Q3a: By Stoke's Theorem, we know that

$$\int_{\mathcal{S}_r^2} \omega = \int_{D_r^3} d\omega$$

Hence we compute that

$$\int_{D_d^3 \setminus int D_c^3} d\omega = \int_{\partial D_d^3} \omega - \int_{\partial int D_c^3} \omega = (a + \frac{b}{d}) - (a + \frac{b}{c}) = \frac{b}{d} - \frac{b}{c}$$

Q2b: Suppose that ω is closed. Then by Stokes' Theorem we see that

$$a + \frac{b}{r} = \int_{s_r^2} \omega = \int_{D_r^3} d\omega = \int_{D_r^3} 0 = 0$$

And we conclude that $a = b = 0$.

Q2c: Suppose that $d\eta = \omega$. Then by Stokes' Theorem we see that

$$a + \frac{b}{r} = \int_{S_r^2} d\eta = \int_{D_r^3} d^2\eta = \int_{D_r^3} 0 = 0$$

We conclude that $a = b = 0$.