

### 1 Exercise 3.3:

$$(S_W + \frac{1}{4}S_B)\hat{w} = \frac{\mu_1 - \mu_{-1}}{2} \quad (1)$$

We define our constant  $c$  as  $c = (\mu_1 - \mu_{-1})^T \hat{w}$ .

$$S_B \hat{w} = (\mu_1 - \mu_{-1})^T \hat{w} = c(\mu_1 - \mu_{-1}) \quad (2)$$

$$S_W \hat{w} + \frac{1}{4}c(\mu_1 - \mu_{-1}) = \frac{1}{2}(\mu_1 - \mu_{-1}) \quad (3)$$

$$S_W \hat{w} = (c' + \frac{1}{2})(\mu_1 - \mu_{-1}) \quad (4)$$

$$\hat{w} = (c' + \frac{1}{2})S_w^{-1}(\mu_1 - \mu_{-1}) = \tau S_w^{-1}(\mu_1 - \mu_{-1}) \quad (5)$$

In the last step we identified a new constant  $\tau = c' + \frac{1}{2}$ .