KOLEJ UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF COMPUTING AND INFORMATION TECHNOLOGY

ACADEMIC YEAR 2020/2021

Assignment 1

MATHEMATICS AAMS3163

ALGEBRA

STUDENT'S DECLARATION OF ORIGINALITY

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Course Code: AAMS3163

Course Title: ALGEBRA

Signature: 

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Date: 13/3/2021

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Q2	
Q3	
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Total	

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AAMS3163

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Q1. (a)

$\vec{PQ} = \vec{PO} + \vec{OQ}$

$= -\vec{OP} + \vec{OQ}$

$= -(\underset{\sim}{i} + 2\underset{\sim}{j} + 3\underset{\sim}{k}) + (4\underset{\sim}{i} + \underset{\sim}{j} + 2\underset{\sim}{k})$

$= -\underset{\sim}{i} - 2\underset{\sim}{j} - 3\underset{\sim}{k} + 4\underset{\sim}{i} + \underset{\sim}{j} + 2\underset{\sim}{k}$

$= 3\underset{\sim}{i} - \underset{\sim}{j} - \underset{\sim}{k}$

$\therefore 3\underset{\sim}{i} - \underset{\sim}{j} - \underset{\sim}{k} = (3, -1, -1)$

$\vec{PR} = \vec{PO} + \vec{OR}$

$= -\vec{OP} + \vec{OR}$

$= -(\underset{\sim}{i} + 2\underset{\sim}{j} + 3\underset{\sim}{k}) + (\underset{\sim}{i} + 2\underset{\sim}{j} - \underset{\sim}{k})$

$= -\underset{\sim}{i} - 2\underset{\sim}{j} - 3\underset{\sim}{k} + \underset{\sim}{i} + 2\underset{\sim}{j} - \underset{\sim}{k}$

$= -4\underset{\sim}{k}$

$\therefore -4\underset{\sim}{k} = (0, 0, -4)$

Q1. (b)

$\vec{PQ} \cdot \vec{PR} = (3)(0) + (-1)(0) + (-1)(-4)$

$= 4$

$\|\vec{PQ}\| = (3^2 + (-1)^2 + (-1)^2)^{\frac{1}{2}}$

$= \sqrt{11}$

$\|\vec{PR}\| = (0^2 + 0^2 + (-4)^2)^{\frac{1}{2}}$

$= 4$

$\cancel{\cos\theta = \frac{u \cdot v}{\|u\|\|v\|}}$

$\cos\theta = \dfrac{\vec{PQ} \cdot \vec{PR}}{\|\vec{PQ}\| \, \|\vec{PR}\|}$

$\cos\theta = \dfrac{4}{(\sqrt{11})(4)}$

$\cos\theta = \dfrac{1}{\sqrt{11}}$

$\theta = 72.45°$ degree

$\therefore \angle\theta = 72.45°$ degree

~~Q1. (c) $\vec{PQ} \times \vec{PR} = ((-1)(-4) - (-1)(0))\underset{\sim}{i} + ((-1)(0) - (3)(-4))\underset{\sim}{j} + ((3)(0) - (-1)(0))\underset{\sim}{k}$~~

Q1. (c)

$\vec{PQ} \times \vec{PR} = \begin{vmatrix} \underset{\sim}{i} & \underset{\sim}{j} & \underset{\sim}{k} \\ 3 & -1 & -1 \\ 0 & 0 & -4 \end{vmatrix}$

$= \begin{vmatrix} -1 & -1 \\ 0 & -4 \end{vmatrix}\underset{\sim}{i} - \begin{vmatrix} 3 & -1 \\ 0 & -4 \end{vmatrix}\underset{\sim}{j} + \begin{vmatrix} 3 & -1 \\ 0 & 0 \end{vmatrix}\underset{\sim}{k}$

$= 4\underset{\sim}{i} + 12\underset{\sim}{j} + 0\underset{\sim}{k}$

$= 4\underset{\sim}{i} + 12\underset{\sim}{j}$

$\therefore 4\underset{\sim}{i} + 12\underset{\sim}{j} = (4, 12, 0)$

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Q1.(d) $\vec{PQ} = U$, $\vec{PR} = V$

