

PG No. 27  $D_{6h}$   $6/mmm$  [ hexagonal ] (polar, internal axial octupole)

\* Harmonics for rank 0

\* Harmonics for rank 1

$$\bar{Q}_1^{(3,2)}[g](A_{2u})$$

\*\* symmetry

$$z$$

\*\* expression

$$-\frac{3\sqrt{70}G_1x(x^2-3y^2)}{56} + \frac{3\sqrt{70}G_2y(3x^2-y^2)}{56} - \frac{\sqrt{105}G_3z(x-y)(x+y)}{14} - \frac{\sqrt{42}G_{3x}y(x^2+y^2-4z^2)}{56} + \frac{\sqrt{42}G_{3y}x(x^2+y^2-4z^2)}{56} + \frac{\sqrt{105}G_{bz}xyz}{7}$$

$$\bar{Q}_{1,1}^{(3,2)}[g](E_{1u}), \bar{Q}_{1,2}^{(3,2)}[g](E_{1u})$$

\*\* symmetry

$$x$$

$$y$$

\*\* expression

$$\begin{aligned} & \frac{3\sqrt{70}G_1z(x-y)(x+y)}{56} - \frac{3\sqrt{70}G_2xyz}{28} - \frac{\sqrt{105}G_3x(y-z)(y+z)}{14} - \frac{5\sqrt{42}G_{3x}xyz}{28} \\ & - \frac{\sqrt{42}G_{3y}z(x^2+11y^2-4z^2)}{56} + \frac{3\sqrt{7}G_{az}y(x^2+y^2-4z^2)}{28} - \frac{\sqrt{105}G_{bz}y(x^2-y^2+2z^2)}{28} \\ & - \frac{3\sqrt{70}G_1xyz}{28} - \frac{3\sqrt{70}G_2z(x-y)(x+y)}{56} + \frac{\sqrt{105}G_3y(x-z)(x+z)}{14} + \frac{\sqrt{42}G_{3x}z(11x^2+y^2-4z^2)}{56} \\ & + \frac{5\sqrt{42}G_{3y}xyz}{28} - \frac{3\sqrt{7}G_{az}x(x^2+y^2-4z^2)}{28} + \frac{\sqrt{105}G_{bz}x(x^2-y^2-2z^2)}{28} \end{aligned}$$

\* Harmonics for rank 2

$$\bar{Q}_2^{(3,0)}[g](A_{1g})$$

\*\* symmetry

$$-\frac{x^2}{2} - \frac{y^2}{2} + z^2$$

\*\* expression

$$-\frac{\sqrt{210}G_3(x-y)(x+y)}{28} + \frac{\sqrt{21}G_{3x}yz}{7} - \frac{\sqrt{21}G_{3y}xz}{7} + \frac{\sqrt{210}G_{bz}xy}{14}$$

$$\bar{Q}_2^{(3,2)}[g](A_{1g})$$

\*\* symmetry

$$-\frac{x^2}{2} - \frac{y^2}{2} + z^2$$

\*\* expression

$$\begin{aligned} & -\frac{\sqrt{70}G_1xz(x^2-3y^2)}{8} + \frac{\sqrt{70}G_2yz(3x^2-y^2)}{8} + \frac{\sqrt{105}G_3(x-y)(x+y)(x^2+y^2-6z^2)}{42} \\ & - \frac{5\sqrt{42}G_{3x}yz(3x^2+3y^2-4z^2)}{168} + \frac{5\sqrt{42}G_{3y}xz(3x^2+3y^2-4z^2)}{168} - \frac{\sqrt{105}G_{bz}xy(x^2+y^2-6z^2)}{21} \end{aligned}$$

$$\bar{Q}_{2,1}^{(3,0)}[g](E_{1g}), \bar{Q}_{2,2}^{(3,0)}[g](E_{1g})$$

\*\* symmetry

$$\sqrt{3}yz$$

$$-\sqrt{3}xz$$

\*\* expression

$$\begin{aligned} & \frac{\sqrt{105}G_1xy}{14} + \frac{\sqrt{105}G_2(x-y)(x+y)}{28} + \frac{\sqrt{7}G_{3x}(5x^2-y^2-4z^2)}{28} + \frac{3\sqrt{7}G_{3y}xy}{14} + \frac{\sqrt{42}G_{az}xz}{7} \\ & \frac{\sqrt{105}G_1(x-y)(x+y)}{28} - \frac{\sqrt{105}G_2xy}{14} + \frac{3\sqrt{7}G_{3x}xy}{14} - \frac{\sqrt{7}G_{3y}(x^2-5y^2+4z^2)}{28} + \frac{\sqrt{42}G_{az}yz}{7} \end{aligned}$$

$$\bar{Q}_{2,1}^{(3,2)}[g](E_{1g}), \bar{Q}_{2,2}^{(3,2)}[g](E_{1g})$$

\*\* symmetry

$$\sqrt{3}yz$$

$$-\sqrt{3}xz$$

\*\* expression

$$\begin{aligned} & -\frac{\sqrt{210}G_1xy(11x^2-17y^2+18z^2)}{168} - \frac{\sqrt{210}G_2(2x^4-21x^2y^2+9x^2z^2+5y^4-9y^2z^2)}{168} \\ & + \frac{\sqrt{35}G_3yz(y-z)(y+z)}{6} - \frac{5\sqrt{14}G_{3x}(2x^4+3x^2y^2-15x^2z^2+y^4-9y^2z^2+4z^4)}{168} \\ & - \frac{5\sqrt{14}G_{3y}xy(x^2+y^2-6z^2)}{168} - \frac{5\sqrt{21}G_{az}xz(3x^2+3y^2-4z^2)}{84} + \frac{\sqrt{35}G_{bz}xz(x^2+3y^2-2z^2)}{12} \\ & \frac{\sqrt{210}G_1(5x^4-21x^2y^2-9x^2z^2+2y^4+9y^2z^2)}{168} - \frac{\sqrt{210}G_2xy(17x^2-11y^2-18z^2)}{168} + \frac{\sqrt{35}G_3xz(x-z)(x+z)}{6} - \frac{5\sqrt{14}G_{3x}xy(x^2+y^2-6z^2)}{168} \\ & - \frac{5\sqrt{14}G_{3y}(x^4+3x^2y^2-9x^2z^2+2y^4-15y^2z^2+4z^4)}{168} - \frac{5\sqrt{21}G_{az}yz(3x^2+3y^2-4z^2)}{84} - \frac{\sqrt{35}G_{bz}yz(3x^2+y^2-2z^2)}{12} \end{aligned}$$

$$\tilde{\mathbb{Q}}_{2,1}^{(3,0)}[g](E_{2g}), \tilde{\mathbb{Q}}_{2,2}^{(3,0)}[g](E_{2g})$$

