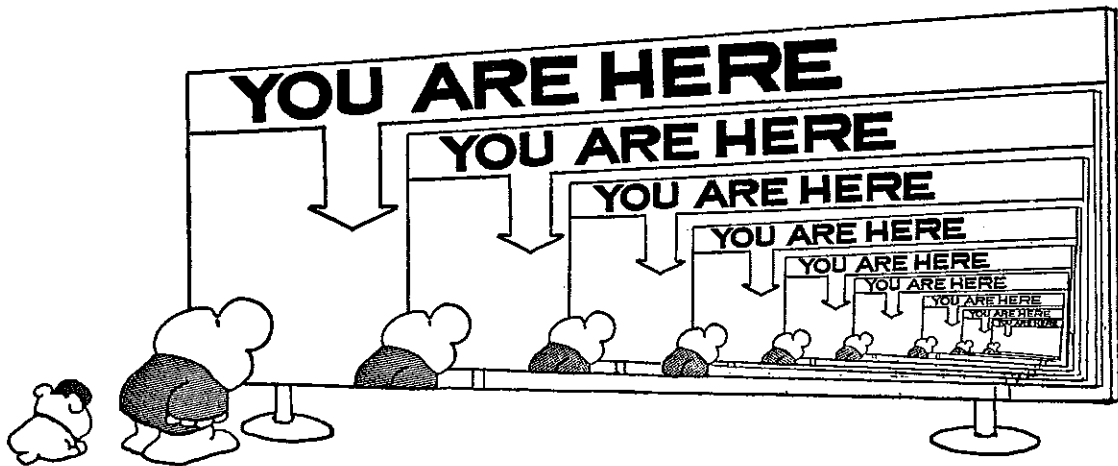


Friendship Junior High School
Sixth Grade Accelerated Math Program

Room 102A (Mr. Lavine)

Critical Thinking & Problem Solving



Special 3rd Quarter Unit

Problem Attack Skills
Illinois Math League
S.A.T.

Introduction to the S.A.T.

SUBSTITUTION PROBLEMS

Bill has savings of \underline{s} dollars that earn no interest. If he earns \underline{k} dollars per week, spends \underline{p} dollars per week (where $p > k$), and makes up the shortage from \underline{s} , how many weeks will his savings last?

(A) $\frac{p-s}{k}$

(C) $\frac{s}{p-k}$

(E) $\frac{s-k}{p}$

(B) $\frac{p-k}{s}$

(D) $\frac{s}{k-p}$

Solution

Substitute values for s , p , and k . Make sure that $p > k$. Choose numbers that are easy to work with.

Example: $s=10$, $p=25$, $k=20$

Determine the solution using these numbers. Then substitute into the 5 possible answers to see which one works.

Earn \$20/wk } \$10 savings will
Spend \$25/wk } last $\boxed{2}$ weeks



(A) $\frac{p-s}{k} = \frac{(25)-(10)}{(20)} = \frac{3}{4}$

(B) $\frac{p-k}{s} = \frac{1}{2}$ (C) $\frac{s}{p-k} = \boxed{2} *$

(D) $\frac{s}{k-p} = -2$ (E) $\frac{s-k}{p} = -\frac{2}{5}$

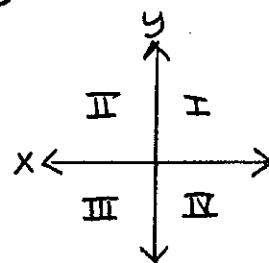
*** (C) is the answer**

① If $3x + 2y = 17$ and x and y are positive integers, then y could equal which of the following?

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

② On the coordinate axis, which quadrants contain all ordered pairs (x, y) if $\frac{x}{y} = 1$?

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



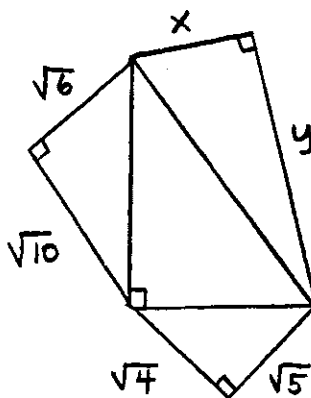
ANGLE PROBLEMS

In the figure to the right, $x^2 + y^2 = ?$

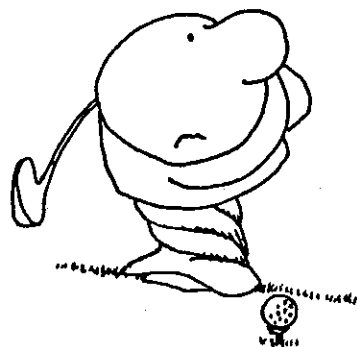
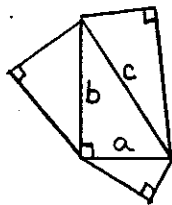
Solution

Notice that the figure has several right triangles.

Use the Pythagorean Theorem:



- (A) 5
 (B) 7
 (C) 25
 (D) 80
 (E) 625



$$1) a^2 = (\sqrt{4})^2 + (\sqrt{5})^2$$

$$a^2 = 4 + 5$$

$$a^2 = 9$$

$$a = 3$$

$$2) b^2 = (\sqrt{6})^2 + (\sqrt{10})^2$$

$$b^2 = 6 + 10$$

$$b^2 = 16$$

$$b = 4$$

$$3) c^2 = 3^2 + 4^2$$

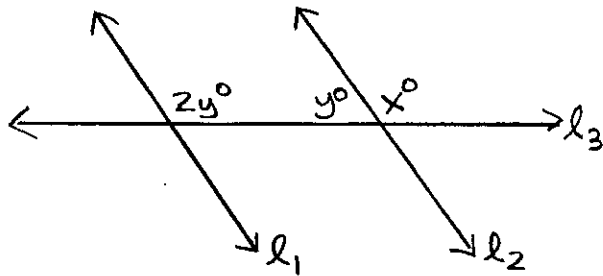
$$c^2 = 25$$

$$c = 5$$

$$4) x^2 + y^2 = 5^2$$

$$x^2 + y^2 = 25$$

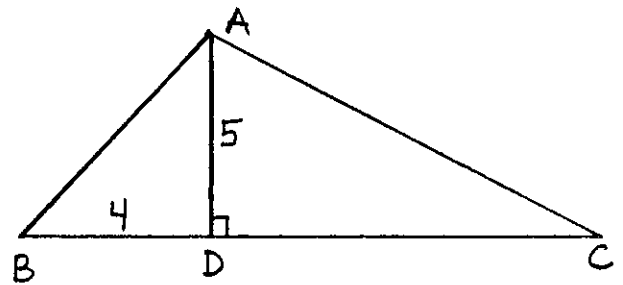
- ③ If $l_1 \parallel l_2$ in the figure below, determine x .



Note: Figure not drawn to scale

- (A) 60 (C) 100 (E) 150
 (B) 90 (D) 120

- ④ If the area of $\triangle ABC$ is 30, determine the length of \overline{AC} .



Note: Figure not drawn to scale

- (A) 8 (C) 12 (E) $2\sqrt{10}$
 (B) $\sqrt{89}$ (D) 40

FUNCTION PROBLEMS

If the operation \boxtimes is defined as $x \boxtimes y = 2x - 3y$, find the value of:

$$(2a \boxtimes b) \boxtimes -2b$$

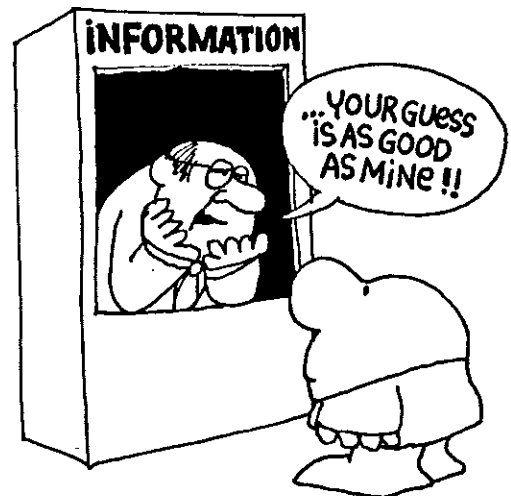
- (A) $2a - 3b$ (C) $4a + 6b$ (E) $6b$
 (B) $4a - 6b$ (D) $8a$

Solution

Solve inside the parenthesis: $2a \boxtimes b = 2(2a) - 3(b) = 4a - 3b$

Substitute and solve: $(4a - 3b) \boxtimes -2b = 2(4a - 3b) - 3(-2b)$

$$8a - 6b + 6b = \boxed{8a}$$



⑤ The operation \odot is defined as $a \odot b = 3a + 2b$. What is the value of:

$$(3x \odot 4) \odot 2x ?$$

- (A) $27x + 8$ (D) $24x + 27$
 (B) $31x + 24$ (E) $16x + 21$
 (C) $12x + 16$

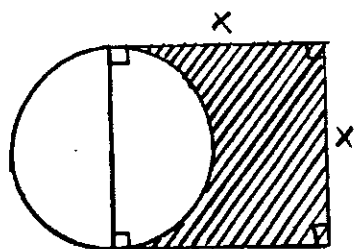
⑥ $a \begin{smallmatrix} b \\ \times \\ d \end{smallmatrix} c$ is defined as $ac - bd$. Determine:

$$x \begin{smallmatrix} 3 \\ \times \\ x \end{smallmatrix} 2 - 4 \begin{smallmatrix} y \\ \times \\ 3 \end{smallmatrix} y + x \begin{smallmatrix} 3 \\ \times \\ y \end{smallmatrix} 2$$

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

CIRCLE PROBLEMS

If the area of the circle below is 9π , what is the area of the shaded region?



- (A) $36 - \frac{9}{2}\pi$
 (B) π
 (C) $x^2 - 3\pi$
 (D) $9\pi + 9$
 (E) $9 + 2\pi$

Solution

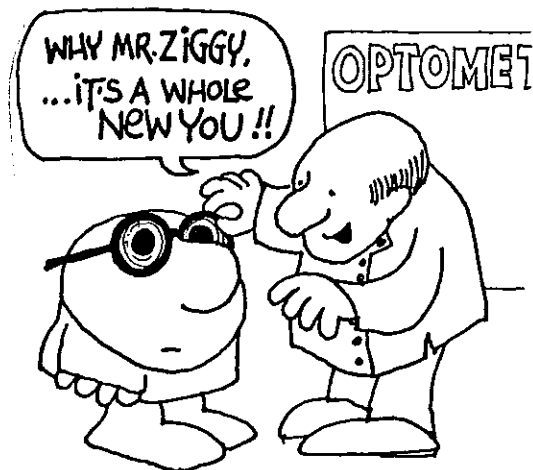
The area of the shaded region equals the area of the square minus the area of the half circle.

$$A = \pi r^2 = 9\pi \rightarrow r = 3$$

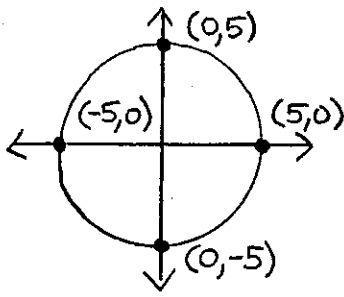
Side of square = 6

$$\square \text{ area} - D \text{ area}$$

$$6^2 - \frac{1}{2}(9\pi) = \boxed{36 - \frac{9}{2}\pi}$$

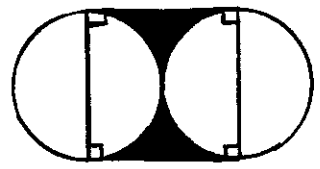


⑦ What is the circumference of the circle?



- (A) 5π
- (B) 10π
- (C) $25\frac{1}{2}\pi$
- (D) 20π
- (E) 25π

⑧ What is the shaded area if the circumference of one circle is 6π ?



- (A) $16 - 4\pi$
- (B) $24 - 6\pi$
- (C) $64 - 12\pi$
- (D) $36 - 9\pi$
- (E) $18 - 6\pi$

READING PROBLEMS

Six children start to count off "one, two, three, four," in a game. Each child who calls "four" drops out and the next child starts over with "one." Rosa starts the counting. At which of her calls will Rosa have to drop out?

