

CBSE 12 MATHEMATICS

**Time allowed: 3 hours
100**

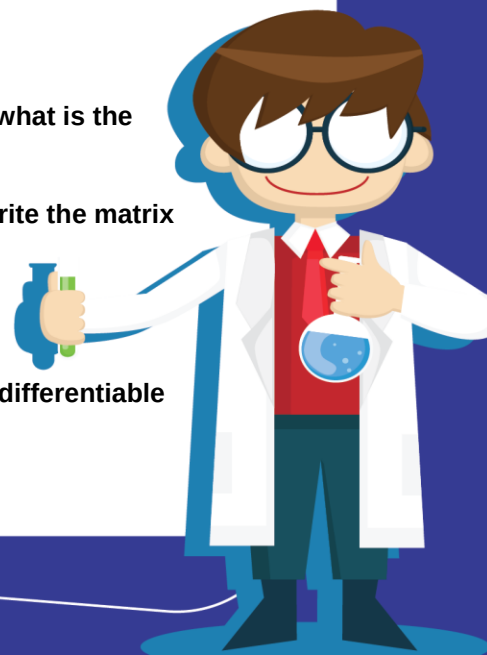
Maximum Marks:

General Instructions:

- (i) All questions are compulsory.
- (ii) The question paper consists of **29** questions divided into three sections A, B and C.
Section A
comprises of **10** questions of **one mark** each, Section B comprises of **12** questions of **four marks** each and Section C comprises of **7** questions of **six marks** each.
- (iii) All questions in Section A are to be answered in one word, one sentence or as per exact requirement of the question
- (iv) There is no overall choice. However, internal choice has been provided in 4 questions of four marks each and 2 questions of six marks each. You have to attempt only one of the alternatives in all such questions.
- (v) Use of calculators is **not** permitted.

SECTION – A

- 1) If $g(x) = x^2 + 1$, find $g^{-1}(x)$
- 2) Write the domain and range of $\operatorname{cosec}^{-1}(x)$.
- 3) If the order of matrix A is 3×4 and if the order of matrix B is 4×2 , what is the order of the matrix $A \cdot B$?
- 4) If A and B are square matrices of order 3 and if B is inverse of A, write the matrix $A \cdot B$.
- 5) If $f(x) = \frac{x^2 - 9}{x - 3}$, $x \neq 3$, describe the nature of discontinuity of $f(x)$.
- 6) Give an example of a function which is continuous at $x = 4$ but not differentiable there.



7) What is the slope of the normal to the parabola $y = 3x^2 + 2x - 4$ at $x = -1$?

8) Evaluate

$$\int \frac{\log x^2}{x} dx$$

9) Perform the integration $\int \frac{dx}{9+x^2}$

10) Find the area between the graphs of the functions $y = x^2$ and $y = x$

SECTION – B

11) If $f(x) = x^2 - 4x + 8$, state the condition for $f(x)$ to be invertible. Find $f^{-1}(x)$ and state its domain and range.

12) Simplify: $\tan^{-1} \left[\frac{\cos(x) - \sin(x)}{\cos(x) + \sin(x)} \right]$, $x < \pi$

OR

Evaluate, $\tan^{-1}[2\sin(2\cos^{-1}(1/2))]$

13) Using short cut method, find the inverse of the matrix,

$$\begin{bmatrix} 2 & 5 \\ 3 & -1 \end{bmatrix}$$

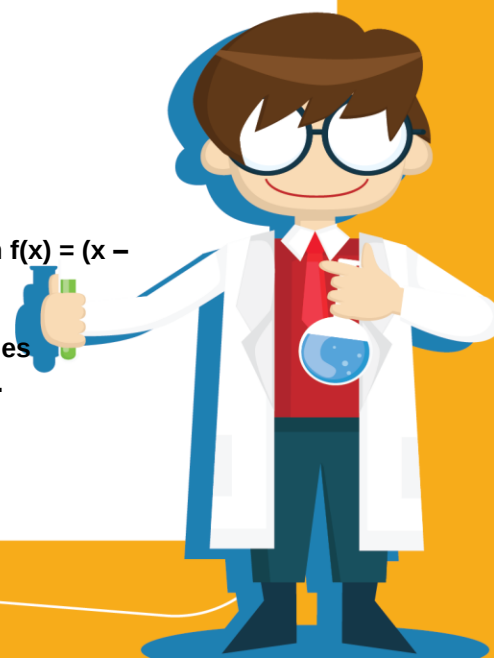
14) If $x > y > z > 0$, show that the value of D is negative where,

$$D = \begin{vmatrix} x & y & z \\ y & z & x \\ z & x & y \end{vmatrix}$$

15) Using logarithmic differentiation, find the derivative of the function $f(x) = (x - 3)(x - 4)(x - 5)$

16) Show that the area of a rectangle inscribed in a given circle becomes maximum when the length and breadth of the rectangle are congruent.

17) Find the anti derivative of $e^x(\operatorname{cosec}^2(x) + \cot(x))$



Evaluate

$$\int \frac{\sec(x)}{\sec(x) - \tan(x)} dx$$

18) Evaluate

$$\int \frac{3}{x^2 + 4x + 1} dx$$

19) Prove that

$$\int_0^{2a} f(x) dx = \int_0^a f(x) dx + \int_0^a f(2a - x) dx$$

20) Show that the vectors $2i - j - 5k$ and $-i + 3j - k$ are orthogonal.

OR

Find the magnitude and direction $u - v$, if $u = 5i - 3j$ and $v = 2i + j$

21) Find the general the general solution of the equation $xy' = 2y$

22) A card is drawn at random from a standard pack of cards and simultaneously a die is rolled. What is the probability of the outcome as 2 in both the events?

OR

Two dices are thrown simultaneously. What is the probability that the sum of the numbers that

are rolled is a prime number?

SECTION - C

23) Show that $\sin^{-1} \frac{4}{5} + \cos^{-1} \frac{12}{13} - \tan^{-1} \frac{63}{16} = 0$

24) By using properties of determinants, show that

$$\begin{vmatrix} x^2 + 1 & xy & xz \\ xy & y^2 + 1 & yz \\ zx & zy & z^2 + 1 \end{vmatrix} = 1 + x^2 + y^2 + z^2$$

25) Using matrix method, solve the following system of equations

$$5x - y + z = 6; x + 2y - z = 2; 2x - 3y - 4z = -16$$



26) Two cars are leaving from a station at the same time, one in the direction of north at 60 kmph and the other in the direction of east at 80 kmph. At what rate the distance between the cars are changing after 2 hours?

OR

Prove that the diameter of the right circular cylinder of greatest lateral area which can be inscribed in a given cone is equal to the radius that of the cone.

27) The graph of the function $f(x) = x^2 - 4x + 6$ has a tangent at $x = 4$. Find the equation of the secant line passing through $x = 3$ and parallel to that tangent.

OR

Find the intervals of increasing and decreasing of the function $f(x) = 2x^3 - 15x^2 + 36x + 20$ and hence

determine the local maximum and minimum points

28) Perform the integral

$$\int e^x \cos x dx$$

29) Evaluate

$$\int_0^{\frac{\pi}{4}} \frac{1}{1 + \tan^4 x} dx$$

