Question 1

A: The answer can be seen in figure below.

1. (a)

$$\underbrace{\begin{bmatrix} 1 & t_1 & -\frac{1}{2}t_1^2 \\ 1 & t_2 & -\frac{1}{2}t_2^2 \\ 1 & t_3 & -\frac{1}{2}t_3^2 \end{bmatrix}}_{3\times 3} \underbrace{\begin{bmatrix} m_1 \\ m_2 \\ m_3 \end{bmatrix}}_{3\times 1} = \underbrace{\begin{bmatrix} y(t_1) \\ y(t_2) \\ y(t_3) \end{bmatrix}}_{3\times 1}$$

(b)

$$\underbrace{\begin{bmatrix} 1 & t_1 & -\frac{1}{2}t_1^2 \\ 1 & t_2 & -\frac{1}{2}t_2^2 \end{bmatrix}}_{2\times 3} \underbrace{\begin{bmatrix} m_1 \\ m_2 \\ m_3 \end{bmatrix}}_{3\times 1} = \underbrace{\begin{bmatrix} y(t_1) \\ y(t_2) \end{bmatrix}}_{2\times 1}$$

Question 2

(a) A: Basically, d_{noise} and d_{true} have similar trend but the variation in d_{noise} is much higher.

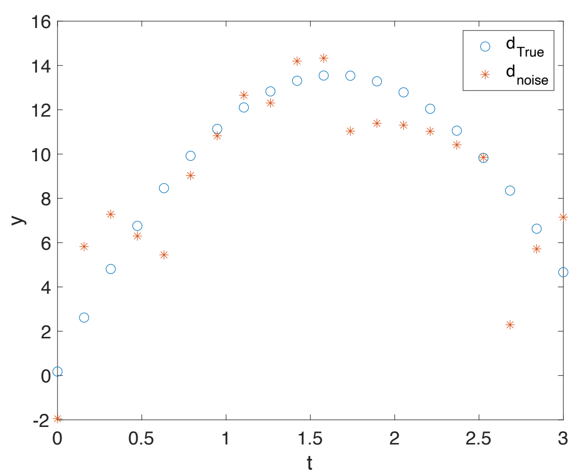

Figure 1. The comparison between d_{noise} and d_{true}.

(b) A: $y_{estimation}$ and y_{true} have a similar trend generally. About t = 0 to 1, the difference between $y_{estimation}$ and y_{true} seems not very large. Then between t=1 to 2.5, the difference become larger and after t=2.5, it seems become smaller.

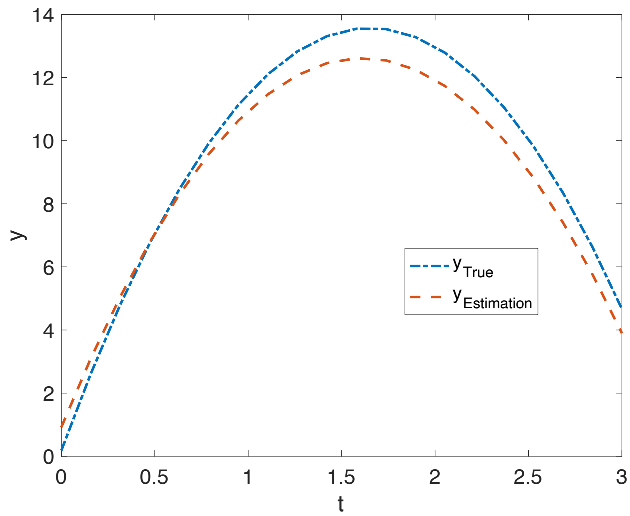

Figure 2. The comparison between $y_{estimation}$ and y_{true}

Codes:

```
clear

%% solving for (a)
m_true = [0.18;16.21;9.81];


t = linspace(0,3,20)';

G = [ones(20,1),t,-1/2*t.^2];


d_true = G*m_true;

d_noise = d_true + 2*randn(20,1);

figure(1)
plot(t,d_true,'o','MarkerSize',8)
hold on
plot(t,d_noise,'*','MarkerSize',8)
xlabel('t')
ylabel('y')
legend('d_{True}','d_{noise}')
set(gca,'fontsize',16)
%% solving for (b)

m_est = G\d_noise;


figure(2)
plot(t,G*m_true,'-.','LineWidth',2)
hold on
plot(t,G*m_est,'--','LineWidth',2)
xlabel('t')
ylabel('y')
```

```
legend('y_{True}','y_{Estimation}')
set(gca,'fontsize',16)
```