- (A) second
- (B) third
- (C) fourth
- (D) fifth
- (E) sixth

Solution

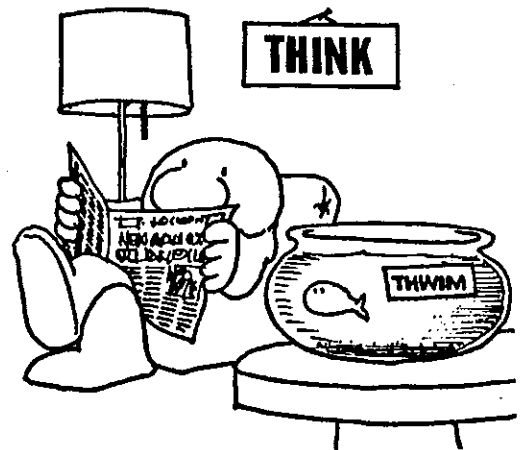
The key is to read very patiently and carefully.

Ⓡ stands for Rosa

Ⓡ 2 3 ✗ 5 6 Ⓡ ✗ 3 5 6 ✗ → third call



- ⑨ When flying a plane, a standard rate turn is one in which the rate of turning is 3 degrees per second. A heading is the number of degrees in a clockwise direction starting from "0" at due north to the path of the plane. If a plane has a heading of 246° and makes a standard rate turn to a heading of 171° , how long will it take to make the turn (in seconds)?



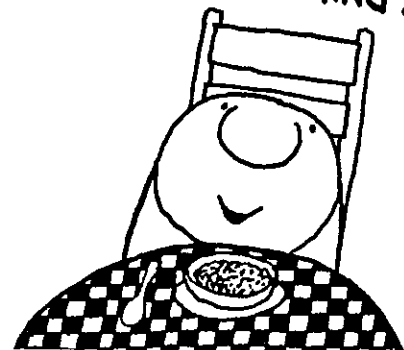
- (A) 15 (D) 95
 (B) 25 (E) 225
 (C) 57

- ⑩ The set T consists of all the integer multiples of three.

$$T = \{ \dots -9, -6, -3, 0, 3, 6, 9 \dots \}$$

If the integers a and b are both elements in set T , all of the following must be in set T except one. Which one is not in set T ?

**I'M A VERY LIGHT EATER
 ...WHEN IT STARTS GETTING
 LIGHT... I START EATING !!**



- (A) ab (B) $a+b$ (C) $a-b$ (D) $-a-b$ (E) a/b

QUANTITATIVE PROBLEMS

In a quantitative problem, you are given a value in Column A and a value in Column B. There are four possible solutions when you compare values:

	<u>Column A</u>	<u>Column B</u>
(A) Column A is larger	$x > 0$	
(B) Column B is larger		$x < 0$
(C) The values are equal	x	x^2
(D) Cannot be determined		

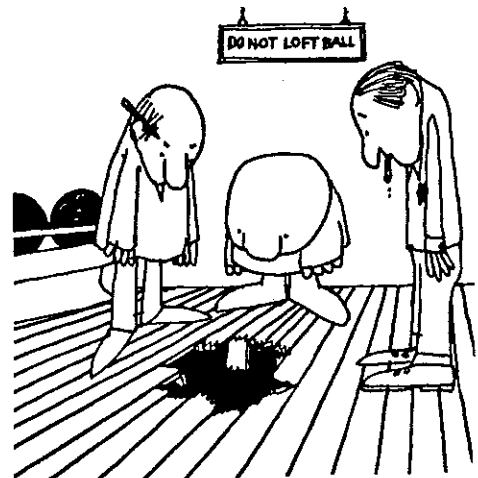
Solution

When solving, it is often necessary to substitute values that are positive, negative, zero, or fractions.

In this problem, $x > 0$ so you do not have to try negative values.

If $x = 2$	If $x = 1$	If $x = 1/2$	Answer: (D)
$x < x^2$	$x = x^2$	$x > x^2$	It cannot be determined
$2 < 4$	$1 = 1$	$1/2 > 1/4$	

	<u>Column A</u>	<u>Column B</u>
	$\frac{1}{N} > 1$	
⑪	N^2	1
	$x > y$	
⑫	$x + y$	$x - y$



AVERAGING

- Ⓐ Average these expressions:
 $(2x+y)$, $(3x-5y)$, $(4x-2y)$

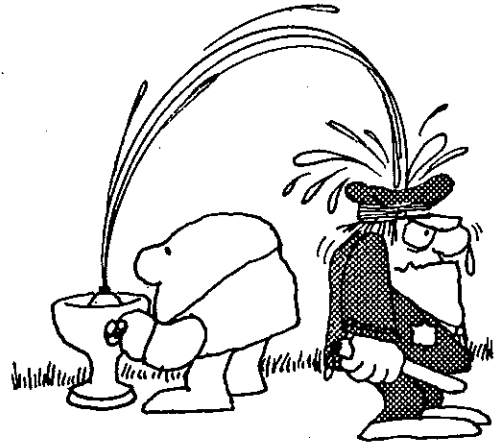
Solution

Determine the sum:

$$(2x+y) + (3x-5y) + (4x-2y) = 9x-6y$$

Divide by number of expressions:

$$\frac{9x-6y}{3} = \frac{9x}{3} - \frac{6y}{3} = \boxed{3x-2y}$$



- Ⓑ The average of a set of 15 numbers is 10. If one number is removed, the average of the remaining numbers is $9\frac{1}{2}$. What is the number removed?

Solution

original sum:	$15 \times 10 = 150$	(15 numbers, avg 10)
new sum:	$14 \times 9\frac{1}{2} = 133$	(14 numbers, avg $9\frac{1}{2}$)
number removed:	$150 - 133 = \boxed{17}$	

- Ⓒ The Jones family drove 4 hours at 50 mph, 3 hours at 55 mph, and 3 hours at 52 mph. What was the average speed for the trip?

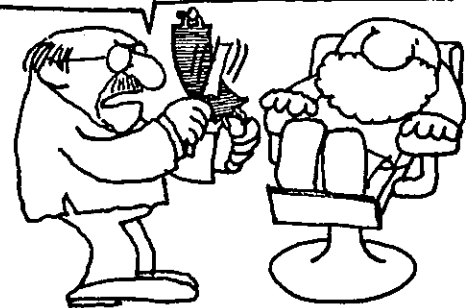
Solution

$$\text{Avg. Speed} = \frac{\text{Total Distance}}{\text{Total Time}} = \frac{(4 \times 50) + (3 \times 55) + (3 \times 52)}{4 + 3 + 3} = \frac{521}{10} = \boxed{52.1 \text{ mph}}$$

Find the average:

- ① $(4x+1), (6x-7)$ ③ $(x+2xy), (3x-y), (-2x+10xy), (5y-6x)$
- ② $(3a+9), (4a-2b), (5b+5a)$ ④ $(a), (3a), (8), (4b)$
- ⑤ The average of 12 numbers is 11. If 2 numbers are removed, the average of the remaining numbers is 12. What is the average of the 2 numbers removed?
- ⑥ In a reading competition, one team read 24 books, 2 teams read 30 books, 4 teams read 32 books, and 2 teams read 38 books. What was the average number of books read by the 9 teams?
- ⑦ Angela needs to average 92% for an "A." If she scores: 89%, 96%, 96%, and 85% on the first four tests, what score does she need on the last test to receive an "A"?
- ⑧ Sandra drove from Chicago to Milwaukee (a distance of 90 miles). She drove there at 45 mph. On the return trip, she drove 30 mph. What was her average speed for the round trip?
- ⑨ It is 120 miles from Flossmoor to Bloomington. If you make the trip at 30 mph, at what speed must you drive on the return trip to average 40 mph for the round trip?
- ⑩ The Williams family took a long car trip out west. They drove 2 hours at 35 mph, 2 hours at 40 mph, and 3 hours at 50 mph. At what speed must they drive on the return trip to average 40 mph for the round trip?

IT'S BEEN ONE OF THOSE DAYS...
... FIRST I GET INTO A BIG FIGHT WITH MY WIFE... THEN I GO OUT TO START THE CAR AND FIND I HAVE A FLAT TIRE
... NEXT I GET A PARKING TICKET RIGHT OUTSIDE MY OWN BARBER SHOP....



S.A.T. Multiple Choice

Demonstration Problems

① If $\frac{1}{x-1} = \frac{1}{5}$, then $x =$

- (A) $\frac{5}{6}$ (B) $\frac{6}{5}$ (C) 4 (D) 5 (E) 6

② John and Bill agreed to meet at a certain time. John arrived at 3:40 p.m. which was 25 minutes later than the time agreed upon. If Bill was twice as late as John, at what time did he arrive?

- (A) 3:45 p.m. (B) 3:50 p.m. (C) 3:55 p.m.
(D) 4:00 p.m. (E) 4:05 p.m.

③ If $x = 2^2$, then $x^2 =$

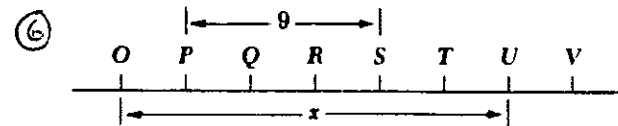
- (A) 2 (B) 8 (C) 16 (D) 32 (E) 64

④ If 60 is reduced by 10 percent and the resulting number is increased by 10 percent, then the final result is

- (A) 48.6 (B) 54 (C) 57.6 (D) 59.4 (E) 60

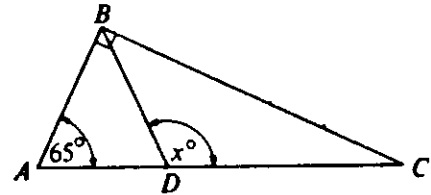
⑤ If $k = \frac{2ab}{a^2 - b}$, what is the value of k when $a = b = 2$?

- (A) $\frac{1}{2}$ (B) 2 (C) 3 (D) 4 (E) 8



In the figure above, the lettered points divide line segment OV into segments of equal length. If the length of PS is 9, then $x =$

- (A) 3 (B) 9 (C) 12 (D) 15 (E) 18



⑧ In the figure above, ABC is a right triangle and $AB = BD$. What is the value of x ?

- (A) 130 (B) 125 (C) 120 (D) 115 (E) 110

⑨ If m and n are whole numbers and $m + n$ is divisible by 7, which of the following must also be divisible by 7?

- (A) Both m and n
(B) Either m or n but not necessarily both
(C) $m - n$
(D) mn
(E) None of the above

⑩ A man's usual bowling average is x . If the scores on his first 5 games are $x + 5$, $x - 3$, $x + 6$, $x - 7$, and $x - 4$, what score must he get on his 6th game in order to have an average (arithmetic mean) score of $x + 1$ for the 6 games?

- (A) $x + 4$ (B) $x + 6$ (C) $x + 7$
(D) $x + 8$ (E) $x + 9$

⑪ The greatest number of solid wooden cubes that can be clustered about a common vertex is

- (A) 2 (B) 4 (C) 8 (D) 16 (E) 32

⑫ What is the height of the smallest equilateral triangle with sides whose lengths are positive integers?

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

⑬

$$\frac{\frac{4}{3} + \frac{4}{3} + \frac{4}{3}}{\frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4}} =$$

- (A) $\frac{1}{4}$ (B) $\frac{1}{3}$ (C) $\frac{3}{4}$ (D) 1 (E) $\frac{4}{3}$

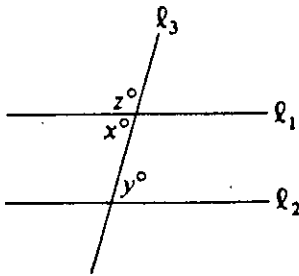
⑬ A woman walks K kilometers in T minutes. At the same rate, how many hours will it take her to walk 20 kilometers?

- (A) $\frac{T}{3K}$ (B) $\frac{K}{20T}$ (C) $\frac{3T}{K}$
(D) $\frac{3K}{T}$ (E) $\frac{20T}{K}$

$$\begin{array}{r} 7 \\ x \\ + y \\ \hline 21 \end{array}$$

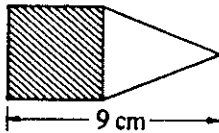
- (14) In the addition problem above, if x and y are 1-digit positive integers, the least possible value of x is
 (A) 0 (B) 1 (C) 3 (D) 5 (E) 7

- (15) If k is not zero and $ky = x$, then $y =$
 (A) $\frac{1}{k}$ (B) $\frac{x}{k}$ (C) kx (D) $\frac{1}{x}$ (E) $\frac{k}{x}$

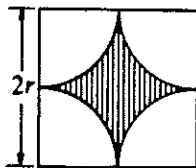


Note: Figure not drawn to scale.

