Basic Science Department Mathematics II Code: Math 102 Final Exam: May 2014 Time Allowed: **2** Hours	Modern University For Technology & Information Faculty of Engineering	Academic year: 2013 / 2014 Semester: Spring Examiners: Dr. Mona Samir Dr. Mohamed Eid
Answer **All** questions		No. of Questions: 4 Total Mark: 40

ممنوع إستخدام المحمول كألة حاسبة. يُسمح **فقط** بإستخدام الألة الحاسبة العادية

Do not use Mobile as Calculator. Only use regular Calculator

Question 1

(a) Prove using mathematical induction that for all $n \geq 1$, 3

$$1 + 4 + 7 + \cdots + (3n - 2) = \frac{1}{2}n(3n - 1)$$

(b) Find the sum of **n** terms of the series: $\sum_{r=1}^{n} \frac{1}{r(r+1)}$ 2

(c) Using Horner's method, divide $(x^4 - 6x^3 + 28x - 30)$ by $(x - 5)$. 2

(d) If $\alpha_1, \alpha_2, \alpha_3, \alpha_4$ are the roots of the equation: $2x^4 - 4x^3 - 12x^2 + 16 = 0$. 3

Then find : (i) $\sum_{i=1}^{4}(\alpha_i)^2$ (ii) the roots if they form geometric series.

Question 2

(a) Evaluate $(-4 - 8i)^{2/3}$ 2

(b)Find the eigenvalues and the eigenvectors of the matrix $A=\begin{bmatrix} -5 & 0 & 0 \\ 3 & 7 & 0 \\ 4 & -2 & 3 \end{bmatrix}$. 4

(c)Solve the following linear system using inverse matrix: 4

$$-y - z + 2x = 4, \quad 4y - 2z - 11 = -3x, \quad 4z - 2y + 3x = 11.$$

Question 3

(a)State the definition of the parabola. 2

(b) Show that the circles $x^2 + y^2 + 4x + 2y - 3 = 0, x^2 + y^2 - 6x + 6y - 3 = 0$ 2

(c)Write the equation of circle where the points (2, 1), (0, –3) are ends of diameter. 3

Also, find the equation of tangent at the point (2, 1).

(d)Find center, vertices and sketch the ellipse $4x^2 + y^2 - 8x + 4y + 4 = 0$. 3

Question 4

(a)Write the equation of the sphere of radius 2 and its center at the point (1, 2, – 2). 2

(b)Describe the surface $2x^2 - y^2 - 3z^2 = 0$. 2

(c)Write the equation of the plane that passes through the point (1, –1, 3) and parallels to the plane $2x + y - 2z = 3$. 3

(d)Determine the value of c such that the following equation represents pair of lines: $2x^2 + 3xy + y^2 - x + c = 0$. 3

Good luck *Dr. Mona Samir* *Dr. Mohamed Eid*

Basic Science Department Math. 2 Code: Math 102 Mid-Term Exam: April 2014 Time Allowed: 60 Minutes	Modern University For Technology & Information Faculty of Engineering	Academic year: 2013 / 2014 Semester: Spring Examiners: Dr. Mona Samir Dr. Mohamed Eid
Answer All questions		**Total Mark: 30**

ممنوع إستخدام المحمول كألة حاسبة. يُسمح **فقط** بإستخدام الألة الحاسبة العادية

Do not use Mobile as Calculator. Only use regular Calculator

[1] Using mathematical induction to prove the validity of the following: $1 + 3 + 5 + \cdots + (2n - 1) = n^2$	4
[2] Find the sum of **n** terms of the series: $\sum_{r=1}^{n}(r^2 - 4)(r + 3)$.	4
[3] Using Horner's method, divide $f(x) = 2x^4 + 4x^3 - x + 16$ by (x + 4), then find $f\,`(6)$.	4
[4] Using the binomial theorem, expand $(4x^3 - 12)^{-4}$.	3
A. Geometry: Answer in a separate paper	
[1] State the definition of the parabola.	2
[2] Write the equation of circle where the points (1, 2), (–1, 3) are ends of diameter.	2
[3] Write the equation of tangent to the circle $x^2 + y^2 - 2x - 4y + 3 = 0$ at (2, 3).	3
[4] Find vertex, focus and sketch the parabola $y^2 + 8x + 2y - 7 = 0$.	4
[5] Find center, vertices and sketch the ellipse $x^2 + 4y^2 - 4x - 8y + 4 = 0$.	4

