7.24 We are asked to determine the grain diameter for an iron which will give a yield strength of 310 MPa (45,000 psi). The best way to solve this problem is to first establish two simultaneous expressions of Equation 7.7, solve for σ_0 and k_y, and finally determine the value of d when σ_y = 310 MPa. The data pertaining to this problem may be tabulated as follows:

σ_y	d (mm)	$d^{-1/2}$ $(mm)^{-1/2}$
230 MPa	1×10^{-2}	10.0
275 MPa	6×10^{-3}	12.91

The two equations thus become

$$230 \text{ MPa} = \sigma_0 + (10.0)\, k_y$$

$$275 \text{ MPa} = \sigma_0 + (12.91)\, k_y$$

Which yield the values, σ_0 = 75.4 MPa and k_y = 15.46 MPa$(mm)^{1/2}$. At a yield strength of 310 MPa

$$310 \text{ MPa} = 75.4 \text{ MPa} + \left[15.46 \text{ MPa } (mm)^{1/2}\right] d^{-1/2}$$

or $d^{-1/2}$ = 15.17 $(mm)^{-1/2}$, which gives $d = 4.34 \times 10^{-3}$ mm.