In[118]:=
```
ClearAll[QFn, k, m, ω, γ]
```

```
(*calcualating q based on ω0 / width at .5 max val*)
```

In[99]:=
```
ω0 = Sqrt[k / m]
```

Out[99]=
$$\sqrt{\frac{k}{m}}$$

In[119]:=
```
QFn = 2 γ^2 (k / m) == (k - m ω^2)^2 + (γ ω)^2
ws = Solve[QFn, ω]
ω- = ω /. ws[[2]]
ω+ = ω /. ws[[4]]

Q = ω0 / (ω+ - ω-)
```

Out[119]=
$$\frac{2\,k\,\gamma^2}{m} == \gamma^2\,\omega^2 + \left(k - m\,\omega^2\right)^2$$

Out[120]=
$$\left\{\left\{\omega \to -\frac{\sqrt{\frac{2\,k}{m} - \frac{\gamma^2}{m^2} - \frac{\gamma\sqrt{4\,k\,m+\gamma^2}}{m^2}}}{\sqrt{2}}\right\}, \left\{\omega \to \frac{\sqrt{\frac{2\,k}{m} - \frac{\gamma^2}{m^2} - \frac{\gamma\sqrt{4\,k\,m+\gamma^2}}{m^2}}}{\sqrt{2}}\right\},\right.$$
$$\left.\left\{\omega \to -\sqrt{\frac{k}{m} - \frac{\gamma^2}{2\,m^2} + \frac{\gamma\sqrt{4\,k\,m+\gamma^2}}{2\,m^2}}\right\}, \left\{\omega \to \sqrt{\frac{k}{m} - \frac{\gamma^2}{2\,m^2} + \frac{\gamma\sqrt{4\,k\,m+\gamma^2}}{2\,m^2}}\right\}\right\}$$

Out[121]=
$$\frac{\sqrt{\frac{2\,k}{m} - \frac{\gamma^2}{m^2} - \frac{\gamma\sqrt{4\,k\,m+\gamma^2}}{m^2}}}{\sqrt{2}}$$

Out[122]=
$$\sqrt{\frac{k}{m} - \frac{\gamma^2}{2\,m^2} + \frac{\gamma\sqrt{4\,k\,m+\gamma^2}}{2\,m^2}}$$

Out[123]=
$$\frac{\sqrt{\frac{k}{m}}}{-\frac{\sqrt{\frac{2\,k}{m} - \frac{\gamma^2}{m^2} - \frac{\gamma\sqrt{4\,k\,m+\gamma^2}}{m^2}}}{\sqrt{2}} + \sqrt{\frac{k}{m} - \frac{\gamma^2}{2\,m^2} + \frac{\gamma\sqrt{4\,k\,m+\gamma^2}}{2\,m^2}}}$$

In[117]:=
```
(*m = k = 1
    γ = .1
    ω+
     ω-
    Q*)
```

```
(*calulating Q for an undapne oscilator *)
```