Secondary Four

Date : 16/01/2008

Time : 8:30 – 9:30 a.m.

Instructions:

1. Attempt ALL questions.
2. All answers should be put in the answer sheet provided.
3. The diagrams in the paper are not necessary drawn to scales.
4. Choose only ONE answer for each question, two or more answers will score no marks.
5. Each question carries 2 marks.

DO NOT turn over this question paper until you are told to do so.
Multiple Choice questions (80 marks)

1. Which of the following numbers is rational?
   A. $2\pi$
   B. $\sqrt{2} + 1$
   C. $\sqrt{8}$
   D. $\sqrt{-9}$

2. Suppose $9x^2 + 3x + k$ is a perfect square. Find the value of k.
   A. $\frac{9}{4}$
   B. $\frac{3}{2}$
   C. $\frac{1}{2}$
   D. $\frac{1}{4}$

3. If $f(x) = 3^x - x^3$, find $f(-2)$.
   A. $\frac{73}{9}$
   B. $-\frac{71}{8}$
   C. $-\frac{71}{9}$
   D. $-\frac{73}{9}$

4. Which of the following numbers is/are surd(s)?
   I. $\sqrt{36}$
   II. $6^{1/2}$
   III. $\sqrt{36}$
   A. I only
   B. II only
   C. III only
   D. I and II only

5. If $2x(3x - 1) = (2 - 3x)(3x - 1)$, then $x =$
   A. $2$ only.
   B. $\frac{1}{3}$ only.
   C. $2$ or $\frac{1}{3}$
   D. $\frac{2}{3}$ or $\frac{1}{3}$

6. If $k$ is a root of $x^2 - x - 4 = 0$, find the value of $k^4 - 2k^3 + k^2$.
   A. -16
   B. 16
   C. 12
   D. 4

7. Let $f(x) = (2x - 1)(x + 1) + 2x + 1$. Find the remainder when $f(x)$ is divided by $2x + 1$.
   A. 2
   B. 1
   C. -1
   D. 0

8. Suppose 2 is a root of the quadratic equation $x^2 - 5x + k(1-x) = 0$, then $k =$

   P.2
9. If the equation \( x^2 - 4x + k = 1 \) has no real roots, then the range of values of \( k \) is:
A. \( k > 4 \)
B. \( k \geq 4 \)
C. \( k \geq 5 \)
D. \( k > 5 \)

10. Which of the following shows the graph of the quadratic function \( y = 2x^2 + k \), where \( k > 0 \)?
A.  
![Graph A](image)
B.  
![Graph B](image)
C.  
![Graph C](image)
D.  
![Graph D](image)

11. The equation of the line of symmetry of the graph of \( y = x^2 - 6x + 15 \) is
A. \( x = -3 \)
B. \( x = 3 \)
C. \( x = -6 \)
D. \( y = 6 \)

12. The coordinates of the vertex of the graph \( y = -x^2 - 10x + 9 \) are
A. \((5, 34)\)
B. \((-5, -34)\)
C. \((-5, 54)\)
D. \((5, -34)\)

13. If \( g(x) = x + \frac{1}{x} \), then \( g(x) \cdot g\left(\frac{1}{x}\right) = \)
A. \( x^2 + \frac{1}{x^2} + 2 \)
B. 1
C. \( \frac{1}{x} \)
D. \( 2x + \frac{1}{x} \)

14. If we transform the graph of \( y = -(x + 2)^2 - 5 \), 3 units to the left and 1 unit downwards. Which of the following is the equation after transformation?
A. \( y = -(x-1)^2 - 6 \)
B. \( y = -(x+5)^2 - 4 \)
C. \( y = -(x-5)^2 - 6 \)
D. \( y = -(x+5)^2 - 6 \)

15. If \( 10^{a+b} = c \), then \( b = ? \)
A. \( \log c - a \)
B. \( a - \log c \)
C. \( \frac{c}{10} - a \)
D. \( c - 10^a \)

P.3
16. Simplify: \((\sqrt[3]{a^4})^3\) =
A. \(a^4\)
B. \(a\)
C. \(a^8\)
D. \(a^{16}\)

17. Simplify: \(\frac{4^{x+1} - 2^{2x}}{2^{2x}}\) =
A. \(2\)
B. \(2^{-1}\)
C. \(-1\)
D. \(-2\)

18. Find the value of \(x\) if \(3x^2 = 12\).
A. \(-6\)
B. \(6\)
C. \(-\frac{1}{6}\)
D. \(\frac{1}{6}\)

19. Given: \(x^2 + x^{-2} = 3\), find the value of \(x + \frac{1}{x}\).
A. 9
B. 7
C. 3
D. 1

20. If \(\log a = 1 - \log \sqrt{b}\), then \(b =\)
A. \(10a\)
B. \(100a^2\)
C. \(10\)
D. \(\frac{100}{a^2}\)

21. If \(M > N > 0\), then which of the following must be true?
   I. \(\log M > \log N\),
   II. \(\log MN > 0\),
   III. \(\log M > 0\).
A. I only
B. I and II only
C. I and III only
D. I, II and III only

