the degree measure of the largest angle if it is not a base angle?

(A) 26°
(B) 36°
(C) 51°
(D) 92°
(E) 108°

8. In the figure, which one of the following is the measure of angle θ?



$x \neq y$

(A) $\theta < 45^\circ$
(B) $\theta > 45^\circ$
(C) $\theta = 45^\circ$
(D) $\theta \leq 45^\circ$
(E) It cannot be determined from the information given

USE THIS SPACE FOR SCRATCHWORK.

9. Given the positions of numbers x and y on the number line shown, which of the following must be true?

I. $xy > 0$
II. $x/y < 0$
III. $x - y > 0$

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) I, II, and III

USE THIS SPACE FOR SCRATCHWORK.

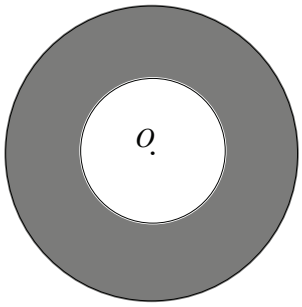
10. Let x and y be prime numbers such that $x > y$. If $q = x/y$, then q must be

(A) An integer greater than one.
(B) An integer less than one.
(C) A fraction less than one.
(D) A fraction greater than one.
(E) An even number.

11. $\sqrt{\dfrac{25+10x+x^2}{2}} =$

(A) $\dfrac{\sqrt{2}(5-x)}{2}$
(B) $\dfrac{\sqrt{5+x}}{\sqrt{2}}$
(C) $\dfrac{\sqrt{2}(5+x)}{2}$
(D) $\dfrac{5+x}{2}$
(E) $\dfrac{5-x}{2}$

12. In the figure, the radius of the larger circle is twice that of the smaller circle. If the circles are concentric, what is the ratio of the shaded region's area to the area of the smaller circle?



(A) 10 : 1
(B) 9 : 1
(C) 3 : 1
(D) 2 : 1
(E) 1 : 1

USE THIS SPACE FOR SCRATCHWORK.

13. $\frac{7^9 + 7^8}{8} =$

(A) 1/8
(B) 7/8
(C) $\frac{7^7}{8}$
(D) 7^8
(E) 7^9

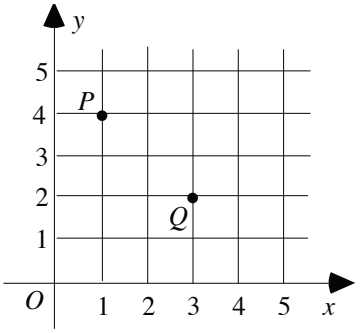
USE THIS SPACE FOR SCRATCHWORK.

14. The operation * is defined for all non-zero x and y by the equation $x * y = \frac{x}{y}$. Then the expression $(x-2)^2 * x$ is equal to

(A) $x - 4 + 4/x$
(B) $x + 4/x$
(C) $4/x$
(D) $1 + 4/x$
(E) $1 - 4x + 4/x$

USE THIS SPACE FOR SCRATCHWORK.

15. In the figure, which of the following points is three times as far from P as from Q ?



(A) (0, 3)
(B) (1, 1)
(C) (4, 5)
(D) (2, 3)
(E) (4, 1)

USE THIS SPACE FOR SCRATCHWORK.

16. If two non-zero positive integers p and q are such that $p = 4q$ and $p < 8$, then $q =$

(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

Test 9

Section 1

Questions: 20
Time: 25 minutes

1. If n is an integer, then which one of the following expressions must be even?

   (A) $n^2 + 1$
   (B) $n(n + 2)$
   (C) $n(n + 1)$
   (D) $n(n + 4)$
   (E) $(n + 1)(n + 3)$

USE THIS SPACE FOR SCRATCHWORK.

2. If both x and y are positive even integers, then which of the following expressions must also be even?

   I. y^{x-1}
   II. $y - 1$
   III. $x/2$

   (A) I only
   (B) II only
   (C) III only
   (D) I and III only
   (E) I, II, and III

USE THIS SPACE FOR SCRATCHWORK.

3. The opposite sides of quadrilateral Q are parallel and one of the four angles of Q is 90 degrees. If θ is an angle of quadrilateral Q, which one of the following must be true?

