५.   गणित **(Mat. 008)**

Secondary Education Examination
Test Specification Chart, 2078

Grade: 12   **Subject: Mathematics (Mat. 008)**

SN	Content Area	Working hour	Knowledge MCQ No. of Questions	Marks	Knowledge SAQ No. of Questions	Marks	Understanding MCQ No. of Questions	Marks	Understanding SAQ No. of Questions	Marks	Understanding LAQ No. of Questions	Marks	Application MCQ No. of Questions	Marks	Application SAQ No. of Questions	Marks	Application LAQ No. of Questions	Marks	Higher Ability MCQ No. of Questions	Marks	Higher Ability SAQ No. of Questions	Marks	Higher Ability LAQ No. of Questions	Marks	Areawise Marks	Number of Questions
1	**Algebra**	31																							20	MCQ: 2 SAQ: 2 LAQ: 1
2	**Trigonometry**	8																							5	MCQ: 4 SAQ: 1 LAQ: 1
3	**Analytic Geometry**	13																							8	
4	**Vector**	7																							4	
5	**Statistics and Probability**	9	2	2	2	10	5	5	1	5	1	8	2	2	4	20	1	8	2	2	1	5	1	8	6	MCQ: 1 SAQ: 1
6	**Calculus**	31																							20	MCQ: 2 SAQ: 2 LAQ: 1
7	**Computational methods**	10																							6	MCQ: 1 SAQ: 1
8	**Mechanics or Mathematics for Economics and Finance**	11																							6	MCQ: 1 SAQ: 1
	Total Marks	**120**	**12**				**18**						**30**						**15**						**75**	MCQ: 11 SAQ: 8 LAQ: 3

			Number of questions					
			**Question format plan**				
S.N.	**Types of Questions**	**Marks per question**	**Knowledge**	**Understanding**	**Application**	**Higher Ability**	**Total number of questions**	**Total Marks**
1.	Multiple Choice Question	1	2	5	2	2	11	11
2.	Short Answer Question	5	2	1	4	1	8	40
3.	Long Answer Question	8	0	1	1	1	3	24
	Grand Total		**4**	**7**	**7**	**4**	**22**	**75**

Note:

- *Appropriate extra time will be provided for the handicapped students and the alternative questions to the figure-based questions should be prepared for blind students.*

- *Questions should be prepared by giving the context and one question may have more than one sub-question.*

- *Application and higher ability questions can be made by relating the other content areas.*

- *Questions should be made by addressing all the sub-areas of content.*

- *At least one multiple choice question should be asked from each area (Trigonometry, Analytic geometry and Vector).*

Subject: Mathematics (Mat. 008)   **Full marks: 75**

Attempt all the questions

Group 'A'   **[1 × 11 = 11]**

Rewrite the correct option in your answer sheet.

1. If $1, \omega, \omega^2$ are the cube roots of unit then

   (a) $\omega = \omega^2$ (b) $\omega^2 = \omega^3$ (c) $1 + \omega + \omega^2 = 0$ (d) $1 + \omega = \omega^2$

2. The number of ways that 7 beads of different colors can be strung together so as to form a necklace is

   (a) 5040 (b) 2520 (c) 720 (d) 360

3. $\tan^{-1}\frac{5}{12}$ is equal to

   (a) $\sin^{-1}\frac{12}{13}$ (b) $\cos^{-1}\frac{12}{13}$ (c) $\sec^{-1}\frac{12}{13}$ (d) $\operatorname{cosec}^{-1}\frac{12}{13}$

4. If $2\cos\theta + 1 = 0$ is the trigonometric equation of the locus related to the string attached in the wall of a hall then the general value for θ is

   (a) $n\pi + (-1)^n\frac{2\pi}{3}$ for $n \in Z$

   (b) $n\pi + \frac{2\pi}{3}$ for $n \in Z$

   (c) $2n\pi \pm \frac{2\pi}{3}$ for $n \in Z$.

   (d) $2n\pi + \frac{\pi}{3}$ for $n \in Z$.

