Matlab Project: **Least-Squares Problems** **Name:** **Lewis Collum**

ANSWER SHEET

Step 2: Least-square line for student number data

Student number: **0621539** $\beta_0 =$ **0.5526** $\beta_1 =$ **0.9511**

Step 3: Matrices and vectors *in terms of the symbols* t_i, β_0, β_1, β_2, *and* β_3 (the first is done for you)

Linear: $A = \begin{bmatrix} 1 & t_i \end{bmatrix}$ $\mathbf{x} = \begin{bmatrix} \beta_0 & \beta_1 \end{bmatrix}^T$

Quadratic: $A = \begin{bmatrix} 1 & t_i & t_i^2 \end{bmatrix}$ $\mathbf{x} = \begin{bmatrix} \beta_0 & \beta_1 & \beta_2 \end{bmatrix}^T$

Linear+cycle: $A = \begin{bmatrix} 1 & t_i & \sin(2\pi t_i) & \cos(2\pi t_i) \end{bmatrix}$ $\mathbf{x} = \begin{bmatrix} \beta_0 & \beta_1 & \beta_2 & \beta_3 \end{bmatrix}^T$

Solutions (full data set):

Function	β_0	β_1	β_2	β_3	T (2100)
Linear	11.107	0.02132	—	—	55.880947
Quadratic	-432.84	0.4757	-0.0001162	—	53.572368
Linear+cycle	11.381	0.02127	-11.912	-19.707	56.046488

Solutions (only using data from 2000 on):

Function	β_0	β_1	β_2	β_3	T (2100)
Linear	-42.566	0.046765	—	—	55.639285
Quadratic	-65247.72838	64.985	-0.016168	—	-80.169157
Linear+cycle	-47.061	0.049066	2.5408	-10.180	55.977387

Circle the value of T (2100) which you trust most, and briefly explain why here:

The linear function has a low coefficient of determination, the quadratic function has a t^2 term which doesn't match the pattern of the data (based on its residuals plot). The Linear+cycle function has a higher coefficient of determination and there is homoscedasticity. So, I trust the Linear+cycle model the most.

Upload to Moodle: Scan and upload this sheet to Moodle along with your **M-file** and two plots.