(A) $\theta = 80^\circ$
(B) $\theta = 88^\circ$
(C) $\theta = 90^\circ$
(D) $\theta = 91^\circ$
(E) It cannot be determined from the information given

4. For all $p \neq 1/4$ define p^* by the equation $p^* = \dfrac{\frac{p}{2}}{4p - 1}$. If $q = 1^*$, then $q^* =$

(A) –5/7
(B) –1/3
(C) –1/4
(D) 2/3
(E) 3/4

5. Two cars start at the same point and travel in opposite directions. If one car travels at 45 miles per hour and the other at 60 miles per hour, how much time will pass before they are 210 miles apart?

(A) .5 hours
(B) 1 hour
(C) 1.5 hours
(D) 2 hours
(E) 2.5 hours

6. The symbol @ denotes one of the operations: addition, subtraction, multiplication, or division. Further, 1 @ 1 = 1 and 0 @ 0 = 0. What is the value of π @ $\sqrt{2}$?

(A) $\frac{\pi \cdot \sqrt{2}}{3}$
(B) $\frac{\pi \cdot \sqrt{2}}{2}$
(C) $\pi \cdot \sqrt{2}$
(D) $2\pi \cdot \sqrt{2}$
(E) $3\pi \cdot \sqrt{2}$

USE THIS SPACE FOR SCRATCHWORK.

7. In the system of equations shown, $z \neq 0$. What is ratio of x to z?

$$x + 2y - z = 1$$
$$3x - 2y - 8z = -1$$

(A) –9/4
(B) –1/3
(C) 1/3
(D) 4/9
(E) 9/4

USE THIS SPACE FOR SCRATCHWORK.

8. The average of 8 numbers is A, and one of the numbers is 14. If 14 is replaced with 28, then what is the new average in terms of A ?

(A) $A + 7/4$
(B) $A + 1/2$
(C) $A + 2$
(D) $2A + 1$
(E) $A + 4$

USE THIS SPACE FOR SCRATCHWORK.

9. $\dfrac{2+\sqrt{5}}{2-\sqrt{5}} =$

(A) $-9-4\sqrt{5}$

(B) $-1-\dfrac{4}{9}\sqrt{5}$

(C) $1+\dfrac{4}{9}\sqrt{5}$

(D) $9+4\sqrt{5}$

(E) 20

USE THIS SPACE FOR SCRATCHWORK.

10. In isosceles triangle ABC, $CA = CB = 4$. Which one of the following is the area of triangle ABC ?

(A) 7
(B) 8
(C) 9
(D) 10
(E) It cannot be determined from the information given

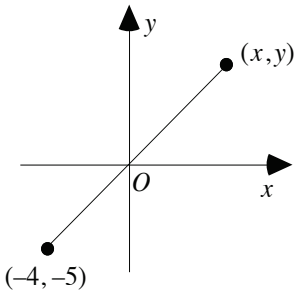
USE THIS SPACE FOR SCRATCHWORK.

11. If $\dfrac{x^2+2x-10}{5} = 1$, then x could equal

(A) –5
(B) –3
(C) 0
(D) 10
(E) 15

USE THIS SPACE FOR SCRATCHWORK.

12. In the figure, which one of the following must be true?



(A) $y < x$
(B) $y > x$
(C) $y < 4$
(D) $y = x$
(E) $y > 5$

13. $\left(2+\sqrt{7}\right)\left(4-\sqrt{7}\right)(-2x) =$

(A) $78x - 4x\sqrt{7}$
(B) $\sqrt{7}x$
(C) $-2x - 4x\sqrt{7}$
(D) $-2x$
(E) $4x\sqrt{7}$

14. John bought a shirt, a pair of pants, and a pair of shoes, which cost \$10, \$20, and \$30, respectively. What percent of the total expense was spent for the pants?

(A) $16\frac{2}{3}\%$
(B) 20%
(C) 30%
(D) $33\frac{1}{3}\%$
(E) 60%

USE THIS SPACE FOR SCRATCHWORK.

