Note: Throughout the test you may mark "E" for none of these answers.

For all questions, $i^2 = -1$ and all variables are real unless otherwise specified.

1. Evaluate
$$4(3 + 17) - 3(2 \times 6 - 2) + 2(2 + 8 \div 2) \times 2 + 10$$

   A. 84   B. 100   C. 338   D. 642   E. NOTA

2. Which answer is equivalent to the following product?
$$\left(\frac{1 + 2i}{3 - i}\right)\left(\frac{1 - 2i}{2 - i}\right)\left(\frac{2 + i}{3 + i}\right)$$

   A. $-\frac{3+4i}{8}$ B. $-\frac{5+4i}{8}$ C. $\frac{3+4i}{10}$ D. $\frac{5-4i}{10}$ E. NOTA

3. Which of the following lines is perpendicular to $y = 2 - \frac{4}{3}x$?
   A. $3x + 4y = 10$ B. $4x + 3y = 8$ C. $4x - 3y = 2$ D. $6x - 8y = 1$ E. NOTA

4. The volume of a spherical balloon varies directly with the time spent inflating it. If, after 2 seconds, the diameter is 3 centimeters, what will the diameter be after 16 seconds?
   A. 6   B. 12   C. 24   D. 48   E. NOTA

5. How many negative real roots does the following polynomial have?
$$5x^5 + 4x^3 - 3x^2 + 2x + 1 = 0$$

   A. 0   B. 1   C. 3   D. 4   E. NOTA

For questions 6-8, suppose $f(x) = 1 - 2\sqrt{8 + 2x - x^2}$.

6. What is the domain of f?
   A. $x < -2$ or $x > 4$ B. $x \le -2$ or $x \ge 4$ C. $-2 < x < 4$ D. $-2 \le x \le 4$ E. NOTA

7. What is the range of f?
   A. $-5 \le f(x) \le 1$ B. $f(x) \le -5$ or $f(x) \ge 1$ C. $f(x) \le 1$ D. $f(x) \ge 1$ E. NOTA

8. For what value of x if f(x) equal to –5?
   A. -5   B. -2   C. 1   D. 4   E. NOTA

9. How many positive integer factors does 720000 have?

   A. 30   B. 60   C. 120   D. 240   E. NOTA

10. Find the distance from the vertex to the focus of

$$4x = 2y^2 + 2y + 3$$

   A. $\frac{1}{8}$ B. $\frac{1}{2}$ C. 2   D. 8   E. NOTA

11. Suppose A and B are real numbers and $(A + Bi)^2 = i$. What is $A^2 + B^2$?

   A. 0   B. 1   C. $\sqrt{2}$ D. 2   E. NOTA

12. What is the inverse function of $f(x) = 4x + 8$?

   A. $8x + 4$ B. $-4x - 8$ C. $\frac{1}{4}x - 8$ D. $\frac{1}{4}x + 2$ E. NOTA

13. Find the area of the solution set of

$$x + y \leq 5$$
$$5x + y \geq 5$$
$$x - 3y \leq 1$$

   A. $\frac{15}{2}$ B. 8   C. $\frac{25}{2}$ D. 16   E. NOTA

14. Find the sum of the roots,

$$\log_2(x^3) - \log_2(4x^2) + (\log_2 x)^2 = 0$$

   A. $\frac{1}{4}$ B. 2   C. $\frac{9}{4}$ D. 4   E. NOTA

15. Evaluate

$$(\log_{11} 9)(\log_5 8)(\log_3 49)(\log_7 125)(\log_2 11)$$

   A. 6   B. 12   C. 24   D. 36   E. NOTA

16. How many distinct values of x satisfy the following equation?

$$2^x + \log_2(x^2 + 4) = 0$$

A. 0   B. 1   C. 2   D. 4   E. NOTA

17. Define the binary operator $\diamond$ by

$$z_1 \diamond z_2 = |z_1 - z_2|$$

What is $(5 + 3i) \diamond (10 - 9i)$?

A. 5   B. 9   C. 13   D. 17   E. NOTA

18. Evaluate

$$\left(25^{\frac{3}{2}}\right)\left(8^{\frac{2}{3}}\right)\left(1000^{-\frac{1}{3}}\right)$$

A. $\frac{1}{5}$ B. 5   C. 50   D. 100   E. NOTA

19. Find the sum of the squares of the roots of

$$x^2 - 5x + 3 = 0$$

A. 4   B. 14   C. 19   D. 31   E. NOTA

20. Let

$$Y = \prod_{j=1}^{100} 2^j$$

, where $\prod_{j=j_0}^{j_n} a_j$ denotes the product of the values of a_j for all j from j_0 to j_n. Find $\log_4 Y$.

A. 1000   B. 2525   C. 5050   D. 10000   E. NOTA

21. What is the perpendicular distance from $y = \frac{4}{3}x - 3$ to $(5, 12)$?

A. 2.6   B. 5   C. 8   D. 13   E. NOTA

22. A family has two different-aged children. Assuming male and female children are equally likely, what is the probability that the elder child is female given that at least one child is male?

A. $\frac{1}{4}$ B. $\frac{1}{3}$ C. $\frac{1}{2}$ D. $\frac{2}{3}$ E. NOTA

23. Let (x, y) be the intersection point of

$$4x + 3y = 12$$
$$5x + 2y = 8$$

What is $x + y$?

A. -12   B. $-\frac{12}{11}$ C. $\frac{12}{11}$ D. 12   E. NOTA

24. What choice best describes the graph of the following equation?

$$\log_2 y = 2 + \log_2 x$$

A. half-line   B. line   C. two intersecting lines   D. parabola   E. NOTA

25. What is the remainder when $x^2 + 3x + 4$ is divided by $x + 2$?

A. -2   B. -1   C. 0   D. 1   E. NOTA

26. Suppose $z = 1 + 3i$. What is $|z^6|$?

A. 1   B. 64   C. 1000   D. 4096   E. NOTA

27. Suppose $f(x) = \frac{2x}{2x-1}$, $x \neq \frac{1}{2}$. What is $f(1 - x) + f(x)$?

A. -2   B. 0   C. 2   D. 4   E. NOTA

28. How many integers x between -10 and 10, inclusive, satisfy the following?

$$|4x + 2| > x + 8$$

A. 5   B. 7   C. 14   D. 16   E. NOTA

29. What is the characteristic of $\log_{10}(\frac{1}{128})$ to the nearest thousandth?

A. -3   B. -2   C. -0.107   D. 0.893   E. NOTA

30. With how many zeros does 50! end?

A. 10   B. 12   C. 20   D. 50   E. NOTA