# M E T U
# Department of Mathematics

| | Analytic Geometry<br>MidTerm II | |
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| Code : *Math 115*<br>Acad. Year : *2017-2018*<br>Semester : *Fall*<br>Coordinator : *E. Coskun*<br>Date : *14.12.2017*<br>Time : *17.40*<br>Duration : *120 minutes* | Last Name :<br>Name : Student No :<br>Department :<br>Signature :<br><br>**5** Questions on **4** Pages<br>Total **100** Points |

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**1.(10+10 pts.)** **a)** Show that the four points $A(1,1,2)$, $B(3,5,4)$, $C(0,-3,5)$ and $D(3,7,0)$ are coplanar (they all lie on a plane).

**b)** Write down the parametric equations of the line $L$ which is the intersection of the two planes $2x-3y+5z=15$ and $x+4y+3z=2$.

**2.(7+7+6 pts.)** Let two lines $L_1$ and $L_2$ be given as follows

$$L_1 : \frac{x+2}{2} = \frac{y-1}{3} = \frac{z+1}{-1} \quad \text{and} \quad L_2 : \frac{x-1}{-1} = \frac{y+1}{2} = \frac{z-2}{4}.$$

**a)** Show that $L_1$ and $L_2$ are skew lines.

**b)** Write down the equation of the plane $P$ which contains the line $L_2$ such that the line $L_1$ is parallel to the plane $P$.

**c)** Find the distance between the line $L_1$ and the plane $P$ found in part (b).

**3. (4×5 pts.)** Let $S$ be the parabola with vertex at $V(4,1)$ which has the line $d = \{(x,y) \in \mathbb{R}^2 \,|\, y = -3\}$ as its directrix.

**a)** Find the equation of the axis $\ell$ of $S$.

**b)** Find the point of intersection $G$ of $d$ and $\ell$.

**c)** Find the focus $F$ of $S$.

**d)** Find an equation, in coordinate form, of $S$.

**4. (10+10 pts.)** Let $L_1 : (x, y, z) = (-2 + 2t, 3 + 3t, 6t)$, $t \in \mathbb{R}$ and $L_2 : (x, y, z) = (1 + 2t, 2 + 3t, -2 + 6t)$, $t \in \mathbb{R}$ be two lines in $\mathbb{R}^3$.

**a)** Calculate the distance between $L_1$ and $L_2$.

**b)** Find an equation of the plane $\mathcal{P}$ which contains both of the lines $L_1$ and $L_2$.

**5. (10+10 pts.)** Let $P = (1, 3, 4)$ and $T$ be the plane given by $x - 2y + 5z = 5$.

**a)** Find the point $Q \in T$ which is closest to $P$ among all points of $T$.

**b)** Write down a vector equation of the line $L_1$ which passes through $P$ such that $L_1$ is parallel to the plane $T$ and $L_1$ intersects the line $L_2$ at a point, where $L_2$ is the line given by $L_2 : \dfrac{x-1}{2} = \dfrac{y-6}{5} = \dfrac{z-1}{3}$.