15. If the value of x quarters is equal to the value of $x + 32$ nickels, $x =$

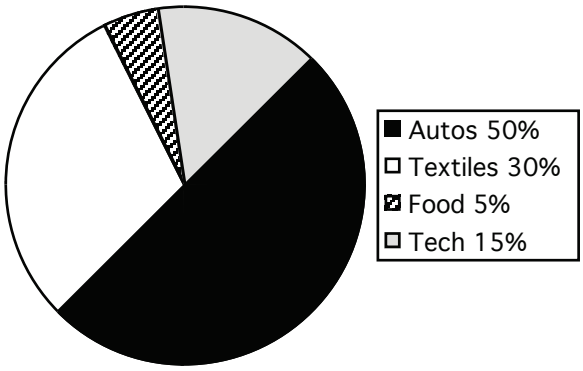
(A) 8
(B) 11
(C) 14
(D) 17
(E) 20

USE THIS SPACE FOR SCRATCHWORK.

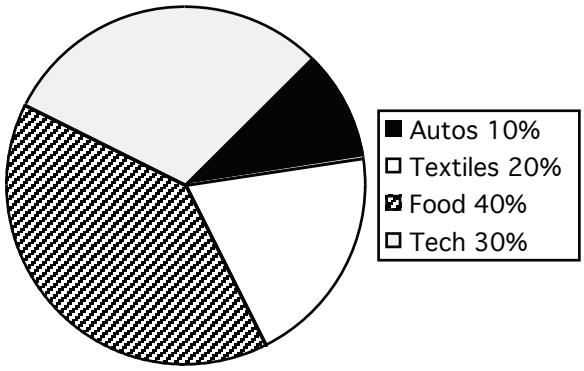
Questions 21–25 refer to the following graphs.

DISTRIBUTION OF IMPORTS AND EXPORTS FOR COUNTRY X IN 2014.

Imports
200 million items



Exports
100 million items



16. How many autos did Country X export in 2014?

(A) 10 million
(B) 15 million
(C) 16 million
(D) 20 million
(E) 30 million

USE THIS SPACE FOR SCRATCHWORK.

17. In how many categories did the total number of items (import and export) exceed 75 million?

(A) 1
(B) 2
(C) 3
(D) 10
(E) none

USE THIS SPACE FOR SCRATCHWORK.

18. The ratio of the number of technology items imported in 2014 to the number of textile items exported in 2014 is

(A) 1/3
(B) 3/5
(C) 1
(D) 6/5
(E) 3/2

19. If in 2015 the number of autos exported was 16 million, then the percent increase from 2014 in the number of autos exported is

(A) 40%
(B) 47%
(C) 50%
(D) 60%
(E) 65%

20. In 2014, if twice as many autos imported to Country X broke down as autos exported from Country X and 20 percent of the exported autos broke down, what percent of the imported autos broke down?

(A) 1%
(B) 1.5%
(C) 2%
(D) 4%
(E) 5.5%

Section 2

Questions: 18
Time: 25 minutes

1. The ten's digit of a two-digit number is twice the unit's digit. Reversing the digits yields a new number that is 27 less than the original number. Which one of the following is the original number?

(A) 12
(B) 21
(C) 43
(D) 63
(E) 83

USE THIS SPACE FOR SCRATCHWORK.

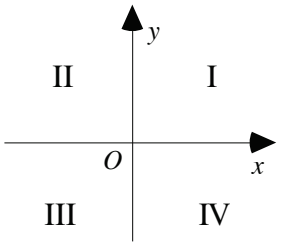
2. ϕ is a function such that $1 \phi a = 1$ and $a \phi b = b \phi a$ for all a and b. Which of the following must be true?

I. $a \phi 1 = 1$
II. $(1 \phi b) \phi c = 1 \phi (b \phi c)$
III. $\dfrac{1 \phi a}{b \phi 1} = 1$

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) I, II, and III

USE THIS SPACE FOR SCRATCHWORK.

3. In the figure, which quadrants contain points (x, y) such that $xy = -2$?



(A) I only
(B) II only
(C) III and IV only
(D) II and IV only
(E) II, III, and IV

USE THIS SPACE FOR SCRATCHWORK.

4. A square with sides of length 3 is intersected by a line at S and T. What is the maximum possible distance between S and T?

(A) $\sqrt{6}$
(B) $2\sqrt{3}$
(C) $3\sqrt{2}$
(D) $2\sqrt{5}$
(E) 9

USE THIS SPACE FOR SCRATCHWORK.

5. If $s + S \neq 0$ and $\frac{1}{3} = \frac{1}{4}\frac{s - S}{s + S}$, then what is s in terms of S ?

(A) $s = S + 3$
(B) $s = 4S$
(C) $s = S/12$
(D) $s = -7S$
(E) $s = 4S - 6$

USE THIS SPACE FOR SCRATCHWORK.