- (16) In the figure above, if $l_1 \parallel l_2$ and $x + y = 110$, then $z =$
 (A) 55 (B) 70 (C) 110 (D) 115 (E) 125



- (17) In the figure above, the area of the shaded square region is 16 square centimeters. What is the area in square centimeters of the triangular region?
 (A) 4 (B) 8 (C) 10 (D) 18 (E) 36

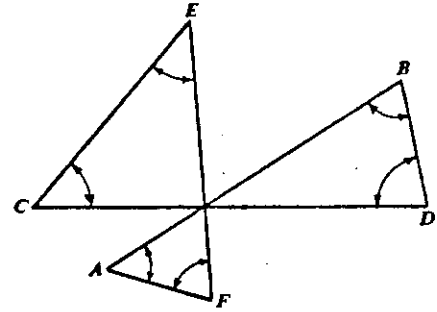


- (18) In the square above, what is the area of the shaded region bounded by arcs of circles with radius r ?
 (A) π (B) πr^2 (C) $4r^2$
 (D) $4\pi r^2 - 4r^2$ (E) $4r^2 - \pi r^2$

- (19) If x , y , and z are the lengths of the sides of a right triangle and if $x < y < z$, then the area of the triangle equals

- (A) $\frac{xy}{2}$ (B) $\frac{xz}{2}$ (C) $\frac{yz}{2}$ (D) $\frac{xyz}{2}$ (E) $\frac{x(x+y)}{2}$

- (20) If $1 < a < b$, of the following, which is greatest?
 (A) a^2 (B) $\frac{1}{ab}$ (C) b^2 (D) $\frac{1}{a^2}$ (E) ab



- (21) In the triangles above, if AB , CD , and EF are line segments, what is the sum of the measures of the six marked angles?
 (A) 180° (B) 360° (C) 540° (D) 720°
 (E) It cannot be determined from the information given.

- (22) If for any number x , \boxed{x} is defined as the least integer that is greater than or equal to x , then $\boxed{-2.5} + \boxed{12} =$

- (A) 9 (B) 9.5 (C) 10 (D) 11 (E) 14.5

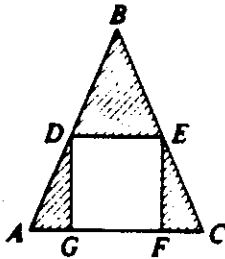
- (23) A 25-foot ladder is placed against a vertical wall of a building, with the bottom of the ladder standing on concrete 7 feet from the base of the building. If the top of the ladder slips down 4 feet, then the bottom of the ladder will slide out

- (A) 4 ft
 (B) 5 ft
 (C) 6 ft
 (D) 7 ft
 (E) 8 ft

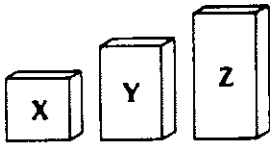
PART II

- ① If $\frac{x}{y} = 3$ and $x = 12$, then $x - y =$
 (A) 3 (B) 5 (C) 6 (D) 8 (E) 9

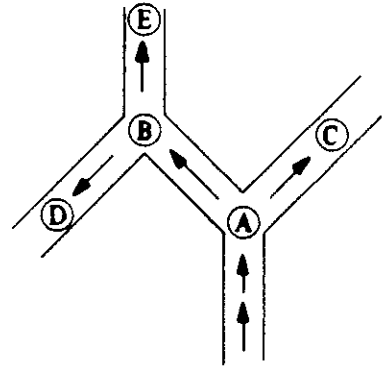
- ② If $a, b, c, d,$ and e are whole numbers, the expression $a(b(c + d) + e)$ will be an even number whenever which of the following is even?
 (A) a (B) b (C) c (D) d (E) e



- ③ In the figure above, the area of triangle ABC is 32 and the total area of the shaded regions is 16. If $DEFG$ is a square, what is the length of segment GF ?
 (A) 4 (B) 5 (C) $\sqrt{34}$ (D) 6 (E) $5\sqrt{2}$

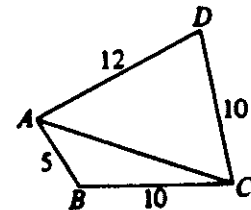


- ④ In the figure above, the number of grams of cereal in box Y is greater than the number in box X and less than the number in box Z . If box Z contains 500 grams, each of the following could be the total number of grams of cereal in the three boxes EXCEPT
 (A) 900 g
 (B) 1,000 g
 (C) 1,200 g
 (D) 1,350 g
 (E) 1,500 g



A traffic survey shows that of every 12 cars that arrive at point A , 7 turn toward point B and 5 turn toward point C . Of every 7 cars that arrive at point B , 3 turn toward point D and 4 turn toward point E .

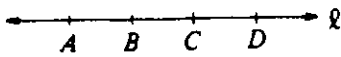
- ⑤ Of 48 cars arriving at point A , how many are expected to turn toward point B ?
 (A) 15 (B) 20 (C) 28 (D) 30 (E) 36
- ⑥ Of 72 cars arriving at point A , how many are expected eventually to turn toward point D ?
 (A) 18 (B) 24 (C) 26 (D) 32 (E) 42
- ⑦ The sum of the digits of a three-digit number is 12. If the hundreds' digit is 3 times the tens' digit and the tens' digit is $\frac{1}{2}$ the units' digit, what is the number?
 (A) 312
 (B) 624
 (C) 912
 (D) 936
 (E) 963



- ⑧ In the figure above, the perimeter of $\triangle ACD$ is how much greater than the perimeter of $\triangle ACB$?
 (A) 22 (B) 14 (C) $5\sqrt{5}$ (D) 7 (E) $\sqrt{2}$

- 9 The average (arithmetic mean) mass of 4 objects is 50 kilograms. If 3 of the objects each have a mass of 45 kilograms, what is the mass, in kilograms, of the fourth object?

(A) 70 (B) 65 (C) 60 (D) 55 (E) 50



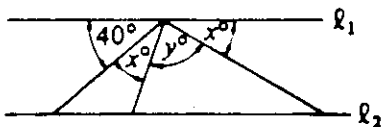
- 10 Which of the following statements is (are) true of the lengths of the segments on line l above?

- I. $AB + CD = AD$
 II. $AB + BC = AD - CD$
 III. $AC - AB = AD - CD$

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

- 11 If $Q = \frac{(x+y)h}{2}$, what is the average (arithmetic mean) of x and y when $Q = 20$ and $h = 5$?

(A) 100
 (B) $\frac{25}{2}$
 (C) 10
 (D) 4
 (E) 2



- 12 In the figure above, if lines l_1 and l_2 are parallel, what is the value of y ?

(A) 30
 (B) 40
 (C) 70
 (D) 80
 (E) It cannot be determined from the information given.

- 13 If half the people in a room leave at the end of every five-minute interval and at the end of twenty minutes the next to the last person leaves, how many people were in the room to start with? (Assume that no one enters the room once the process begins.)

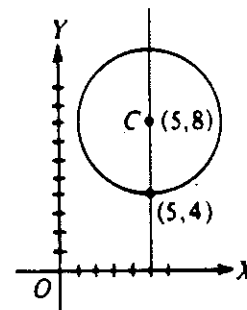
(A) 32
 (B) 28
 (C) 16
 (D) 12
 (E) 8

- 14 Susan finds approximately f four-leaf clovers in every square meter of a field. If the field is a rectangle l meters long and w meters wide, what is the best approximation of the number of four-leaf clovers she finds?

(A) flw

(B) fl^2w^2 (D) $\frac{f}{lw}$

(C) $\frac{f^2}{lw}$ (E) $\frac{lw}{f}$



- 15 In the figure above, what is the circumference of the circle with center C ?

(A) 2π (B) 4π (C) 5π (D) 8π (E) 10π

- 16 For all integers x ,

$x = x$ if x is positive or zero and

$x = x + 1$ if x is negative.

$18 + (-18) =$

(A) -1
 (B) 0
 (C) 1
 (D) 2
 (E) 36

S.A.T. Quantitative

Demonstration Problems

Column A

Column B

- ① The number of tens in 48 The number of hundreds in 348

$$x \neq 0$$

- ② $\frac{1}{x^2}$ 0

- ③ $4(2x - 2)$ $2(4x - 4)$

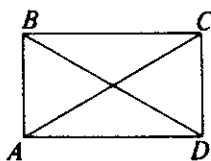
- ④ The length of the hypotenuse of a right triangle with legs of lengths 8 and 6 The length of the hypotenuse of a right triangle with legs of lengths 12 and 5

The sum of two positive numbers is 24.
The difference of the numbers is 10.

- ⑤ The larger of these two numbers 18

- ⑥ $8 - (7 - 6 - 5)$ $8 - 7 - (6 - 5)$

- ⑦ Volume of a rectangular block with dimensions 1 meter by 2 meters by 3 meters Volume of a rectangular block with dimensions 1 meter by 12 meters by 0.5 meters



Note: Figure not drawn to scale.

In parallelogram $ABCD$, $\angle ABC \neq \angle BAD$.

- ⑧ Length of AC Length of BD

Column A

Column B

- ⑨ x and y are positive integers.
 $(3^x)^y$ $3^x \cdot 3^y$

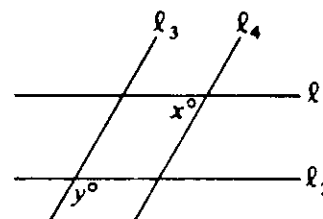
- ⑩ Area of a circle with radius r Area of a circle with diameter $2r$

$$x + y = y$$

- ⑪ x y

$$2x + 2 < 1$$

- ⑫ x 0



Lines l_1 and l_2 are parallel.
Lines l_3 and l_4 are parallel.

- ⑬ x $180 - y$

$$\begin{matrix} a & b \\ c & d \end{matrix} = ab + bd + cd + ac$$

- ⑭ $\begin{matrix} 1 & 2 \\ 4 & 3 \end{matrix}$ $\begin{matrix} 4 & 1 \\ 3 & 2 \end{matrix}$

$$\begin{matrix} x > 0 \\ y > 0 \end{matrix}$$

- ⑮ $\begin{matrix} 0 & x \\ y & 0 \end{matrix}$ $\begin{matrix} x & 0 \\ y & 0 \end{matrix}$

Column A

Column B

$$10 + x + y = 10$$

(16)	$x + y$	$x - y$
------	---------	---------

$$x \neq 0$$

(17)	$\frac{3x^2 + x}{x}$	$3x + 1$
------	----------------------	----------

$$n < 3 \text{ and } n \neq 0$$

(18)	$4 - \frac{1}{n}$	$3 + \frac{3}{4}$
------	-------------------	-------------------

x is a 2-digit number divisible by 2, 3, and 7.

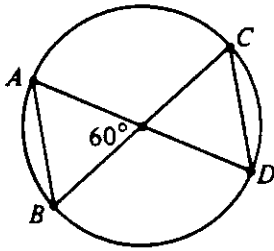
(19)	x	84
------	-----	----

(20)	$10^6 - 2^6$	$10^6 - 3^6$
------	--------------	--------------

(21)	The number of seconds in a half hour	1,800
------	--------------------------------------	-------

$$y = 2x \text{ and } x \neq 0$$

(22)	$2x - y$	$2xy$
------	----------	-------



AD and BC intersect at the center of the circle.

(23)	Length of chord AB	Length of chord CD
------	----------------------	----------------------

$$a^2 = b^2$$

(24)	ab	a^2
------	------	-------

(25)	$\frac{1}{\frac{3}{2} - 1}$	$\frac{3}{2} - 1$
------	-----------------------------	-------------------

Column A

Column B

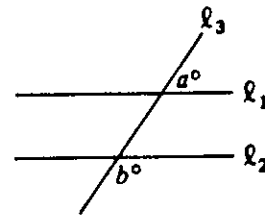
$$x < 0$$

(26)	$\sqrt{x^2 + 1}$	$\sqrt{x^2}$
------	------------------	--------------

(27)	Twice an even integer greater than 5	Three times an even integer greater than 2
------	--------------------------------------	--

x and y are positive integers less than 10.

