Representations of geometric relations in point geometry and vector geometry

NO.	Geometric relations	Expressions in point geometry	Expressions in vector geometry
1	A, B, C are collinear and $t\overrightarrow{CA}=(t-1)\overrightarrow{CD}$. If $t=1/2$, C is the midpoint of AB.	$C=tA+(1-t)B$	$\overrightarrow{OC}=t\overrightarrow{OA}+(1-t)\overrightarrow{OB}$
2	$ABCD$ is a parallelogram	$D=A-B+C$	$\overrightarrow{CD}=\overrightarrow{BA}$
3	$ABCD$ is a trapezoid with $AB//CD$ and $CD=t\cdot BA$	$D=t(A-B)+C, t\neq 1$	$\overrightarrow{CD}=t\overrightarrow{BA}$
4	G is the centroid of $\triangle ABC$.	$G=\dfrac{A+B+C}{3}$	$\overrightarrow{OG}=\dfrac{\overrightarrow{OA}+\overrightarrow{OB}+\overrightarrow{OC}}{3}$
5	ABC is a triangle with orthocenter H and circumcenter D	$H=A+B+C-2D$	$\overrightarrow{OH}=\overrightarrow{OA}+\overrightarrow{OB}+\overrightarrow{OC}-2\overrightarrow{OD}$
6	$AB\perp CD$	$(A-B)(C-D)=0$	$\overrightarrow{BA}\cdot\overrightarrow{DC}=0$
7	A is on the perpendicular bisector of BC.	$(A-\dfrac{B+C}{2})(B-C)=0$	$(\overrightarrow{OA}-\dfrac{\overrightarrow{OB}+\overrightarrow{OC}}{2})\cdot\overrightarrow{CB}=0$
8	$\angle BAC=90^\circ$	$(A-B)(A-C)=0$	$\overrightarrow{BA}\cdot\overrightarrow{CA}=0$
9	H is the orthocenter of $\triangle ABC$.	$(A-H)(B-C)=0$ and $(B-H)(C-A)=0$	$\overrightarrow{HA}\cdot\overrightarrow{CB}=0$ and $\overrightarrow{HB}\cdot\overrightarrow{CA}=0$
10	O is the circumcenter of $\triangle ABC$.	$(O-A)^2-(O-B)^2=0$ and $(O-A)^2-(O-C)^2=0$	$\overrightarrow{OA}^2=\overrightarrow{OB}^2$ and $\overrightarrow{OA}^2=\overrightarrow{OC}^2$
11	Projection Theorem: BAC is a triangle with $BA\perp AC$ and $AD\perp BC$ where D lies on BC.	$(A-D)^2-(B-D)(D-C)=0$	$\overrightarrow{DA}^2-\overrightarrow{DB}\cdot\overrightarrow{CD}=0$
		$(A-B)^2-(B-D)(B-C)=0$	$\overrightarrow{BA}^2-\overrightarrow{DB}\cdot\overrightarrow{CB}=0$
12	Circle-Power Theorem: $ABCD$ is a cyclic quadrilateral, AC intersects BD at P.	$(P-A)(P-B)-(P-C)(P-D)=0$	$\overrightarrow{AP}\cdot\overrightarrow{BP}-\overrightarrow{CP}\cdot\overrightarrow{DP}=0$
13	$\sqrt{k_1}AB=\sqrt{k_2}CD$	$k_1(A-B)^2-k_2(C-D)^2=0$	$k_1\overrightarrow{BA}^2-k_2\overrightarrow{DC}^2=0$
14	$AB^2=k_1CD^2+k_2EF^2$	$(A-B)^2-k_1(C-D)^2-k_2(E-\mathrm{F})^2=0$	$\overrightarrow{AB}^2-k_1\overrightarrow{CD}^2-k_2\overrightarrow{EF}^2=0$
15	CD//EF and $k_1AB^2=k_2CD\cdot EF$	$k_1(A-B)^2-k_2(C-D)(E-\mathrm{F})=0$	$k_1\overrightarrow{AB}^2-k_2\overrightarrow{DC}\cdot\overrightarrow{FE}=0$
	C, D, E are collinear and $k_1AB^2=k_2CD\cdot DE$	$k_1(A-B)^2-k_2(C-D)(D-E)=0$	$k_1\overrightarrow{AB}^2-k_2\overrightarrow{CD}\cdot\overrightarrow{DE}=0$
16	A, B, C are collinear. D, E, F are collinear. And $k_1AB\cdot BC=k_2DE\cdot EF$	$k_1(A-B)(B-C)-k_2(D-E)(E-F)=0$	$k_1\overrightarrow{AB}\cdot\overrightarrow{BC}=k_2\overrightarrow{DE}\cdot\overrightarrow{EF}$
17	AB//CD. E, F, G are collinear. And $k_1AB\cdot CD=k_2EF\cdot FG$	$k_1(A-B)(C-D)-k_2(E-F)(F-G)=0$	$k_1\overrightarrow{AB}\cdot\overrightarrow{CD}=k_2\overrightarrow{EF}\cdot\overrightarrow{FG}$
18	AB//CD, EF//GH and $k_1AB\cdot CD=k_2EF\cdot GH$	$k_1(A-B)(C-D)-k_2(E-F)(G-H)=0$	$k_1\overrightarrow{AB}\cdot\overrightarrow{CD}=k_2\overrightarrow{EF}\cdot\overrightarrow{GH}$