80 reasons you want to take the geometric product of a point/line/plane with a point/line plane in your game engine

If you want the	When A is a		When B is a	M=AB lets you get it with	
Intersection of a	Plane	with a	Plane	⟨M⟩ ₂	Remember: $\langle M \rangle_2$ means the <i>point</i> part of M; $\langle M \rangle_2$, the line part is $\langle M \rangle_2$, the plane part is $\langle M \rangle_1$
			Line	$\langle M \rangle_3$	
	Point	onto a	Plane	⟨M⟩₂/B	
			Line	⟨M⟩₁/B	
Projection of a	Plane	onto a	Line	⟨M⟩₁/B	
			Point	⟨M⟩₂/B	
	Line	onto a	Plane	⟨M⟩₁/B	
			Point	⟨M⟩₁/B	
	Point	to a	Plane	√M	The principle square root of M is 1+normalize(M)
			Line	√√(M²)	$\sqrt{(M^2)}$ can be different from M if, for example, M is a planar reflection - then $\sqrt{(M^2)}$ will just be the identity
			Point	√M	
	Line	to a	Plane	√√(M²)	
Transform that takes a			Line	√M	
			Point	√√(M²)	
	Plane	to a	Plane	√M	This is how you are already getting a quaternion (rotation) from a start vector to an end vector!
			Line	√√(M²)	
			Point	√M	
	Rotation	to a	Point	M/A	And this is how you are applying quaternions to vertices!
			Line	M/A	
			Plane	M/A	
			Rotation	M/A	
			Translation	M/A	
	Translation	to c	Rigid motion	M/A	
	Hansidlion	to a	Point Line	M/A M/A	
			Plane	M/A M/A	
Result of applying a			Rotation	M/A	
			Translation	M/A	
			Rigid motion	M/A	
	Rigid motion	to a	Point	M/A	
	9		Line	M/A	
			Plane	M/A	
			Rotation	M/A	
			Translation	M/A	
			Rigid motion	M/A	
	Planar reflection	to a	Translation	M/A	
			Rigid motion	M/A	
			Line	M/A	
			Rotation	M/A	
			Plane	-M/A	Yes, negative! It's because planar reflections and "point reflections" *both* change handedness
			Point	-M/A	
Angle between a	Line	and a	Line	atan(√ ⟨M⟩₂²/⟨M⟩₀²	$\langle M \rangle_x^2$ will be a scalar for all of these; it is the magnitude of the grade-x part of M
Distance between a			Plane	atan(√ ⟨M⟩₃²/⟨M⟩₁²	So we are taking a ratio between the magnitudes of the lowest- and second-lowest-grade parts of a transformation from A toward B
	Point	and a	Plane	$\sqrt{ (\langle M \rangle_4^*)^2/\langle M \rangle_2^2 }$	
			Line	$\sqrt{ (\langle M \rangle_3^*)^2/\langle M \rangle_1^2 }$	
			Point	$\sqrt{ (\langle M \rangle_2^*)^2/\langle M \rangle_0^2 }$	
	Line	and a	Parallel plane	$\sqrt{ (\langle M \rangle_3^*)^2/\langle M \rangle_1^2 }$	
			Non-parallel line	√ (⟨M⟩₄*)²/⟨M⟩₂²	In all cases, we are taking a ratio between the magnitudes of the highest-grade parts of a transformation from A toward B
			Parallel line	$\sqrt{ (\langle M \rangle_2^*)^2/\langle M \rangle_0^2 }$	
			Point	$\sqrt{ (\langle M \rangle_3^*)^2/\langle M \rangle_1^2 }$	
	Plane	and a	Parallel plane	$\sqrt{ (\langle M \rangle_2^*)^2/\langle M \rangle_0^2 }$	
			Parallel line	$\sqrt{ (\langle M \rangle_3^*)^2/\langle M \rangle_1^2 }$	
			Parallel line Point	$\sqrt{ (\langle M \rangle_s^*)^2/\langle M \rangle_1^2 }$ $\sqrt{ (\langle M \rangle_s^*)^2/\langle M \rangle_2^2 }$	
Derivative of a	Plane		Point	$\sqrt{ (\langle M \rangle_z^*)^2/\langle M \rangle_z^2 }$ $\sqrt{ (\langle M \rangle_z^*)^2/\langle M \rangle_z^2 }$ $\langle M \rangle_z$	
Derivative of a	Line	wrt a		$\sqrt{ (\langle M\rangle_z^*)^2/\langle M\rangle_z^2 }$ $\sqrt{ (\langle M\rangle_z^*)^2/\langle M\rangle_z^2 }$ $\langle M\rangle_z$ $\langle M\rangle_z$	If your rotation is R, your rotation axis line B is the logarithm of R, and the rotation angle is B
