Part I

Answer all questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed.

Directions (1-17): Write in the space provided on the answer sheet the numeral preceding the expression that best completes each statement or answers each question.

1. A value of $x$ which satisfies the inequality $x + 3 < 2x + 7$ is
   (1) $-5$ (2) $-10$ (3) $-3$ (4) $-4$ 1___

2. If $\cos x = \frac{3}{5}$ and angle $x$ lies in the fourth quadrant, what is the value of $\tan x$?
   (1) $\frac{5}{4}$ (2) $-\frac{5}{4}$ (3) $\frac{3}{4}$ (4) $-\frac{4}{3}$ 2___

3. The fraction $\frac{(x + 2)(x - 5)}{(x - 1)(x + 3)}$ is undefined for which value of $x$?
   (1) $-1$ (2) $-2$ (3) $-3$ (4) $5$ 3___

4. If $\sin A < 0$, in which quadrants may angle $A$ lie?
   (1) I, II (2) II, III (3) I, IV (4) III, IV 4___

5. The graph of the equation $\frac{x^2}{4} + \frac{y^2}{16} = 1$ is (1) a hyperbola
   (2) a parabola (3) a circle (4) an ellipse 5___

6. The numeral value of $\sin \frac{7\pi}{6}$ is
   (1) $1$ (2) $\frac{1}{2}$ (3) $-\frac{\sqrt{3}}{2}$ (4) $-\frac{\sqrt{3}}{2}$ 6___

7. The solution set of the equation $2x^2 + 5x - 3 = 0$ is
   (1) $\left\{ \frac{1}{2}, -3 \right\}$ (2) $\left\{ -\frac{1}{2}, 3 \right\}$ (3) (3) (4) $\left\{ -\frac{1}{2} \right\}$ 7___

8. If triangle $ABC$ is a right triangle and angle $C$ is the right angle, then which is always true?
   (1) $\sin A = \cos B$ (2) $\sin A \cos B - 1$ (3) $\sin A + \cos B = 1$ (4) $\sin A = \cos B = 1$ 8___

9. Which statement about the graphs of the equations $2x + 3y = 5$ and $2x + 3y = -5$ is true?
   (1) They coincide (2) They intersect (3) They are parallel (4) They are perpendicular 9___

10. The fraction $\frac{1}{x + 1}$ is equivalent to
    (1) $1$ (2) $1$ (3) $1$ (4) $1$ 10___
11. The equation $\sqrt{x} - 2 = x - 4$ is satisfied when $x$ is equal to (1) both 3 and 6 (2) 6, only (3) 3, only (4) neither 3 nor 6 11___

12. If $2^x = 7$, what is the numerical value of $2^{2x}$? (1) 49 (2) 14 (3) 5 (4) 4 12___

13. In the interval $0 < A < \frac{\pi}{2}$, which value of $A$ satisfies the equation $\tan^2 A - \tan A = 0$? (1) $\frac{\pi}{6}$ (2) $\frac{\pi}{2}$ (3) $\frac{\pi}{3}$ (4) $\frac{\pi}{4}$ 13___

14. The range of the function $y = 2\sin x$ is (1) $y \geq 1$ (2) $x \geq 1$ (3) $-2 \leq y \leq 2$ (4) $-2 \leq x \leq 2$ 14___

15. Which is the equation of the graph shown below?
(1) $y = \sin \frac{x}{2}$ (2) $y = \cos \frac{x}{2}$ (3) $y = \frac{1}{2} \sin x$ (4) $y = \frac{1}{2} \cos x$ 15___

16. Which is equivalent to $\sin x \cot x + \sec x \cos x$? (1) 1 (2) $\cos x$ (3) $\sin x + 1$ (4) $\cos x + 1$ 16___

17. If $m \angle B = 30$ and $AB = 10$, it is possible to construct two distinct triangles when $AC$ is (1) 10 (2) 6 (3) 5 (4) 4 17___

Directions (18-30): Write your answers in the spaces provided on the answer sheet. Unless otherwise specified, answers may be left in terms of $\pi$ or in radical form.

18. What is the solution set of the equation $50(x - \frac{1}{2}) = 45x$? 18_____

19. If $y = \text{Arc} \sin \left( \frac{\sqrt{2}}{2} \right)$, what is the value of $y$? 19_____

20. If $x$ varies inversely as $y$ and $x = 8$ when $y = 3$, find $x$ when $y = 6$. 20_____

21. When the number 56,100,000 is written in the form of $5.61 \times 10^n$, what is the value of $n$? 21_____

22. Solve for $x$: $2x + 3y = 13$
$5x - 2y = 4$ 22_____

23. Steve has $1.40 in nickels and dimes. If he has twice as many nickels as dimes, how many dimes does he have? 23_____

24. Solve for the positive value of $x$: $\frac{2x}{3\sqrt{2}} = \frac{3\sqrt{2}}{x}$ 24_____

25. In triangle $ABC$, $a = 8$, $b = 12$, and $\sin A = \frac{1}{2}$. Find the value of $\sin B$. 25_____
26. If \( f(x) = x^{1/4} - 4x^0 \), evaluate \( f(8) \) in simplest form.

27. Express \( \frac{1}{3 + \sqrt{2}} \) as a fraction with a rational denominator.

28. Using logarithms, find the value of \( \sqrt[5]{5} \) to the nearest hundredth.

29. In a circle, a central angle of 1 radian intercepts an arc of 2 centimeters. What is the length in centimeters of the radius of this circle?

30. What is the value of \( \tan 23^\circ 38' \) to four decimal places?

Part II

Answer four questions from this part. Show all work unless otherwise directed.

31. \( a \) Find, to the nearest tenth, the value(s) of \( \tan \theta \) which satisfy the equation \( \tan^2 \theta - 3 \tan \theta + 1 = 0 \). [8]

\( b \) Using the answer(s) obtained in part \( a \), find the quadrant(s) in which angle \( \theta \) may lie. [2]

32. A pendulum formula is given by the equation below:

\[ t = 6.28 \sqrt{\frac{L}{32.2}} \]

Using logarithms, find \( t \) to the nearest tenth if \( L = 25.5 \). [10]

33. If the perimeter of a rectangle is 46 units and its diagonal is 17 units, find its length and width. [Only an algebraic solution will be accepted.] [5, 5]

34. \( a \) On the same set of axes, sketch the graphs of \( y = 2 \cos \frac{1}{2}x \) and \( y = \frac{1}{2} \) for values of \( x \) in the interval \(-\pi \leq x \leq \pi \). [Label each graph with its equation.] [6, 2]

\( b \) From the graphs sketched in part \( a \), find the number of values of \( x \) in the interval \(-\pi \leq x \leq \pi \) that satisfy \( 2 \cos \frac{1}{2}x = \frac{1}{2} \). [2]

35. Given: obtuse angle \( x \) and \( \sin x = \frac{24}{25} \).

Find:

\( a \) \( \sin \frac{x}{2} \) [5]

\( b \) \( \sin 2x \) [5]

36. The sides of triangle \( ABC \) are \( a = 10 \), \( b = 12 \), and \( c = 18 \). Find, to the nearest degree, the measure of the largest angle of triangle \( ABC \). [10]

37. \( a \) On the same set of axes, graph the following system of inequalities:

\[ y \geq x^2 - 2x - 8 \text{ and } x - y + 2 > 0 \] [8]

\( b \) Find the coordinates of a third quadrant point with integer values which satisfies the system in part \( a \). [2]