22. If \(\sqrt{ab} = 10\), then \(\log a + \log b =\)
A. \(\frac{1}{2}\)
B. 1
C. 2
D. 4

23. If \(\log (x - 3) + \log (x + 2) = \log 6\), then \(x =\)
A. \(-3\) only
B. \(-3\) or 4
C. 3 only
D. 4 only

24. Which of the following may be the equation of the graph above?
A. \(y = \log x + 3\)
B. \(y = \log (10x) + 3\)
C. \(y = 3 \log x\)
D. \(y = \log (x + 10) + 2\)
25. Simplify: \( \frac{\log(100a)}{1 + \log \sqrt{a}} \)
   A. 2
   B. \( \frac{1}{2} \)
   C. -1
   D. -2

26. What is the coefficient of \( x^2 \) in the expansion of \((x-1)(2x+3)(x+2)\)?
   A. 5
   B. 4
   C. 2
   D. -1

27. Which of the following is an identity?
   A. \( x^3 - 2x + 1 = 0 \)
   B. \( x^3 + 1 = (x+1)(x^2-1) \)
   C. \( x^3 - 1 = (x-1)(x^2 + x + 1) \)
   D. \( (x+3)(x+2) = 0 \)

28. Given an identity: \( x^3 = A(x-1)(x-3) + B(x+2)(x-3) + C(x-1)(x+2) \). Find the value of \( B \).
   A. -4
   B. -1
   C. -9
   D. \( \frac{5}{6} \)

29. If a polynomial \( f(x) \) is divisible by \( x - 2 \), then \( f(x - 2) \) is divisible by:
   A. \( x \)
   B. \( x - 2 \)
   C. \( x - 4 \)
   D. \( x + 4 \)

30. \( (x+1) \) is a factor of \( x^2 + 1 \) if
   A. \( n \) is an integer
   B. \( n \) is a natural number
   C. \( n \) is an even integer
   D. \( n \) is an odd integer

31. If \((x-a)\) is a common factor of \( x^3 + 2kx - 8 \) and \( x^2 + k \), then \( k = \)
   A. -4
   B. -2
   C. 2
   D. 4

32. Which of the following polynomial is of degree 4?
   A. \((4x^4 + 1)^4\)
   B. \((3x^1)(5x-1)(6x+2)\)
   C. \((6x^4 + 3x^1)^4\)
   D. \((5x^1)(x^4 - 4)\)

33. If \( f(x) = x^2 - 1 \), then \( f(a - 1) = \)
   A. \( a^2 - 1 \)
   B. \( x^2 - 2 \)
   C. \( a^2 - 2a \)
   D. \( a^2 - 3a - 2 \)

34. If \((x + 2)\) is a factor of \( 2x^3 + ax^2 + bx + 4 \), then \( 2a - b - 5 = \)
   A. -4
   B. -2
   C. 1
   D. 7

35. How many intersecting points do the following simultaneous equations have?
   \( y = x^2 - 2x - 3 \), \( y = -2x - 4 \)
   A. 0
   B. 1
   C. 2
   D. 3

P.5
36. Which of the following equations cannot be reduced to a quadratic equation?
   A. \( x + \frac{1}{x-1} = 12 \)
   B. \( 4^x - 2^{x+1} = 1 \)
   C. \( \sqrt{x-4} = 5 + x \)
   D. \( \frac{1}{x} + \frac{1}{x-1} + \frac{1}{x+2} = \frac{1}{3} \)

37. If the graph of \( y = x^2 - 2x - 3 \) is translated horizontally to \( y = f(x) \) as shown, then \( f(x) = \)

   ![Graph](image)

   A. \( x^2 - 2x + 3 \)
   B. \( x^2 + 2x + 3 \)
   C. \( x^2 - 10x + 21 \)
   D. \( x^2 - 10x - 21 \)

38. The figure shows the graph of \( y = ax^2 + bx + c \). Which of the following is true?

   ![Graph](image)

   A. \( a > 0, b > 0, c > 0 \)
   B. \( a > 0, b < 0, c > 0 \)
   C. \( a > 0, b < 0, c < 0 \)
   D. \( a < 0, b > 0, c < 0 \)

39. Find two consecutive positive integers if the sum of their reciprocals is \( \frac{15}{56} \).
   A. 6, 7
   B. 7, 8
   C. 8, 9
   D. -7, -8

40. Which of the following graphs shows that \( y \) is not a function of \( x \)?

   ![Graph](image)

   A. 
   B. 
   C. 
   D. 

End of the paper
ROUGH WORK SHEET 1