(28)	$x - y$	9
------	---------	---



Parallel lines l_1 and l_2 are intersected by line l_3 .

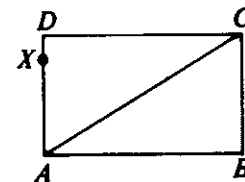
(29)	a	$180 - b$
------	-----	-----------

$$2x - 7 = 13$$

(30)	$2x + 7$	21
------	----------	----

A film cartoon is shown at the rate of 24 frames per second.

(31)	The number of frames used for a 6-minute cartoon shown at this rate	8,640
------	---	-------



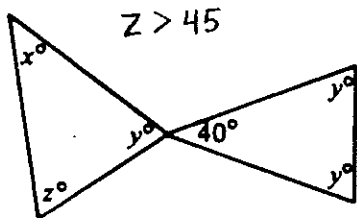
Rectangle $ABCD$

(32)	Length of diagonal AC	Length of a line segment from X to a point Y (not shown) on segment BC .
------	-------------------------	--

PART II

Column A

Column B



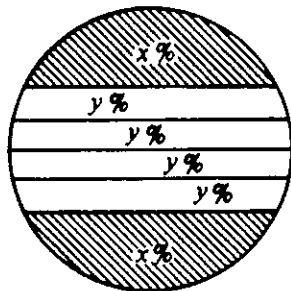
Note: Figure not drawn to scale.

①	x	65
---	-----	----

For all nonzero numbers x and y , let $x \circ y = \frac{x}{y}$ and $x \Delta y = \frac{y}{x}$.

②	$3 \circ 2$	$3 \Delta 2$
	$z \neq 0$	

③	$1 \circ z$	$1 \Delta z$
---	-------------	--------------



$2x\%$ of the circle is shaded and $4y\%$ is unshaded.

$x > 30$

④	y	10
---	-----	----

The average (arithmetic mean) of 18, 30, x , and y equals 12.

$x > 0$

⑤	y	0
---	-----	---

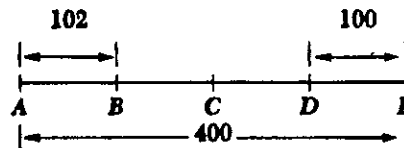
Juan is h years old and Lisa is k years older than Juan.

⑥	$k - h$	$h - k$
---	---------	---------

Column A

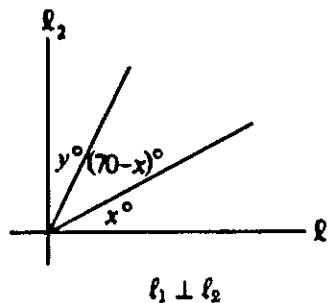
Column B

⑦	90% of 10	9% of 100
---	-----------	-----------



C is the midpoint of segment AE.

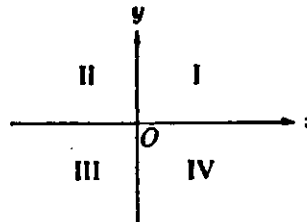
⑧	AC	BD
---	----	----



⑨	y	25
---	-----	----

The first half of a 180-kilometer trip takes twice as long as the second half. The second half of the trip takes $1\frac{1}{2}$ hours.

⑩	The average speed in kilometers per hour for the whole trip	45 kilometers per hour
---	---	------------------------



⑪	x -coordinate of a point in quadrant II	y -coordinate of a point in quadrant IV
---	---	---

⑫	Remainder when 731^{500} is divided by 10	1
---	---	---

S.A.T. (A)

SECTION II

Time—30 minutes

25 QUESTIONS

In this section solve each problem, using any available space on the page for scratchwork. Then indicate the one correct answer in the appropriate space on the answer sheet.

The following information is for your reference in solving some of the problems.

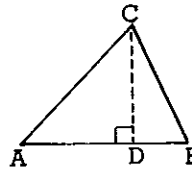
Circle of radius r : Area = πr^2 ; Circumference = $2\pi r$

The number of degrees of arc in a circle is 360.

The measure in degrees of a straight angle is 180.

Definitions of symbols:

= is equal to	\leq is less than or equal to
\neq is unequal to	\geq is greater than or equal to
< is less than	\parallel is parallel to
> is greater than	\perp is perpendicular to



Triangle: The sum of the measures in degrees of the angles of a triangle is 180.

If $\angle CDA$ is a right angle, then

$$(1) \text{ area of } \triangle ABC = \frac{AB \times CD}{2}$$

$$(2) AC^2 = AD^2 + DC^2$$

Note: Figures which accompany problems in this test are intended to provide information useful in solving the problems. They are drawn as accurately as possible EXCEPT when it is stated in a specific problem that its figure is not drawn to scale. All figures lie in a plane unless otherwise indicated. All numbers used are real numbers.

1. If $2x + 2x + 2x = 12$, then $2x - 1 =$

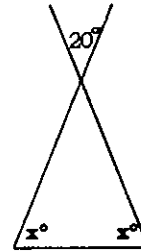
- (A) 2
- (B) 3
- (C) 4
- (D) 5
- (E) 6

2. If $\frac{1}{8}$ of a number is 3, what is $\frac{1}{3}$ of the number?

- (A) 24
- (B) 8
- (C) 3
- (D) 1
- (E) It cannot be determined from the information given.

3. The meter in a taxicab registers \$0.50 for the first $\frac{1}{5}$ of a mile and \$0.10 for each additional $\frac{1}{5}$ of a mile. How many miles is a trip for which the meter registers \$2.50?

- (A) 5
- (B) $4\frac{4}{5}$
- (C) $4\frac{3}{5}$
- (D) $4\frac{2}{5}$
- (E) $4\frac{1}{5}$



4. In the figure above, $x =$

- (A) 20
- (B) 40
- (C) 70
- (D) 80
- (E) 160

5. $\left(\frac{2}{3} \div \frac{3}{4}\right) - \left(\frac{1}{9} \div \frac{1}{7}\right) =$

- (A) $-\frac{9}{56}$
- (B) 0
- (C) $\frac{1}{9}$
- (D) $\frac{335}{630}$
- (E) $\frac{8}{7}$

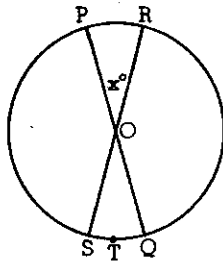
GO ON TO THE NEXT PAGE

6. In the currency of the country of Ug, 15 dops are equal to 1 tif. If 10 dops equal 1 decadop, what is the value in tifs of 6 decadops?

- (A) $\frac{1}{15}$
- (B) $\frac{2}{5}$
- (C) $\frac{3}{2}$
- (D) 3
- (E) 4

7. If a set of numbers is "quotiable," then the quotient $\frac{x}{y}$ of any two numbers x and y in the set is also in the set. One reason that the set $\{1, 3, 9, 27, 81\}$ is not "quotiable" is that $\frac{27}{k}$ is not in the set. What is the value of k ?

- (A) 1 (B) 3 (C) 9 (D) 27 (E) 81



8. In the figure above, PQ and RS are diameters of circle O . If $x = 30$, then the ratio

$$\frac{\text{length of arc } STQ}{\text{circumference of circle } O} =$$

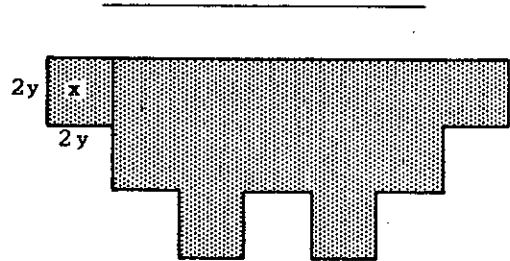
- (A) $\frac{1}{12}$ (B) $\frac{1}{10}$ (C) $\frac{1}{9}$ (D) $\frac{1}{6}$ (E) $\frac{1}{3}$

9. If $x^3 = -(2x)^2$ and $x \neq 0$, then $x =$

- (A) 1 (B) 2 (C) 4 (D) 6 (E) 8

10. If x and y are positive integers and $x - y = 5$, what is the least possible value of $x + y$?

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



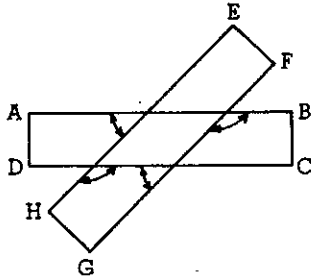
11. In the figure above, the area of the small square is x . If each short line segment in the figure has length $2y$ and every pair of intersecting segments is perpendicular, then the area of the shaded region in terms of x is

- (A) $12x$ (B) $13x$ (C) $14x$ (D) $14x^2$ (E) $196x^2$

12. When purchased, a bottle with a 10-ounce capacity contains 8 ounces of soda. If the buyer drinks 6 ounces of the soda, then what per cent of the bottle is empty?

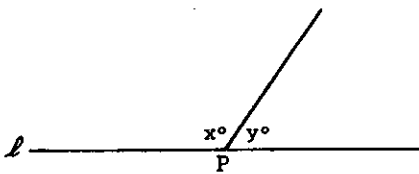
- (A) 20%
- (B) 25%
- (C) 60%
- (D) 75%
- (E) 80%

GO ON TO THE NEXT PAGE



13. In the figure above, if ABCD and EFGH are rectangles, what is the sum of the measures of the marked angles?
- (A) 180°
 (B) 270°
 (C) 360°
 (D) 540°
 (E) It cannot be determined from the information given.

14. If x and y are integers, which of the conditions below is sufficient for $\frac{x-y}{x}$ to be positive?
- (A) $x < 0$
 (B) $x > 0$
 (C) $y < 0$ and $x < 0$
 (D) $y > 0$ and $x > 0$
 (E) $x > y$ and $x > 0$



Note: Figure not drawn to scale.

15. If P is a point on line l in the figure above and $x - y = 0$, then $y =$
- (A) 0
 (B) 45
 (C) 90
 (D) 135
 (E) 180

16. After John gave 6 marbles to Bill, they each had the same number of marbles. John originally had how many more marbles than Bill?

(A) 3 (B) 6 (C) 9 (D) 12 (E) 15

17. If p , q , and r are integers and $\frac{q}{p}$ and $\frac{r}{q}$ are both integers greater than 1, which of the following is NOT an integer?

(A) $\frac{p}{r}$ (B) $\frac{r}{p}$ (C) $\frac{rp}{q}$ (D) $\frac{rq}{p}$ (E) $\frac{qr}{rp}$

18. If $\frac{P}{M} = \frac{H+k}{T+k}$, where P , M , H , T , and k are positive real numbers, which of the following is (are) true?

I If $T > H$, then $M > P$.
 II If $T = 2H$, then $M = 2P$.
 III If $T = H$, then $M = P$.

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

19. If a is not 0 or 1, what is the reciprocal of

$$\frac{a}{1 - \frac{1}{a}} ?$$

(A) $\frac{a-1}{a^2}$ (B) $\frac{a-1}{a}$ (C) $a-1$
 (D) $\frac{1}{a-1}$ (E) $\frac{a^2}{a-1}$

GO ON TO THE NEXT PAGE

20. If $\frac{7}{3}x = \frac{3}{7}y$ and $y \neq 0$, then $\frac{x}{y} =$

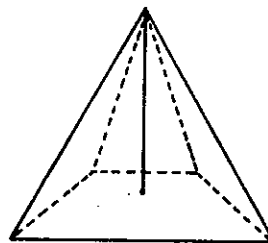
- (A) $\frac{9}{49}$
 (B) $\frac{3}{7}$
 (C) 1
 (D) $\frac{7}{3}$
 (E) $\frac{49}{9}$

21. What is the greatest number of equilateral triangular pieces of paper with sides of length 2 and altitudes of length $\sqrt{3}$ that can be cut whole from a rectangular sheet of paper with dimensions 6 by $\sqrt{3}$?

- (A) 7
 (B) 5
 (C) 4
 (D) 3
 (E) 2

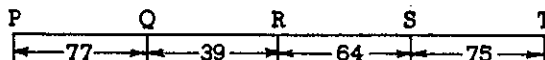
22. If the average of v and w is p and the average of x , y , and z is q , what is the average of v , w , x , y , and z in terms of p and q ?

