UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2009/2010

SUBJECT	:	MATHEMATICS I
CODE	:	BSM 1223
COURSE	:	1 BBV
DATE	:	NOVEMBER 2009
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER ALL QUESTIONS IN **PART A** AND **THREE (3)** QUESTIONS IN **PART B**

THIS EXAMINATION PAPER CONSISTS OF 5 PAGES

PART A

Q1 (a) The point (3, 4) lies on a circle whose center is at (-1, 2).

(i) Determine the radius of the circle.
(ii) Find the standard form of the equation of the circle.
(iii) Sketch the graph.

(7 marks)

(b) Find the vertex, focus and the directrix of the parabola $2x-3y^2+9y+5=0$.

(13 marks)

Q2 (a) Given the vectors $\mathbf{u}=\langle 2,-1,3\rangle$, $\mathbf{v}=\langle -4,0,-2\rangle$ and $\mathbf{w}=\langle -1,1,3\rangle$. Find

(i) $\mathbf{w}\times(2\mathbf{u}+\mathbf{w})$.
(ii) $\mathbf{u}\cdot\mathbf{v}$.
(iii) a unit vector with the same direction as $\mathbf{v}$.
(iv) the angle between $\mathbf{u}$ and $\mathbf{v}$.
(v) an equation of the plane which passes through the point $\mathbf{w}$ and parallel to the plane $3x-3y-5z+1=0$.

(15 marks)

(b)

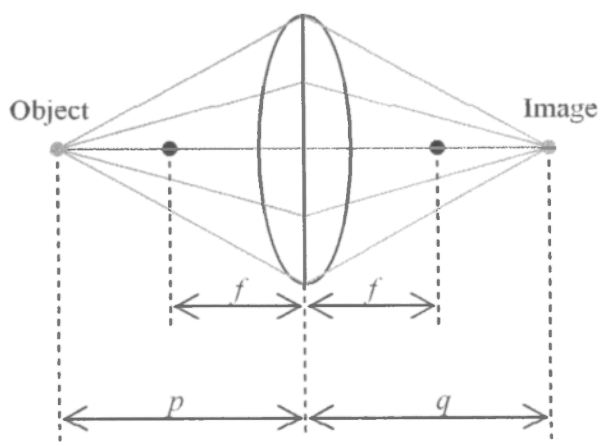

Figure Q2

As illustrated in **Figure Q2** above, if a convex lens has focal length f centimeters and if an object is placed a distance p centimeters from the lens with $p>f$, then the distance q from the lens to the image is related to p and f by the formula

$$\frac{1}{p}+\frac{1}{q}=\frac{1}{f}.$$

If $f=5$ cm, how close must the object be to the lens for the image to be more than 12 centimeters from the lens?

(5 marks)

PART B

Q3 (a) (i) Solve $\log_5 x + \log_{25} x = 3$.

(ii) Simplify $\dfrac{\log_a \dfrac{1}{81} a^{-4}}{\log_a \dfrac{1}{3a}}$.

(11 marks)

(b) (i) Express $e^{3+\frac{11\pi}{6}i}$ in the Cartesian form $(a+bi)$.

(ii) By using De Moivre Theorem, simplify

$$\left(\cos\frac{\pi}{3}+i\sin\frac{\pi}{3}\right)^3\left(\cos\frac{\pi}{4}+i\sin\frac{\pi}{4}\right)^4.$$

(9 marks)

Q4 A bakery produces cakes, doughnuts and muffins. Each product requires three ingredients flour, sugar and butter as listed below.

	Flour	Sugar	Butter
Cakes	30	21	12
Doughnuts	14	12	6
Muffins	8	6	4

The bakery has available 480 kg of flour, 360 kg of sugar and 200 kg of butter.

(a) Based on the information above and by assuming that x_1, x_2 and x_3 as the number of cakes, doughnuts and muffins to be baked that day respectively, write the system in matrix form, $AX = B$.

(2 marks)

(b) Based on the system of linear equations in (a), find the number of cakes, doughnuts and muffins to be baked that day by using

(i) Gauss elimination method.
(ii) Cramer's Rule.

(18 marks)

Q5 (a) If α and β are the roots for the quadratic equation $x^2 - 4x + 7 = 0$, find

(i) $\dfrac{1}{\alpha+1} + \dfrac{1}{\beta+1}$.

(ii) $\alpha^2 + \beta^2$.

(6 marks)

(b) Express $\dfrac{-2x^2 + 7x + 7}{(x^2 + x + 2)(x+3)}$ as a partial fraction.

(8 marks)

(c) The equations of L_1 and L_2 are $y = 3x + 4$ and $y = 5x - 6$ respectively.

(i) Determine if L_1 and L_2 are parallel.

(ii) If they are not, find the point of their intersection.

(6 marks)

Q6 (a) Given $z_1 = 3 + 3i$, $z_2 = i^{43}(3+4i)^2$ and $z_3 = 1 - \sqrt{3}\,i$. Find $\overline{\dfrac{z_1 + z_2}{z_3}}$.

(6 marks)

(b) Solve $7\tan\theta + \cot\theta = 5\sec\theta$ for $0 \le \theta \le 2\pi$.

(5 marks)

(c) Verify $\dfrac{\sin^2 x}{1+\cos x} = \dfrac{1-\cos x}{\csc x}$.

(3 marks)

(d) Solve the inequality

$$\sqrt{3-3x} - \sqrt{2x+5} > \sqrt{2-x}$$

by using sign analysis and write the answer in interval notation.

(6 marks)

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Formulae

Trigonometry

1	$\sin^2 x + \cos^2 x = 1$
2	$\tan^2 x + 1 = \sec^2 x$
3	$1 + \cot^2 x = \csc^2 x$

Cramer's Rule

$$x_i = \frac{|A_i|}{|A|}$$

Vectors

$$\text{vector unit} = \frac{v}{|v|}$$

$$u \bullet v = |u||v|\cos\theta$$

Conic Section

Circle	$(x-h)^2 + (y-k)^2 = r^2$
Parabola	$(y-k)^2 = 4p(x-h)$ Focus $(h+p, k)$ Directrix $h-p$