Important Water Demand and Quantity Formulas PDF

Formulas
Examples
with Units

List of 31
Important Water Demand and Quantity Formulas

1) Determination of Population For Inter Censal and Post Censal Years Formulas

1.1) Constant Factor given Population at Last Census Formula

Evaluate Formula

Formula

$$K_A = \frac{P_L - P_E}{T_L - T_E}$$

Example

$$1.99 = \frac{20.01 - 22}{19 - 20}$$

1.2) Earlier Census Date given Constant Factor Formula

Evaluate Formula

Formula

$$T_E = T_L - \left(\frac{P_L - P_E}{K_A}\right)$$

Example

$$19.995 = 19 - \left(\frac{20.01 - 22}{2}\right)$$

1.3) Earlier Census Date given Proportionality Factor Formula

Evaluate Formula

Formula

$$T_E = T_L - \left(\frac{\log\left(P_L, e\right) - \log\left(P_E, e\right)}{K_G}\right)$$

Example

$$18.6588 = 19 - \left(\frac{\log\left(20.01, e\right) - \log\left(22, e\right)}{0.03}\right)$$

1.4) Last Census Date given Constant Factor Formula

Evaluate Formula

Formula

$$T_L = T_E + \left(\frac{P_L - P_E}{K_A}\right)$$

Example

$$19.005 = 20 + \left(\frac{20.01 - 22}{2}\right)$$

1.5) Last Census Date given Proportionality Factor Formula

Evaluate Formula

Formula

$$T_L = T_E + \left(\frac{\log\left(P_L, e \right) - \log\left(P_E, e \right)}{K_G} \right)$$

Example

$$20.3412 = 20 + \left(\frac{\log\left(20.01, e \right) - \log\left(22, e \right)}{0.03} \right)$$

1.6) Population at Earlier Census Formula

Evaluate Formula

Formula

$$P_E = P_L - K_A \cdot \left(T_L - T_E \right)$$

Example

$$22.01 = 20.01 - 2 \cdot \left(19 - 20 \right)$$

1.7) Population at Last Census Formula

Evaluate Formula

Formula

$$P_L = P_E + K_A \cdot \left(T_L - T_E \right)$$

Example

$$20 = 22 + 2 \cdot \left(19 - 20 \right)$$

1.8) Population at Last Census given Proportionality Factor Formula

Evaluate Formula

Formula

$$P_L = \exp\left(\left(T_L - T_E \right) \cdot K_G + \log10\left(P_E \right) \right)$$

Example

$$3.7152 = \exp\left(\left(19 - 20 \right) \cdot 0.03 + \log10\left(22 \right) \right)$$