\*\* symmetry

$$\frac{\sqrt{3}(x-y)(x+y)}{2}$$

$$-\sqrt{3}xy$$

\*\* expression

$$\begin{aligned} & \frac{\sqrt{105}G_1xz}{14} - \frac{\sqrt{105}G_2yz}{14} - \frac{\sqrt{70}G_3(x^2+y^2-2z^2)}{28} - \frac{3\sqrt{7}G_{3x}yz}{14} - \frac{3\sqrt{7}G_{3y}xz}{14} + \frac{\sqrt{42}G_{az}xy}{14} \\ & \frac{\sqrt{105}G_1yz}{14} + \frac{\sqrt{105}G_2xz}{14} - \frac{3\sqrt{7}G_{3x}xz}{14} + \frac{3\sqrt{7}G_{3y}yz}{14} + \frac{\sqrt{42}G_{az}(x-y)(x+y)}{28} - \frac{\sqrt{70}G_{bz}(x^2+y^2-2z^2)}{28} \end{aligned}$$

$$\tilde{\mathbb{Q}}_{2,1}^{(3,2)}[g](E_{2g}), \tilde{\mathbb{Q}}_{2,2}^{(3,2)}[g](E_{2g})$$

\*\* symmetry

$$\frac{\sqrt{3}(x-y)(x+y)}{2}$$

$$-\sqrt{3}xy$$

\*\* expression

$$\begin{aligned} & \frac{\sqrt{210}G_1xz(3x^2+3y^2-4z^2)}{168} - \frac{\sqrt{210}G_2yz(3x^2+3y^2-4z^2)}{168} + \frac{\sqrt{35}G_3(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4)}{42} \\ & - \frac{5\sqrt{14}G_{3x}yz(27x^2-y^2-8z^2)}{168} + \frac{5\sqrt{14}G_{3y}xz(x^2-27y^2+8z^2)}{168} + \frac{5\sqrt{21}G_{az}xy(x^2+y^2-6z^2)}{42} - \frac{\sqrt{35}G_{bz}xy(x-y)(x+y)}{6} \\ & \frac{\sqrt{210}G_1yz(3x^2+3y^2-4z^2)}{168} + \frac{\sqrt{210}G_2xz(3x^2+3y^2-4z^2)}{168} - \frac{\sqrt{35}G_3xy(x-y)(x+y)}{6} - \frac{5\sqrt{14}G_{3x}xz(13x^2-15y^2-8z^2)}{168} \\ & - \frac{5\sqrt{14}G_{3y}yz(15x^2-13y^2+8z^2)}{168} + \frac{5\sqrt{21}G_{az}(x-y)(x+y)(x^2+y^2-6z^2)}{84} - \frac{\sqrt{35}G_{bz}(5x^4-18x^2y^2-12x^2z^2+5y^4-12y^2z^2+4z^4)}{84} \end{aligned}$$

\* Harmonics for rank 3

$$\tilde{\mathbb{Q}}_3^{(3,-2)}[g](A_{2u})$$

\*\* symmetry

$$-\frac{z(3x^2+3y^2-2z^2)}{2}$$

\*\* expression

$$\frac{\sqrt{2}G_{3xy}}{2} - \frac{\sqrt{2}G_{3yx}}{2}$$

$$\tilde{\mathbb{Q}}_3^{(3,0)}[g](A_{2u})$$

\*\* symmetry

$$-\frac{z(3x^2+3y^2-2z^2)}{2}$$

\*\* expression

$$\frac{\sqrt{15}G_1x(x^2-3y^2)}{12} - \frac{\sqrt{15}G_2y(3x^2-y^2)}{12} - \frac{\sqrt{10}G_3z(x-y)(x+y)}{4} - \frac{G_{3xy}(x^2+y^2-4z^2)}{4} + \frac{G_{3yx}(x^2+y^2-4z^2)}{4} + \frac{\sqrt{10}G_{bz}xyz}{2}$$

$$\tilde{\mathbb{Q}}_3^{(3,2)}[g](A_{2u})$$

\*\* symmetry

$$-\frac{z(3x^2+3y^2-2z^2)}{2}$$

\*\* expression

$$\frac{7\sqrt{330}G_1x(x^2-3y^2)(x^2+y^2-8z^2)}{528} - \frac{7\sqrt{330}G_2y(3x^2-y^2)(x^2+y^2-8z^2)}{528} + \frac{7\sqrt{55}G_3z(x-y)(x+y)(x^2+y^2-2z^2)}{44} \\ + \frac{5\sqrt{22}G_{3x}y(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4)}{176} - \frac{5\sqrt{22}G_{3y}x(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4)}{176} - \frac{7\sqrt{55}G_{bz}xyz(x^2+y^2-2z^2)}{22}$$

$$\bar{\mathbb{Q}}_3^{(3,-2)}[g](B_{1u})$$

\*\* symmetry

$$\frac{\sqrt{10}y(3x^2-y^2)}{4}$$

\*\* expression

$$-\frac{\sqrt{3}G_2z}{2} - \frac{\sqrt{2}G_3y}{4} + \frac{\sqrt{2}G_{bz}x}{4}$$

$$\bar{\mathbb{Q}}_3^{(3,0)}[g](B_{1u})$$

\*\* symmetry

$$\frac{\sqrt{10}y(3x^2-y^2)}{4}$$

\*\* expression

$$-\frac{\sqrt{6}G_2z(3x^2+3y^2-2z^2)}{12} - \frac{G_3y(x^2+y^2-4z^2)}{4} + \frac{\sqrt{10}G_{3x}z(x-y)(x+y)}{4} - \frac{\sqrt{10}G_{3y}xyz}{2} - \frac{\sqrt{15}G_{az}x(x^2-3y^2)}{12} + \frac{G_{bz}x(x^2+y^2-4z^2)}{4}$$

$$\bar{\mathbb{Q}}_3^{(3,2)}[g](B_{1u})$$

\*\* symmetry

$$\frac{\sqrt{10}y(3x^2-y^2)}{4}$$

\*\* expression

$$-\frac{\sqrt{33}G_2z(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4)}{528} + \frac{\sqrt{22}G_3y(25x^4-55x^2y^2+15x^2z^2+4y^4+15y^2z^2-10z^4)}{88} \\ + \frac{7\sqrt{55}G_{3x}z(5x^4-18x^2y^2-4x^2z^2+y^4+4y^2z^2)}{176} + \frac{7\sqrt{55}G_{3y}xyz(x^2-2y^2+z^2)}{22} \\ - \frac{7\sqrt{330}G_{az}x(x^2-3y^2)(x^2+y^2-8z^2)}{528} + \frac{\sqrt{22}G_{bz}x(13x^4-100x^2y^2-30x^2z^2+55y^4-30y^2z^2+20z^4)}{176}$$

