Annihilation DESY data

See www.hepdata.net/record/ins191231, Table 2, 14.0 GeV.

x	y
0.0502	0.09983
0.1505	0.10791
0.2509	0.12026
0.3512	0.13002
0.4516	0.17681
0.5521	0.19570
0.6526	0.27900
0.7312	0.33204

For columns x and y we have

$$x = \cos\theta, \quad y = \frac{d\sigma}{d\Omega}$$

The cross section formula is

$$\frac{d\sigma}{d\Omega} = \frac{\alpha^2}{2s}\left(\frac{1+\cos\theta}{1-\cos\theta} + \frac{1-\cos\theta}{1+\cos\theta}\right) \times (\hbar c)^2$$

Let $\hat{y}$ be predicted values. The factor 10^{37} converts square meters to nanobarns.

$$\hat{y}_i = \left.\frac{d\sigma}{d\Omega}\right|_{\cos\theta = x_i} = \frac{\alpha^2}{2s}\left(\frac{1+x_i}{1-x_i} + \frac{1-x_i}{1+x_i}\right) \times (\hbar c)^2 \times 10^{37}$$

The following table shows predicted values for $s = (14.0\,\mathrm{GeV})^2$.

x	y	$\hat{y}$
0.0502	0.09983	0.106325
0.1505	0.10791	0.110694
0.2509	0.12026	0.120005
0.3512	0.13002	0.135559
0.4516	0.17681	0.159996
0.5521	0.19570	0.198562
0.6526	0.27900	0.262745
0.7312	0.33204	0.348884

The coefficient of determination R^2 measures how well predicted values fit the data.

$$R^2 = 1 - \frac{\sum(y-\hat{y})^2}{\sum(y-\bar{y})^2} = 0.98$$

The result indicates that $d\sigma$ explains 98% of the variance in the data.