- (A) $p + q$
 (B) $\frac{p + q}{2}$
 (C) $2p + 3q$
 (D) $\frac{2p + 3q}{5}$
 (E) $\frac{3p + 2q}{5}$



23. If the pyramid in the figure above has a square base and all equilateral faces with edges of length 6, what is the perpendicular height of the pyramid?

- (A) 3
 (B) $2\sqrt{3}$
 (C) $3\sqrt{2}$
 (D) $3\sqrt{3}$
 (E) 6



Note: Figure not drawn to scale.

24. In the figure above, if Q , R , and S are points on segment PT , the distance from the midpoint of QS to the midpoint of PT is

- (A) 0 (B) 1 (C) 2 (D) 3 (E) 128

25. If quadrilateral $ABCD$ has sides of lengths x , x , y , and z (not necessarily in that order) and angles of degree measures 90 , 90 , p , and q (not necessarily in that order), which of the following must be true?

- I. $ABCD$ is either a rectangle or a square.
 II. $p + q = 180$
 III. $y = z$

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

S T O P

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS SECTION ONLY.
 DO NOT WORK ON ANY OTHER SECTION IN THE TEST.

5

SECTION V

Time—30 minutes

35 QUESTIONS

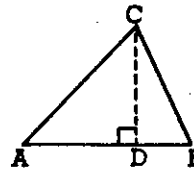
In this section solve each problem, using any available space on the page for scratchwork. Then indicate the one correct answer in the appropriate space on the answer sheet.

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Circle of radius r : Area = πr^2 ; Circumference = $2\pi r$
 The number of degrees of arc in a circle is 360.
 The measure in degrees of a straight angle is 180.

Definitions of symbols:

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\neq is unequal to	\geq is greater than or equal to
< is less than	\parallel is parallel to
> is greater than	\perp is perpendicular to



Triangle: The sum of the measures in degrees of the angles of a triangle is 180.

If $\angle CDA$ is a right angle, then

(1) area of $\triangle ABC = \frac{AB \times CD}{2}$

(2) $AC^2 = AD^2 + DC^2$

Note: Figures which accompany problems in this test are intended to provide information useful in solving the problems. They are drawn as accurately as possible EXCEPT when it is stated in a specific problem that its figure is not drawn to scale. All figures lie in a plane unless otherwise indicated. All numbers used are real numbers.

1. If $x = 3$, then $x^2 + 3 =$

- (A) 0
- (B) 3
- (C) 6
- (D) 9
- (E) 12

2. When a certain number is divided by 3, there is no remainder. If there is a remainder when the number is divided by 6, then the remainder must be

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

3. If $x + 2$ is an even integer, which of the following is NOT an even integer?

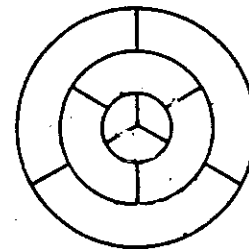
- (A) $2x + 2$ (B) $2x + 4$ (C) $x - 2$
- (D) x (E) $x + 1$

4. If $\frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \times \frac{5}{6} \times \frac{6}{7} \times y = 1$, then $y =$

- (A) $\frac{2}{7}$ (B) 1 (C) 2 (D) $\frac{7}{2}$ (E) 7

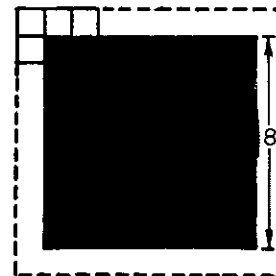
5. If $x = \sqrt{y}$ and $y^2 = 64$, then $x =$

- (A) $\sqrt{2}$
- (B) $2\sqrt{2}$
- (C) 4
- (D) 8
- (E) 16



6. If the nine regions in the figure above are to be colored so that no two bordering regions have the same color, what is the least number of colors that can be used?

- (A) Two (B) Three (C) Four
- (D) Five (E) Six



7. How many 1-centimeter squares are required to make a border around the edge of the shaded square with a side of 8 centimeters as shown in the figure above?

- (A) 32 (B) 36 (C) 40 (D) 48 (E) 64

GO ON TO THE NEXT PAGE

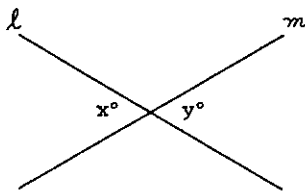
Questions 8-27 each consist of two quantities, one in Column A and one in Column B. You are to compare the two quantities and on the answer sheet blacken space

- A if the quantity in Column A is greater;
- B if the quantity in Column B is greater;
- C if the two quantities are equal;
- D if the relationship cannot be determined from the information given.

- Notes:
1. In certain questions, information concerning one or both of the quantities to be compared is centered above the two columns.
 2. A symbol that appears in both columns represents the same thing in Column A as it does in Column B.
 3. Letters such as x , n , and k stand for real numbers.
 4. Since there are only four choices **NEVER MARK (E)**.

EXAMPLES			
	Column A	Column B	Answers
E1.	2×6	$2 + 6$	<input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E
E2.	$180 - x$	y	<input type="radio"/> A <input type="radio"/> B <input checked="" type="radio"/> C <input type="radio"/> D <input type="radio"/> E
E3.	$p - q$	$q - p$	<input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input checked="" type="radio"/> D <input type="radio"/> E

	Column A	Column B
8.	$23^2 + 2(5)(23) + 5^2$	$23^2 - 2(5)(23) + 5^2$



Lines l and m intersect as shown above.

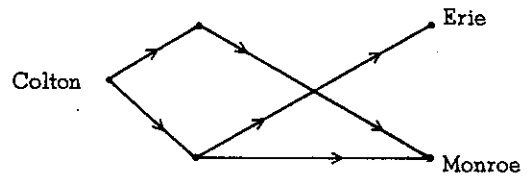
9.	x	y
10.	x	y
		$3x = 6$ $y + y = 6$
11.	105°	Number of degrees in the largest angle of a right triangle

X and Y are two different sets of four consecutive integers.

12.	The least integer in X	The greatest integer in Y
-----	------------------------	---------------------------

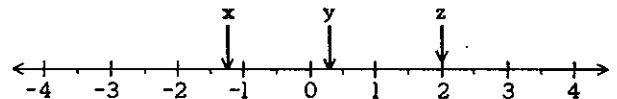
	Column A	Column B
		$y < x$
13.	$x - y$	$y - x$

14.	$\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32}$	1
-----	---	---



- | | | |
|-----|---|---|
| 15. | The total number of ways you can go from Colton to Erie if you follow the arrows on the map | The total number of ways you can go from Colton to Monroe if you follow the arrows on the map |
|-----|---|---|

Questions 16-18 refer to the number line below.



16.	1	yz
17.	w	$-y$
18.	x	$\frac{1}{x}$

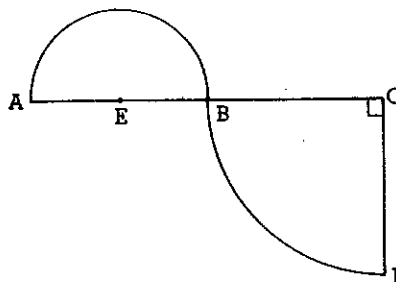
		$\frac{5}{x} = \frac{1}{3}$
19.	$\frac{3}{x}$	$\frac{1}{5}$

GO ON TO THE NEXT PAGE

5

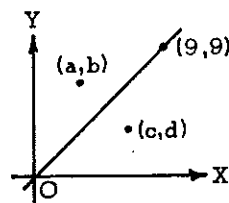
<u>Column A</u>	<u>Column B</u>
n is an integer	
20. n	$(-1)n$
21. Number of minutes in 1 week	Number of seconds in 7 hours
22. The volume of a cube of edge 6	Eight times the volume of a cube of edge 3
Ted picks a number at random between 1 and 100. Sam guesses 37 and Mike guesses 42.	
23. The probability that Sam will be closer to Ted's number	The probability that Mike will be closer to Ted's number
24. Length of the hypotenuse of a right triangle with legs 10 and 15	Length of the side of a square with area 324

Column A Column B



B is the midpoint of segment AC; AB and BD are arcs of circles with centers at E and C, respectively.

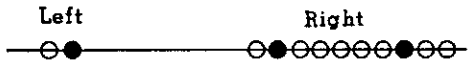
25. Length of arc AB	Length of arc BD
26. The ratio $\frac{a}{a+1}$ where $100 < a < 200$	The ratio $\frac{b}{b+2}$ where $200 < b < 1,000$



27. $a + d$ $b + c$

GO ON TO THE NEXT PAGE

Solve each of the remaining problems in this section using any available space for scratchwork. Then indicate the one correct answer in the appropriate space on the answer sheet.



28. The figure above shows a rod with black and white beads. How many beads must be slid from the right to the left so that one-fourth of the beads on each side are black?
- (A) Two (B) Four (C) Five
(D) Six (E) Nine

Questions 29-30 refer to the following score card.

ANNUAL SWIM MEET

School	Back Stroke	Side Stroke	Crawl	Total
Jefferson				7
Lincoln				9
Washington				

The figure above shows the score card for a swim meet in which there were 3 races and no ties. In each race, points were awarded as follows: 5 points for first place, 3 points for second place, and 1 point for third place.

29. What was Washington's total score?
- (A) 5 (B) 11 (C) 15 (D) 16 (E) 27
30. What is the greatest number of third places that Lincoln could have taken?
- (A) 3 (B) 2 (C) 1 (D) 0
(E) It cannot be determined from the information given.
31. If the ratio of p to q is $\frac{3}{5}$ and the ratio of q to r is $\frac{10}{13}$, then the ratio of p to r is
- (A) $\frac{1}{2}$ (B) $\frac{6}{13}$ (C) $\frac{5}{13}$ (D) $\frac{3}{10}$ (E) $\frac{3}{13}$

32.
$$\begin{array}{r} AB \\ + AB \\ \hline CD \end{array}$$

- A, B, C, and D are different digits in the correctly worked sum of 2 two-digit numbers above. If A and B are even numbers and if B is equal to twice A, then C is
- (A) 2 (B) 4 (C) 6 (D) 7 (E) 9
33. If $J = \frac{rK}{M+r}$, then $r =$

- (A) $\frac{JM}{K-J}$
(B) $\frac{JM}{J-K}$
(C) $\frac{JM}{K-1}$
(D) $\frac{M}{-K}$
(E) $\frac{M}{K}$

34. How many cubes, each with surface area of 54 square centimeters, are needed to form 2 cubes, each with surface area of 216 square centimeters?
- (A) 4
(B) 8
(C) 10
(D) 16
(E) 32
35. The sum of 10 numbers is what per cent of the average of the 10 numbers?
- (A) 0.001% (B) 2% (C) 10%
(D) 200% (E) 1,000%

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS SECTION ONLY.
DO NOT WORK ON ANY OTHER SECTION IN THE TEST.

S.A.T. (B)

2

SECTION 2

Time—30 minutes

25 QUESTIONS

In this section solve each problem, using any available space on the page for scratchwork. Then decide which is the best of the choices given and blacken the corresponding space on the answer sheet.

The following information is for your reference in solving some of the problems.

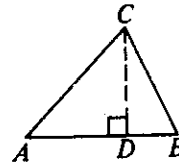
Circle of radius r : Area = πr^2 ; Circumference = $2\pi r$

The number of degrees of arc in a circle is 360.

The measure in degrees of a straight angle is 180.

Definitions of symbols:

=	is equal to	\leq	is less than or equal to
\neq	is unequal to	\geq	is greater than or equal to
<	is less than	\parallel	is parallel to
>	is greater than	\perp	is perpendicular to



Triangle: The sum of the measures in degrees of the angles of a triangle is 180.

If $\angle CDA$ is a right angle, then

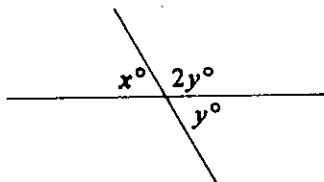
$$(1) \text{ area of } \triangle ABC = \frac{AB \times CD}{2}$$

$$(2) AC^2 = AD^2 + DC^2$$

Note: Figures which accompany problems in this test are intended to provide information useful in solving the problems. They are drawn as accurately as possible EXCEPT when it is stated in a specific problem that its figure is not drawn to scale. All figures lie in a plane unless otherwise indicated. All numbers used are real numbers.

