Our task for today is to compute transmissivity, hydraulic conductivity and sustained yield from pump test measurements of drawdown and recovery data. Refer to your handout for basic definitions of terms and discussion.

\[ T = \frac{2.303Q(\log_{10} t_2 - \log_{10} t_1)}{4\pi(s_2 - s_1)} \]

*This equation is used to compute transmissivity (gpm/ft) from the drawdown or pumping phase of the test. Note that Q in this expression is the pumping rate (gallons/min), s is the corrected drawdown.

The hydraulic conductivity K is derived from transmissivity and then K is used to estimate the maximum sustained yield (Q) of the aquifer,
where \[ Q = K(H^2 - h^2) / [1055 \log_{10}(R/r)] \]

Basic pump test data

Note that Dr. Rauch reports water levels as a function of time in days, rather than in minutes.
Jacob straight-line time-drawdown method for the well pumping test phase (Cooper and Jacob, 1946; Jacob, 1950)

\[ T = 2.303Q(\log_{10} t_2 - \log_{10} t_1)/4\pi(s_2 - s_1) \]

Keeping units straight - Transmissivities may be reported in units of (gal/min)/ft or (gal/day)/ft, or (ft³/day)/ft.

Refer to page 2 of today’s handout for discussions of unit conversions!

Calculation of transmissivity based on the recovery phase data is made using this equation

\[ T = 2.303Q(\log_{10} t_2/\log_{10} t_1 - \log_{10} t_1/\log_{10} t_1)/4\pi(s_2 - s_1) \]

This method is referred to as the Jacob single well recovery test method (Jacob, 1963)

In these equations,
• \( t \) is the time since well pumping was initiated
• \( t' \) is the time since pumping stopped.
• \( s = s_e \) is the equivalent or corrected drawdown \( (s_s - s_e^2/2m) \)

Working with the drawdown data, corrected drawdown is plotted as a function of \( \log \) \( t \) and the slope is

\[ \frac{(s_2 - s_1)}{(\log_{10} t_2 - \log_{10} t_1)} \]
Once you’ve got $T$ you compute the hydraulic conductivity $K$:

$$K = \frac{T}{m}$$

Where $m$ is the initial saturated thickness of the aquifer.

The long term sustained yield is:

$$Q = K(H^2 - h^2)[1055\log_{10}(R/r)]$$

- $H$ is the static saturated aquifer thickness above the well bottom. $H > m$
- $h$ is the height of the water column above well bottom during maximum sustained pumping.
- $R$ is the radius of the steady state pumping cone of depression in the water table, and
- $r$ is the well radius below the casing.
- $K$ is still the hydraulic conductivity.

In practice two estimates of $Q$ are made using $K$’s derived independently from the pumping and recovery phases of the pump test.
Take a few minutes and enter your pump test data.

Pay particular attention to the givens in your handout.

\[ d = 76.21 \]
\[ m = 229 \]
\[ \text{pumping rate (Q)} = 13.8 \text{gpm} \]
\[ H = m = 229 \text{feet} \]
\[ h = 20 \text{ft} \]
\[ R = 100, 300, \text{and 1000 feet} \]
\[ r = 0.292 \text{feet} \]