$$\bar{\mathbb{Q}}_3^{(3,-2)}[g](B_{2u})$$

\*\* symmetry

$$\frac{\sqrt{10}x(x^2-3y^2)}{4}$$

\*\* expression

$$\frac{\sqrt{3}G_1z}{2} - \frac{\sqrt{2}G_3x}{4} - \frac{\sqrt{2}G_{bz}y}{4}$$

$$\bar{\mathbb{Q}}_3^{(3,0)}[g](B_{2u})$$

\*\* symmetry

$$\frac{\sqrt{10}x(x^2-3y^2)}{4}$$

\*\* expression

$$\frac{\sqrt{6}G_1z(3x^2+3y^2-2z^2)}{12} - \frac{G_3x(x^2+y^2-4z^2)}{4} - \frac{\sqrt{10}G_{3x}xyz}{2} - \frac{\sqrt{10}G_{3y}z(x-y)(x+y)}{4} + \frac{\sqrt{15}G_{az}y(3x^2-y^2)}{12} - \frac{G_{bz}y(x^2+y^2-4z^2)}{4}$$

$$\bar{\mathbb{Q}}_3^{(3,2)}[g](B_{2u})$$

\*\* symmetry

$$\frac{\sqrt{10}x(x^2-3y^2)}{4}$$

\*\* expression

$$\frac{\sqrt{33}G_1z(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4)}{528} + \frac{\sqrt{22}G_3x(4x^4-55x^2y^2+15x^2z^2+25y^4+15y^2z^2-10z^4)}{88} \\ - \frac{7\sqrt{55}G_{3x}xyz(2x^2-y^2-z^2)}{22} + \frac{7\sqrt{55}G_{3y}z(x^4-18x^2y^2+4x^2z^2+5y^4-4y^2z^2)}{176} \\ + \frac{7\sqrt{330}G_{az}y(3x^2-y^2)(x^2+y^2-8z^2)}{528} - \frac{\sqrt{22}G_{bz}y(55x^4-100x^2y^2-30x^2z^2+13y^4-30y^2z^2+20z^4)}{176}$$

$$\tilde{\mathbb{Q}}_{3,1}^{(3,-2)}[g](E_{1u}), \tilde{\mathbb{Q}}_{3,2}^{(3,-2)}[g](E_{1u})$$

\*\* symmetry

$$-\frac{\sqrt{6}x(x^2+y^2-4z^2)}{4}$$

$$-\frac{\sqrt{6}y(x^2+y^2-4z^2)}{4}$$

\*\* expression

$$-\frac{\sqrt{30}G_3x}{12} + \frac{\sqrt{3}G_{3y}z}{6} - \frac{\sqrt{2}G_{az}y}{2} + \frac{\sqrt{30}G_{bz}y}{12}$$

$$\frac{\sqrt{30}G_3y}{12} - \frac{\sqrt{3}G_{3x}z}{6} + \frac{\sqrt{2}G_{az}x}{2} + \frac{\sqrt{30}G_{bz}x}{12}$$

$$\tilde{\mathbb{Q}}_{3,1}^{(3,0)}[g](E_{1u}), \tilde{\mathbb{Q}}_{3,2}^{(3,0)}[g](E_{1u})$$

\*\* symmetry

$$-\frac{\sqrt{6}x(x^2+y^2-4z^2)}{4}$$

$$-\frac{\sqrt{6}y(x^2+y^2-4z^2)}{4}$$

\*\* expression

$$-\frac{\sqrt{10}G_1z(x-y)(x+y)}{4} + \frac{\sqrt{10}G_2xyz}{2} - \frac{\sqrt{15}G_3x(x^2-3y^2)}{12} - \frac{\sqrt{6}G_{3y}z(3x^2+3y^2-2z^2)}{12} + \frac{G_{az}y(x^2+y^2-4z^2)}{4} + \frac{\sqrt{15}G_{bz}y(3x^2-y^2)}{12}$$

$$\frac{\sqrt{10}G_1xyz}{2} + \frac{\sqrt{10}G_2z(x-y)(x+y)}{4} - \frac{\sqrt{15}G_3y(3x^2-y^2)}{12} + \frac{\sqrt{6}G_{3x}z(3x^2+3y^2-2z^2)}{12} - \frac{G_{az}x(x^2+y^2-4z^2)}{4} - \frac{\sqrt{15}G_{bz}x(x^2-3y^2)}{12}$$

$$\tilde{\mathbb{Q}}_{3,1}^{(3,2)}[g](E_{1u}), \tilde{\mathbb{Q}}_{3,2}^{(3,2)}[g](E_{1u})$$

\*\* symmetry

$$-\frac{\sqrt{6}x(x^2+y^2-4z^2)}{4}$$

$$-\frac{\sqrt{6}y(x^2+y^2-4z^2)}{4}$$

\*\* expression

$$-\frac{7\sqrt{55}G_1z(5x^4-18x^2y^2-4x^2z^2+y^4+4y^2z^2)}{176} + \frac{7\sqrt{55}G_2xyz(2x^2-y^2-z^2)}{22} + \frac{\sqrt{330}G_3x(4x^4+x^2y^2-41x^2z^2-3y^4+15y^2z^2+18z^4)}{264} + \frac{5\sqrt{33}G_{3y}z(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4)}{528} - \frac{5\sqrt{22}G_{az}y(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4)}{176} - \frac{\sqrt{330}G_{bz}y(15x^4+16x^2y^2-138x^2z^2+y^4-26y^2z^2+36z^4)}{528}$$

$$-\frac{7\sqrt{55}G_1xyz(x^2-2y^2+z^2)}{22} - \frac{7\sqrt{55}G_2z(x^4-18x^2y^2+4x^2z^2+5y^4-4y^2z^2)}{176} + \frac{\sqrt{330}G_{3y}(3x^4-x^2y^2-15x^2z^2-4y^4+41y^2z^2-18z^4)}{264} - \frac{5\sqrt{33}G_{3x}z(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4)}{528} + \frac{5\sqrt{22}G_{az}x(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4)}{176} - \frac{\sqrt{330}G_{bz}x(x^4+16x^2y^2-26x^2z^2+15y^4-138y^2z^2+36z^4)}{528}$$

$$\tilde{\mathbb{Q}}_{3,1}^{(3,-2)}[g](E_{2u}), \tilde{\mathbb{Q}}_{3,2}^{(3,-2)}[g](E_{2u})$$

