Mirrors, Refracting Surfaces & Lenses

Optics (facing Obj.)	r	f	Object Location	Image Type	Image Location wrt Obj	i	m
MIRRORS							
Plane	∞	∞	Anywhere	Virtual	opposite side	$-p$	+1
Concave	+	+	Inside f	Virtual	opposite side	–	+
			Outside f	Real	same side	+	–
			f	×	same side	$+\infty$	×
Convex	–	–	$\neq f$	Virtual	opposite side	–	+
			f	×	same side	$-\infty$	×
SPHERICAL REFRACTING SURFACES							
Concave	–		in low or high n	R/V	opp/same side	+/–	+/–
Convex	+		in low or high n	R/V	opp/same side	+/–	+/–
LENSES							
Converging	*	+	Inside f	Virtual	same side	–	+
			Outside f	Real	opposite side	+	–
			f	×	opposite side	$+\infty$	×
			∞	×	opposite side	$+f$	0
Diverging	*	–	Anywhere	Virtual	same side	–	+
			∞	×	same side	$-f$	0
* signs for r_1 and r_2 as for Spherical Refracting Surfaces							

Optics	Focus	Image Distance	Mag.
Plane Mirror	×	$-p$	1
Spherical Mirror	½ r	$\frac{1}{p}+\frac{1}{i}=\frac{1}{f}$	$\lvert m\rvert=\frac{h_i}{h_o}$
Thin Lens	$\frac{1}{f}=(n-1)\left(\frac{1}{r_1}-\frac{1}{r_2}\right)$ [1]	$\frac{1}{p}+\frac{1}{i}=\frac{1}{f}$	$m=-\frac{i}{p}$
Spherical Refr. Surf	none	$\frac{n_1}{p}+\frac{n_2}{i}=\frac{n_2-n_1}{r}$ [2]	$\lvert m\rvert=\frac{h_i}{h_o}$
[1] r_1 (r_2) = radius of curvature of surface closest to (farthest from) object [2] n_1 (n_2) = index of refraction of material containing (not containing) object			