Derivative of a	Line Point		Point	$ \sqrt{ (\langle M \rangle_a^*)^2/\langle M \rangle_i^2 } $ $ \sqrt{ (\langle M \rangle_a^*)^2/\langle M \rangle_z^2 } $ $ \langle M \rangle_i $ $ \langle M \rangle_z $ $ \langle M \rangle_3 $	If your rotation is R, your rotation axis line B is the logarithm of R, and the rotation angle is B
Derivative of a	Line Point Plane	- wrt a	Point Rotation axis line	$ \sqrt{ (\langle M \rangle_{a}^{+})^{2}/\langle M \rangle_{c}^{2} } $ $ \sqrt{ (\langle M \rangle_{a}^{+})^{2}/\langle M \rangle_{c}^{2} } $ $ \langle M \rangle_{1} $ $ \langle M \rangle_{2} $ $ \langle M \rangle_{2} $ $ \langle M \rangle_{3} $	
Derivative of a	Line Point Plane Line		Point	\(\(\lambda\)_2^\(\rangle\)_7^\(\lambda\)_7^\(\rangle\)_7^\(\rangle\)_2^\(\rangle\)_2^\(\rangle\)_2^\(\rangle\)_2^\(\rangle\)_2^\(\rangle\)_2^\(\rangle\)_2^\(\rangle\)_2^\(\rangle\)_2^\(\rangle\)_3^\(\rangle\)_2^\(\rangl	If your rotation is R, your rotation axis line B is the logarithm of R, and the rotation angle is B If your translation is T, your translation axis line B is the logarithm of T, and the translation distance is B
Derivative of a	Line Point Plane Line Point	- wrt a	Point Rotation axis line	\ \((\M)_2^*)^2/(\M)_2^2\ \ \((\M)_2^*)^2/(\M)_2^2\ \((M)_2^*\) \((M)_2^*\) \((M)_2^*\) \((M)_2^*\) \((M)_2^*\)	
Derivative of a	Point Plane Line Point Plane	wrt a	Point Rotation axis line Translation axis line	\ \(((M)_2^*)^2/(M)_1^2 \] \ \(((M)_2^*)^2/(M)_2^2 \] \ \((M)_1^* \) \ \((M)_2^* \) \ \((If your translation is T, your translation axis line B is the togarithm of T, and the translation distance is B
Derivative of a	Line Point Plane Line Point Plane Line Line	- wrt a	Point Rotation axis line	\ \((\M)_2^*)^2/\(M\)_2^2\ \ \((\M)_2^*)^2/\(M\)_2^2\ \(\M)_1^*\) \(\M)_2^*\) \(\M)_2^*\) \(\M)_2^*\) \(\M)_2^*\) \(\M)_2^*\) \(\M)_2^*\)	
	Point Plane Line Point Plane Line Point Plane Line Point	wrt a	Point Rotation axis line Translation axis line Rigid motion axis	\ \((\M)_2^*\)^2\(\M\)_2\ \\\\((\M)_*\)^2\((\M)_2^2\] \(\M\)_1 \(\M\)_2 \(\M\)_2 \(\M\)_3 \(\M\)_3 \(\M\)_3 \(\M\)_3 \(\M\)_3 \(\M\)_3	If your translation is T, your translation axis line B is the logarithm of T, and the translation distance is B
	Line Point Plane Line Point Plane Line Line	wrt a	Point Rotation axis line Translation axis line Rigid motion axis Planar reflection	\ \((\M)_2^*)^2/\(M)_2^2\ \ \((\M)_2^*)^2/\(M)_2^2\ \(\M)_2^*\\(If your translation is T, your translation axis line B is the togarithm of T, and the translation distance is B
	Point Plane Line Point Plane Line Point Plane Line Point	wrt a	Point Rotation axis line Translation axis line Rigid motion axis Planar reflection Rotation	\ \(((M)_2^*)^2 / (M)_2^2 \] \ \(((M)_2^*)^2 / (M)_2^2 \] \((M)_1^* \) \((M)_2^* \) \((M)_3^* \) \((M)_4 \) \((M)_5 \) \((If your translation is T, your translation axis line B is the logarithm of T, and the translation distance is B
	Point Plane Line Point Plane Line Point Plane Line Point	wrt a	Point Rotation axis line Translation axis line Rigid motion axis Planar reflection Rotation Translation	\ \((\M)_2^*)^2\(/\M)_2^2\ \ \((\M)_2^*)^2\(/\M)_2^2\ \((M)_1^*)^2\((M)_2^*\) \((M)_2^*) \(M)_2^*) \((M)_2^*) \((M)_2^*	If your translation is T, your translation axis line B is the logarithm of T, and the translation distance is B