Good luck *Dr. Mona Samir* *Dr. Mohamed Eid*

W1	ID	Name

[1]State the definition of the plane.

[2]Write the equation of the plane that passes through the points $(1, -1, 0)$, $(-1, 1, 2)$, $(3, 0, -1)$.

[3]Describe the surface $x^2 - 2y^2 + z^2 = 0$.

[4]Determine the type of the curve $3x^2 - 8xy - 3y^2 - 2x - 4y = 0$.

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Answer

W2	ID	Name

[1]State the definition of the sphere.

[2]Find the angle between the planes: $2x - 2y + z - 1 = 0$, $3x - 4z + 2 = 0$.

[3] Write the equation of the sphere with center $(1, -1, -2)$, radius 3.

[4]Determine the type of the curve $2x^2 - 3xy + 2y^2 - 16 = 0$.

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Answer

W3	ID	Name

[1]State the definition of the hyperbola.

[2]Write the equation of the plane that passes through the point (2, – 1, 3) and its normal vector is $\vec{U} = i - 2j + 3k$

[3]Describe the surface $x^2 + y^2 + z^2 - 3y + 2z - 1 = 0$.

[4]Determine the type of the curve $x^2 + 2xy + y^2 + x = 0$.

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Answer

W4	ID	Name

[1]State the definition of the plane.

[2]Find the angle between the planes: $x - y + 3z - 1 = 0$, $4x + y - z + 2 = 0$.

[3] Write the equation of the sphere with center $(0, 0, -3)$, radius 3.

[4]Determine the type of the curve $x^2 - 4xy + 4y^2 - x + 3y - 2 = 0$.

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Answer

T1	ID	Name

[1]State the definition of the plane.

[2]Write the equation of the plane that passes through the points (1, 2, 0), (– 1, 1, 2), (3, 0, 3).

[3]Describe the surface $y^2 - 3x^2 + z^2 = 0$.

[4]Find the center, vertices and sketch of the hyperbola $4x^2 - y^2 + 16x - 4y + 16 = 0$

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Answer

T2	ID	Name

[1]State the definition of the hyperbola.

[2] Write the equation of the sphere with center $(1, 0, -2)$, radius 2.

[3]Write the equation of the plane that passes through the point $(1, -2, 3)$ and its normal vector is $\vec{U} = 3i - 2j + k$

[4]Find the center, vertices and sketch of the hyperbola $4x^2 - y^2 + 24x + 4y + 36 = 0$

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Answer

T3	ID	Name

[1]State the definition of the sphere.

[2]Write the equation of the plane that passes through the point (1, 1, – 3) and its normal vector is $\vec{U} = 3i - 2k$

[3]Describe the surface $x^2 + y^2 + z^2 - 4y + 3z = 0$.

[4]Find the center, vertices and sketch of the hyperbola $x^2 - 4y^2 + 4x - 16y - 16 = 0$

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Answer

T4	ID	Name

[1]State the definition of the hyperbola.

[2]Write the equation of the plane that passes through the points (2, 2, 1), (– 1, 1, 2), (3, 0, – 2).

[3]Describe the surface $x^2 + z^2 - 3 = 0$.

[4]Find the center, vertices and sketch of the hyperbola $x^2 - y^2 + 4x + 6y + 4 = 0$

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Answer

M1	Group	ID	Name

[1]State the definition of the circle.

[2]Write the equation of straight line that passes through the points $(2, -1), (0, 3)$.

