The loop integral can be evaluated immediately using (2.19), which gives

$$B\left(d\,;n_1\,,m\,;n_2\,,m\right)=\frac{i}{(4\pi)^2}\left[-\frac{q^2}{4\pi\mu^2}\right]^{\frac{d}{2}-2}\frac{\left(q^2\right)^{2-n_1-n_2}}{\Gamma\left(n_1\right)\Gamma\left(n_2\right)}\int_{-i\infty}^{i\infty}\frac{ds}{2\pi i}\int_{-i\infty}^{i\infty}\frac{dt}{2\pi i}\left[-\frac{m^2}{q^2}\right]^{s+t}$$
$$\Gamma\left(-s\right)\Gamma\left(-t\right)\frac{\Gamma\left(\frac{d}{2}-n_1-s\right)\Gamma\left(\frac{d}{2}-n_2-t\right)\Gamma\left(n_1+n_2+s+t-\frac{d}{2}\right)}{\Gamma\left(d-n_1-n_2-s-t\right)}\,. \tag{2.29}$$

Now, making the change of variables $v=s$, $w=\frac{d}{2}-n_1-n_2-s-t$, the integral becomes

$$B\left(d\,;n_1\,,m\,;n_2\,,m\right)=\frac{i}{(4\pi)^2}\left[\frac{m^2}{4\pi\mu^2}\right]^{\frac{d}{2}-2}\frac{\left(-m^2\right)^{2-n_1-n_2}}{\Gamma\left(n_1\right)\Gamma\left(n_2\right)}\int_{-i\infty}^{i\infty}\frac{dv}{2\pi i}\int_{-i\infty}^{i\infty}\frac{dw}{2\pi i}\left(-\frac{q}{m^2}\right)^{w}$$
$$\Gamma\left(n_1+w+v\right)\Gamma\left(n_1+n_2-\frac{d}{2}+w+v\right)\Gamma\left(-v\right)\Gamma\left(\frac{d}{2}-n_1-v\right) \tag{2.30}$$
$$\frac{\Gamma\left(-w\right)}{\Gamma\left(\frac{d}{2}+w\right)}\,.$$

The contour integral over the variable v can now be evaluated using Barnes' Lemma (B.15). Doing so, the integral becomes

$$B\left(d\,;n_1\,,m\,;n_2\,,m\right)=\frac{i}{(4\pi)^2}\left[\frac{m^2}{4\pi\mu^2}\right]^{\frac{d}{2}-2}\frac{\left(-m^2\right)^{2-n_1-n_2}}{\Gamma\left(n_1\right)\Gamma\left(n_2\right)}\int_{-i\infty}^{i\infty}\frac{dw}{2\pi i}\left(-\frac{q}{m^2}\right)^{w}\Gamma\left(-w\right)$$
$$\frac{\Gamma\left(n_1+w\right)\Gamma\left(n_1+n_2-\frac{d}{2}+w\right)\Gamma\left(n_2+w\right)}{\Gamma\left(n_1+n_2+2w\right)}\,. \tag{2.31}$$

The Gamma function in the denominator of (2.31) can be simplified using Eq. (B.4), which gives

$$B\left(d\,;n_1\,,m\,;n_2\,,m\right)=\frac{i}{(4\pi)^2}\left[\frac{m^2}{4\pi\mu^2}\right]^{\frac{d}{2}-2}\frac{\left(-m^2\right)^{2-n_1-n_2}}{\Gamma\left(n_1\right)\Gamma\left(n_2\right)}2^{1-n_1-n_2}\pi^{\frac{1}{2}}\int_{-i\infty}^{i\infty}\frac{dw}{2\pi i}\left(-\frac{q}{4m^2}\right)^{w}$$
$$\Gamma\left(-w\right)\frac{\Gamma\left(n_1+w\right)\Gamma\left(n_1+n_2-\frac{d}{2}+w\right)\Gamma\left(n_2+w\right)}{\Gamma\left(\frac{1}{2}\left(n_1+n_2\right)+w\right)\Gamma\left(\frac{1}{2}\left(n_1+n_2+1\right)+w\right)}\,. \tag{2.32}$$

Note that the remaining contour integral can be evaluated in terms of the generalized hyper-