FWC

தொண்டைமானாறு வெளிக்கள நிலையம் நடாத்தும்

முதலாம் தவணைப் பரீட்சை - 2022

Conducted by Field Work Centre, Thondaimanaru.

1st Term Examination - 2022

இணைந்த கணிதம் – A Combined mathematics – A	Three Hours Gr -12 (2023)	10	E	A

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 I		
Part	Question	Marks
A	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
B	11	
	12	
	13	
	14	
	15	
	16	
	17	
	Total	

Combined Maths I	
Combined MathsII	
Total	
Final Marks	

01) Let $a, b, c \in \mathbb{R}^+ \setminus \{1\}$, show that $\frac{1}{1-\log_a \frac{1}{bc}} + \frac{1}{1-\log_b \frac{1}{ca}} + \frac{1}{1-\log_c \frac{1}{ab}} = 1$

02) Find the real values of x satisfying the inequality $\frac{x^2+3}{x} > 4$.

03) Let $f(x) = x^3 + ax^2 + bx + 5$, if the reminders are equal, when $f(x)$ is divided by $x^2 - 1$ and $x + 2$ Find the values of a, b

04) $\frac{2x}{(x-1)(2x-1)}$ into partial fractions, Hence $\frac{2x}{(x-1)(x-2)}$ into partial fractions.

05) Solve, $2^{2x} - 2^{x+3} + 15 = 0$

06) Let $\sin\alpha = \frac{1}{\sqrt{17}}$ and $\cos\beta = -\frac{1}{\sqrt{5}}$ where $\frac{\pi}{2} < \alpha < \pi$ and $\frac{\pi}{2} < \beta < \pi$. Find $\cos(\alpha + \beta)$

07) $\underline{a}$ and $\underline{b}$ are non zero and non parallel vectors. If $\alpha\underline{a} + \beta\underline{b} = 0$ such that α, β are scalars show that $\alpha = 0$ and $\beta = 0$

08) If $\underline{a} = \lambda\underline{\imath} + \mu\underline{j}$, $\underline{b} = 2\imath - \mu j$, $|\underline{a}| = \sqrt{3}$ and $\underline{a} \perp \underline{b}$ Then find the values of λ and μ $(\mu > 0)$

09) The two forces P and Q acting at an angle θ in a point. Q is not change. When P be doubled, If the new resultant as not change same as P Show that $\sqrt{3}P = Q$ find the angle between P and Q

10) The magnitudes 8 and $8\sqrt{3}$ N of two forces acting at an angle $60°$ in a point

i) Find the magnitude of the resultant

ii) Find the resultant makes an angle with $8N$ force

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இணைந்த கணிதம் – B Combined mathematics – B	Gr -12 (2023)	10	E	B

11) (a) Let $k > 2$, show that the equation $x^2 - 2kx + (4-k)^2 = 0$ has two real distinct roots. Let α and β be the roots of the above equation. Find $\alpha + \beta$, and $\alpha\beta$ in terms of k show that.

(i) $(\alpha - 2) + (\beta - 2) = 2(k-2)$

(ii) $(\alpha - 2)(\beta - 2) = (k-2)(k-10)$

Hence find the value of k such that the roots α and β greater than two.

Find the quadratic in terms of k whore roots are $\alpha - 2$ and $\beta - 2$.

(b) Salve the equation $2x^4 - 9x^3 + 14x^2 - 9x + 2 = 0$

12) (a) Let $f(x) = \lambda x^2 - 4\lambda x + \lambda^2 + 4\lambda + 4$ for $\lambda \epsilon R$

$f(x)$ Express in the form of $A(x-B)^2 + C$ where A, B and C are calculated constant.

(i) Show that $f(x) \geq 8$ if $\lambda = 2$ for all $x \epsilon R$

(ii) Show that $f(x) \leq 5$ if $\lambda = -1$, for all $x \epsilon R$

(iii) Find the values of λ such that $f(x) > 5$ for all x EIR

(b) Let $g(x) = ax^3 + bx^2 - x - 6$ for $a, b \epsilon R$ given that

$x - 1$ is a factor of $g(x)$

The remainder when $g(x)$ divided by $(x+1)$ is (-2)

Show that $a = 2, b = 5$

(i) If $a = 2, b = 5$, find the quotient and remainder when the $g(x)$ divided by $(x^2 + 1)$

(ii) If $a = 2$ and $b = 5$, write $g(x)$ as product of linear factor, hence solve the equation $g(x+1) = 0$

13) (a) Prove the following identity equations

(i) $\frac{1+\sin A}{\cos A}+\frac{\cos A}{1+\sin A}=2\sec A$

(ii) $(1+\tan A)^2+(1+\cot A)^2=(\sec A+CosecA)^2$

(b) Write $\cos(A+B), \cos(A-B)$ in terms of $\cos A, \cos B, \sin A, \sin B$

Hence show that $\cos C+\cos D=2\cos\left(\frac{C+D}{2}\right)\cos\left(\frac{C-D}{2}\right)$

$\cos 3\theta+\cos 7\theta+\cos 11\theta+\cos 21\theta=4\cos 5\theta\cos 7\theta\cos 9\theta$