6. $2^{12} + 2^{12} + 2^{12} + 2^{12} =$

(A) 4^{12}
(B) 2^{14}
(C) 2^{16}
(D) 4^{16}
(E) 2^{48}

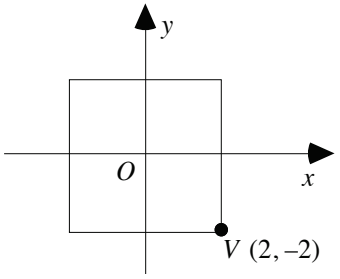
USE THIS SPACE FOR SCRATCHWORK.

7. If $x + y = 2\sqrt{xy}$, then which one of the following must be true?

(A) $x < y$
(B) $x = 2$
(C) $x = y$
(D) $x > y$
(E) $x = 4$

USE THIS SPACE FOR SCRATCHWORK.

8. If the square in the figure is rotated clockwise about the origin until vertex V is on the negative y-axis, then the new y-coordinate of V is



(A) –2
(B) $-2\sqrt{2}$
(C) –4
(D) $-3\sqrt{2}$
(E) –8

USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

9. If 15% of a number is 4.5, then 45% of the same number is

USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

10. Steve has $5.25 in nickels and dimes. If he has 15 more dimes than nickels, how many nickels does he have?

USE THIS SPACE FOR SCRATCHWORK.

[Grid-in Problem]

11. If $m = 3^{n-1}$ and $3^{4n-1} = 27$, what is the value of m/n ?

[Grid-in Problem]

12. What is the absolute value of twice the difference of the roots of the equation $5y^2 - 20y + 15 = 0$?

[Grid-in Problem]

13. If $p = z + 1/z$ and $q = z - 1/z$, where z is a real number not equal to zero, then $(p + q)(p - q) =$

[Grid-in Problem]

14. Richard leaves to visit his friend Steve who lives 200 miles down Interstate 10. One hour later his friend Steve leaves to visit Richard via Interstate 10. If Richard drives at 60 mph and Steve drives at 40 mph, how many miles will Steve have driven when they cross paths?

[Grid-in Problem]

15. A person travels 16 miles due north and then 12 miles due east. How many miles is the person from his initial location?

[Grid-in Problem]

16. If $x = y/2$ and $y = z/2$, then $\sqrt{x/z} =$

[Grid-in Problem]

17. Define the symbol # by the following equations:

$x \# y = (x - y)^2$, if $x > y$.
$x \# y = x + y/4$, if $x \leq y$.

Then $4 \# 12 =$

[Grid-in Problem]

18. Cathy has equal numbers of nickels and quarters worth a total of $7.50. How many coins does she have?

Section 3

Questions: 16
Time: 20 minutes

1. If $3^x = 81$, then $\left(3^{x+3}\right)\left(4^{x+1}\right) =$

   (A) $5(7)^5$
   (B) $9(7)^5$
   (C) $2(12)^4$
   (D) $9(12)^5$
   (E) $2(12)^7$

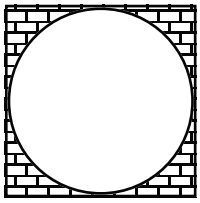
USE THIS SPACE FOR SCRATCHWORK.

2. If x and y are prime numbers such that $x > y > 2$, then $x^2 - y^2$ must be divisible by which one of the following numbers?

   (A) 3
   (B) 4
   (C) 5
   (D) 9
   (E) 12

USE THIS SPACE FOR SCRATCHWORK.

3. In the figure, the circle is inscribed in the square. If the area of the circle is 1.21π square feet, what is the area of the shaded region?



(A) $14 - 14.4\pi$
(B) $4.84 - 1.21\pi$
(C) $8 - 3\pi$
(D) 1.21π
(E) $11\pi/2$

USE THIS SPACE FOR SCRATCHWORK.

4. If $\frac{1}{x} + \frac{1}{y} \neq 0$, then which one of the following is equal to the negative reciprocal of $\frac{1}{x} + \frac{1}{y}$?

(A) $\frac{xy}{x + y}$
(B) $-\frac{x + y}{xy}$
(C) $-(x + y)$
(D) $\frac{x - y}{xy}$
(E) $\frac{-xy}{x + y}$

USE THIS SPACE FOR SCRATCHWORK.