\*\* symmetry

$$\sqrt{15}xyz$$

$$\frac{\sqrt{15}z(x-y)(x+y)}{2}$$

\*\* expression

$$\frac{\sqrt{2}G_1y}{4} + \frac{\sqrt{2}G_2x}{4} + \frac{\sqrt{30}G_{3x}x}{12} - \frac{\sqrt{30}G_{3y}y}{12} - \frac{\sqrt{3}G_{bz}z}{3}$$

$$-\frac{\sqrt{2}G_1x}{4} + \frac{\sqrt{2}G_2y}{4} + \frac{\sqrt{3}G_3z}{3} - \frac{\sqrt{30}G_{3x}y}{12} - \frac{\sqrt{30}G_{3y}x}{12}$$

$$\tilde{\mathbb{Q}}_{3,1}^{(3,0)}[g](E_{2u}), \tilde{\mathbb{Q}}_{3,2}^{(3,0)}[g](E_{2u})$$

\*\* symmetry

$$\sqrt{15}xyz$$

$$\frac{\sqrt{15}z(x-y)(x+y)}{2}$$

\*\* expression

$$\begin{aligned} & \frac{G_1y(x^2+y^2-4z^2)}{4} + \frac{G_2x(x^2+y^2-4z^2)}{4} + \frac{\sqrt{15}G_{3xx}(x^2-3y^2)}{12} + \frac{\sqrt{15}G_{3yy}(3x^2-y^2)}{12} + \frac{\sqrt{10}G_{az}z(x-y)(x+y)}{4} + \frac{\sqrt{6}G_{bzz}(3x^2+3y^2-2z^2)}{12} \\ & - \frac{G_1x(x^2+y^2-4z^2)}{4} + \frac{G_2y(x^2+y^2-4z^2)}{4} - \frac{\sqrt{6}G_3z(3x^2+3y^2-2z^2)}{12} - \frac{\sqrt{15}G_{3xy}(3x^2-y^2)}{12} + \frac{\sqrt{15}G_{3yx}(x^2-3y^2)}{12} - \frac{\sqrt{10}G_{az}xyz}{2} \end{aligned}$$

$$\tilde{\mathbb{Q}}_{3,1}^{(3,2)}[g](E_{2u}), \tilde{\mathbb{Q}}_{3,2}^{(3,2)}[g](E_{2u})$$

\*\* symmetry

$$\sqrt{15}xyz$$

$$\frac{\sqrt{15}z(x-y)(x+y)}{2}$$

\*\* expression

$$\begin{aligned} & - \frac{\sqrt{22}G_1y(25x^4-55x^2y^2+15x^2z^2+4y^4+15y^2z^2-10z^4)}{88} - \frac{\sqrt{22}G_2x(4x^4-55x^2y^2+15x^2z^2+25y^4+15y^2z^2-10z^4)}{88} \\ & - \frac{\sqrt{330}G_{3xx}(4x^4+x^2y^2-41x^2z^2-3y^4+15y^2z^2+18z^4)}{264} - \frac{\sqrt{330}G_{3yy}(3x^4-x^2y^2-15x^2z^2-4y^4+41y^2z^2-18z^4)}{264} \\ & - \frac{7\sqrt{55}G_{az}z(x-y)(x+y)(x^2+y^2-2z^2)}{44} + \frac{\sqrt{33}G_{bzz}(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4)}{132} \\ & - \frac{\sqrt{22}G_1x(13x^4-100x^2y^2-30x^2z^2+55y^4-30y^2z^2+20z^4)}{176} + \frac{\sqrt{22}G_2y(55x^4-100x^2y^2-30x^2z^2+13y^4-30y^2z^2+20z^4)}{176} \\ & - \frac{\sqrt{33}G_3z(15x^4+30x^2y^2-40x^2z^2+15y^4-40y^2z^2+8z^4)}{132} + \frac{\sqrt{330}G_{3xy}(15x^4+16x^2y^2-138x^2z^2+y^4-26y^2z^2+36z^4)}{528} \\ & + \frac{\sqrt{330}G_{3yx}(x^4+16x^2y^2-26x^2z^2+15y^4-138y^2z^2+36z^4)}{528} + \frac{7\sqrt{55}G_{az}xyz(x^2+y^2-2z^2)}{22} \end{aligned}$$

\* Harmonics for rank 4

$$\tilde{\mathbb{Q}}_4^{(3,-2)}[g](A_{1g})$$

\*\* symmetry

$$\frac{3x^4}{8} + \frac{3x^2y^2}{4} - 3x^2z^2 + \frac{3y^4}{8} - 3y^2z^2 + z^4$$

\*\* expression

$$\frac{\sqrt{21}G_3(x-y)(x+y)}{14} + \frac{\sqrt{210}G_{3xyz}}{14} - \frac{\sqrt{210}G_{3yxz}}{14} - \frac{\sqrt{21}G_{bzy}}{7}$$

$$\tilde{\mathbb{Q}}_4^{(3,0)}[g](A_{1g})$$

\*\* symmetry

$$\frac{3x^4}{8} + \frac{3x^2y^2}{4} - 3x^2z^2 + \frac{3y^4}{8} - 3y^2z^2 + z^4$$

\*\* expression

$$\begin{aligned} & \frac{5\sqrt{77}G_1xz(x^2-3y^2)}{44} - \frac{5\sqrt{77}G_2yz(3x^2-y^2)}{44} + \frac{5\sqrt{462}G_3(x-y)(x+y)(x^2+y^2-6z^2)}{616} \\ & - \frac{3\sqrt{1155}G_{3xyz}(3x^2+3y^2-4z^2)}{308} + \frac{3\sqrt{1155}G_{3yxz}(3x^2+3y^2-4z^2)}{308} - \frac{5\sqrt{462}G_{bzy}(x^2+y^2-6z^2)}{308} \end{aligned}$$

$$\tilde{\mathbb{Q}}_4^{(3,2)}[g](A_{1g})$$

\*\* symmetry

$$\frac{3x^4}{8} + \frac{3x^2y^2}{4} - 3x^2z^2 + \frac{3y^4}{8} - 3y^2z^2 + z^4$$