(c) using $\cos 2\theta=1-2\sin^2\theta$

Show that $\sin^2 10°+\sin^2 50°+\sin^2 70°=\frac{3}{2}$

14) (a) Solve the following equations

(i) $2\sin^2 x=3(1-\cos x)$

(ii) $\cos 6x+\cos 4x=\cos 5x$

(iii) $\sin 5x+\cos 5x=2\sin 3x+\cos x-\sin x$

(b) If $\tan x=k\tan\left(\frac{\pi}{4}-x\right)$

Show that $\frac{k-1}{k+1}=\sqrt{2}\sin\left(2x-\frac{\pi}{4}\right)$

Hence solve the equation $\tan x=2\tan\left(\frac{\pi}{4}-x\right)$

15) (i) The position vectors of three points A, B and C are $\underline{a}, \underline{b}$ and $\underline{c}$ respectively, λ is a scalar. If $\underline{c}=\lambda\underline{a}+(1-\lambda)\underline{b}$, show that A, B and C are on a straight line

(ii) Let $\underline{a}=2\underline{i}+\underline{j}$ and $\underline{b}=\underline{i}+3\underline{j}$

Find the unit vector in the direction of $(\underline{a}+\underline{b})$

(iii) The position vectors of three points A, B and C with respect to a fixed origin O are $\underline{a}, \underline{b}$ and $\alpha\underline{a} + \beta\underline{b}$. AB and OC are intersect at M let $OM = \lambda OC$, $AM = \mu AB$

i. Find $\overrightarrow{OM}, \overrightarrow{AM}$ in terms of $\underline{a}, \underline{b}, \lambda, \mu, \alpha, \beta$

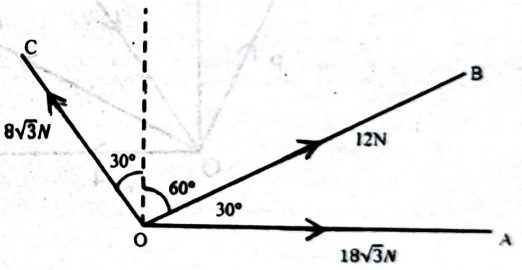
ii. Find λ and μ using the vector addition

iii. Hence deduce $AM : MB, OM : MC$

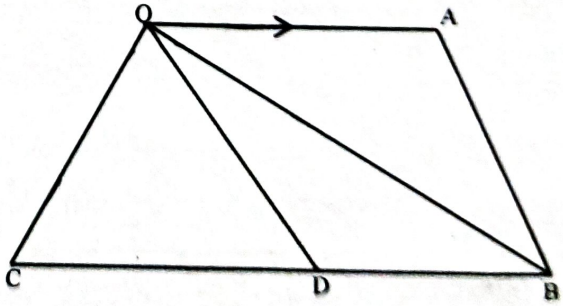
iv. If the point C is on AB deduce $\alpha + \beta = 1$

16) (a) The forces $\underline{F_1} = \left(\underline{i} - 3\underline{j}\right) N$ and $\underline{F_2} = \left(P\underline{i} + 2P\underline{j}\right) N$ act on a particle. If the resultant of these forces parallel to $\left(-\underline{i} + \underline{j}\right)$, find the value P and also the magnitude of the resultant

(b) The forces acting at a point O of magnitudes $18\sqrt{3}, 12, 8\sqrt{3}$ N act along the sides $\overrightarrow{OA}, \overrightarrow{OB}, \overrightarrow{OC}$ respectively as shown in the figure. Find the magnitude of these forces and find the angle of the resultant make with OB.

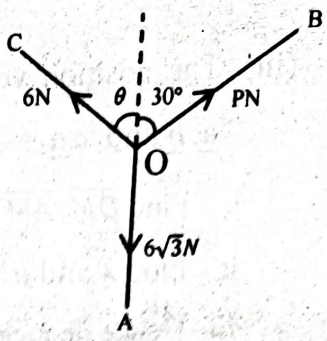


(c) $OABC$ is a trapezium such that $OA // CB$, $CB = 2OA$, D is the midpoint of BC, $OD = OA$ and $O\hat{D}C = \frac{\pi}{3}$. The forces acting at a point O of magnitudes $6N, 4\sqrt{3}N, 8N, 12N$ act along the sides $\overrightarrow{OA}, \overrightarrow{OB}, \overrightarrow{OC}$ and $\overrightarrow{OD}$ respectively. Find the magnitueles of resultant and find the angle of the resultant make with OB.



17) (a) A particle of weight W is attached to one end of a light inextensible string and its other end is suspended from a point on the celling (roof). The sting is held inclined at an angle θ with the vertrcal upwards by means of a horizontal force F applied to the particle. The system is in equilibrium. If the tension of the string is double of the force F, find the tension of the string, force F and angle θ by drawing the triangle of force.

(b) The force acting at a point O of magnifies $6\sqrt{3}, P, 6$ newton act along the direction $\overrightarrow{OA}, \overrightarrow{OB}$ and $\overrightarrow{OC}$ respectively. If the system is in equilibrium find P and angle θ



(c) $OABCDE$ is a regular hexagon. The forces acting at a point O of magnitudes $4, 2\sqrt{3}, Q, 4\sqrt{3}, P$ newton act along the directions $\overrightarrow{OA}, \overrightarrow{OB}, \overrightarrow{CO}, \overrightarrow{OD}, \overrightarrow{OE}$ The system is in equilibrium. Find the values of P and Q