5. At 1 PM, Ship A leaves port traveling 15 mph. Three hours later, Ship B leaves the same port in the same direction traveling 25 mph. At what time does Ship B pass Ship A?

(A) 8:30 PM
(B) 8:35 PM
(C) 9 PM
(D) 9:15 PM
(E) 9:30 PM

USE THIS SPACE FOR SCRATCHWORK.

6. If the operation * is defined for all non-zero x and y by the equation $x * y = (xy)^2$, then $(x * y) * z =$

(A) $x^2y^2z^2$
(B) $x^4y^4z^2$
(C) $x^2y^4z^2$
(D) $x^4y^2z^2$
(E) $x^4y^4z^4$

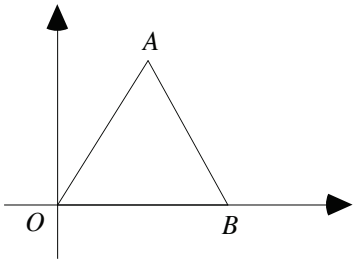
USE THIS SPACE FOR SCRATCHWORK.

7. Last year Jenny was 5 feet tall, and this year she is 5 feet 6 inches. What is the percent increase of her height?

(A) 5%
(B) 10%
(C) 15%
(D) 20%
(E) 40%

USE THIS SPACE FOR SCRATCHWORK.

8. In the figure, the coordinates of A are $(\sqrt{3}, 3)$. If ΔABO is equilateral, what is the area of ΔABO ?



(A) $\frac{1}{2}\sqrt{3}$
(B) $\frac{3}{2}\sqrt{3}$
(C) $3\sqrt{3}$
(D) $6\sqrt{3}$
(E) $9\sqrt{3}$

USE THIS SPACE FOR SCRATCHWORK.

9. In x hours and y minutes a car traveled z miles. What is the car's speed in miles per hour?

(A) $\frac{z}{60 + y}$
(B) $\frac{60z}{60x + y}$
(C) $\frac{60}{60 + y}$
(D) $\frac{z}{x + y}$
(E) $\frac{60 + y}{60z}$

USE THIS SPACE FOR SCRATCHWORK.

10. A bowl contains 500 marbles. There are x red marbles and y blue marbles in the bowl. Which one of the following expresses the number marbles in the bowl that are neither red nor blue?

(A) $500 + x - y$
(B) $500 - x + y$
(C) $500 - x - y$
(D) $500 + x + y$
(E) $500 - x - y/2$

USE THIS SPACE FOR SCRATCHWORK.

11. A 30% discount reduces the price of a commodity by $90. If the discount is reduced to 20%, then the price of the commodity will be

(A) $180
(B) $210
(C) $240
(D) $270
(E) $300

USE THIS SPACE FOR SCRATCHWORK.

12. If $x \neq 3/4$, which one of the following will equal –2 when multiplied by $\frac{3-4x}{5}$?

(A) $\frac{5-4x}{4}$
(B) $\frac{10}{3-4x}$
(C) $\frac{10}{4x-3}$
(D) $\frac{3-4x}{5}$
(E) $\frac{4x-3}{10}$

USE THIS SPACE FOR SCRATCHWORK.

13. For all numbers N, let $\overset{\infty}{N}$ denote the least integer greater than or equal to N. What is the value of $\overset{\infty}{-2.1}$?

(A) –4
(B) –3
(C) –2
(D) –1
(E) 0

USE THIS SPACE FOR SCRATCHWORK.

14. If $x > y > 0$, which of the following are true?

I. $\dfrac{x+2}{y+2} > \dfrac{x}{y}$

II. $\dfrac{x+2}{y+2} = \dfrac{x}{y}$

III. $\dfrac{x+2}{y+2} > 1$

(A) I only
(B) II only
(C) III only
(D) I and III only
(E) II and III only

USE THIS SPACE FOR SCRATCHWORK.