\*\* expression

$$\begin{aligned} & \frac{9\sqrt{10010}G_1xz(x^2-3y^2)(3x^2+3y^2-8z^2)}{2288} - \frac{9\sqrt{10010}G_2yz(3x^2-y^2)(3x^2+3y^2-8z^2)}{2288} \\ & - \frac{\sqrt{15015}G_3(x-y)(x+y)(x^4+2x^2y^2-16x^2z^2+y^4-16y^2z^2+16z^4)}{572} + \frac{5\sqrt{6006}G_{3xyz}(5x^4+10x^2y^2-20x^2z^2+5y^4-20y^2z^2+8z^4)}{2288} \\ & - \frac{5\sqrt{6006}G_{3yxz}(5x^4+10x^2y^2-20x^2z^2+5y^4-20y^2z^2+8z^4)}{2288} + \frac{\sqrt{15015}G_{bzy}(x^4+2x^2y^2-16x^2z^2+y^4-16y^2z^2+16z^4)}{286} \end{aligned}$$

$$\tilde{\mathbb{Q}}_4^{(3,-2)}[g](B_{1g})$$

\*\* symmetry

$$\frac{\sqrt{70}xz(x^2 - 3y^2)}{4}$$

\*\* expression

$$-\frac{3\sqrt{5}G_1(x^2 + y^2 - 2z^2)}{20} + \frac{\sqrt{30}G_3xz}{20} - \frac{\sqrt{3}G_{3x}xy}{2} - \frac{\sqrt{3}G_{3y}(x-y)(x+y)}{4} + \frac{\sqrt{30}G_{bz}yz}{20}$$

$$\tilde{\mathbb{Q}}_4^{(3,0)}[g](B_{1g})$$

\*\* symmetry

$$\frac{\sqrt{70}xz(x^2 - 3y^2)}{4}$$

\*\* expression

$$-\frac{\sqrt{110}G_1(3x^4 + 6x^2y^2 - 24x^2z^2 + 3y^4 - 24y^2z^2 + 8z^4)}{176} - \frac{\sqrt{165}G_3xz(3x^2 + 3y^2 - 4z^2)}{44} - \frac{\sqrt{66}G_{3x}xy(3x^2 - 4y^2 + 3z^2)}{22} \\ + \frac{\sqrt{66}G_{3y}(9x^4 - 42x^2y^2 - 12x^2z^2 + 5y^4 + 12y^2z^2)}{176} - \frac{7\sqrt{11}G_{az}yz(3x^2 - y^2)}{44} - \frac{\sqrt{165}G_{bz}yz(3x^2 + 3y^2 - 4z^2)}{44}$$

$$\tilde{\mathbb{Q}}_4^{(3,2)}[g](B_{1g})$$

\*\* symmetry

$$\frac{\sqrt{70}xz(x^2 - 3y^2)}{4}$$

\*\* expression

$$-\frac{3\sqrt{143}G_1(19x^6 - 240x^4y^2 - 45x^4z^2 + 255x^2y^4 - 90x^2y^2z^2 + 60x^2z^4 - 14y^6 - 45y^4z^2 + 60y^2z^4 - 8z^6)}{2288} + \frac{9\sqrt{143}G_2xy(x^2 - 3y^2)(3x^2 - y^2)}{208} \\ - \frac{\sqrt{858}G_3xz(13x^4 + 125x^2y^2 - 85x^2z^2 - 20y^4 - 85y^2z^2 + 34z^4)}{1144} + \frac{\sqrt{2145}G_{3x}xy(43x^4 + 26x^2y^2 - 508x^2z^2 - 17y^4 + 92y^2z^2 + 208z^4)}{2288} \\ - \frac{\sqrt{2145}G_{3y}(x^6 - 44x^4y^2 + 29x^4z^2 - 31x^2y^4 + 450x^2y^2z^2 - 104x^2z^4 + 14y^6 - 179y^4z^2 + 104y^2z^4)}{2288} \\ + \frac{27\sqrt{1430}G_{az}yz(3x^2 - y^2)(3x^2 + 3y^2 - 8z^2)}{2288} - \frac{\sqrt{858}G_{bz}yz(125x^4 - 80x^2y^2 - 170x^2z^2 + 59y^4 - 170y^2z^2 + 68z^4)}{2288}$$

$$\tilde{\mathbb{Q}}_4^{(3,-2)}[g](B_{2g})$$

\*\* symmetry

$$\frac{\sqrt{70}yz(3x^2 - y^2)}{4}$$

\*\* expression

$$\frac{3\sqrt{5}G_2(x^2 + y^2 - 2z^2)}{20} + \frac{\sqrt{30}G_3yz}{20} + \frac{\sqrt{3}G_{3x}(x-y)(x+y)}{4} - \frac{\sqrt{3}G_{3y}xy}{2} - \frac{\sqrt{30}G_{bz}xz}{20}$$

$$\tilde{\mathbb{Q}}_4^{(3,0)}[g](B_{2g})$$

\*\* symmetry

$$\frac{\sqrt{70}yz(3x^2 - y^2)}{4}$$

\*\* expression

$$\frac{\sqrt{110}G_2(3x^4 + 6x^2y^2 - 24x^2z^2 + 3y^4 - 24y^2z^2 + 8z^4)}{176} - \frac{\sqrt{165}G_3yz(3x^2 + 3y^2 - 4z^2)}{44} + \frac{\sqrt{66}G_{3x}(5x^4 - 42x^2y^2 + 12x^2z^2 + 9y^4 - 12y^2z^2)}{176} \\ + \frac{\sqrt{66}G_{3y}xy(4x^2 - 3y^2 - 3z^2)}{22} + \frac{7\sqrt{11}G_{az}xz(x^2 - 3y^2)}{44} + \frac{\sqrt{165}G_{bz}xz(3x^2 + 3y^2 - 4z^2)}{44}$$

$$\tilde{\mathbb{Q}}_4^{(3,2)}[g](B_{2g})$$

\*\* symmetry

$$\frac{\sqrt{70}yz(3x^2 - y^2)}{4}$$

\*\* expression

$$-\frac{9\sqrt{143}G_1xy(x^2 - 3y^2)(3x^2 - y^2)}{208} - \frac{3\sqrt{143}G_2(14x^6 - 255x^4y^2 + 45x^4z^2 + 240x^2y^4 + 90x^2y^2z^2 - 60x^2z^4 - 19y^6 + 45y^4z^2 - 60y^2z^4 + 8z^6)}{2288} \\ + \frac{\sqrt{858}G_3yz(20x^4 - 125x^2y^2 + 85x^2z^2 - 13y^4 + 85y^2z^2 - 34z^4)}{1144} \\ - \frac{\sqrt{2145}G_{3x}(14x^6 - 31x^4y^2 - 179x^4z^2 - 44x^2y^4 + 450x^2y^2z^2 + 104x^2z^4 + y^6 + 29y^4z^2 - 104y^2z^4)}{2288} \\ - \frac{\sqrt{2145}G_{3y}xy(17x^4 - 26x^2y^2 - 92x^2z^2 - 43y^4 + 508y^2z^2 - 208z^4)}{2288} - \frac{27\sqrt{1430}G_{az}xz(x^2 - 3y^2)(3x^2 + 3y^2 - 8z^2)}{2288} \\ + \frac{\sqrt{858}G_{bz}xz(59x^4 - 80x^2y^2 - 170x^2z^2 + 125y^4 - 170y^2z^2 + 68z^4)}{2288}$$

$$\tilde{\mathbb{Q}}_{4,1}^{(3,-2)}[g](E_{1g}), \tilde{\mathbb{Q}}_{4,2}^{(3,-2)}[g](E_{1g})$$