[3]Find the radical axis of the circles $x^2 + y^2 + 4x + y - 4 = 0,\ x^2 + y^2 + y - 1 = 0$

[4]Find vertex, focus and sketch the parabola $x^2 + 4x + 8y - 4 = 0$.

[5]Write the equation of circle where the points $(2, -1), (0, 3)$ are ends of diameter and find its center.

M2	Group	ID	Name

[1]State the definition of the parabola.

[2]Find vertex, focus and sketch the parabola $x^2 + 4x + 8y - 4 = 0$.

[3]Write the equation of circle where the points (2, – 1), (0, 3) are ends of diameter and find its center.

[4]Write the equation of straight line that passes through the points (2, – 1), (0, 3).

[5]Find the radical axis of the circles $x^2 + y^2 + 4x + y - 4 = 0$, $x^2 + y^2 + y - 1 = 0$

M3	Group	ID	Name

[1]State the definition of the straight line.

[2]Write the equation of straight line that passes through the points $(2, -1), (0, 3)$.

[3]Write the equation of circle where the points $(2, -1), (0, 3)$ are ends of diameter and find its center.

[4]Find the radical axis of the circles $x^2 + y^2 + 4x + y - 4 = 0,\ x^2 + y^2 + y - 1 = 0$

[5]Find vertex, focus and sketch the parabola $x^2 + 4x + 8y - 4 = 0$.

M4	Group	ID	Name

[1]State the definition of the circle.

[2]Find the radical axis of the circles $x^2 + y^2 + 4x + y - 4 = 0$, $x^2 + y^2 + y - 1 = 0$

[3]Write the equation of straight line that passes through the points $(2, -1), (0, 3)$.

[4]Write the equation of circle where the points $(2, -1), (0, 3)$ are ends of diameter and find its center.

[5]Find vertex, focus and sketch the parabola $x^2 + 4x + 8y - 4 = 0$.

N1	Group	ID	Name

[1]State the definition of the parabola.

[2]Write the equation of circle with center (2, – 1) and radius 3.

[3]Show that the circles $x^2 + y^2 + 4x + 1 = 0$, $x^2 + y^2 + y - 1 = 0$ are orthogonal.

[4]Write the equation of straight line that passes through the point (2, – 1) and parallels to the line $2x - 3y + 1 = 0$

[5]Find vertex, focus and sketch the parabola $y^2 + 4x + 8y - 4 = 0$.

N2	Group	ID	Name

[1]State the definition of the circle.

[2]Show that the circles $x^2 + y^2 + 4x + 1 = 0$, $x^2 + y^2 + y - 1 = 0$ are orthogonal.

[3]Write the equation of straight line that passes through the point $(2, -1)$ and parallels to the line $2x - 3y + 1 = 0$.

[4]Write the equation of circle with center $(2, -1)$ and radius 3.

[5]Find vertex, focus and sketch the parabola $y^2 + 4x + 8y - 4 = 0$.

N3	Group	ID	Name

[1]State the definition of the line.

[2]Write the equation of straight line that passes through the point (2, – 1) and parallels to the line $2x - 3y + 1 = 0$

[3]Find vertex, focus and sketch the parabola $y^2 + 4x + 8y - 4 = 0$.

[4]Write the equation of circle with center (2, – 1) and radius 3.

[5]Show that the circles $x^2 + y^2 + 4x + 1 = 0$, $x^2 + y^2 + y - 1 = 0$ are orthogonal.

N4	Group	ID	Name

[1]State the definition of the parabola.

[2]Write the equation of circle with center (2, – 1) and radius 3.

[3]Write the equation of straight line that passes through the point (2, – 1) and parallels to the line $2x - 3y + 1 = 0$

[4]Show that the circles $x^2 + y^2 + 4x + 1 = 0$, $x^2 + y^2 + y - 1 = 0$ are orthogonal.

[5]Find vertex, focus and sketch the parabola $y^2 + 4x + 8y - 4 = 0$.