$U = (3,-1,-1)$ $V = (0,0,-4)$

$U \times V = (4,12,0)$, $U \times V = W$

$A = \frac{1}{2}\|W\|$

$= \frac{1}{2}(4^2+12^2+0^2)^{\frac{1}{2}}$

$= \frac{1}{2}\sqrt{160}$

$= 6.32$

Q1.(e) $P_0 = P(1,2,3)$ $n = \vec{PQ} \times \vec{PR}$

$= 4i + 12j + 0k$ $(4,12,0)$

$n \cdot \vec{P_0P} = 0$

$(4,12,0)\cdot(x-1, y-2, z-3) = 0$

$4(x-1) + 12(y-2) + 0(z-3) = 0$

$4x - 4 + 12y - 24 + 0z = 0$

$4x + 12y + 0z - 28 = 0$

$4x + 12y - 28 = 0$ $\therefore 4x + 12y + 0z - 28 = 0$, ~~ax+by+cz+d=0~~

$a=4, b=12, c=0, d=-28$

~~Q1.(f)~~

Q1.(f) ~~x+z=t~~

$\vec{r_0} = P$

~~$\vec{r_0}$ $\vec{r_0}$ <1,2,3>~~

$\vec{r_0} = \langle 1,2,3 \rangle$

$\vec{v} = \langle 4-1, 1-2, 2-3 \rangle$

$= \langle 3,-1,-1 \rangle$

$\vec{r}(t) = \langle 1,2,3 \rangle + t\langle 3,-1,-1 \rangle$

$\vec{r}(t) = \langle 1+3t, 2-t, 3-t \rangle$

$\therefore x = 1+3t$, $y = 2-t$, $z = 3-t$

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Q2. line : $V = (3, -2, 7)$

~~plane : n :~~

$-3x + 2y - 7z = 6$

$-3(2+3t) + 2(3-2t) - 7(4+7t) = 6$

$-6 - 9t + 6 - 4t - 28 - 49t = 6$

$-62t = 34$

$t = -\frac{34}{62}$

$t = -\frac{17}{31}$

$\therefore t = -\frac{17}{31}$

~~Q3. $n_1 = (2, 4, -1)$~~

~~$n_2 = (1, 2, -1)$~~

~~$\cancel{2n_1 = n_2}$~~

~~$n_1 = kn_2$~~

~~$k = 2$ $1 = 2k$~~

~~$k = \frac{1}{2}$~~

~~$\Rightarrow n_1 \neq kn_2$ $\therefore$ They are not parallel.~~

~~Q4.~~

Q3. $n_1 = (2, 4, -1)$

$n_2 = (1, 2, -1)$

$n_1 = kn_2$

$(2, 4, -1) = k(1, 2, -1)$

$k = 2$, $4 = 2k$ $-1 = -k$

$k = 2$ $k = 1$

$\Rightarrow n \neq kn_2$ $\therefore$ They are not parallel.

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Q4. ~~$4x+2y-3z-3=0$~~
~~$4x+2y-3z-8=0$~~

~~$A=4,\ B=2,\ C=-3,\ D_1=-3,\ D_2=-8$~~

~~$d=\frac{|-8-(-3)|}{\sqrt{(4)^2+(2)^2+(-3)^2}}$~~

~~$=\frac{5}{\sqrt{29}}$ unit~~

~~$=0.93$ unit~~

~~$\therefore 0.93$ unit~~

Q4. $4x+2y-3z-3=0$
$4x+2y-3z-8=0$

$A=4,\ B=2,\ C=-3,\ D_1=-3,\ D_2=-8$

$d=\frac{|-8-(-3)|}{\sqrt{(4)^2+(2)^2+(-3)^2}}$

$=\frac{5}{\sqrt{29}}$ unit

$=0.93$ unit

$\therefore 0.93$ unit

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Q5. $x+1 = 5-y = z+3$

$5-y = z+3$, $x+1 = z+3$

$z+y = 2$ — ① $x-z = 2$ — ②

① = ②

$z+y = x-z$

$x-y-2z = 0$

~~∴ Line L is x-y-2z=0~~

~~Line L → x-y-2z~~

Line $L = (1,-1,-2)$

$$n = \vec{P} \times \vec{Q}$$

$$= \begin{vmatrix} \underset{\sim}{i} & \underset{\sim}{j} & \underset{\sim}{k} \\ 2 & 3 & 6 \\ a & b & c \end{vmatrix}$$

$$= (3c-6b)\underset{\sim}{i} - (2c-6a)\underset{\sim}{j} + (2b-3a)\underset{\sim}{k} \quad (3c-6b, -2c+6a, 2b-3a)$$

$v = n$

$3c-6b = 1$, $-2c+6a = -1$, $2b-3a = -2$

$3c = 1+6b$; $-2c+6\left(\frac{3c+5}{9}\right) = -1$; $2b = -2+3a$

$3c = 1+6\left(\frac{-2+3a}{2}\right)$; $-18c+18c+30 = -9$; $b = \frac{-2+3a}{2}$

$3c = 1-6+9a$; $0c = -39$; $b = \frac{-2+\frac{5}{3}}{9}$

$3c = -5+9a$; $c = 0$; $b = -\frac{1}{27}$

$9a = 3c+5$

$a = \frac{3c+5}{9}$

$a = \frac{5}{9}$

∴ $a = \frac{5}{9}$, $b = -\frac{1}{27}$, $c = 0$

$n = \left(\frac{5}{9}, -\frac{1}{27}, 0\right)$

$\left(\frac{5}{9}, -\frac{1}{27}, 0\right) = k(1,-1,-2)$

$\frac{5}{9} = k$, $-k = -\frac{1}{27}$

$k = \frac{5}{9}$; $k = \frac{1}{27}$ ∴ They are not perpendicular

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$P_0\,(1,-1,-2)$

$n = \left(\frac{5}{9}, -\frac{1}{27}, 0\right)$

$a = \frac{5}{9},\ b = -\frac{1}{27},\ c = 0,\ d = 0$

$$D = \frac{\left|\frac{5}{9}(1) + \left(-\frac{1}{27}\right)(-1) + 0(-2)\right|}{\left[\left(\frac{5}{9}\right)^2 + \left(-\frac{1}{27}\right)^2 + (0)^2\right]^{\frac{1}{2}}}$$

$$D = \frac{\frac{16}{27}}{\frac{226}{729}}$$

$$D = 1\frac{103}{113}$$

$D = 1.91$