20. Mathematics (Mat. 402)

Test Specification Chart, 2078

Grade: 12　　　　　　　　　　　　　　　　　　　　**Subject: Mathematics (Mat. 402)**

SN	Content Area	Working hour	Knowledge MCQ No.	MCQ Marks	SAQ No.	SAQ Marks	Understanding MCQ No.	MCQ Marks	SAQ No.	SAQ Marks	LAQ No.	LAQ Marks	Application MCQ No.	MCQ Marks	SAQ No.	SAQ Marks	LAQ No.	LAQ Marks	Higher Ability MCQ No.	MCQ Marks	SAQ No.	SAQ Marks	LAQ No.	LAQ 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

Question format plan								
S.N.	**Types of Questions**	**Marks per question**	**Number of questions**				**Total number of questions**	**Total Marks**
			Knowledge	**Understanding**	**Application**	**Higher Ability**		
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-questions.*

- *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. 402)   **Full marks: 75**

Time: 3 hrs.

Candidates are required to give their answer in their own words as far as practicable. The figures in the margin indicate full marks.

Attempt all the questions.

<div align="center">

Group 'A' $[1 \times 11 = 11]$

</div>

Rewrite the correct option in your answer sheet.

1. If ω is a complex cube root of unity, then the value of $(1 + \omega - \omega^2)(1 - \omega + \omega^2)$ is

    (a) ω (b) ω^2 (c) $1 + \omega$ (d) 4

2. An equation $(m + 2)x^2 - 2(m + 4)x + (m + 7) = 0$ have equal roots. The value of m is

    (a) 2   (b) –2   (c) 7   (d) –4

3. Solution of $\sin\left(2\sin^{-1}\dfrac{4}{5}\right)$ is

    (a) $\dfrac{4}{5}$ (b) $\dfrac{24}{25}$ (c) $\dfrac{25}{24}$ (d) 1

4. If $\cos mx = \cos nx$, then the value of x is

    (a) $2n\pi$ (b) $2n\pi \pm \dfrac{\pi}{3}$

    (c) $(4k - 1)\dfrac{\pi}{2(m \pm n)}, k = 0, \pm 1, \pm 2, \ldots$ (d) $\dfrac{2k\pi}{m \pm n}, k = 0, \pm 1, \pm 2, \ldots$

5. The area of a parallelogram whose diagonals are the vectors $\vec{i} - 2\vec{k}$ and $4\vec{i} + 3\vec{j} + \vec{k}$ is

    (a) $5\sqrt{14}$ sq. units   (b) $\dfrac{3}{2}$ sq. units   (c) $\dfrac{3}{2}\sqrt{14}$ sq. units   (d) $\sqrt{14}$ sq. units

6. The equation of a hyperbola in standard position satisfying transverse and conjugate axes are respectively 4 and 5 is

    (a) $\dfrac{x^2}{4} - \dfrac{4y^2}{25} = 1$ (b) $4x^2 - 7y^2 = 36$ (c) $4x^2 + 7y^2 = 36$ (d) $\dfrac{x^2}{4} - \dfrac{y^2}{5} = 1$

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 points on the curve $x^2 + y^2 - 2x - 3 = 0$ where the tangents are parallel to the X-axis are

    (a) (1, 2), (1, – 2)   (b) (1, 2), (1, 2)   (c) (–1, 2), (1, – 2)   (d) (1, 2), (1, 3)

9. The order and degree of the differential equation $\left(\frac{dy}{dx}\right)^3 + 2y\left(\frac{d^2y}{dx^2}\right) = 0$ is

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

10. When Gauss forward elimination method is used for solving the equations

    $3x + 4y = 18$ …. (i)

    $3y - x = 7$ …. (ii)

    we apply the operation

    (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. If the resultant of two like parallel forces acting at a distance of 3 m is 80 N at a distance of 75 cm from one of the forces, then the force is

    (a) 20 N   (b) 9.8 N   (c) 60 N   (d) 40 N

    <div align="center">OR</div>

    If profit function $(\pi) = Q^2 - 10Q + 9$, then the breakeven coin is

    (a) 9 or 10   (b) 1 or 10   (c) 1 or 9   (d) 4 or 5

<div align="center">

Group 'B'   **[5 × 8 = 40]**

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12. (a) If the numerical coefficients in the second, third and fourth terms of the expansion of $(x + a)^n$ are 30, 375 and 2500 respectively, find the value of n. Let a, b, c and x be elements of a group G. [3]

