H.9 a) $\Delta_2^{\mu}(p',p) = \alpha\left(\gamma^\mu + \beta (p+p')^\mu\right)$

$$\alpha = \frac{2m^2}{(d-2)q^2(q^2-4m^2)} \quad , \quad \beta = \frac{(d-2)q^2+4m^2}{2m(q^2-4m^2)}$$

$$\mathrm{Tr}\left[P_2^\mu(p',p)\,\Gamma_\mu(p',p)\right]$$

$$= \mathrm{Tr}\left\{(\not p + m)\,\alpha(\gamma^\mu + \beta(p+p')^\mu)(\not p' + m)\left[\underbrace{\gamma_\mu F_1}_{=0,\ \text{odd \# of } \gamma \ \to\ ?} + \frac{i\sigma_{\mu\nu}}{2m}(p'-p)^\nu F_2\right]\right\}$$

$$= \alpha\, \mathrm{Tr}\Big[\underbrace{(\not p + m)(\gamma^\mu + \beta(p+p')^\mu)(\not p' + m)}\ \frac{i\sigma_{\mu\nu}}{2m}(p'-p)^\nu F_2\Big]$$

$$\gamma^\mu(\not p + m)(\not p' + m) \overset{tr}{=} \gamma^\mu \not p\, m + \gamma^\mu \not p'\, m$$

$$= \alpha\, \mathrm{Tr}\left\{\left[m\gamma^\mu(\not p + \not p') + \beta(p+p')^\mu(\not p'\not p' + m^2)\right]\frac{i\sigma_{\mu\nu}}{2m}(p'-p)^\nu F_2\right\}$$

$$= \frac{-\alpha}{4m}(p'-p)^\nu F_2 \cdot \mathrm{Tr}\left\{\left[m\gamma^\mu(\not p + \not p') + \beta(p+p')^\mu(\not p\not p' + m^2)\right]\cdot(\gamma_\mu\gamma_\nu - \gamma_\nu\gamma_\mu)\right\}$$

$$\mathrm{Tr} = m(p+p')_\alpha\, \mathrm{Tr}\left[\gamma^\mu\gamma^\alpha(\gamma_\mu\gamma_\nu - \gamma_\nu\gamma_\mu)\right]$$
$$+ \beta(p'+p)^\mu\left\{p_\alpha p'_\beta\, \mathrm{Tr}\left[\gamma^\alpha\gamma^\beta(\gamma_\mu\gamma_\nu - \gamma_\nu\gamma_\mu)\right] + m^2 \overset{=0}{\underline{\mathrm{Tr}\left[\gamma_\mu\gamma_\nu - \gamma_\nu\gamma_\mu\right]}}\right\}$$

$$= m(p+p')_\alpha\left[-4(d-2)g^\alpha_{\ \nu} - 4d\, g^\alpha_{\ \nu}\right] + \beta(p'+p)^\mu\Big\{4p_\alpha p'_\beta\left(\cancel{g^{\alpha\beta}g_{\mu\nu}} - g^\alpha_{\ \mu}g^\beta_{\ \nu} + g^\alpha_{\ \nu}g^\beta_{\ \mu}\right) - 4p_\alpha p'_\beta\left(\cancel{g^{\alpha\beta}g_{\nu\mu}} - g^\alpha_{\ \nu}g^\beta_{\ \mu} + g^\alpha_{\ \mu}g^\beta_{\ \nu}\right)\Big\}$$

$$= m(p+p')_\alpha\cdot(-8)(d+1)\, g^\alpha_{\ \nu} + 8\beta(p'+p)^\mu\left[p_\alpha p'_\beta\left(g^\alpha_{\ \nu}g^\beta_{\ \mu} - g^\alpha_{\ \mu}g^\beta_{\ \nu}\right)\right]$$

$$= -8(d+1)m(p+p')_\nu + 8\beta\underbrace{(p'+p)^\mu(p_\nu p'_\mu - p_\mu p'_\nu)}$$

$$= p'^\mu p_\nu p'_\mu + p^\mu p_\nu p'_\mu - p'^\mu p_\mu p'_\nu - p^\mu p_\mu p'_\nu$$

$$= m^2(p-p')_\nu + p^\mu p'_\mu(p-p')_\nu$$

$$= (m^2 + p^\mu p'_\mu)(p-p')_\nu$$

$$= F_2 \cdot \frac{-\alpha}{4m} \, (p' - p)^\nu \left\{ -8(d+1)\, m \, (p+p')_\nu + 8\beta \left(m^2 + p^\mu p'_\mu \right) (p - p')_\nu \right\}$$

$$= q^2$$

$$= (p' - p) \cdot (p + p')$$

$$= 2m^2$$

$$= F_2 \, \underbrace{\frac{-\alpha}{4m} \left[-8(d+1)\, m \cdot 2m^2 + 8\beta \left(m^2 + p \cdot p' \right) q^2 \right]}$$

$$= -\alpha \, \frac{1}{4m} \cdot \left[-16(d+1)\, m^3 + 8 \left(m^2 + p \cdot p' \right) q^2 \, \frac{(d-2) q^2 + 4m}{2m \left(q^2 - 4m^2 \right)} \right]$$