Examination January, 1977  Ninth Year Mathematics

Elementary Algebra

PART ONE  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. If three times a certain number is decreased by 7, the result is 20. What is the number?  
   \[ 3n - 7 = 20 \]
   \[ n = \frac{27}{3} = 9 \]
   \[ \boxed{9} \]

2. Solve for \( y \):  
   \[ \frac{y + 1}{12} = \frac{3}{4} \]
   \[ y + 1 = 9 \]
   \[ y = 8 \]
   \[ \boxed{8} \]

3. Solve for \( x \):  
   \[ 3x = 2(5 - x) \]
   \[ 3x = 10 - 2x \]
   \[ 5x = 10 \]
   \[ x = 2 \]
   \[ \boxed{2} \]

4. Solve for \( x \):  
   \[ 5 - 2x = -3 \]
   \[ -2x = -8 \]
   \[ x = 4 \]
   \[ \boxed{4} \]

5. If \( x = -3 \), find the value of \( 2x^2 \).  
   \[ 2(-3)^2 = 2(9) = 18 \]
   \[ \boxed{18} \]

6. Express in lowest terms:  
   \[ \frac{8x^4y^3}{2xy^3} \]
   \[ \frac{8x^4y^3}{2xy^3} = \frac{4x^3}{1} = 4x^3 \]
   \[ \boxed{4x^3} \]

7. The legs of a right triangle are 9 and 12. What is the length of the hypotenuse?  
   \[ c = \sqrt{9^2 + 12^2} = \sqrt{81 + 144} = \sqrt{225} = 15 \]
   \[ \boxed{15} \]

8. Find the numerical value of \( | -7 | + | 10 | \).  
   \[ | -7 | + | 10 | = 7 + 10 = 17 \]
   \[ \boxed{17} \]

9. Find the positive square root of 55 to the nearest tenth.  
   \[ \sqrt{55} \approx 7.4 \]
   \[ \boxed{7.4} \]

10. A person 5 feet tall is standing near a tree 30 feet high. If the person's shadow is 4 feet long, how many feet long is the shadow of the tree?  
    \[ \text{Shadow of tree} = \frac{30}{5} \times 4 = 6 \times 4 = 24 \text{ feet} \]
    \[ \boxed{24} \]
11. Find the positive root of \(2x^2 = 72\).

12. If \(\cos x = .4020\), find the measure of angle \(x\) to the nearest degree.

13. What is the slope of the line whose equation is \(2x - y = 3\)?

14. Solve the following system of equations for \(x\):
   \[
   y = 2x \\
   x + y = 6
   \]

15. Express the sum of \(\frac{x}{3}\) and \(\frac{x}{2}\) as a single fraction in simplest form.

16. Two numbers are in the ratio 1:5 and their sum is 54. Find the smaller number.

17. Express in terms of \(a\) the average (arithmetic mean) of \(2a + 4\) and \(4a - 2\).

18. Solve for \(x\) in terms of \(a, b,\) and \(c\):
   \[a + bx = c\]

19. Factor completely: \(3x^2 + 2x - 5\)

DIRECTIONS (20-30): Write in the space provided the numeral preceding the expression that best completes each statement or answers each question.

20. Which number does not have a reciprocal?
   (1) 1   (2) -2   (3) \(\frac{1}{2}\)   (4) 0

21. A member of the solution set of \(2x - 3 \geq 9\) is
   (1) 7   (2) 5   (3) 3   (4) -3

22. Which represents the area of a rectangle whose length is \(x + 1\) and whose width is \(x - 1\)?
   (1) \(x^2 + 1\)   (2) \(2x\)   (3) \(x^2 - 1\)   (4) \(4x\)

23. The expression \(3(x + 4) = 3x + 12\) is an illustration of which property?
   (1) associative property of addition
(2) commutative property of addition
(3) transitive property of equality
(4) distributive property of multiplication over addition

24. The graph of the equation $y = 2$ is a line
(1) parallel to the y-axis
(2) parallel to the x-axis
(3) passing through the origin
(4) passing through the point (2,0)

25. Which expression is equivalent to $\sqrt{48}$?
(1) $16\sqrt{3}$  
(2) $4\sqrt{12}$  
(3) $4\sqrt{3}$  
(4) $2\sqrt{3}$

26. The solution set for $x^2 - x - 6 = 0$ is
(1) {2,3}  
(2) {2, -3}  
(3) {-2,3}  
(4) {-2,-3}

27. The number of feet in $c$ inches is
(1) $\frac{c}{12}$  
(2) $12c$  
(3) $\frac{12}{c}$  
(4) $36c$

28. Which is a subset of the set of integers?
(1) real numbers  
(2) natural numbers  
(3) rational numbers  
(4) irrational numbers

29. If $n - 2$ represents an even integer, what is the next larger even integer?
(1) $n$  
(2) $n - 1$  
(3) $n - 4$  
(4) $n + 2$

30. Which graph shows the solution set of $-1 \leq x < 3$?

(1) 
(2) 
(3) 
(4)
PART TWO  Answer four questions from this part. Show all work unless otherwise directed.

31. Answer either a or b but not both.
   
   a  Solve graphically and check:
      \[ x + y = 8 \]
      \[ 2x - y = 7 \]  
      [8,2]
      
      OR

   b  (1) On the same set of coordinate axes, graph the following system of inequalities:
      \[ y < x - 5 \]
      \[ y \geq -2x + 4 \]  
      [8]

      (2) Write the coordinates of a point in the solution set of this system.  
      [2]

32. Answer both a and b.

   a  Find the solution set:
      \[ \frac{5}{x} + 3x = \frac{17}{x} \]  
      [5]

   b  Express as a single fraction in lowest terms:
      \[ \left( \frac{y^2 - 9}{y^2 - 3y - 18} \right) \left( \frac{y - 6}{2y - 6} \right) \]  
      [5]

33. The length of a rectangle is 12 less than 3 times its width. The perimeter of the rectangle is 136. Find the dimensions of the rectangle.  
   [Only an algebraic solution will be accepted.]  
   [5,5]

34. A clerk wishes to mix candy selling for 65 cents per pound with candy selling for 90 cents per pound in order to produce 40 pounds of candy which can be sold for 75 cents per pound. How many pounds of each kind should be used?  
   [Only an algebraic solution will be accepted.]  
   [5,5]

35. In right triangle \( ABC \) shown in the accompanying diagram, hypotenuse \( AB = 11 \) and leg \( AC = 6 \).
a Find angle $B$ to the nearest degree. [5]

b Find $BC$ to the nearest integer. [5]

36. Find two consecutive positive integers such that the square of the first decreased by 25 equals three times the second. [Only an algebraic solution will be accepted.] [5,5]

37. The replacement set for $x$ for each of the open sentences below is $\{-2, -1, 0, 1, 2\}$. On your answer paper write the letters $a$ through $e$, and next to each write the solution set of each open sentence. [Each answer must be a subset of the replacement set.] [10]

$\begin{align*}
a & \quad (x + 1)(x + 2) = 0 \\
b & \quad -1 < x \leq 1 \\
c & \quad 5x + 1 > 3x + 1 \\
d & \quad x - 1 = 5 \\
e & \quad |x| = 2
\end{align*}$