**Conic Sections**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Name | Graph | Equation | Eccentricity | Focus | Directrix | Other Notes |
| Circle | Screen Shot 2014-01-10 at 08.06.43.png | $$x^{2}+y^{2}=r^{2}$$ | $$e=0$$ |  |  |  |
| Ellipse | Screen Shot 2014-01-10 at 08.07.01.png | $$\frac{x^{2}}{a}+\frac{y^{2}}{b}=1$$ | $$0<e<1$$$$b^{2}=a^{2}(1-e^{2})$$ | $$(\pm ae,0)$$ | $$x\pm \frac{a}{e}$$ |  |
| Parabola | Screen Shot 2014-01-10 at 08.07.19.png | $$y^{2}=4ax$$ | $$e=1$$ | $$(a,0)$$ | $$x=-a$$ |  |
| Hyperbola | Screen Shot 2014-01-10 at 08.07.10.png | $$\frac{x^{2}}{a}-\frac{y^{2}}{b}=1$$ | $$e>1$$$$b^{2}=a^{2}(1+e^{2})$$ | $$(\pm ae,0)$$ | $$x\pm \frac{a}{e}$$ | Asymptotes given by $y=\pm \frac{b}{a}x$ |
| RectangularHyperbola | Screen Shot 2014-01-11 at 17.04.04.png | $$xy=c^{2}$$ | $$e=\sqrt{2}$$ | $$(\pm a\sqrt{2},0)$$ | $$x\pm \frac{a}{\sqrt{2}}$$ | Asymptotes $x=0$, $y=0$ |

$$e \left(a constant\right)=\frac{distance of P from a fixed point}{distance of P from a fixed line}=\frac{focus}{directrix}$$

**Transformations of the Standard Conic Equations**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Standard Equation | Translation $\left[\begin{matrix}g\\h\end{matrix}\right]$ | Reflection in $y=x$ | Stretch horizontal scale factor *p* | Stretch vertical scale factor *q* |
| Circle | $$x^{2}+y^{2}=r^{2}$$ | $$(x-g)^{2}+(y-h)^{2}=r^{2}$$ | Equation remains same | Transforms into an ellipse | Transforms into an ellipse |
| Ellipse | $$\frac{x^{2}}{a^{2}}+\frac{y^{2}}{b^{2}}=1$$ | $$\frac{(x-g)^{2}}{a^{2}}+\frac{(y-h)^{2}}{b^{2}}=1$$ | $$\frac{x^{2}}{b^{2}}+\frac{y^{2}}{a^{2}}=1$$ | $$\frac{\left(\frac{x}{p}\right)^{2}}{a^{2}}+\frac{y^{2}}{b^{2}}=1$$$$⟹\frac{x^{2}}{p^{2}a^{2}}+\frac{y^{2}}{b^{2}}=1$$ | $$\frac{x^{2}}{a^{2}}+\frac{\left(\frac{y}{q}\right)^{2}}{b^{2}}=1$$$$⟹\frac{x^{2}}{a^{2}}+\frac{y^{2}}{q^{2}b^{2}}=1$$ |
| Parabola | $$y^{2}=4ax$$ | $$(y-h)^{2}=4a(x-g)$$ | $$x^{2}=4ay$$ | $$y^{2}=4a\left(\frac{x}{p}\right)$$$$⟹y^{2}=\frac{4ax}{p}$$ | $$\left(\frac{y}{q}\right)^{2}=4ax$$$$⟹y^{2}=q^{2}4ax$$ |
| Hyperbola | $$\frac{x^{2}}{a^{2}}-\frac{y^{2}}{b^{2}}=1$$ | $$\frac{(x-g)^{2}}{a^{2}}-\frac{(y-h)^{2}}{b^{2}}=1$$ | $$\frac{y^{2}}{a^{2}}-\frac{x^{2}}{b^{2}}=1$$ | $$\frac{\left(\frac{x}{p}\right)^{2}}{a^{2}}-\frac{y^{2}}{b^{2}}=1$$$$⟹\frac{x^{2}}{p^{2}a^{2}}-\frac{y^{2}}{b^{2}}=1$$ | $$\frac{x^{2}}{a^{2}}-\frac{\left(\frac{y}{q}\right)^{2}}{b^{2}}=1$$$$⟹\frac{x^{2}}{a^{2}}-\frac{y^{2}}{q^{2}b^{2}}=1$$ |
| RectangularHyperbola | $$xy=c^{2}$$ | $$(x-g)(y-h)=c^{2}$$ | Equation remains same | $$\left(\frac{x}{p}\right)y=c^{2}$$$$⟹xy=pc^{2}$$ | $$x\left(\frac{y}{q}\right)=c^{2}$$$$⟹xy=qc^{2}$$ |

**AQA FP1 Conic Topics Covered**

6A – Page 77-80.

Intersection of a line and a parabola

6B – Page 80-82.

Transformations of a parabola; translation, reflection in y=x, horizontal stretch, vertical stretch

6C – Page 82-86.

Intro to the ellipse as a stretched circle

Intersection of a line and an ellipse

Transformations of an ellipse; translation, reflection in y=x, horizontal stretch, vertical stretch

6D – Page 87-90.

Intro to the hyperbola

Intersection of a line and an hyperbola

Transformations of an ellipse; translation, reflection in y=x, horizontal stretch, vertical stretch

6E – Page 91-94.

Intro to the rectangular hyperbola as a special hyperbola

Intersection of a line and a rectangular hyperbola

Transformations of an ellipse; translation, reflection in y=x, horizontal stretch, vertical stretch