1. For $x > 0$, $e^{-\ln x}$ may be expressed as

(A) $\ln\frac{1}{x}$

(B) $-\ln x$

(C) $-x$

(D) $\frac{1}{x}$

2. $\frac{x+5}{x(x^2+6x+17)}$ may be expressed as

(A) $\frac{P}{x}+\frac{Q}{(x-1)}+\frac{R}{x+17}$

(B) $\frac{P}{x}+\frac{Qx+R}{(x-1)(x+17)}$

(C) $\frac{P}{x}+\frac{Qx+R}{x^2+6x+17}$

(D) $\frac{P}{x}+\frac{Qx}{x^2+6x+17}$

3. Given that a, b, c and k are constants, then $\int\frac{3}{x^2(x-1)}dx$ can be expressed as

(A) $\frac{a}{x}+b\ln|x-1|+k$

(B) $a\ln|x|+b\ln|x-1|+k$

(C) $a\ln|x|+\frac{b}{x}+\frac{c}{x-1}+k$

(D) $a\ln|x|+\frac{b}{x}+c\ln|x-1|+k$

4. $\int(\cos 5x\cos 3x)\,dx =$

(A) $\frac{1}{2}\int(\cos 8x+\cos 2x)\,dx$

(B) $\frac{1}{2}\int(\cos 8x-\cos 2x)\,dx$

(C) $\int(\cos 8x-\cos 2x)\,dx$

(D) $\int(\cos 8x+\cos 2x)\,dx$

5. The general solution for the second-order differential equation $\frac{d^2y}{dx^2}-3\frac{dy}{dx}+2y=0$ is

(A) $y = Ae^{2x} + x\,Be^{x}$

(B) $y = Ae^{2x} + Be^{x}$

(C) $y = e^{x}(A + Bx)$

(D) $y = e^{2x}(A + Bx)$

6. If $x = \log_a m$, then $\log_m \frac{a^5}{m} =$

(A) $\frac{1}{x^5}-1$

(B) $\frac{5}{x}-1$

(C) $5x-1$

(D) x^5-1

7. $\frac{d}{dx}\sin^{-1}(2x)$ is equal to

(A) $\sqrt{1-4x^2}$

(B) $2\sqrt{1-4x^2}$

(C) $\frac{2}{\sqrt{1-4x^2}}$

(D) $\frac{1}{\sqrt{1-4x^2}}$

8. Given $\sec^2 x = 1 + \tan^2 x$, $\int_0^{\pi} \frac{\tan^2 x}{4}\,dx$ is

(A) $-\frac{\pi}{4}$

(B) $\frac{\pi}{4}$

(C) $\frac{\pi}{4}-1$

(D) $1-\frac{\pi}{4}$

9. $\int \frac{dx}{\sqrt{16-x^2}}$ is

(A) $\frac{1}{16}\sin^{-1}\frac{x}{4}+c$

(B) $\frac{1}{4}\sin^{-1}\frac{x}{4}+c$

(C) $\sin^{-1}\frac{x}{4}+c$

(D) $\sin^{-1}4x+c$

10. $\int \frac{1}{1+9x^2}\,dx$ is

(A) $\frac{1}{3}\tan^{-1}\left(\frac{x}{3}\right)+c$

(B) $\frac{1}{3}\tan^{-1}(3x)+c$

(C) $3\tan^{-1}\left(\frac{x}{3}\right)+c$

(D) $3\tan^{-1}(3x)+c$

11. If $\frac{dy}{dx}=2xy$, then the value of $\frac{d^2y}{dx^2}$ at the point $(1,2)$ is

(A) 6
(B) 8
(C) 12
(D) 16

12. $\int \sin^2 x\,dx =$

(A) $\frac{1}{3}\sin^3 x+c$

(B) $\frac{1}{3}\cos^3 x+c$

(C) $\frac{1}{2}x+\frac{1}{4}\sin 2x+c$

(D) $\frac{1}{2}x-\frac{1}{4}\sin 2x+c$

13. A function f is defined by $f(x)=2e^{3x}-1$ for all real values of x. The inverse function, f^{-1} of f, is defined by

(A) $3\ln(x+1),\ x\in R$

(B) $\frac{1}{3}\ln(x+1),\ x\in R$

(C) $\frac{1}{3}\ln\left(\frac{x+1}{2}\right),\ x>-1$

(D) $\frac{1}{3}\ln\left(\frac{x+1}{2}\right),\ x\in R$

14. If $\log_{10}2=x$, then $\log_{10}0.128$, in terms of x, is

(A) $7x-3$

(B) $7-3x$

(C) $\frac{7x}{3}$

(D) $4x$

15. The number of bacteria present in a culture is modelled by $y = y_0 e^{kt}$, where $k > 0$, y is the population after t hours, and y_0 is the initial population. The rate of growth, c, when $t = 5$ is given by