	Line Point Plane Line Point Plane Line Point Plane Line Rotation	wrt a wrt a wrt a wrt a	Point Rotation axis line Translation axis line Rigid motion axis Planar reflection Rotation Translation Rigid motion	\ \((\M)_2^*)^2/\(M\)_2^2\ \sqrt{(\((M)_2^*)^2/\(M\)_2^2\]} \ \((M)_1^*\) \((M)_2^*\) \(M)_2^*\) \((M)_2^*\) \((M	If your translation is T, your translation axis line B is the logarithm of T, and the translation distance is B
	Point Plane Line Point Plane Line Point Plane Line Point	wrt a	Point Rotation axis line Translation axis line Rigid motion axis Planar reflection Rotation Rotation Rigid motion Planar reflection	\ \((\M)_2^*)^2/\(M)_2^2\ \sqrt{(\((M)_2^*)^2/\(M)_2^2\)}\ \(\M)_2^*\\ \(\M)_2^*\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	If your translation is T, your translation axis line B is the togarithm of T, and the translation distance is B
	Line Point Plane Line Point Plane Line Point Plane Line Rotation	wrt a wrt a wrt a wrt a	Point Rotation axis line Translation axis line Rigid motion axis Planar reflection Rotation Translation Rigid motion Planar reflection Rotation Rotation Rotation	\(\left((M) \cdot \gamma^2 \right((M) \cdot \gamma^2 \right) \left((M) \cdot \gamma^2 \right) \right((M) \cdot \gamma^2 \right) \right) \right((M) \cdot \gamma^2 \right) \right((M) \cdot \gamma^2 \right) \right) \right((M) \cdot \gamma^2 \right) \right) \right((M) \cdot \gamma^2 \right) \right) \right\((M) \cdot \gamma^2 \right) \right\((M)	If your translation is T, your translation axis line B is the logarithm of T, and the translation distance is B
	Line Point Plane Line Point Plane Line Point Plane Line Rotation	wrt a wrt a wrt a wrt a	Point Rotation axis line Translation axis line Rigid motion axis Planar reflection Rotation Translation Rigid motion Planar reflection Rotation Translation Translation Translation	\ \((\M)_2^*)^2\(/\M)_2^2\ \sqrt{\((\M)_2^*)^2\(/\M)_2^2\)}\\ \((\M)_2^*\) \((\M)_	If your translation is T, your translation axis line B is the logarithm of T, and the translation distance is B A rigid motion axis is a sum of a rotation axis line and a translation axis line
	Line Point Plane Line Point Plane Line Point Rotation Translation	wrt a wrt a with a	Point Rotation axis line Translation axis line Rigid motion axis Planar reflection Rotation Translation Rigid motion Planar reflection Rotation Translation Rotation Translation Rigid motion Rigid motion Rigid motion	\ \(\(\(\(\(\) \)_{2}^{*} \) \ \(\(\)_{2}^{*} \) \ \(\(\)_{2}^{*} \) \ \(\(\)_{2}^{*} \) \ \(\)_{2}^{*} \ \(\)_{2}^{*} \ \(\)_{2}^{*} \ \(\)_{2}^{*} \ \(\)_{2}^{*} \ \(\)_{2}^{*} \ \(\)_{3}^{*} \ \(\)_{3}^{*} \ \(\)_{4}^{*} \ \(\)_{5}^{*} \ \(\)_{5}^{*} \ \(\)_{7}^{*} \ \(\)_{7}^{*} \ \(\)_{7}^{*} \ \(\)_{7}^{*} \ \(\)_{8}^{*} \ \(\)_{9	If your translation is T, your translation axis line B is the logarithm of T, and the translation distance is B
	Line Point Plane Line Point Plane Line Point Plane Line Rotation	wrt a wrt a wrt a wrt a wrt a	Point Rotation axis line Translation axis line Rigid motion axis Planar reflection Rotation Translation Rigid motion Planar reflection Rotation Planar reflection Rotation Rotation Rigid motion Planar reflection Rotation Rigid motion Planar reflection	\ \((\M)_2^*)^2/\(M)_2^2\ \sqrt{(\((M)_2^*)^2/\(M)_2^2\)}\ \(\M)_2^*\\ \(\M)_2^*\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	If your translation is T, your translation axis line B is the logarithm of T, and the translation distance is B A rigid motion axis is a sum of a rotation axis line and a translation axis line