    (b) Solve for x: $x^2 = a^2$ and $x^5 = e$. [2]

13. (a) If $z = \cos\theta + i\sin\theta$, find the value of $z^n + \frac{1}{z^n}$ by using De Moivre's Theorem. [2]

    (b) Solve the system of equations by the row-equivalent method: $x + y + z = 6$, $x - y + z = 2$ and $x + y - z = 0$. [3]

14. (a) If $\tan^{-1}x + \tan^{-1}y + \tan^{-1}z = \pi$, then show that: $x + y + z = xyz$ [3]

    (b) Find the eccentricity and the foci of the ellipse $\frac{x^2}{9} + \frac{y^2}{16} = 1$. [2]

15. From the following data

Age in years (X)	5	15	30	45	50	60
Weight in kg (Y)	10	35	50	65	55	45

    compute the

    (a) correlation coefficient by Karl Pearson's method. [2]

    (b) line of regression for estimating X on Y and estimate the most probable age of the weight 37 kg. [3]

16. Evaluate:

(a) $\int \dfrac{dx}{3 - 2x - x^2}$ [2]

(b) $\int \dfrac{x^2}{(x^2 + 9)(x^2 + 4)}\, dx$ [3]

17. Solve $\dfrac{dy}{dx} + \dfrac{\cos x \sin y}{\cos y} = 0$. An equation reacting to the stability of an aeroplane is $\dfrac{dv}{dt} = g \cos \alpha - kv$, where v is the velocity and g, α, k are constants. Find an expression for velocity, if $v = 0$, when $t = 0$. [5]

18. Maximize $P = 25x + 45y$ subject to $x + 3y \le 21$, $2x + 3y \le 24$, x, $y \ge 0$ by using simplex method. [5]

19. (a) Two unlike parallel forces, the greater of which is 75N, have a resultant 25N. Find the ratio of the distances of the resultant from the component forces. [2]

(b) A projectile thrown from a point in a horizontal plane comes back to the plane in 4 sec. at a distance of 60 m in front of the point of projection. Find the velocity of projection. ($g = 10 \text{ m/s}^2$). [3]

OR

State the Hawkins-Simon conditions for the viability of the system. The demand and supply curves for an item are given by $P_d = 20 - 3Q - Q^2$ and $P_s = Q - 1$ respectively. Find the difference between consumer and producer surplus at the equilibrium price. [1 + 4]

Group 'C' [8 × 3 = 24]

20. (a) In how many ways can the letters of the word "CALCULUS" be arranged so that the two L's do not come together? [3]

(b) Sum to n terms of the series $1^2 + 3^2 + 5^2 + \ldots$ [3]

(c) The sum of the roots of a quadratic equation is 4 and the sum of their squares is 14. Find the equation. [2]

21. (a) Find the angle between the lines whose direction cosines are given by $l + m + n = 0$ and $2lm + 2ln - mn = 0$. [5]

(b) Prove by the vector method: $\dfrac{\sin A}{a} = \dfrac{\sin B}{b} = \dfrac{\sin C}{c}$. [3]

22. (a) Find the derivative of $\ln \sin x$ by using first principle. [4]

(b) State the mean value theorem. Use it to verify for the function $f(x) = \sqrt{x^2 - 4}$ in [2, 4]. [1 + 3]

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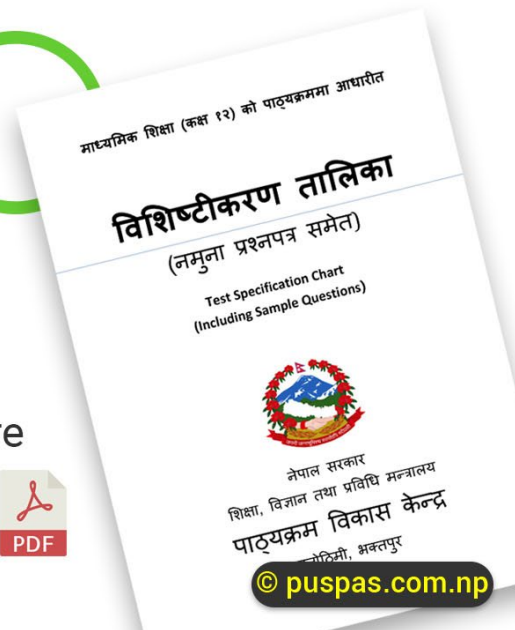## Class 12 Model Question 2078 PDF (All Subjects) With Specification Grid

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