15. If the ratio of an edge of cube *S* and the greatest distance between two points on the cube is $1:\sqrt{3}$, then the volume of cube S must be

(A) greater than 8
(B) less than 8
(C) equal to 8
(D) greater than or equal to 8
(E) Not enough information to decide

16. A train of length *l*, traveling at a constant velocity, passes a pole in *t* seconds. If the same train traveling at the same velocity passes a platform in 3*t* seconds, then the length of the platform is

(A) 0.5*l*
(B) *l*
(C) 1.5*l*
(D) 2*l*
(E) 3*l*

Test 10

Section 1

Questions: 20
Time: 25 minutes

1. The sum of three consecutive positive integers must be divisible by which of the following?

   (A) 2
   (B) 3
   (C) 4
   (D) 5
   (E) 6

2. Two squares each with sides of length s are joined to form a rectangle. The area of the rectangle is

   (A) s^2
   (B) $2s^2$
   (C) $4s^2$
   (D) $8s^2$
   (E) $16s^2$

3. If $2^{2x} = 16^{x+2}$, what is the value of x ?

(A) –4
(B) –2
(C) 0
(D) 2
(E) 4

4. If $\frac{x+y}{x-y} = \frac{1}{2}$, then $\frac{xy+x^2}{xy-x^2} =$

(A) –4.2
(B) –1/2
(C) 1.1
(D) 3
(E) 5.3

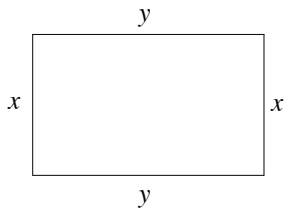
5. If $x^2 + y^2 = xy$, then $(x + y)^4 =$

(A) xy
(B) x^2y^2
(C) $9x^2y^2$
(D) $\left(x^2 + y^2\right)^2$
(E) $x^4 + y^4$

6. If two workers can assemble a car in 8 hours and a third worker can assemble the same car in 12 hours, then how long would it take the three workers together to assemble the car?

(A) 5/12 hrs.
(B) 2 2/5 hrs.
(C) 2 4/5 hrs.
(D) 3 1/2 hrs.
(E) 4 4/5 hrs.

7. If the sides x of the rectangle are increased by 3 units, the resulting figure is a square with area 20. What was the original area?



(A) $20 - 3\sqrt{20}$
(B) $20 - 2\sqrt{20}$
(C) $20 - \sqrt{20}$
(D) $20 - \sqrt{2}$
(E) 19

8. $\left(\frac{\left(x^2y\right)^3 z}{xyz}\right)^3 =$

(A) x^8y^5
(B) xy^6
(C) $x^{15}y^6z$
(D) x^3y^6
(E) $x^{15}y^6$

9. The sum of the digits of a two-digit number is 12, and the ten's digit is one-third the unit's digit. What is the number?

(A) 93
(B) 54
(C) 48
(D) 39
(E) 31

10. If $x^2 + y^2 = 2ab$ and $2xy = a^2 + b^2$, with $a, b, x, y > 0$, then $x + y =$

(A) ab
(B) $a - b$
(C) $a + b$
(D) $\sqrt{a^2 + b^2}$
(E) $\sqrt{a^2 - b^2}$

11. If the length of a diagonal across a face of cube S is 2, then the volume of cube S must be

(A) greater than 8
(B) less than 8
(C) equal to 8
(D) greater than or equal to 8
(E) Not enough information to decide

12. Define the symbol # by the following equations:

$x \# y = (x - y)^2$, if $x > y$.
$x \# y = x + y/4$, if $x \leq y$.

If $x \# y = -1$, which of the following could be true?

I. $x = y$
II. $x > y$
III. $x < y$

(A) I only
(B) II only
(C) III only
(D) I and III only
(E) I, II, and III

13. A dress was initially listed at a price that would have given the store a profit of 20 percent of the wholesale cost. The dress sold for 50 dollars. What was the wholesale cost of the dress?

(A) 100
(B) 90
(C) 75
(D) 60
(E) Not enough information to decide

14. To halve the value of the expression shown by doubling exactly one of the variables, one must double which one of the following variables?

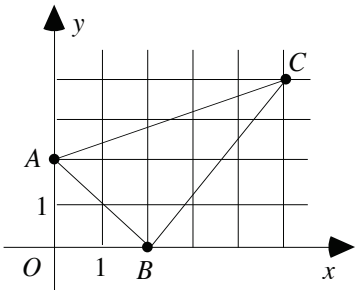
$$\frac{v+w}{x/yz}$$

(A) v
(B) w
(C) x
(D) y
(E) z

15. Suppose half the people on a bus exit at each stop and no additional passengers board the bus. If on the third stop the next to last person exits the bus, then how many people were on the bus?

