FWC

தேசிய வெளிக்கள நிலையம் தொண்டைமானாறு
மூன்றாம் தவணைப் பரீட்சை - 2024
National Field Work Centre, Thondaimanaru
3rd Term Examination - 2024

இணைந்த கணிதம் Combined Maths	Three Hours 10 Min	10	E	A
	Gr. 12 (2024)			

Admission No.						

Instructions

- This question paper consists of two parts;
  Part A (questions 1-10) and **part B** (questions 11- 17).

Part - A

- Answer **all** questions. Answers should be written in the space provided on the questions paper. If additional space needed, you may use additional answer sheets.

Part - B

- Answer only 5 questions.
- After the allocated time hand over the paper to the supervisor with both parts attached together.
- **Only part B** of the paper is allowed to be taken out of the Examination Hall.

Combined Mathematics		
Part	**Que. No.**	**Marks**
A	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
B	11	
	12	
	13	
	14	
	15	
	16	
	17	
Total		

Combined Mathematics A	
Combined Mathematics B	
Final Marks	

Part - A

01) Let $a, b, c, p, q, r \in \boldsymbol{R}$ and $a \neq 0, p \neq 0$. If α, β are the roots of the equation $ax^2 + bx + c = 0$ and $\alpha + \gamma, \beta + \gamma$ are the roots of the equation $px^2 + qx + r = 0$, show that $\frac{b^2-4ac}{a^2} = \frac{q^2-4pr}{p^2}$.

02) Sketch the graphs of $y = |x + 3|$ and $y = x + 2$ in the same diagram.

Hence or otherwise, find all real values of x satisfying the inequality $\frac{|x+3|+x}{x+2} > 1$.

03) Show that $\lim_{x\to 0} \frac{2\sin x - \sin 2x}{x^2(\sqrt{2+x}-\sqrt{2-x})} = \sqrt{2}$.

04) Let $a, b > 0$. Show that the equation of the normal line to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ at the point $P(a\sec\theta\,,\ b\tan\theta)$ is $ax\sin\theta + by = (a^2+b^2)\tan\theta$, where $0 < \theta < \frac{\pi}{2}$. If it is given that $a = 2,\ b = 1$ and the normal line passes through the point $(0, 5)$, find the coordinates of P.

05) Let $\tan(A+B)=\frac{1}{2}$ and $\tan(A-B)=\frac{1}{3}$ for the acute angles A and B.

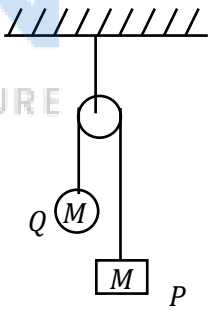
Show that $\tan(2B)=\frac{1}{7}$ and $A=\frac{\pi}{8}$.

06) A particle P is projected vertically upwards with velocity u under the action of gravity from horizontal ground. At the same moment of projection of P, another particle Q is dropped from a height $\frac{u^2}{3g}$. If both the particles meet each other at a height $\frac{4u^2}{15g}$ above the horizontal floor, find the time taken for the intersection and find their velocities at that instant.

07) A particle P is projected in a vertical plane from a point O on the horizontal ground with velocity V at an angle β with horizontal. When the particle P is at its maximum height, another particle Q is projected in the vertical plane from point O with velocity u at angle α with horizontal. Both the particles P and Q hit at point A which is along the horizontal through point O, at the same instant. Where $tan\beta = \frac{4}{3}$.

(i) Show that $u = \frac{2V}{5sin\alpha}$ (ii) Show that $\tan\alpha = \frac{1}{3}$

08) A light inextensible string passes above a light, smooth pulley stationed at a higher point as shown in the figure. Particles P and Q of masses M, m $(M > m)$ respectively are attached to its ends and the system is released from rest gently such that the parts of the strings are vertical and taut. If the acceleration of P related to Q is $\frac{2g}{3}$, then find the tension in the string and the value of M in terms of m.



09) Position vector of point A with respect to origin O is $\sqrt{3}i + 3j$. B is a point such that $BA \perp OA$ and $A\hat{O}B = 30°$. Find the position vectors of point B.

10) One end A of a uniform rod AB of length $4l$ and weight W is hinged smoothly at a point on horizontal floor as shown in the figure. Point C lies on a smooth peg such that $AC = l$ and the rod is in equilibrium making an angle $60°$ with horizontal. At equilibrium, find the reaction given by peg on rod and find the reaction at the hinge A.