\*\* symmetry

$$-\frac{\sqrt{10}yz(3x^2+3y^2-4z^2)}{4}$$

$$\frac{\sqrt{10}xz(3x^2+3y^2-4z^2)}{4}$$

\*\* expression

$$\begin{aligned} & -\frac{3\sqrt{35}G_1xy}{70} - \frac{3\sqrt{35}G_2(x-y)(x+y)}{140} + \frac{\sqrt{210}G_3yz}{20} - \frac{\sqrt{21}G_{3x}(x^2-3y^2+2z^2)}{28} - \frac{\sqrt{21}G_{3y}xy}{7} + \frac{3\sqrt{14}G_{az}xz}{14} + \frac{\sqrt{210}G_{bz}xz}{20} \\ & - \frac{3\sqrt{35}G_1(x-y)(x+y)}{140} + \frac{3\sqrt{35}G_2xy}{70} + \frac{\sqrt{210}G_3xz}{20} - \frac{\sqrt{21}G_{3x}xy}{7} + \frac{\sqrt{21}G_{3y}(3x^2-y^2-2z^2)}{28} + \frac{3\sqrt{14}G_{az}yz}{14} - \frac{\sqrt{210}G_{bz}yz}{20} \end{aligned}$$

$$\tilde{\mathbb{Q}}_{4,1}^{(3,0)}[g](E_{1g}), \tilde{\mathbb{Q}}_{4,2}^{(3,0)}[g](E_{1g})$$

\*\* symmetry

$$-\frac{\sqrt{10}yz(3x^2+3y^2-4z^2)}{4}$$

$$\frac{\sqrt{10}xz(3x^2+3y^2-4z^2)}{4}$$

\*\* expression

$$\begin{aligned} & \frac{\sqrt{770}G_1xy(x^2-6y^2+15z^2)}{154} - \frac{\sqrt{770}G_2(3x^4+42x^2y^2-60x^2z^2-17y^4+60y^2z^2)}{1232} \\ & - \frac{\sqrt{1155}G_3yz(3x^2-y^2)}{44} - \frac{\sqrt{462}G_{3x}(5x^4+18x^2y^2-48x^2z^2+13y^4-96y^2z^2+24z^4)}{1232} \\ & + \frac{\sqrt{462}G_{3y}xy(x^2+y^2-6z^2)}{154} - \frac{9\sqrt{77}G_{az}xz(3x^2+3y^2-4z^2)}{308} - \frac{\sqrt{1155}G_{bz}xz(x^2-3y^2)}{44} \\ & - \frac{\sqrt{770}G_1(17x^4-42x^2y^2-60x^2z^2-3y^4+60y^2z^2)}{1232} + \frac{\sqrt{770}G_2xy(6x^2-y^2-15z^2)}{154} + \frac{\sqrt{1155}G_3xz(x^2-3y^2)}{44} + \frac{\sqrt{462}G_{3x}xy(x^2+y^2-6z^2)}{154} \\ & - \frac{\sqrt{462}G_{3y}(13x^4+18x^2y^2-96x^2z^2+5y^4-48y^2z^2+24z^4)}{1232} - \frac{9\sqrt{77}G_{az}yz(3x^2+3y^2-4z^2)}{308} - \frac{\sqrt{1155}G_{bz}yz(3x^2-y^2)}{44} \end{aligned}$$

$$\tilde{\mathbb{Q}}_{4,1}^{(3,2)}[g](E_{1g}), \tilde{\mathbb{Q}}_{4,2}^{(3,2)}[g](E_{1g})$$

\*\* symmetry

$$-\frac{\sqrt{10}yz(3x^2+3y^2-4z^2)}{4}$$

$$\frac{\sqrt{10}xz(3x^2+3y^2-4z^2)}{4}$$

\*\* expression

$$\begin{aligned} & \frac{3\sqrt{1001}G_1xy(13x^4-10x^2y^2-100x^2z^2-23y^4+260y^2z^2-80z^4)}{2288} \\ & + \frac{3\sqrt{1001}G_2(2x^6-25x^4y^2-5x^4z^2-20x^2y^4+270x^2y^2z^2-40x^2z^4+7y^6-85y^4z^2+40y^2z^4)}{2288} \\ & + \frac{\sqrt{6006}G_3yz(20x^4-5x^2y^2-35x^2z^2-25y^4+85y^2z^2-22z^4)}{1144} \\ & + \frac{\sqrt{15015}G_{3x}(2x^6+7x^4y^2-37x^4z^2+8x^2y^4-90x^2y^2z^2+52x^2z^4+3y^6-53y^4z^2+68y^2z^4-8z^6)}{2288} \\ & - \frac{\sqrt{15015}G_{3y}xy(x^4+2x^2y^2-16x^2z^2+y^4-16y^2z^2+16z^4)}{2288} + \frac{3\sqrt{10010}G_{az}xz(5x^4+10x^2y^2-20x^2z^2+5y^4-20y^2z^2+8z^4)}{2288} \\ & - \frac{\sqrt{6006}G_{bz}xz(5x^4+100x^2y^2-50x^2z^2+95y^4-290y^2z^2+44z^4)}{2288} \\ & - \frac{3\sqrt{1001}G_1(7x^6-20x^4y^2-85x^4z^2-25x^2y^4+270x^2y^2z^2+40x^2z^4+2y^6-5y^4z^2-40y^2z^4)}{2288} \\ & + \frac{3\sqrt{1001}G_2xy(23x^4+10x^2y^2-260x^2z^2-13y^4+100y^2z^2+80z^4)}{2288} \\ & - \frac{\sqrt{6006}G_3xz(25x^4+5x^2y^2-85x^2z^2-20y^4+35y^2z^2+22z^4)}{1144} - \frac{\sqrt{15015}G_{3x}xy(x^4+2x^2y^2-16x^2z^2+y^4-16y^2z^2+16z^4)}{2288} \\ & + \frac{\sqrt{15015}G_{3y}(3x^6+8x^4y^2-53x^4z^2+7x^2y^4-90x^2y^2z^2+68x^2z^4+2y^6-37y^4z^2+52y^2z^4-8z^6)}{2288} \\ & + \frac{3\sqrt{10010}G_{az}yz(5x^4+10x^2y^2-20x^2z^2+5y^4-20y^2z^2+8z^4)}{2288} + \frac{\sqrt{6006}G_{bz}yz(95x^4+100x^2y^2-290x^2z^2+5y^4-50y^2z^2+44z^4)}{2288} \end{aligned}$$

$$\tilde{Q}_{4,1}^{(3,-2)}[g](E_{2g}, 1), \tilde{Q}_{4,2}^{(3,-2)}[g](E_{2g}, 1)$$

