So $w = \frac{a}{I}\int_0^{Z}(t^2-1)^{-3/4}\,dt$

ii) $B(1/4, 1/4) = \frac{\Gamma(1/4)\Gamma(1/4)}{\Gamma(1/2)} = \frac{\Gamma^2(1/4)}{\sqrt{\pi}}$

Also, using the defining formula for $B(z,\omega)$

$$B(1/4, 1/4) = \int_0^1 t^{(1/4-1)}(1-t)^{(1/4-1)}\,dt$$

$$= \int_0^1 t^{-3/4}(1-t)^{-3/4}\,dt$$

$$= \int_0^1 (t - t^2)^{-3/4}\,dt$$

$$= \int_0^1 (1/4 - (1/2-t)^2)^{-3/4}\,dt,$$ by completing the square

$$= \int_0^1 \frac{dt}{(1/4 - (1/2-t)^2)^{3/4}} = \frac{1}{(1/4)^{3/4}}\int_0^1 \frac{dt}{(1-(1-2t)^2)^{3/4}}$$

$$= 2^{3/2}\int_0^1 \frac{dt}{(1-(1-2t)^2)^{3/4}}$$

Put $1-2t = u$ then $dt = -\frac{du}{2}$

when $t=1$ $u=-1$
$t=0$ $u=1$

$$B(1/4, 1/4) = 2^{3/2}\int_1^{-1}\frac{-du/2}{(1-u^2)^{3/4}} = \frac{-2^{3/2}}{2}\int_1^{-1}\frac{du}{(1-u^2)^{3/4}}$$

Integral in u is even about 0 so can write

$$B(1/4, 1/4) = \frac{-2\times 2^{3/2}}{2}\int_0^{-1}\frac{du}{(1-u^2)^{3/4}} = -2^{3/2}\int_0^{-1}\frac{du}{(1-u^2)^{3/4}}$$

Now write $u=-v$ then $u=-1$ $v=1$, $du=-dv$
$u=0$ $v=0$

$$B(1/4, 1/4) = 2^{3/2}\int_0^1 \frac{dv}{(1-v^2)^{3/4}}$$