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

- (A) -5 (B) $-\sqrt[3]{5}$ (C) $\sqrt[3]{5}$ (D) 5 (E) 5^3



2. In the figure above, two lines intersect as shown. What is the value of x ?

- (A) 30 (B) 60 (C) 90 (D) 120 (E) 180

3. If $x = -3$ and $y = 0$, then $x^2y + \frac{y}{x} =$

- (A) 9
(B) 6
(C) 3
(D) 0
(E) -3

4. The number 99,999,999 is NOT divisible by

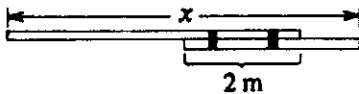
- (A) 9 (B) 11 (C) 99
(D) 111 (E) 9,999

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Sun.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.
						30
29	28	27	26	25	24	23
22	21	20	19	18	17	16

5. If the days of a month are numbered consecutively backward as shown on the partial calendar above, on what day of the week will the day numbered 1 occur?

(A) Sunday (B) Monday (C) Tuesday
(D) Friday (E) Saturday



6. In the figure above, a 5-meter pole and a 3-meter pole are tied together so that the length of the overlapping portion is 2 meters. What is the length x of the two poles combined in this way?

(A) 4 m
(B) 5 m
(C) 6 m
(D) 7 m
(E) 8 m

Questions 7-8 refer to the following price list.

PLACE SETTING OF TABLEWARE

Item	Price
Dinner plate	\$2.95
Salad plate	\$2.45
Bowl	\$2.20
Cup	\$1.95
Saucer	\$1.90

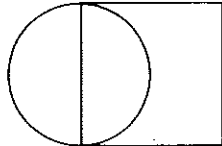
7. Charles bought one of each of the 5 items listed. What was the average (arithmetic mean) price per item for the 5 items?
- (A) \$2.00 (B) \$2.21 (C) \$2.29
(D) \$2.32 (E) \$2.39
8. If the price of each item in the list above is reduced by 10 percent during a sales promotion, which of the following is the amount of money saved by purchasing 8 saucers at the sale price?
- (A) \$1.52 (B) \$1.73 (C) \$13.68
(D) \$15.20 (E) \$17.00

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2

9. Of the following numbers, which is the LEAST?

- (A) 0.102
- (B) 0.11
- (C) 0.1201
- (D) 0.101
- (E) 0.1001



10. In the figure above, one side of the square is a diameter of the circle. If the area of the circle is p and the area of the square is s , which of the following must be true?

- I. $s > p$
- II. $s \geq 2p$
- III. $s < p$

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

List I: 1, 3, 5, 7
List II: 2, 4, 6, 8

11. For how many different ordered pairs, (x, y) , where x is a number from List I and y is a number from List II, is $x + y > 11$?

- (A) Nine
- (B) Seven
- (C) Six
- (D) Four
- (E) Three

12. If a and b are even integers, which of the following must be true?

- I. $\frac{a+b}{2}$ is odd.
- II. $a-b$ is even.
- III. $a+b$ is divisible by 2.

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

13. If $x^2 - y^2 = 27$, then $3(x+y)(x-y) =$

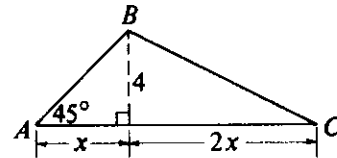
- (A) 9
- (B) 24
- (C) 27
- (D) 36
- (E) 81

14. Points $A, B, X,$ and Y lie on the same line but not necessarily in that order. Given the lengths $AB = 12, BX = 2,$ and $XY = 8,$ what is length AY ?

- (A) 2
- (B) 6
- (C) 18
- (D) 22
- (E) It cannot be determined from the information given.

15. When x is divided by 7, the remainder is 4. What is the remainder when $2x$ is divided by 7?

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



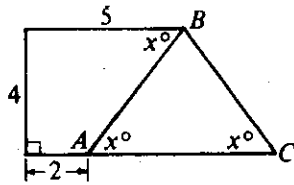
16. In $\triangle ABC$ above, what is the length of side AC ?

- (A) 24
- (B) 18
- (C) 12
- (D) 8
- (E) It cannot be determined from the information given.

17. If one hundred equally priced tickets cost a total of d dollars, then, in terms of d , five of these tickets cost how many dollars?

- (A) $\frac{d}{20}$
- (B) $\frac{d}{5}$
- (C) $5d$
- (D) $\frac{5}{d}$
- (E) $\frac{20}{d}$

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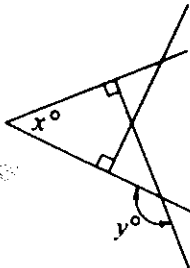


18. In the figure above, what is the area of $\triangle ABC$?

- (A) 12
- (B) 14
- (C) 16
- (D) 24
- (E) 28

19. In a certain period, an agency's editors read 4 out of every 20 scripts submitted. What was the ratio of unread scripts to scripts read during that time?

- (A) 3:4
- (B) 4:5
- (C) 5:4
- (D) 4:1
- (E) 5:1



20. In the figure above, what is y in terms of x ?

- (A) $90 + x$
- (B) $90 + 2x$
- (C) $180 - x$
- (D) $180 - 2x$
- (E) $2x$

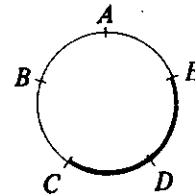
21. Ten people meet and everybody shakes hands exactly once with everybody else. What is the total number of handshakes?

- (A) 9
- (B) 10
- (C) 45
- (D) 50
- (E) 90

22. If $\frac{x}{y} = \frac{2}{3}$ and $\frac{y}{z} = \frac{-3}{2}$, which of the following must be true?

- I. $\frac{x}{z} = -1$
- II. $xy = 6$
- III. $(x + z)^2 = 0$

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



23. In the figure above, points $A, B, C, D,$ and E divide the circle into 5 equal arcs. If the area of the circle is 25π , what is the length of arc CDE ?

- (A) 2π
- (B) 4π
- (C) 5π
- (D) 8π
- (E) 10π

24. If x is an odd number, what is the sum of the next two odd numbers greater than $3x + 1$?

- (A) $6x + 8$
- (B) $6x + 6$
- (C) $6x + 5$
- (D) $6x + 4$
- (E) $6x + 3$

25. In a race, if Bob's running speed was $\frac{4}{5}$ Alice's, and Chris's speed was $\frac{3}{4}$ Bob's, then Alice's speed was how many times the average (arithmetic mean) of the other two runners' speeds?

- (A) $\frac{3}{5}$
- (B) $\frac{7}{10}$
- (C) $\frac{40}{31}$
- (D) $\frac{10}{7}$
- (E) $\frac{5}{3}$

S T O P

5

SECTION 5

Time—30 minutes

35 QUESTIONS

In this section solve each problem, using any available space on the page for scratchwork. Then decide which is the best of the choices given and blacken the corresponding space on the answer sheet.

The following information is for your reference in solving some of the problems.

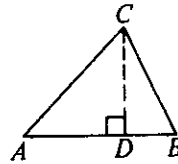
Circle of radius r : Area = πr^2 ; Circumference = $2\pi r$

The number of degrees of arc in a circle is 360.

The measure in degrees of a straight angle is 180.

Definitions of symbols:

=	is equal to	\leq	is less than or equal to
\neq	is unequal to	\geq	is greater than or equal to
<	is less than	\parallel	is parallel to
>	is greater than	\perp	is perpendicular to



Triangle: The sum of the measures in degrees of the angles of a triangle is 180:

If $\angle CDA$ is a right angle, then

$$(1) \text{ area of } \triangle ABC = \frac{AB \times CD}{2}$$

$$(2) AC^2 = AD^2 + DC^2$$

Note: Figures which accompany problems in this test are intended to provide information useful in solving the problems. They are drawn as accurately as possible EXCEPT when it is stated in a specific problem that its figure is not drawn to scale. All figures lie in a plane unless otherwise indicated. All numbers used are real numbers.

- If $\frac{9}{5} + \frac{x}{5} = 2$, then $x =$
(A) 0 (B) 1 (C) 2 (D) 3 (E) 4
- A triangle with sides of lengths 4, 8, and 9 has the same perimeter as an equilateral triangle with side of length
(A) $5\frac{1}{2}$ (B) 6 (C) $6\frac{1}{2}$ (D) 7 (E) $7\frac{1}{2}$
- If $x = \frac{y}{5}$ and $10x = 14$, then $y =$
(A) 28
(B) 14
(C) 7
(D) 5
(E) 2
- If 14 is 5 more than x and 12 is 3 less than y , then $x - y =$
(A) 24 (B) 6 (C) 0 (D) -2 (E) -6
- The memory capacity of one microcomputer is 4K bytes, whereas a larger computer has a memory capacity of 32K bytes ($K = 1,024$). The memory capacity of the larger computer is how many times that of the smaller?
(A) 6
(B) 6K
(C) 8
(D) 8K
(E) 28
- A set of numbers P is called "heavier" than a set of numbers Q if every number in P is exactly twice some number in Q . If $P = \{2, 6, 10, 14\}$, then P is "heavier" than which of the following?
(A) $\{\frac{1}{2}, \frac{3}{2}, \frac{5}{2}, \frac{7}{2}\}$
(B) $\{1, 2, 3, 4\}$
(C) $\{1, 3, 4, 7\}$
(D) $\{1, 3, 5, 7\}$
(E) $\{4, 12, 20, 28\}$
- In a certain city, the average (arithmetic mean) of the high temperature readings for four days was 63°F . If the high temperature readings on the first three days were 62°F , 56°F , and 68°F , respectively, what was the high reading on the fourth day in degrees Fahrenheit?
(A) 70 (B) 66 (C) 63 (D) 62 (E) 58

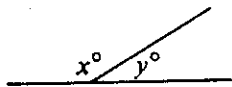
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Questions 8-27 each consist of two quantities, one in Column A and one in Column B. You are to compare the two quantities and on the answer sheet blacken space

- A if the quantity in Column A is greater;
- B if the quantity in Column B is greater;
- C if the two quantities are equal;
- D if the relationship cannot be determined from the information given.

- Notes:
1. In certain questions, information concerning one or both of the quantities to be compared is centered above the two columns.
 2. In a given question, a symbol that appears in both columns represents the same thing in Column A as it does in Column B.
 3. Letters such as x , n , and k stand for real numbers.

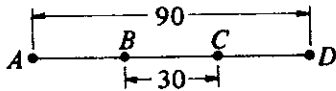
EXAMPLES			
	Column A	Column B	Answers
E1.	2×6	$2 + 6$	<input type="radio"/> A <input checked="" type="radio"/> B <input type="radio"/> C <input type="radio"/> D
E2.	$180 - x$	y	<input type="radio"/> A <input type="radio"/> B <input checked="" type="radio"/> C <input type="radio"/> D
E3.	$p - q$	$q - p$	<input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input checked="" type="radio"/> D



Column A Column B

8. 0 0×2

9. $a + 25$ $a - 5$



Note: Figure not drawn to scale.

On segment AD , length AB is not equal to length CD .

10. Length AC Length BD

When a certain pitcher contains 3 cups of water, the pitcher contains half its capacity.

11. The capacity, in cups, of the pitcher 6 cups

12. The cost of a stereo that is marked "15% off" The cost of a television set that is marked "20% off"

Column A Column B

$$x = -2$$

$$y = 1$$

13. The value of $3y^2 - 2x$ 0

A triangle has angles with measures x° , 100° , and z° .

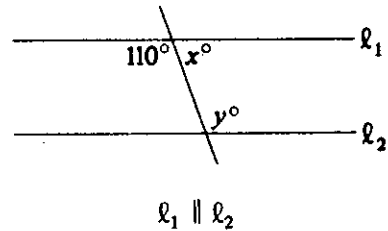
14. 90 x

15. $a(b + c)$ $b + c$

$$y = 2x + 3$$

$$x \geq 0$$

16. x y



17. $x + 40$ y

$$-1, 0, 1, -1, 0, 1, \dots$$

The numbers $-1, 0, 1$ repeat in a sequence as shown.