5. If $\vec{a} = 2\vec{i}$ and $\vec{b} = 3\vec{j}$ where, $\vec{i}, \vec{j}$ and $\vec{k}$ unit vectors along X,Y,Z- axes respectively, then the value $\vec{b} \times \vec{a}$ is equal to

   (a) $-6\vec{k}$ (b) $6\vec{k}$ (c) $6\vec{i}$ (d) $6\vec{j}$

6. There is a large grassy area near the president house of Nepal. The area is the set of all points in a plane. The sum of whose distances from two fixed places (points) is constant. The conic section represented by the grassy area is…

   (a) Circle (b) Parabola (c) Hyperbola (d) Ellipse

7. Four unbiased coins are tossed successively. The mean and variance of the distribution differed by

   (a) 1 (b) 2 (c) 3 (d) 4

8. The degree of the differential equation $\frac{d^3y}{dx^3} + 5\left(\frac{d^2y}{dx^2}\right)^2 + 4\left(\frac{dy}{dx}\right)^4 + 6 = 0$ is

   (a) 1 (b) 2 (c) 3 (d) 4

9. According to L Hospital's rule the value of $\displaystyle \lim_{x \to 0} \frac{x^3}{4 \sin x}$ is equal to

(a) $\frac{3}{4}$ (b) 0   (c) $\frac{1}{4}$ (d) ∞

10. When Gauss forward elimination method is used for solving the equations $3x + 4y = 18$…. (i) and $3y - x = 7$ ….(ii), we apply the operation like….

(a) $eq^n(i) + 4\ eq^n(ii)$ (b) $eq^n(i) + 3\ eq^n(ii)$

(c) $eq^n(i) + eq^n(ii)$ (d) $eq^n(ii) + 3\ eq^n(i)$

11. The amount of gravity exerted by the earth on the mass 10 kg ($g = 9.8\ ms^{-2}$) is ...

(a) 9.8 Joule   (b) 9.8 Newton   (c) 98 Joule   (d) 98 Newton

OR   For the quadratic function $f(Q) = aQ^2 + bQ + C$ for real numbers a, b, c and $a \neq 0$, the maximum value attained at

(a) $\left(\dfrac{b}{2a}, \dfrac{4ac - b^2}{4a} \right)$ (b) $\left(-\dfrac{b}{2a}, \dfrac{4ac - b^2}{4a} \right)$

(c) $\left(-\dfrac{b}{2a}, \dfrac{b^2 - 4ac}{4a} \right)$ (d) $\left(\dfrac{b}{2a}, \dfrac{b^2 - 4ac}{4a} \right)$

Group 'B'   [5 × 8 = 40]

12. The binomial expression for two algebraic terms a and x is given as $(a + x)^n$.

(a) Write the binomial theorem for any positive integer n in expansion form.   1

(b) Write the general term of the expansion.   1

(c) Write any one property of binomial coefficients.   1

(d) Write the single term for $C(n, r) + C(n, r - 1)$.   1

(e) How many terms are there in the expression?   1

13. Given $n^4 < 10^n$ for a fixed positive integer $n \geq 2$, prove that $(n + 1)^4 < 10^{n+1}$ using principle of mathematical induction.   5

14. (a) Evaluate $\cos\left(\sin^{-1}\dfrac{3}{5} + \sin^{-1}\dfrac{5}{13} \right)$.   3

(b) Using vector method, find the area of the triangle with vertices A(1, 4, 6), B(− 2, 5, 1) and C(1, − 1, 1).   2

15. The information given below relates to the advertisement and sales of a departmental store in lakhs of Nepalese rupees.

	Advertisement Expenditure (X)	Sales (Y)
Arithmetic Mean	20	100
Standard deviation	3	12
	Correlation coefficient between (X) and (Y) = 0.8	

(a) Find the two regression equations related to above data.   4

(b) What should be the advertisement expenditure if the department store wants to attain sales target of Rs. 200 lakhs.   1

16. Suman and Nikita are studying about application of derivative and integration in a class. They ask each other the quiz questions as given below. On the basis of these questions answer the following.