	Line Point Plane Line Point Plane Line Point Rotation Translation	wrt a wrt a with a	Point Rotation axis line Translation axis line Rigid motion axis Planar reflection Rotation Translation Rigid motion Planar reflection Rotation Translation Rigid motion Planar reflection Rigid motion Planar reflection Rotation Rotation Rotation Rotation Rotation Rotation	\ \(((M)_2^*)^2 / (M)_2^2 \ \ \(((M)_2^*)^2 / (M)_2^2 \ \((M)_2^*	If your translation is T, your translation axis line B is the logarithm of T, and the translation distance is B A rigid motion axis is a sum of a rotation axis line and a translation axis line
	Line Point Plane Line Point Plane Line Point Rotation Translation	wrt a wrt a with a	Point Rotation axis line Translation axis line Rigid motion axis Planar reflection Rotation Translation Rigid motion Planar reflection Rotation Translation Rotation Translation Rigid motion Planar reflection Rotation Rigid motion Planar reflection Rotation Translation	\ \((\M)_2^*)^2\(/\M)_2^2\ \sqrt{\((\M)_2^*)^2\(/\M)_2^2\)}\\ \((\M)_2^*\) \((\M)_	If your translation is T, your translation axis line B is the logarithm of T, and the translation distance is B A rigid motion axis is a sum of a rotation axis line and a translation axis line
	Line Point Plane Line Point Plane Line Point Rotation Translation	wrt a wrt a wrt a with a with a	Point Rotation axis line Translation axis line Rigid motion axis Planar reflection Rotation Translation Rigid motion Planar reflection Rotation Translation Rotation Rotation Translation Rigid motion Planar reflection Rotation Translation Rotation Translation Screw motion	\ \(((M)_2^*)^2/(M)_2^2 \ \ \(((M)_2^*)^2/(M)_2^2 \ \((M)_2^* (M)	If your translation is T, your translation axis line B is the logarithm of T, and the translation distance is B A rigid motion axis is a sum of a rotation axis line and a translation axis line
Derivative of a	Line Point Plane Line Point Plane Line Point Rotation Translation	wrt a wrt a with a	Point Rotation axis line Rigid motion axis Planar reflection Rotation Rotation Rigid motion Planar reflection Rotation Planar reflection Rotation Planar reflection Rotation Rotation Rigid motion Planar reflection Rotation Translation Rotation Planar reflection Rotation Planar reflection Rotation Planar reflection Rotation Planar reflection Planar reflection Planar reflection	\ \(((M)_2^*)^2 / (M)_2^2 \ \ \(((M)_2^*)^2 / (M)_2^2 \ \((M)_1^* \) \((M)_2^* \	If your translation is T, your translation axis line B is the logarithm of T, and the translation distance is B A rigid motion axis is a sum of a rotation axis line and a translation axis line
	Line Point Plane Line Point Plane Line Point Rotation Translation	wrt a wrt a wrt a with a with a	Point Rotation axis line Translation axis line Rigid motion axis Planar reflection Rotation Translation Rigid motion Planar reflection Rotation Translation Rotation Rotation Translation Rigid motion Planar reflection Rotation Translation Rotation Translation Screw motion	\ \(((M)_2^*)^2/(M)_2^2 \ \ \(((M)_2^*)^2/(M)_2^2 \ \((M)_2^* (M)	If your translation is T, your translation axis line B is the logarithm of T, and the translation distance is B A rigid motion axis is a sum of a rotation axis line and a translation axis line