18. The 34th number in the sequence 0

GO ON TO THE NEXT PAGE

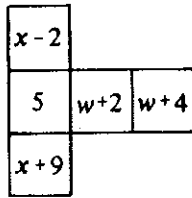
SUMMARY DIRECTIONS FOR COMPARISON QUESTIONS

- Answer: A if the quantity in Column A is greater;
 B if the quantity in Column B is greater;
 C if the two quantities are equal;
 D if the relationship cannot be determined from the information given.

Column A

Column B

19. A speed of one meter per second A speed of 60 meters per hour

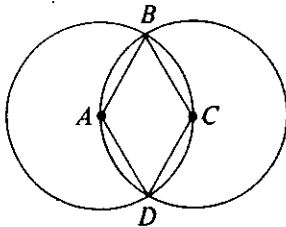


The sum of the three numbers in the column is equal to the sum of the three numbers in the row.

20. x w

The ratio of Tina's weight to Rita's weight is 3:2.
 The ratio of Rita's weight to Maria's weight is 1:2.

21. Tina's weight Maria's weight



The two circles have centers A and C , respectively, and diameter of length x . B and D are the points of intersection of the two circles.

22. Perimeter of quadrilateral $ABCD$ $2x$

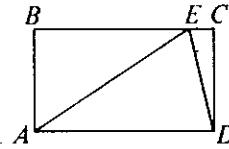
$$y > 2x - 1$$

$$x > y$$

23. x 1

Column A

Column B

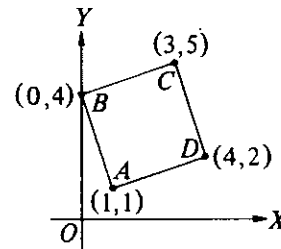


$ABCD$ is a rectangle.

24. Perimeter of $\triangle ABE$ Perimeter of $\triangle AED$

$2n + 1$ is a multiple of 3 and n is a positive integer less than 10.

25. n 5



26. Area of square $ABCD$ 10

x is called a "perfect hypercube" if $x = y^4$ and y is a positive integer.

27. The number of perfect hypercubes less than 1,000 5

GO ON TO THE NEXT PAGE

Solve each of the remaining problems in this section using any available space for scratchwork. Then decide which is the best of the choices given and blacken the corresponding space on the answer sheet.

28. The number of seniors at East High School is $\frac{2}{3}$ the number of juniors and the number of juniors is $\frac{3}{4}$ the number of sophomores. What is the number of seniors if the total enrollment for the three classes is 360?

(A) 160 (B) 120 (C) 100
(D) 80 (E) 60

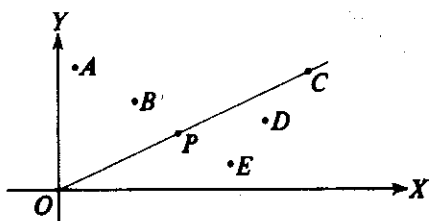
Questions 29-30 refer to the operation defined by the equation $a \oplus b = ab + a$.

29. $3 \oplus 4 =$

(A) 7
(B) 12
(C) 15
(D) 16
(E) 21

30. If $4 \oplus 6 = x \oplus 5$, then $x =$

(A) 3 (B) $\frac{14}{3}$ (C) $\frac{24}{5}$ (D) 5 (E) 6

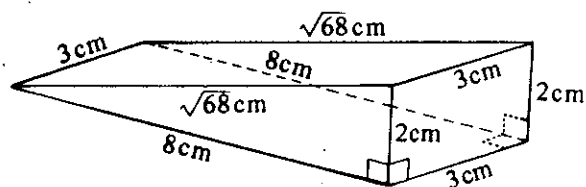


31. In the graph above, point P has coordinates (x, y) . If $r > x > y > s$, which of the following points could have coordinates (r, s) ?

(A) A (B) B (C) C (D) D (E) E

32. If $3 = b^x$, then $3b$ must equal

(A) b^{x+1}
(B) b^{x+2}
(C) b^{x+3}
(D) b^{2x}
(E) b^{3x}



33. If the wedge above is half of a rectangular solid, what is the total surface area of this wedge in square centimeters?

(A) $\sqrt{68} + 14$
(B) $\sqrt{68} + 46$
(C) $6\sqrt{68} + 14$
(D) $3\sqrt{68} + 46$
(E) $6\sqrt{68} + 46$

34. Jim is now twice as old as Polly. In 2 years Jim will be n years old. In terms of n , how old will Polly be then?

(A) $\frac{n}{2}$
(B) $\frac{n}{2} + 1$
(C) $\frac{n}{2} + 2$
(D) $n + 2$
(E) $2n$

35. The price of a shirt, after it was reduced 20 percent, was P dollars. What was the price of the shirt before the reduction?

(A) $\$1.80P$ (B) $\$1.25P$ (C) $\$1.20P$
(D) $\$0.80P$ (E) $\$0.75P$

S T O P

S.A.T. (C)

SECTION 2

Time—30 minutes

25 QUESTIONS

In this section solve each problem, using any available space on the page for scratchwork. Then decide which is the best of the choices given and blacken the corresponding space on the answer sheet.

The following information is for your reference in solving some of the problems.

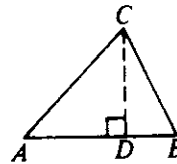
Circle of radius r : Area = πr^2 ; Circumference = $2\pi r$

The number of degrees of arc in a circle is 360.

The measure in degrees of a straight angle is 180.

Definitions of symbols:

=	is equal to	\leq	is less than or equal to
\neq	is unequal to	\geq	is greater than or equal to
<	is less than	\parallel	is parallel to
>	is greater than	\perp	is perpendicular to



Triangle: The sum of the measures in degrees of the angles of a triangle is 180.

If $\angle CDA$ is a right angle, then

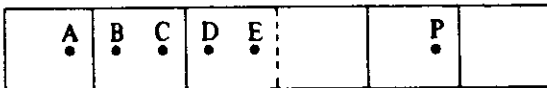
$$(1) \text{ area of } \triangle ABC = \frac{AB \times CD}{2}$$

$$(2) AC^2 = AD^2 + DC^2$$

Note: Figures which accompany problems in this test are intended to provide information useful in solving the problems. They are drawn as accurately as possible EXCEPT when it is stated in a specific problem that its figure is not drawn to scale. All figures lie in a plane unless otherwise indicated. All numbers used are real numbers.

1. If $22 \times 3 \times Q = 6$, then $Q =$

(A) $\frac{1}{11}$ (B) $\frac{1}{10}$ (C) 10 (D) 11 (E) 20

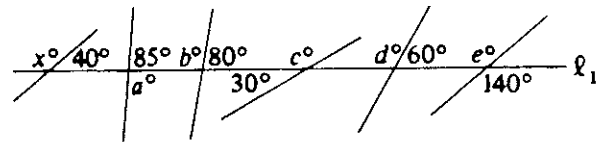


2. All the boxes in the strip above are of equal size. When the strip is folded together along the dotted line, point P is most likely to coincide with point

(A) A (B) B (C) C (D) D (E) E

3. How many tenths of a mile will a car travel on a 100-mile trip?

(A) 1,000
(B) 100
(C) 10
(D) 1
(E) $\frac{1}{10}$



4. In the figure above, six segments intersect line l_1 . Which of the degree measures, a , b , c , d , or e , is equal to x ?

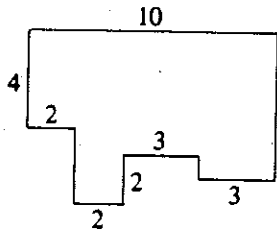
(A) a (B) b (C) c (D) d (E) e

5. A grocer has 100 apples, 100 oranges, and 100 pears. If he packs 1 apple, 2 oranges, and 1 pear in a bag, then the maximum number of bags he can fill in this manner is

(A) 20
(B) 25
(C) 50
(D) 75
(E) 100

GO ON TO THE NEXT PAGE

2



Note: Figure not drawn to scale.

6. What is the perimeter of the figure above?
 (A) 15 (B) 20 (C) 26 (D) 32
 (E) It cannot be determined from the information given.

7. $(45)^2 + 2(45)(55) + (55)^2 =$
 (A) 5,050
 (B) 9,100
 (C) 9,900
 (D) 10,000
 (E) 14,950

8. Add $8x$ to $2x$ and then subtract 5 from the sum. If x is a positive integer, the result must be an integer multiple of
 (A) 2
 (B) 5
 (C) 8
 (D) 10
 (E) 15

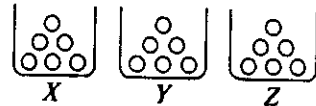
9. A line segment containing the points $(0, 0)$ and $(12, 8)$ will also contain the point
 (A) $(2, 3)$
 (B) $(2, 4)$
 (C) $(3, 2)$
 (D) $(3, 4)$
 (E) $(4, 2)$

10. If $x < 2$, which of the following is NOT true?
 (A) $2 + x < 2 + 2$
 (B) $x - 2 < 2 - 2$
 (C) $x(2) < 2(2)$
 (D) $2 - x < 2 - 2$
 (E) $\frac{x}{2} < \frac{2}{2}$

11. If $2\frac{3}{8} = 1 + \frac{x}{24}$, then $x =$
 (A) 9
 (B) 27
 (C) 30
 (D) 33
 (E) 57

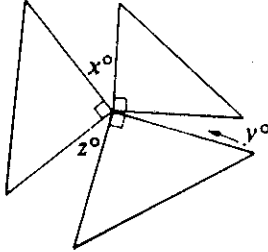
$$\begin{array}{r} 235 \\ \times 4\Delta 7 \\ \hline 1645 \\ 1\Box 10 \\ \hline 940 \\ \hline 10\otimes 745 \end{array}$$

12. In the multiplication problem above, if Δ , \Box , and \otimes represent digits, what digit does \Box represent?
 (A) 2
 (B) 3
 (C) 4
 (D) 5
 (E) 6



13. Each jar above contains 6 marbles. What is the LEAST number of marbles that must be transferred to make the ratio marbles in X : marbles in Y : marbles in Z = 3 : 2 : 1?
 (A) 6 (B) 5 (C) 4 (D) 3 (E) 2

GO ON TO THE NEXT PAGE



14. In the figure above, three right triangles have a common vertex. $x + y + z =$

(A) 90 (B) 120 (C) 135
(D) 180 (E) 270

15. If $x \neq 0$, which value(s) of p satisfy the equation $px = p^3x$?

(A) 0 only (B) 1 only (C) 1 or -1 only
(D) 0 or 1 only (E) 0, 1, or -1

16. Sue ate $\frac{1}{3}$ of a sandwich at noon and then $\frac{1}{2}$ of the remainder at supper. What part of the sandwich remained uneaten?

(A) $\frac{1}{6}$ (B) $\frac{1}{5}$ (C) $\frac{1}{3}$ (D) $\frac{1}{2}$ (E) $\frac{2}{3}$

17. If the diameter of a bicycle wheel is 0.5 meter, how many meters has the center of the wheel traveled when the wheel has made 3 complete revolutions along a straight road?

(A) $\frac{3\pi}{2}$
(B) 3π
(C) 12π
(D) $\frac{25\pi}{2}$
(E) 25π

18. If S is the sum of 7, 5, 2, 4, and x , what must be the value of x in order for x to equal $\frac{1}{4}S$?

(A) 4
(B) 4.5
(C) 6
(D) 18
(E) 24

	Carson	Greco	Polo	Rand
Carson	0	5	5	1
Greco	5	0	10	4
Polo	5	10	0	6
Rand	1	4	6	0

19. The chart above shows distances in kilometers between four towns that are located along a straight road. Which of the following could be a correct order relationship for these towns along the road?

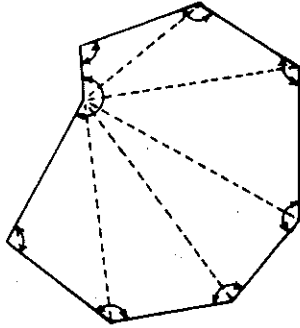
(A) Carson, Polo, Rand, Greco
(B) Carson, Rand, Greco, Polo
(C) Greco, Carson, Rand, Polo
(D) Polo, Carson, Rand, Greco
(E) Rand, Carson, Polo, Greco

20. If $3 < x < 7$ and $4 < y < 7$, which of the following best describes $x - y$?

(A) $-4 < x - y < 3$
(B) $0 < x - y < 4$
(C) $3 < x - y < 4$
(D) $3 < x - y < 7$
(E) $4 < x - y < 7$

GO ON TO THE NEXT PAGE 

2



21. In the figure above, what is the average (arithmetic mean) degree measure of the 8 marked angles?

- (A) 180 (B) 135 (C) 120 (D) 90
(E) It cannot be determined from the information given.