\*\* symmetry

$$\frac{\sqrt{35} (x^2 - 2xy - y^2) (x^2 + 2xy - y^2)}{8}$$

$$\frac{\sqrt{35}xy (x - y) (x + y)}{2}$$

\*\* expression

$$\frac{3\sqrt{10}G_1xz}{10} + \frac{3\sqrt{10}G_2yz}{10} - \frac{\sqrt{15}G_3 (x - y) (x + y)}{10} - \frac{\sqrt{15}G_{bz}xy}{5}$$

$$\frac{3\sqrt{10}G_1yz}{10} - \frac{3\sqrt{10}G_2xz}{10} - \frac{\sqrt{15}G_3xy}{5} + \frac{\sqrt{15}G_{bz} (x - y) (x + y)}{10}$$

$$\tilde{Q}_{4,1}^{(3,-2)}[g](E_{2g}, 2), \tilde{Q}_{4,2}^{(3,-2)}[g](E_{2g}, 2)$$

\*\* symmetry

$$-\frac{\sqrt{5} (x - y) (x + y) (x^2 + y^2 - 6z^2)}{4}$$

$$\frac{\sqrt{5}xy (x^2 + y^2 - 6z^2)}{2}$$

\*\* expression

$$-\frac{9\sqrt{70}G_1xz}{140} + \frac{9\sqrt{70}G_2yz}{140} - \frac{\sqrt{105}G_3 (x^2 + y^2 - 2z^2)}{35} - \frac{\sqrt{42}G_{3x}yz}{28} - \frac{\sqrt{42}G_{3y}xz}{28} - \frac{3\sqrt{7}G_{az}xy}{7}$$

$$-\frac{9\sqrt{70}G_1yz}{140} - \frac{9\sqrt{70}G_2xz}{140} - \frac{\sqrt{42}G_{3x}xz}{28} + \frac{\sqrt{42}G_{3y}yz}{28} - \frac{3\sqrt{7}G_{az} (x - y) (x + y)}{14} - \frac{\sqrt{105}G_{bz} (x^2 + y^2 - 2z^2)}{35}$$

$$\tilde{Q}_{4,1}^{(3,0)}[g](E_{2g}, 1), \tilde{Q}_{4,2}^{(3,0)}[g](E_{2g}, 1)$$

\*\* symmetry

$$\frac{\sqrt{35} (x^2 - 2xy - y^2) (x^2 + 2xy - y^2)}{8}$$

$$\frac{\sqrt{35}xy (x - y) (x + y)}{2}$$

\*\* expression

$$\frac{\sqrt{55}G_1xz (3x^2 + 3y^2 - 4z^2)}{44} + \frac{\sqrt{55}G_2yz (3x^2 + 3y^2 - 4z^2)}{44} - \frac{\sqrt{330}G_3 (x - y) (x + y) (x^2 + y^2 - 6z^2)}{88}$$

$$-\frac{7\sqrt{33}G_{3x}yz (3x^2 - y^2)}{44} - \frac{7\sqrt{33}G_{3y}xz (x^2 - 3y^2)}{44} + \frac{7\sqrt{22}G_{az}xy (x - y) (x + y)}{22} - \frac{\sqrt{330}G_{bz}xy (x^2 + y^2 - 6z^2)}{44}$$

$$\frac{\sqrt{55}G_1yz (3x^2 + 3y^2 - 4z^2)}{44} - \frac{\sqrt{55}G_2xz (3x^2 + 3y^2 - 4z^2)}{44} - \frac{\sqrt{330}G_3xy (x^2 + y^2 - 6z^2)}{44} + \frac{7\sqrt{33}G_{3x}xz (x^2 - 3y^2)}{44}$$

$$-\frac{7\sqrt{33}G_{3y}yz (3x^2 - y^2)}{44} - \frac{7\sqrt{22}G_{az} (x^2 - 2xy - y^2) (x^2 + 2xy - y^2)}{88} + \frac{\sqrt{330}G_{bz} (x - y) (x + y) (x^2 + y^2 - 6z^2)}{88}$$

$$\tilde{Q}_{4,1}^{(3,0)}[g](E_{2g}, 2), \tilde{Q}_{4,2}^{(3,0)}[g](E_{2g}, 2)$$

\*\* symmetry

$$-\frac{\sqrt{5} (x - y) (x + y) (x^2 + y^2 - 6z^2)}{4}$$

$$\frac{\sqrt{5}xy (x^2 + y^2 - 6z^2)}{2}$$

\*\* expression

$$-\frac{5\sqrt{385}G_1xz (3x^2 + 3y^2 - 4z^2)}{308} + \frac{5\sqrt{385}G_2yz (3x^2 + 3y^2 - 4z^2)}{308} - \frac{\sqrt{2310}G_3 (x^4 - 12x^2y^2 + 6x^2z^2 + y^4 + 6y^2z^2 - 2z^4)}{308}$$

$$-\frac{\sqrt{231}G_{3x}yz (27x^2 - y^2 - 8z^2)}{308} + \frac{\sqrt{231}G_{3y}xz (x^2 - 27y^2 + 8z^2)}{308} + \frac{13\sqrt{154}G_{az}xy (x^2 + y^2 - 6z^2)}{308} + \frac{\sqrt{2310}G_{bz}xy (x - y) (x + y)}{44}$$

$$-\frac{5\sqrt{385}G_1yz (3x^2 + 3y^2 - 4z^2)}{308} - \frac{5\sqrt{385}G_2xz (3x^2 + 3y^2 - 4z^2)}{308} + \frac{\sqrt{2310}G_3xy (x - y) (x + y)}{44} - \frac{\sqrt{231}G_{3x}xz (13x^2 - 15y^2 - 8z^2)}{308}$$

$$-\frac{\sqrt{231}G_{3y}yz (15x^2 - 13y^2 + 8z^2)}{308} + \frac{13\sqrt{154}G_{az} (x - y) (x + y) (x^2 + y^2 - 6z^2)}{616} + \frac{\sqrt{2310}G_{bz} (5x^4 - 18x^2y^2 - 12x^2z^2 + 5y^4 - 12y^2z^2 + 4z^4)}{616}$$



$$\tilde{\mathbb{Q}}_{4,1}^{(3,2)}[g](E_{2g}, 1), \tilde{\mathbb{Q}}_{4,2}^{(3,2)}[g](E_{2g}, 1)$$