(A) 20
(B) 16
(C) 8
(D) 6
(E) 4

16. What is the perimeter of Triangle *ABC* in the figure?



(A) $5+\sqrt{2}+\sqrt{29}$
(B) $5+2\sqrt{2}+\sqrt{29}$
(C) $5+4\sqrt{2}+\sqrt{29}$
(D) $3\sqrt{2}+\sqrt{34}$
(E) $4\sqrt{2}+\sqrt{34}$

USE THIS SPACE FOR SCRATCHWORK.

17. If $(x-y)^{\frac{1}{3}}=(x+y)^{-\frac{1}{3}}$, then which one of the following must be true?

(A) $x=1$
(B) $y=1$
(C) $x^2-y^2=1$
(D) $x+y^2=1$
(E) $x^2-2xy+y^2=1$

USE THIS SPACE FOR SCRATCHWORK.

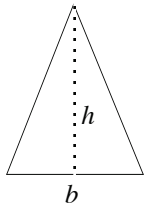
18. If $(x - y)^2 = x^2 + y^2$, then which of the following statements must also be true?

I. $x = 0$
II. $y = 0$
III. $xy = 0$

(A) None
(B) I only
(C) II only
(D) III only
(E) II and III only

USE THIS SPACE FOR SCRATCHWORK.

19. In the figure, h denotes the height and b the base of the triangle. If $2b + h = 6$, what is the area of the triangle?



(A) 1
(B) 2
(C) 3
(D) 4
(E) Not enough information

USE THIS SPACE FOR SCRATCHWORK.

20. Last month the price of a particular pen was $1.20. This month the price of the same pen is $1.50. What is the percent increase in the price of the pen?

(A) 5%
(B) 10%
(C) 25%
(D) 30%
(E) 33 1/3%

Section 2

Questions: 18
Time: 25 minutes

1. If $3x + 9 = 15$, then $x + 2 =$

(A) 2
(B) 3
(C) 4
(D) 5
(E) 6

USE THIS SPACE FOR SCRATCHWORK.

2. $3 - (2^3 - 2[3 - 16 \div 2]) =$

(A) –15
(B) –5
(C) 1
(D) 2
(E) 30

USE THIS SPACE FOR SCRATCHWORK.

3. Define the symbol * by the following equation: $x^* = 2 - x$, for all non-negative x.

   Then $(a + b^*)^* =$

   (A) $b - a$
   (B) $a - b - 4$
   (C) $b - a + 4$
   (D) $a + b - 2$
   (E) $a - b$

4. If p and q are different prime numbers and $pq/2$ is also a prime number, then $p + q$ is

   (A) an odd number
   (B) an even number
   (C) a prime number
   (D) a negative number
   (E) not a prime number

5. In the standard coordinate system, which of the following points is the greatest distance from the origin:

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

6. In a class of 200 students, forty percent are girls. Twenty-five percent of the boys and 10 percent of the girls signed up for a tour to Washington DC. What percent of the class signed up for the tour?

(A) 19%
(B) 23%
(C) 25%
(D) 27%
(E) 35%

7. $-2^4 - \left(x^2 - 1\right)^2 =$

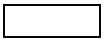
(A) $-x^4 + 2x^2 + 15$
(B) $-x^4 - 2x^2 + 17$
(C) $-x^4 + 2x^2 - 17$
(D) $-x^4 + 2x^2 - 15$
(E) $-x^4 + 2x^2 + 17$

8. The capacity of glass X is 80 percent of the capacity of glass Y. Further, Glass X is 70 percent full, and glass Y is 30 percent full. Glass X contains how many more ounces of punch than glass Y?

(A) 1
(B) 3
(C) 6
(D) 8
(E) Not enough information to decide

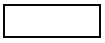
[Grid-in Problem]

9. If $a = 3b$, $b^2 = 2c$, $9c = d$, then $a^2/d =$



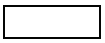
[Grid-in Problem]

10. $\sqrt{(42-6)(20+16)} =$



[Grid-in Problem]

11. If $8^{13} = 2^z$, then $z =$



[Grid-in Problem]

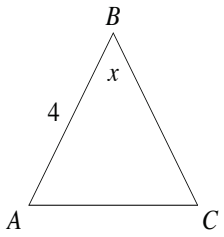
12. $\dfrac{4}{\frac{1}{3}+1} =$

[Grid-in Problem]