(A) $c = e^{5k}$
(B) $c = ke^5$
(C) $c = ky_0 e^{5k}$
(D) $c = 5e^{5k}$

16. For $2n < 1$, $\sum_{r=0}^{\infty} (2n)^r =$

(A) $\dfrac{2}{1-n}$

(B) $\dfrac{1}{1-2n}$

(C) $\dfrac{2n}{1+2n}$

(D) $\dfrac{2n}{1-2n}$

17. Given that $\sum_{k=1}^{n} k(k+1) = S_n$ then, for $m < n$,

$\sum_{k=m+1}^{n} k(k+1) =$

(A) $S_n - S_{m+1}$
(B) $S_{m+1} - S_m$
(C) $S_n - S_{n-1}$
(D) $S_n - S_m$

18. For what values of x is the series $\sum_{r=0}^{\infty} x^r$ convergent?

(A) $x > 1$
(B) $x \leq 1$
(C) $-1 < x < 1$
(D) $-1 \leq x \leq 1$

19. The binomial coefficient $\binom{n}{2}$ is equivalent to

(A) $\binom{n}{1} + \binom{n}{1}$

(B) $\binom{n}{n-2}$

(C) $\binom{n-2}{n}$

(D) $\binom{n}{n+2}$

20. The coefficient of a^2b^5 in the expansion of $(a + b)^7$ is

(A) ${}^3C_2$
(B) ${}^5C_3$
(C) ${}^7C_3$
(D) ${}^7C_5$

21. A sequence is defined as $u_{n+1} = 1 - \dfrac{1}{1+u_n}$ where $u_1 = 1$, $(n \in N)$. The 20th term of the sequence is

(A) $\dfrac{1}{20}$

(B) $\dfrac{1}{21}$

(C) $\dfrac{19}{20}$

(D) $\dfrac{20}{21}$

22. The sum to infinity of the geometric series $16 + 12 + 9 + \ldots\ldots$ is

(A) 64
(B) 37
(C) 16
(D) 6

23. If $\sum_{n=2}^{\infty} 2^{-n} = a$, then a is

(A) $\frac{1}{4}$

(B) $\frac{1}{2}$

(C) 2

(D) 4

24. The coefficient of x^2 in the series expansion of $(1-3x)^{\frac{-1}{3}}$ is

(A) $-\frac{1}{2}$

(B) $\frac{1}{2}$

(C) -2

(D) 2

25. If the coefficient of x^3 in $(6 - ax)^9$ is -84, then the value of a is

(A) $\frac{1}{36}$

(B) $-\frac{1}{36}$

(C) 36

(D) -36

26. If the true length of a piece of pipe is 50 cm and its measured length is 51 cm, then the relative error in length is

(A) 1%
(B) 2%
(C) 3%
(D) 4%

27. By using the Newton-Raphson method with a first approximation x_n, the second approximation x_{n+1} for a root of the equation $x^5 = x^3 + 25$ may be expressed as

(A) $\frac{x_n - x_n^5 - x_n^3 + 25}{5x_n^4 - 3x_n^2}$

(B) $\frac{x_n - x_n^5 - x_n^3 - 25}{5x_n^4 - 3x_n^2}$

(C) $\frac{4x_n^5 - 4x_n^3 - 25}{5}$

(D) $\frac{4x_n^5 - 2x_n^3 + 25}{5x_n^4 - 3x_n^2}$

28. The sum of the first n terms of a series is $1-\left(\frac{1}{4}\right)^n$. The value of the SECOND term is

(A) $\frac{3}{16}$

(B) $\frac{3}{4}$

(C) $\frac{15}{16}$

(D) 1

29. A music artist sells 48 000 CDs in the first year of release. Sales are halved each subsequent year. If each CD is sold for $25, then the value of sales for a particular year, n, can be expressed as

(A) $P = 25(48\ 000)\left(\frac{1}{2}\right)^n$

(B) $P = 25\ (48\ 000)\left(\frac{1}{2}\right)^{n-1}$

(C) $P = \frac{25}{2}(48\ 000)^n$

(D) $P = 25\ (24\ 000)^{n-1}$

30. Two quantities, y and z, were measured. The results, rounded correct to two significant figures, were $y = 9.8$ and $z = 9.3$. The lower and upper bounds repectively for the value of $y - z$ are

(A) 0.4 and 0.5
(B) 0.5 and 0.5
(C) 0.4 and 0.6
(D) 0.5 and 0.6

31. Two events A and B are such that $P\ (A) = 0.5$, $P\ (B) = 0.16$, $P\ (A \cup B) = 0.48$. $P\ (A \cap B) =$

(A) 0.14
(B) 0.18
(C) 0.26
(D) 0.82

32. If $M = \begin{bmatrix} 1 & 3 & 3 \\ -2 & 4 & 1 \\ 0 & 5 & 6 \end{bmatrix}$, the FIRST ROW of the co-factor matrix of M is:

(A) $\begin{bmatrix} 19 & 12 & -10 \\ * & * & * \\ * & * & * \end{bmatrix}$

(B) $\begin{bmatrix} -19 & -12 & 10 \\ * & * & * \\ * & * & * \end{bmatrix}$

(C) $\begin{bmatrix} 1 & -2 & 0 \\ * & * & * \\ * & * & * \end{bmatrix}$

(D) $\begin{bmatrix} -1 & 2 & 0 \\ * & * & * \\ * & * & * \end{bmatrix}$

33. Given that H is a non-singular, square matrix, the determinant, $|H^2|$, of H^2, is

(A) $2\,|H|$

(B) $\frac{1}{2}|H|$

(C) $|H|^2$

(D) $\frac{1}{|H|^2}$

34. The number of possible values of x which satisfy the system of simultaneous equations,

$$2x + 3y + 2z = -5$$

$$4x + 6y + 4z = -10$$

$$6x + 9y + 6z = -25$$

is

(A) 0
(B) 1
(C) 2
(D) 3

35. The roots of the equation $x^2 + 1 = 0$ are

(A) $x = -1, 1$
(B) $x = -1, i$
(C) $x = 1, -i$
(D) $x = -i, i$

36. The FIRST ROW of the product PQ of the two 3×3 matrices

$$P = \begin{pmatrix} 2 & -3 & 1 \\ 5 & -6 & 5 \\ -1 & 2 & 3 \end{pmatrix} \text{ and } Q = \begin{pmatrix} 2 & 1 & 3 \\ 5 & 0 & -1 \\ -3 & -2 & 4 \end{pmatrix}$$

is

(A) $(4 \;\; -3 \;\; 3)$
(B) $(4 \;\; -2 \;\; 4)$
(C) $(-14 \;\; 0 \;\; 13)$
(D) $(-14 \;\; 35 \;\; -1)$

37. The determinant of the matrix

$$M = \begin{pmatrix} 3 & -1 & 5 \\ 2 & 3 & -2 \\ 0 & 5 & 4 \end{pmatrix} \text{ is}$$

(A) 20
(B) 64
(C) 104
(D) 124

38. The roots of a quadratic equation $ax^2 + bx + c = 0$, are the complex numbers $1 + 2i$ and $2 - i$. The equation is

(A) $x^2 - (3 + i)\,x - 4 - 3i = 0$
(B) $x^2 - (3 + i)\,x + 4 + 3i = 0$
(C) $x^2 - (3 - i)\,x + 4 + 3i = 0$
(D) $x^2 + (3 + i)\,x + 4 + 3i = 0$

39. $\dfrac{2-i}{3+2i} =$

(A) $\dfrac{8-i}{13}$

(B) $\dfrac{8+i}{13}$

(C) $\dfrac{7-4i}{13}$

(D) $\dfrac{4-7i}{13}$

40. The expresssion $i\,[(1 + i)^2 - (1 - i)^2]$ is equal to

(A) -4
(B) -2
(C) 2
(D) 4

41. The principal value of the argument of the complex number $2-2i$ is

(A) $\frac{-3\pi}{4}$

(B) $\frac{-\pi}{4}$

(C) $\frac{\pi}{4}$

(D) $\frac{3\pi}{4}$

42. The complex number $Z=-\frac{1}{2}+i\frac{\sqrt{3}}{2}$ can be expressed as

(A) $\frac{1}{2}\left(\cos\frac{2\pi}{3}+i\sin\frac{2\pi}{3}\right)$

(B) $\frac{1}{2}\left(\cos\frac{\pi}{6}+i\sin\frac{\pi}{6}\right)$

(C) $\left(\cos\frac{\pi}{6}+i\sin\frac{\pi}{6}\right)$

(D) $\left(\cos\frac{2\pi}{3}+i\sin\frac{2\pi}{3}\right)$

43. In how many ways can the letters PQRST be arranged so that the letters R and S are always together?

(A) $5!-4!\times 2$

(B) $\frac{5!}{2}-4!$

(C) $4!\times 2$

(D) $4!$

44. The letters of the word I R R E G U L A R are to be arranged in a line. The number of possible arrangements in which the 3 Rs are not together is

(A) $7!$

(B) $\frac{9!}{3!}-7!$

(C) $9!-7!$

(D) $9!-7!\times 3!$

45. The locus of the points described by a complex number z is given by $|z-1-2i|=3$. The locus describes a circle with

(A) centre $(-1,-2)$ and radius 3 units

(B) centre $(-1,-2)$ and radius 9 units

(C) centre $(1,2)$ and radius 3 units

(D) centre $(1,2)$ and radius 9 units

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.