

PLEASE WRITE YOUR NAME IN CAPITAL LETTERS:

This is a multiple choice test. For each question, 3 candidate answers are provided. Only one answer is correct. Please put a cross ('X') near the answer which you think to be correct.

1. Consider the function $f(x) = 1 + x^2$. What is the derivative of f at x ?

: $2x$

: 2

: x

2. Consider the function $f(x) = 2^x - 3 + 1$. What is the value of f at $x = 3$?

: 2

: 6

: 3

3. Consider the function $f(x) = \frac{1}{x}$. What is the limit of $f(x)$ as x goes to ∞ ?

: 0

: ∞

: the limit does not exist

4. Consider the function $f(x) = \log x$. What is the limit of $f(x)$ as x goes to $+\infty$?

: 0

: $+\infty$

: the limit does not exist

5. The function $f(x) = \frac{1}{2^x}$ can also be written as

: 2^{-x}

: $2^{\frac{1}{x}}$

: $\frac{x}{2}$

6. Consider the 2nd order polynomial $p(x) = ax^2 + bx + c$, where a, b, c are some real numbers. The formula for the roots of p is

: $x = \frac{b \pm c}{a}$

: $x = \frac{-b \pm (b^2 - 4ac)}{2a}$

: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

7. Which of the following polynomials has two real zeros?

: $x^2 + 2x + 1$

: $x^2 - 3x + 2$

: $x^2 + x + 1$

8. Consider the linear system of equations:

$$x + y = 1$$

$$x - y = 0$$

The solution to the above system of equations is

: $x = 1, y = 0$

: $x = 1, y = 1$

: $x = 0.5, y = 0.5$

9. What is the result of the following computation $2^2 + 2^3$?

: 2^5

: $3 \cdot 2^2$

: 2^6

10. Consider the matrix

$$A = \begin{bmatrix} 1 & 2 \\ 1 & -1 \end{bmatrix}$$

This matrix is

: symmetric

: invertible

: singular

11. The determinant of matrix A defined in the previous question is:

: -3

: 0

: -1

12. The matrix product between an $n \times k$ matrix and a $k \times \ell$ matrix is a

: $n \times \ell$ matrix

: $k \times k$ matrix

: $k \times \ell$ matrix

13. The identity matrix

: has all its elements equal to 1

: has determinant equal to -1

: is the diagonal matrix with all diagonal elements equal to 1

14. The scalar product between the vectors $(0, 1)$ and $(-2, 0)$ is

: 0

: 1

: -1

15. (NOTE: In this and the next two questions A , B and C are Boolean variables taking values 0 or 1 (where '0' means 'FALSE' and '1' means 'TRUE'). Let “ $-$ ”, “ \cdot ” and “ $+$ ” be the standard operators denoting negation, intersection and union respectively.)

What is the result of the Boolean formula $(A + \bar{B}) \cdot C$ when $A = 1$, $B = 0$ and $C = 1$?

: 1

: 0

: 2

16. The result of the Boolean formula $A + \bar{A}$

: is always equal to 1

: always equal to 0

: depends on the value of A

17. What is the result of the Boolean formula $\overline{A \cdot B}$ when $A = B = 0$

: 0

: 1

: The above formula is not well defined

18. What is the binary representation of the decimal number 7?

: 100

: 101

: 111

19. Consider the sets of integer numbers $\{-3, -2, -1, 0\}$ and $\{0, 1, 2, 3\}$. The union of these two sets is:

: the set $\{0\}$

: the set $\{-3, -2, -1, 0, 1, 2, 3\}$

: equal to 0

20. Consider again the two previous sets. Their intersection is

: the set $\{0\}$

: the set $\{-3, -2, -1, 0, 1, 2, 3\}$

: equal to 0

END OF PAPER