1) a) $\int_0^{0.5} \frac{\delta S}{S}$

$= E\left[\mu(t_2 - t_1) + \sigma(\sqrt{t_2 - t_1} \cdot z)\right]$

$= 0.1(0.5) + 0.15\sqrt{0.5}\, z$

$= E\left[0.05 + 0.15 z\sqrt{0.5}\right]$

$= 0.05 + 0.106(E[z])$

$= 0.05$

b) $\sqrt{Var\left[\mu(t_2 - t_1) + \sigma(\sqrt{t_2 - t_1} \cdot z)\right]}$

$= \sqrt{Var\left[0.05 + 0.15 z\sqrt{0.5}\right]}$

$= \sqrt{(0.15 \cdot \sqrt{0.5})^2\, Var[z]}$

$= 0.106$

2) a) $x^T \sigma \sigma^T x = (\sigma^T x)^T (\sigma^T x)$, $a = \sigma^T x$

$a^T a = \sum_i a_i^T a_i = \sum_i (a_i)^2 \geq 0$

b) $\Sigma^T = (\sigma \sigma^T)^T = (\sigma^T)^T \sigma^T = \sigma \sigma^T = \Sigma$

3) $\sum_{i=1}^{100} c \cdot i = c \sum_{i=1}^{100} i = 5050c$

Max weight $= 100c$

$\frac{100\cancel{c}}{5050\cancel{c}} = \frac{10}{505} = 0.0198$

The stock most invested in still only has a 2% share of the entire portfolio. The portfolio is sufficiently diversified.