    (a) f '(x) and g'(x) are derivatives of the functions f(x) and g(x). What is the expression equal to $\lim\limits_{x \to a} \dfrac{f(x)}{g(x)}$ according to L'Hospital's rule for form ∞/∞. 1

    (b) State Rolle's Theorem. 1

    (c) What is the expression equal to $\int \dfrac{1}{x^2 + a^2} \, dx$? 1

    (d) What does 'C' represent in the expression $\int \dfrac{dx}{3 \sin x + 4 \cos x} = \dfrac{1}{5} \ln \left| \tan\left(\dfrac{x}{2} + \dfrac{1}{2} \tan^{-1} \dfrac{4}{3}\right)\right| + C$? 1

    (e) Write a difference between derivative and antiderivative? 1

17. Integrate $\int \dfrac{1}{x^4 - 1} \, dx$ using the concept of partial fraction. Also give an example of proper rational fraction and improper rational fraction. 3 + 2

18. Use simplex method and maximize: Z(x, y) = x + y subject to constraints 2x + 3y ≥ 22, 2x + y ≥ 14, x ≥ 0, y ≥ 0. 5

19. Write any one difference between like parallel forces and unlike parallel forces. A heavy uniform beam whose mass is 60 kg is suspended in a horizontal position by two vertical strings each of which can sustain a tension of 52.5 kg wt. How far from the centre of the beam must a body of mass 30 kg placed so that one of the strings may just break? 1 + 4

OR

If the demand function P = 85 – 4Q – Q², find the consumer's surplus at demand 4 units and price 64 units. Also make a revenue function for demand equation P = 20 + 5Q – Q². Obtain the standard quadratic equation for marginal revenue. Q represents the number of units demands and P represent the price. 2 + 1 + 1 + 1

Group 'C' **[8 × 3 = 24]**

20. A mixture is to be made of three foods, A, B and C which contain nutrients P, Q, R as shown in the table below. The quantity of P, Q, R is 45 units, 54 units and 45 units respectively.

Food	Units of nutrients per kg of the foods		
	P	Q	R
A	2	2	4
B	3	5	0
C	4	3	5

    (a) Express the information in equation form. 1

    (b) Solve the equations using matrix. 5

(c)   If the cost per kg of the foods A, B, C are Rs. 300, Rs. 240 and Rs. 180 respectively, find the total cost of the mixture by matrix method.   2

21.   A line makes an angle α, β, γ, δ with the four diagonals of a cube kept in a dining room.

(a)   Find the direction ratios of any two diagonals of the cube and express the diagonals in vector form   3

(b)   Find the angle between the any two diagonals of the cube.   2

(c)   Prove that $\cos^2\alpha + \cos^2\beta + \cos^2\gamma + \cos^2\delta = \frac{4}{3}$.   3

22.   A college hostel accommodating 1000 students; one of them came from abroad with infection of   corona virus, then the hostel was isolated. If the rate at which the virus spreads is assumed to be proportional to the product of the number 'N' of infected students and number of non-infected students and the number of infected students is 50 after 4 days.

(a)   Express the above information in the form of differential equation.   2

(b)   Solve the differential equation.   2

(c)   Show that more than 95% students will be infected after 10 days.   4

The end

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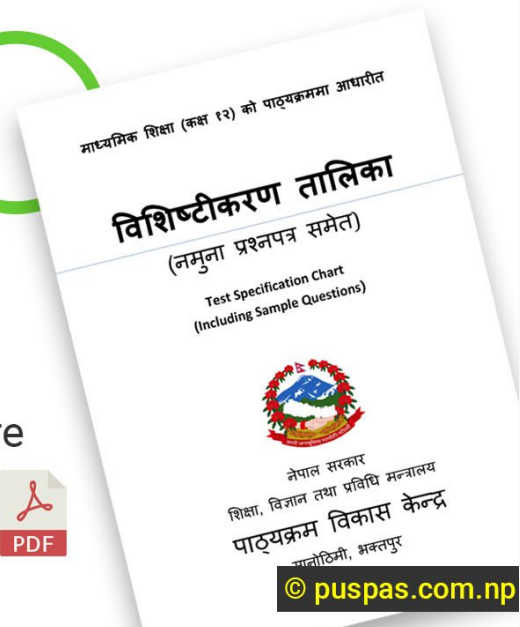## Class 12 Model Question 2078 PDF (All Subjects) With Specification Grid

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