\*\* symmetry

$$\frac{\sqrt{35} (x^2 - 2xy - y^2) (x^2 + 2xy - y^2)}{8}$$

$$\frac{\sqrt{35}xy (x - y) (x + y)}{2}$$

\*\* expression

$$\begin{aligned} & \frac{3\sqrt{286}G_1xz (5x^4 + 10x^2y^2 - 20x^2z^2 + 5y^4 - 20y^2z^2 + 8z^4)}{2288} + \frac{3\sqrt{286}G_2yz (5x^4 + 10x^2y^2 - 20x^2z^2 + 5y^4 - 20y^2z^2 + 8z^4)}{2288} \\ & + \frac{\sqrt{429}G_3 (x - y) (x + y) (7x^4 - 118x^2y^2 + 20x^2z^2 + 7y^4 + 20y^2z^2 - 20z^4)}{572} \\ & - \frac{3\sqrt{4290}G_{3x}yz (73x^4 - 98x^2y^2 - 48x^2z^2 + 5y^4 + 16y^2z^2)}{2288} + \frac{3\sqrt{4290}G_{3y}xz (5x^4 - 98x^2y^2 + 16x^2z^2 + 73y^4 - 48y^2z^2)}{2288} \\ & + \frac{9\sqrt{715}G_{az}xy (x - y) (x + y) (x^2 + y^2 - 10z^2)}{286} - \frac{\sqrt{429}G_{bz}xy (13x^4 - 40x^2y^2 - 10x^2z^2 + 13y^4 - 10y^2z^2 + 10z^4)}{143} \\ & \frac{3\sqrt{286}G_1yz (5x^4 + 10x^2y^2 - 20x^2z^2 + 5y^4 - 20y^2z^2 + 8z^4)}{2288} - \frac{3\sqrt{286}G_2xz (5x^4 + 10x^2y^2 - 20x^2z^2 + 5y^4 - 20y^2z^2 + 8z^4)}{2288} \\ & + \frac{\sqrt{429}G_{3xy} (47x^4 - 170x^2y^2 + 40x^2z^2 + 47y^4 + 40y^2z^2 - 40z^4)}{572} + \frac{3\sqrt{4290}G_{3x}xz (17x^4 - 122x^2y^2 - 16x^2z^2 + 37y^4 + 48y^2z^2)}{2288} \\ & + \frac{3\sqrt{4290}G_{3y}yz (37x^4 - 122x^2y^2 + 48x^2z^2 + 17y^4 - 16y^2z^2)}{2288} - \frac{9\sqrt{715}G_{az} (x^2 + y^2 - 10z^2) (x^2 - 2xy - y^2) (x^2 + 2xy - y^2)}{1144} \\ & + \frac{\sqrt{429}G_{bz} (x - y) (x + y) (19x^4 - 226x^2y^2 - 40x^2z^2 + 19y^4 - 40y^2z^2 + 40z^4)}{1144} \end{aligned}$$

$$\tilde{\mathbb{Q}}_{4,1}^{(3,2)}[g](E_{2g}, 2), \tilde{\mathbb{Q}}_{4,2}^{(3,2)}[g](E_{2g}, 2)$$

\*\* symmetry

$$-\frac{\sqrt{5} (x - y) (x + y) (x^2 + y^2 - 6z^2)}{4}$$

$$\frac{\sqrt{5}xy (x^2 + y^2 - 6z^2)}{2}$$

\*\* expression

$$\begin{aligned} & -\frac{9\sqrt{2002}G_1xz (4x^4 - 25x^2y^2 - 5x^2z^2 + 15y^4 - 5y^2z^2 + 2z^4)}{1144} + \frac{9\sqrt{2002}G_2yz (15x^4 - 25x^2y^2 - 5x^2z^2 + 4y^4 - 5y^2z^2 + 2z^4)}{1144} \\ & + \frac{\sqrt{3003}G_3 (x^6 - 15x^4z^2 + 15x^2z^4 + y^6 - 15y^4z^2 + 15y^2z^4 - 2z^6)}{286} \\ & + \frac{\sqrt{30030}G_{3x}yz (13x^4 + 17x^2y^2 - 43x^2z^2 + 4y^4 - 19y^2z^2 + 10z^4)}{1144} + \frac{\sqrt{30030}G_{3y}xz (4x^4 + 17x^2y^2 - 19x^2z^2 + 13y^4 - 43y^2z^2 + 10z^4)}{1144} \\ & - \frac{3\sqrt{5005}G_{az}xy (x^4 + 2x^2y^2 - 16x^2z^2 + y^4 - 16y^2z^2 + 16z^4)}{572} - \frac{3\sqrt{3003}G_{bz}xy (x - y) (x + y) (x^2 + y^2 - 10z^2)}{572} \\ & \frac{9\sqrt{2002}G_1yz (25x^4 - 60x^2y^2 + 10x^2z^2 + 3y^4 + 10y^2z^2 - 4z^4)}{2288} + \frac{9\sqrt{2002}G_2xz (3x^4 - 60x^2y^2 + 10x^2z^2 + 25y^4 + 10y^2z^2 - 4z^4)}{2288} \\ & - \frac{3\sqrt{3003}G_{3xy} (x - y) (x + y) (x^2 + y^2 - 10z^2)}{572} + \frac{\sqrt{30030}G_{3x}xz (17x^4 + 16x^2y^2 - 62x^2z^2 - y^4 - 14y^2z^2 + 20z^4)}{2288} \\ & + \frac{\sqrt{30030}G_{3y}yz (x^4 - 16x^2y^2 + 14x^2z^2 - 17y^4 + 62y^2z^2 - 20z^4)}{2288} - \frac{3\sqrt{5005}G_{az} (x - y) (x + y) (x^4 + 2x^2y^2 - 16x^2z^2 + y^4 - 16y^2z^2 + 16z^4)}{1144} \\ & + \frac{\sqrt{3003}G_{bz} (x^6 + 15x^4y^2 - 30x^4z^2 + 15x^2y^4 - 180x^2y^2z^2 + 60x^2z^4 + y^6 - 30y^4z^2 + 60y^2z^4 - 8z^6)}{1144} \end{aligned}$$