22. For which of the following pairs of numbers is the square of one of the numbers the reciprocal of the other number?

- I. 0.25, 2
II. 1, 1
III. 0.5, 4
- (A) I only (B) II only (C) III only
(D) I and II only (E) I, II, and III

23. 25 percent of 300 is equal to 7.5 percent of

- (A) 10
(B) 75
(C) 90
(D) 100
(E) 1,000

24. What is the volume of a cube with surface area $54x^2$?

- (A) $9x^2$ (B) $27x^3$ (C) $81x^2$
(D) $81x^3$ (E) $729x^3$

25. A woman drove to work at an average speed of 40 miles per hour and returned along the same route at 30 miles per hour. If her total traveling time was 1 hour, what was the total number of miles in the round trip?

- (A) 30
(B) $30\frac{1}{7}$
(C) $34\frac{2}{7}$
(D) 35
(E) 40

S T O P

IF YOU FINISH BEFORE TIME IS CALLED, YOU MAY CHECK YOUR WORK ON THIS SECTION ONLY.
DO NOT WORK ON ANY OTHER SECTION IN THE TEST.

SECTION 5
Time—30 minutes
35 QUESTIONS

In this section solve each problem, using any available space on the page for scratchwork. Then decide which is the best of the choices given and blacken the corresponding space on the answer sheet.

The following information is for your reference in solving some of the problems.

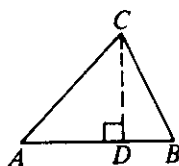
Circle of radius r : Area = πr^2 ; Circumference = $2\pi r$

The number of degrees of arc in a circle is 360.

The measure in degrees of a straight angle is 180.

Definitions of symbols:

- | | |
|----------------------|------------------------------------|
| = is equal to | \leq is less than or equal to |
| \neq is unequal to | \geq is greater than or equal to |
| $<$ is less than | \parallel is parallel to |
| $>$ is greater than | \perp is perpendicular to |



Triangle: The sum of the measures in degrees of the angles of a triangle is 180.

If $\angle CDA$ is a right angle, then

(1) area of $\triangle ABC = \frac{AB \times CD}{2}$

(2) $AC^2 = AD^2 + DC^2$

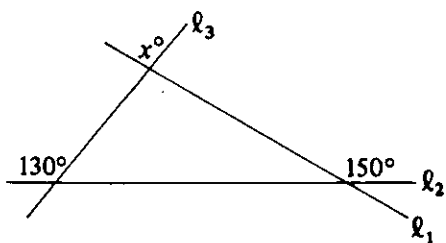
Note: Figures which accompany problems in this test are intended to provide information useful in solving the problems. They are drawn as accurately as possible EXCEPT when it is stated in a specific problem that its figure is not drawn to scale. All figures lie in a plane unless otherwise indicated. All numbers used are real numbers.

1. $22,222 + (5 \times 10^3) =$

- (A) 22,722
- (B) 25,222
- (C) 27,222
- (D) 52,222
- (E) 72,222

2. A gasoline tank on a certain tractor holds 16 gallons of gasoline. If the tractor requires 7 gallons to plow 3 acres, how many acres can the tractor plow with a tankful of gasoline?

- (A) $6\frac{6}{7}$ (B) $7\frac{1}{6}$ (C) $7\frac{1}{3}$
- (D) $10\frac{2}{3}$ (E) $37\frac{1}{3}$



3. If l_1 , l_2 , and l_3 intersect as shown above, then $x =$

- (A) 30 (B) 50 (C) 60 (D) 90 (E) 100

4. What is the maximum possible number of digits in the product of two whole numbers each having two digits?

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

Questions 5-6 refer to the following definition:

Let $D \times B$ be defined as

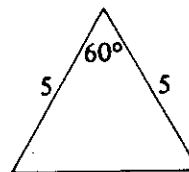
$$D \times B = (A \times C) - (B \times D)$$

5. If $x \times 3 = 10$, then $x =$

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

6. $y \times 2 + 4 \times y - y \times 0 =$

- (A) $y \times 1$ (B) $6y \times 1$ (C) $4 \times 2y$
- (D) $5 \times y$ (E) $3 \times 2y$



7. The perimeter of the triangle above is

- (A) $5\sqrt{2}$ (B) 10 (C) 12.5
- (D) 15 (E) 25

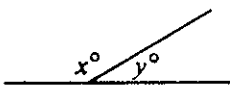
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5

Questions 8-27 each consist of two quantities, one in Column A and one in Column B. You are to compare the two quantities and on the answer sheet blacken space

- A if the quantity in Column A is greater;
- B if the quantity in Column B is greater;
- C if the two quantities are equal;
- D if the relationship cannot be determined from the information given.

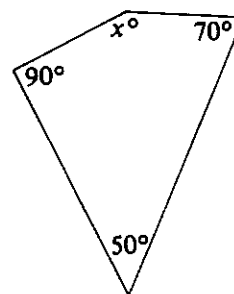
- Notes:**
1. In certain questions, information concerning one or both of the quantities to be compared is centered above the two columns.
 2. In a given question, a symbol that appears in both columns represents the same thing in Column A as it does in Column B.
 3. Letters such as x , n , and k stand for real numbers.

EXAMPLES			
	Column A	Column B	Answers
E1.	2×6	$2 + 6$	<input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D
E2.		y	<input type="radio"/> A <input type="radio"/> B <input checked="" type="radio"/> C <input type="radio"/> D
E3.	$p - q$	$q - p$	<input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input checked="" type="radio"/> D

	Column A	Column B
8.	$\frac{2}{3} \times N$	$\frac{1}{3} \times 2N$
9.	$\begin{array}{r} x \\ 17 \overline{)3536} \end{array}$ x is the quotient.	x
10.	Average speed, in kilometers per hour, required to travel a distance of 100 kilometers in 2 hours	Average speed, in kilometers per hour, required to travel a distance of 100 kilometers in one-half hour

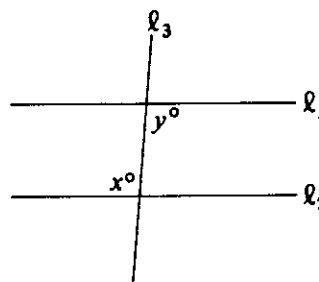
11.	$4 + 5 + n$	$4 + 5 + 12$
-----	-------------	--------------

Column A Column B



12.	x	170°
$x > 0$		

13.	$\frac{x^2 + 2x}{x}$	2
-----	----------------------	---



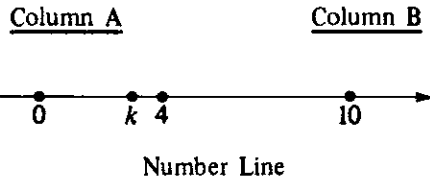
Line l_3 intersects parallel lines l_1 and l_2 .

14.	$x + y$	$2x$
-----	---------	------

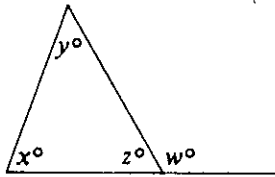
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SUMMARY DIRECTIONS FOR COMPARISON QUESTIONS

- Answer: A if the quantity in Column A is greater;
 B if the quantity in Column B is greater;
 C if the two quantities are equal;
 D if the relationship cannot be determined from the information given.



- | | |
|---------|----------|
| 15. k | $10 - k$ |
|---------|----------|

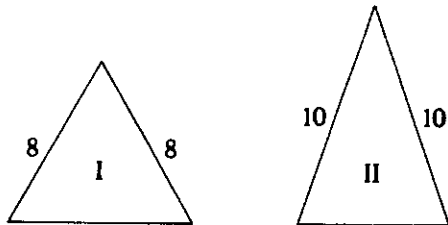


$w = 120$ and $x > y$

- | | |
|---------|-----|
| 16. y | z |
|---------|-----|

$2x < 12 < 3x$ and
 x is an integer.

- | | |
|---------|-----|
| 17. x | 4 |
|---------|-----|



Note: Figures not drawn to scale.

- | | |
|------------------------|---------------------|
| 18. Area of triangle I | Area of triangle II |
|------------------------|---------------------|

$$\frac{0.8}{0.04} = \frac{0.04}{x}$$

- | | |
|---------|-------|
| 19. x | 0.002 |
|---------|-------|

$p > 0 > n$

- | | |
|---------|---------|
| 20. p | $n + p$ |
|---------|---------|

<u>Column A</u>	<u>Column B</u>
-----------------	-----------------

- | | |
|--|--|
| 21. The number of distinct positive integer divisors of 12 | The number of distinct positive integer divisors of 16 |
|--|--|

For all real numbers x and y , let \odot be defined as $x \odot y = (x + y)^2$.

- | | |
|-----------------|----------------|
| 22. $p \odot q$ | $p \odot (-q)$ |
|-----------------|----------------|

$$(x + y)z = 0$$

$$(x + y) - z = x$$

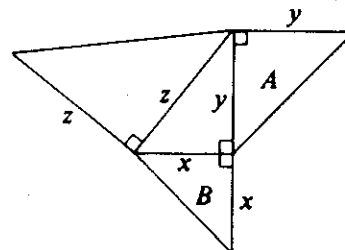
- | | |
|---------|-----|
| 23. y | z |
|---------|-----|

- | | |
|---------------------------------------|-----|
| 24. $\frac{\frac{2}{3}}{\frac{3}{2}}$ | 1 |
|---------------------------------------|-----|

- | | |
|------------------|--------------|
| 25. 15% of 2,000 | 2,000% of 15 |
|------------------|--------------|

x and y are integers
and $x > y > 1$.

- | | |
|-----------|-------|
| 26. x^y | y^x |
|-----------|-------|



- | | |
|---|-----------------|
| 27. Sum of the areas of triangles A and B above | $\frac{z^2}{2}$ |
|---|-----------------|

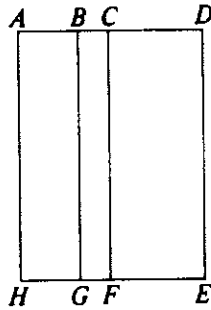
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5

Solve each of the remaining problems in this section using any available space for scratchwork. Then decide which is the best of the choices given and blacken the corresponding space on the answer sheet.

28. If the average (arithmetic mean) of x and $3x$ is 8, then $x =$
- (A) 2
(B) 4
(C) 8
(D) 10
(E) 12

29. If n is an integer greater than 2, which of the following CANNOT be an even integer?
- (A) n^2 (B) $n(n - 1)$ (C) $n - 1$
(D) $3n + 1$ (E) $4n + 3$



30. In rectangle $ADEH$ above, BG and CF are parallel to AH . Given lengths $AB = 2$, $BC = 1$, $CD = 3$, and the length of DH , not shown, is equal to 10, what is the area of the small rectangle $BCFG$?
- (A) 8 (B) 10 (C) 16 (D) 24 (E) 48



31. The LEAST number of trees one would need in order to arrange 4 trees on each line of the plan above is
- (A) 5 (B) 10 (C) 14 (D) 15 (E) 20

32. If $\frac{1}{1 + \frac{1}{x}} = k$, which of the following equals $2k$?

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

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

33. Given four distinct lines, exactly two of which are parallel, which of the following could be the number of points where at least two of the lines intersect?
- I. Three
II. Four
III. Five
- (A) I only (B) III only (C) I and II only
(D) I and III only (E) I, II, and III

34. If B is 125 percent of C , then C is what percent of B ?
- (A) 50%
(B) $66\frac{2}{3}\%$
(C) 75%
(D) 80%
(E) 90%

35. If one side of a ruler is to be marked in $\frac{1}{8}$ -inch units and in $\frac{1}{10}$ -inch units on the same edge, how many different such marks are needed from the 1-inch mark to the 2-inch mark, including the end points?
- (A) 16 (B) 17 (C) 18 (D) 19 (E) 20

S T O P