Part I

Answer all questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Write your answers in the spaces provided.

1. Solve for \( a \): \( 12a - 5 = 10a - 3 \)

2. Solve for \( y \): \( 3(4 + y) = 4y \)

3. If the sum of two consecutive integers is 13, find the smaller integer.

4. Factor: \( x^2 - 100 \)

5. A copying machine can make 40 copies per minute. How many copies can the machine make in \( 3\frac{3}{4} \) minutes?

6. What is the slope of the line whose equation is \( y = \frac{3}{2}x + 7 \)?

7. If 20% of a number is 8, find the number.

8. Solve the following system of equations for \( x \):
   \[
   \begin{align*}
   5x - y &= 20 \\
   y &= 3x
   \end{align*}
   \]

9. Multiply and express as a trinomial: \( (x + 6)(x - 3) \)

10. If \( a^2 + b^2 = c^2 \), find the positive value of \( b \) when \( a = 12 \) and \( c = 13 \).

11. Solve for \( m \):
   \[
   \frac{5}{m} + 5 = 14
   \]

12. What is the greatest common factor of \( 18x \) and \( 12x^2 \)?

13. A vertical pole casts a shadow 10 feet long at the same time that a man 6 feet tall casts a shadow 4 feet long. What is the number of feet in the height of the pole?

14. Solve for \( x \) in terms of \( a, c \), and \( y \): \( ax + y = c \)

15. Find the value of \( \sqrt{86} \) to the nearest tenth.

16. If \( a = 3 \) and \( b = -2 \), find the value of \( ab^2 \).

17. Subtract \( 3x - 2 \) from \( 4x + 3 \).

18. The length of a side of an equilateral triangle is 2. What is the perimeter?

19. Express \( \frac{5}{x - 3} + \frac{5}{x} \) as a single fraction in simplest form.

20. Two numbers are in the ratio of 5 to 13. If the sum of the two numbers is 36, what is the larger number?
Directions (21-30): Write in the space provided the numeral preceding the expression that best completes each statement or answers each question.

21. The reciprocal of $\frac{1}{2}$ is (1) $-\frac{1}{2}$ (2) $1/25$ (3) $-5$ (4) 5 21____

22. If $2x + 7 > 23$ then (1) $x > 8$ (2) $x < 8$ (3) $x > 15$ (4) $x < 15$ 22____

23. The expression $\frac{14}{2} + 3(4 - 2)$ is equal to (1) 20 (2) 17 (3) 13 (4) 10 23____

24. A point on the line whose equation is $3x - 2y = 7$ is (1) $(0,-3)$ (2) $(1,-2)$ (3) $(3,2)$ (4) $(-2,1)$ 24____

25. In the accompanying diagram, the legs of right triangle $ABC$ are 15 and 8, and the hypotenuse is 17. Sin $A$ equals (1) $\frac{15}{8}$ (2) $\frac{15}{17}$ (3) $\frac{3}{17}$ (4) $\frac{8}{15}$ 25____

26. The solution set of $x^2 - 5x - 6 = 0$ is (1) $\{6,-1\}$ (2) $\{-6,1\}$ (3) $\{3,-2\}$ (4) $\{-2,-3\}$ 26____
27. Which graph represents the inequality \( y < 4 \)?

(1) \hspace{1cm} (3)

(2) \hspace{1cm} (4)

28. The expression \( \frac{x^2 + 2x - 3}{x^2 + 3x} \) is equivalent to \( \frac{x - 1}{x} \)

(1) \( \frac{x^2 + 2x - 3}{3x} \) \hspace{1cm} (2) \( \frac{2x - 3}{3x} \)

(3) \( \frac{1}{3} \) \hspace{1cm} (4) \( \frac{3}{x} \)

29. The expression \( (\sqrt{5})(\sqrt{12}) \) is equivalent to \( \sqrt{7} \)

(1) \( \sqrt{7} \) \hspace{1cm} (2) \( 2\sqrt{15} \)

(3) \( \sqrt{17} \) \hspace{1cm} (4) \( 4\sqrt{15} \)

30. Which is equivalent to the empty set? (1) the set of all even natural numbers greater than 12 (2) the set of integers that are multiples of 3 (3) the set of all natural numbers that are greater than 9 and less than 10 (4) the set of ordered pairs that satisfy the equation \( x + y = 10 \)

31. On the same set of coordinate axes, graph the following system of inequalities and label the solution set \( A \).

\[
\begin{align*}
x + y &> 6 \\
y &\leq 2x - 5
\end{align*}
\]

Answers:

27. (2)

28. (4)

29. (1)

30. (4)

31. \( A = \{(8, 2)\} \)
32. Answer both a and b.
   a Perform the indicated multiplication and express the result in simplest form:
   \[
   \frac{a^2 - 25}{5a^2} \cdot \frac{a^2 - 5a}{a^2 - 10a + 25}
   \]
   \[5\]
   b Solve for \(n\) and check:
   \[
   n - 4 = \frac{n - 1}{4}
   \] \[4, 1\]

33. Part of $4,000 is deposited in a credit union at 7%, and the remainder is put in a bank at 6%. The total annual interest from both investments is $265. Find the amount deposited at each rate. [Only an algebraic solution will be accepted.] \[5, 5\]

34. When the first of three consecutive positive integers is multiplied by the third, the result is 1 less than 6 times the second. Find the three integers. [Only an algebraic solution will be accepted.] \[5, 5\]

35. Write an equation or system of equations that can be used to solve each of the following problems. In each case state what the variable or variables represent. [Solution of the equations is not required.]
   a Two automobiles leave a certain place at the same time and travel in opposite directions. The rate of one is three-fourths the rate of the other. If they are 364 miles apart after 4 hours, what is the rate of each? \[5\]
   b Working alone, Maria can mow a lawn in 2 hours, and Adolf can do the job alone in 3 hours. How long will it take them to do the job if they work together? \[5\]

36. Answer both a and b.
   In right triangle \(ABC\), \(C\) is a right angle, \(AC = 4\), and \(BC = 7\).
   a Find, to the nearest degree, the measure of angle \(B\). \[5\]
   b Find, the the nearest integer, the length of \(AB\). \[5\]

37. Write the letters \(a\) through \(e\) on your answer paper and after each letter write the answer to the corresponding question below. \[10\]
   a What value of \(x\) will make \(\frac{3}{x + 2}\) undefined?
   b What number is the additive identity element?
   c The equation \(x^2 - 4 = 0\) has two roots. What is the smaller of these roots?
   d What is the additive inverse of \(-6\)?
   e Solve for \(x\): \(|x| = 9\)