13. If x is an integer and $y = -3x + 7$, what is the least value of x for which y is less than 1?

[Grid-in Problem]

14. In the figure, triangle ABC is isosceles with base AC. If $x = 60°$, then $AC =$



Note, figure not drawn to scale

[Grid-in Problem]

15. A unit square is circumscribed about a circle. If the circumference of the circle is $q\pi$, what is the value of q?

[Grid-in Problem]

16. If the average of $2x$ and $4x$ is 12, then x =

[Grid-in Problem]

17. If the ratio of two numbers is 6 and their sum is 21, what is the value of the larger number?

[Grid-in Problem]

18. How many ounces of water must be added to a 30-ounce solution that is 40 percent alcohol to dilute the solution to 25 percent alcohol?

Section 3

Questions: 16
Time: 20 minutes

1. If $(x - 2)(x + 4) - (x - 3)(x - 1) = 0$, then $x =$

   (A) –5
   (B) –1
   (C) 0
   (D) 1/2
   (E) 11/6

USE THIS SPACE FOR SCRATCHWORK.

2. The smallest prime number greater than 48 is

   (A) 49
   (B) 50
   (C) 51
   (D) 52
   (E) 53

USE THIS SPACE FOR SCRATCHWORK.

3. $\left(4^x\right)^2 =$

(A) 2^{4x}
(B) 4^{x+2}
(C) 2^{2x+2}
(D) 4^{x^2}
(E) 2^{2x^2}

4. 1/2 of 0.2 percent equals

(A) 1
(B) 0.1
(C) 0.01
(D) 0.001
(E) 0.0001

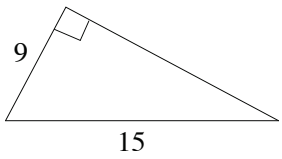
5. If $x + y = k$, then $3x^2 + 6xy + 3y^2 =$

(A) k
(B) $3k$
(C) $6k$
(D) k^2
(E) $3k^2$

6. For which values of x is the following inequality true: $x^2 < 2x$.

(A) $x < 0$
(B) $0 < x < 2$
(C) $-2 < x < 2$
(D) $x < 2$
(E) $x > 2$

7. What is the area of the triangle shown?



(A) 20
(B) 24
(C) 30
(D) 54
(E) 64

8. The average of x, y, and z is 8 and the average of y and z is 4. What is the value of x?

(A) 4
(B) 9
(C) 16
(D) 20
(E) 24

9. What percent of $3x$ is $6y$ if $x = 4y$?

(A) 50%
(B) 40%
(C) 30%
(D) 20%
(E) 18%

USE THIS SPACE FOR SCRATCHWORK.

10. What is the value of the 201^{st} term of a sequence if the first term of the sequence is 2 and each successive term is 4 more than the term immediately preceding it?

(A) 798
(B) 800
(C) 802
(D) 804
(E) 806

USE THIS SPACE FOR SCRATCHWORK.

11. Define $a \ @ \ b$ to be $a^3 - 1$. What is the value of $x \ @ \ 1$?

(A) 0
(B) a^3
(C) $x^3 - 1$
(D) $x^3 + 1$
(E) 2

USE THIS SPACE FOR SCRATCHWORK.

12. If a, b, and c are consecutive integers and $a < b < c$, which one of the following must be true?

(A) b^2 is a prime number
(B) $(a + c)/2 = b$
(C) $a + b$ is even
(D) $ab/3$ is an integer
(E) $c - a = b$

13. $8x^2 - 18 =$

(A) $8(x^2 - 2)$
(B) $2(2x + 3)(2x - 3)$
(C) $2(4x + 3)(4x - 3)$
(D) $2(2x + 9)(2x - 9)$
(E) $2(4x + 3)(x - 3)$

14. If $y = 3x$, then the value of 10% of y is

(A) $.003x$
(B) $.3x$
(C) $3x$
(D) $30x$
(E) $300x$

15. A particular carmaker sells four models of cars, and each model comes with 5 options. How many different types of cars does the carmaker sell?

(A) 15
(B) 16
(C) 17
(D) 18
(E) 20

16. Define $a \@ b$ to be $a^3 - 1$. What is the value of $x \@ 1$?

(A) 0
(B) a^3
(C) $x^3 - 1$
(D) $x^3 + 1$
(E) 2