Q1. $MSE(T) = Bias^2(T) + Var(T)$

$T_1 = \frac{X_1+X_2+X_3}{3} \sim N(\mu, \frac{\sigma^2}{3})$.

$Bias(T_1) = Bias(\frac{X_1+X_2+X_3}{3})$

$= E(\frac{X_1+X_2+X_3}{3}) - \mu$

$= \frac{1}{3}E[X_1] + \frac{1}{3}E[X_2] + \frac{1}{3}[X_3] - \mu$..

$= \mu - \mu = 0$.

$Var[T_1] = \frac{\sigma^2}{3}$

$\Rightarrow MSE(T_1) = \frac{\sigma^2}{3}$

$V[T_1] = V[\frac{X_1+X_2+X_3}{3}]$

$= \frac{\sigma^2}{9} = \frac{\sigma^2}{3}$

$\bar{X_n} \sim N(\mu, \frac{\sigma}{n})$

$V[T_2] = V[\frac{1}{2}X_1 + \frac{1}{4}X_2 + \frac{1}{4}X_3]$

$= \frac{V[X_1]}{4} + \frac{V[X_2]}{16} + \frac{V[X_3]}{16}$

$= \frac{4\sigma^2+\sigma^2+\sigma^2}{16} = \frac{6\sigma^2}{16} = \frac{3\sigma^2}{8}$

$\Rightarrow MSE(T_2) = \frac{3\sigma^2}{8}$

Q2.