1.9) Proportionality Factor given Population at Last Census Formula

Evaluate Formula

Formula

$$K_G = \frac{\log10\left(P_L \right) - \log10\left(P_E \right)}{T_L - T_E}$$

Example

$$0.0412 = \frac{\log10\left(20.01 \right) - \log10\left(22 \right)}{19 - 20}$$

1.10) Arithmetic Increase Method Formulas

1.10.1) Inter Censal Period Formulas

1.10.1.1) Constant Factor for Inter Censal Period Formula

Evaluate Formula

Formula

$$K_A = \frac{P_M - P_E}{T_M - T_E}$$

Example

$$2 = \frac{40 - 22}{29 - 20}$$

1.10.1.2) Earlier Census Date for Inter Censal Period Formula

Evaluate Formula

Formula

$$T_E = T_M - \left(\frac{P_M - P_E}{K_A} \right)$$

Example

$$20 = 29 - \left(\frac{40 - 22}{2} \right)$$

1.10.1.3) Mid Year Census Date for Inter Censal Period Formula

Evaluate Formula

Formula

$$T_M = \left(\frac{P_M - P_E}{K_A} \right) + T_E$$

Example

$$29 = \left(\frac{40 - 22}{2} \right) + 20$$

1.10.1.4) Population at Earlier Census for Inter Censal Period Formula

Evaluate Formula

Formula

$$P_E = P_M - K_A \cdot \left(T_M - T_E \right)$$

Example

$$22 = 40 - 2 \cdot \left(29 - 20 \right)$$

1.10.1.5) Population at Mid Year Formula

Evaluate Formula

Formula

$$P_M = P_E + K_A \cdot \left(T_M - T_E \right)$$

Example

$$40 = 22 + 2 \cdot \left(29 - 20 \right)$$

1.10.2) Post Censal Period Formulas

1.10.2.1) Constant Factor for Post Censal Period Formula

Evaluate Formula

Formula

$$K_A = \frac{P_M - P_L}{T_M - T_L}$$

Example

$$1.999 = \frac{40 - 20.01}{29 - 19}$$

1.10.2.2) Last Census Date for Post Censal Period Formula

Evaluate Formula

Formula

$$T_L = T_M - \left(\frac{P_M - P_L}{K_A} \right)$$

Example

$$19.005 = 29 - \left(\frac{40 - 20.01}{2} \right)$$

1.10.2.3) Mid Year Census Date for Post Censal Period Formula

Evaluate Formula

Formula

$$T_M = T_L + \left(\frac{P_M - P_L}{K_A} \right)$$

Example

$$28.995 = 19 + \left(\frac{40 - 20.01}{2} \right)$$

1.10.2.4) Population at Last Census for Post Censal Period Formula

Evaluate Formula

Formula

$$P_L = P_M - K_A \cdot \left(T_M - T_L \right)$$

Example

$$20 = 40 - 2 \cdot \left(29 - 19 \right)$$

1.10.2.5) Population at Mid Year for Post Censal Period Formula

Evaluate Formula

Formula

$$P_M = P_L + K_A \cdot \left(T_M - T_L \right)$$

Example

$$40.01 = 20.01 + 2 \cdot \left(29 - 19 \right)$$

1.10.1) Geometric Increase Method Formulas

1.10.1.1) Inter Censal Period Formulas

1.10.1.1.1) Earlier Census Date for Geometric Increase Method Formula

Evaluate Formula

Formula

$$T_E = T_M - \left(\frac{\log10\left(P_M \right) - \log10\left(P_E \right)}{K_G} \right)$$

Example

$$20.3454 = 29 - \left(\frac{\log10\left(40 \right) - \log10\left(22 \right)}{0.03} \right)$$

1.10.1.1.2) Mid Year Census Date for Geometric Increase Method Formula

Evaluate Formula

Formula

$$T_M = T_E + \left(\frac{\log10\left(P_M \right) - \log10\left(P_E \right)}{K_G} \right)$$

Example

$$28.6546 = 20 + \left(\frac{\log10\left(40 \right) - \log10\left(22 \right)}{0.03} \right)$$

1.10.1.1.3) Population at Earlier Census for Geometric Increase Method Formula

Evaluate Formula

Formula

$$P_E = \exp\left(\log10\left(P_M \right) - K_G \cdot \left(T_M - T_E \right) \right)$$

Example

$$3.7888 = \exp\left(\log10\left(40 \right) - 0.03 \cdot \left(29 - 20 \right) \right)$$

1.10.1.1.4) Population at Mid Year for Geometric Increase Method Formula

Evaluate Formula

Formula

$$P_M = \exp\left(\log10\left(P_E\right) + K_G \cdot \left(T_M - T_E\right)\right)$$

Example

$$5.0149 = \exp\left(\log10\left(22\right) + 0.03 \cdot \left(29 - 20\right)\right)$$

1.10.1.1.5) Proportionality Factor for Geometric Increase Method Formula

Evaluate Formula

Formula

$$K_G = \frac{\log10\left(P_M\right) - \log10\left(P_E\right)}{T_M - T_E}$$

Example

$$0.0288 = \frac{\log10\left(40\right) - \log10\left(22\right)}{29 - 20}$$

1.10.1.2) Post Censal Period Formulas

1.10.1.2.1) Last Census Date for Geometric Increase Method Post Censal Formula

Evaluate Formula

Formula

$$T_L = T_M - \left(\frac{\log10\left(P_M\right) - \log10\left(P_L\right)}{K_G}\right)$$

Example

$$18.9729 = 29 - \left(\frac{\log10\left(40\right) - \log10\left(20.01\right)}{0.03}\right)$$

1.10.1.2.2) Mid Year Census Date for Geometric Increase Method Post Censal Formula

Evaluate Formula

Formula

$$T_M = T_L + \left(\frac{\log10\left(P_M\right) - \log10\left(P_L\right)}{K_G}\right)$$

Example

$$29.0271 = 19 + \left(\frac{\log10\left(40\right) - \log10\left(20.01\right)}{0.03}\right)$$

1.10.1.2.3) Population at Earlier Census given Proportionality Factor Formula

Evaluate Formula

Formula

$$P_E = \exp\left(\log10\left(P_L\right) - \left(T_L - T_E\right) \cdot K_G\right)$$

Example

$$3.7858 = \exp\left(\log10\left(20.01\right) - \left(19 - 20\right) \cdot 0.03\right)$$

1.10.1.2.4) Population at Last Census for Geometric Increase Method Post Censal Formula

Evaluate Formula

Formula

$$P_L = \exp\left(\log10\left(P_M\right) - K_G \cdot \left(T_M - T_L\right)\right)$$

Example

$$3.6769 = \exp\left(\log10\left(40\right) - 0.03 \cdot \left(29 - 19\right)\right)$$

1.10.1.2.5) Population at Mid Year for Geometric Increase Method Post Censal Formula

Evaluate Formula

Formula

$$P_M = \exp\left(\log10\left(P_L\right) + K_G \cdot \left(T_M - T_L\right)\right)$$

Example

$$4.9592 = \exp\left(\log10\left(20.01\right) + 0.03 \cdot \left(29 - 19\right)\right)$$

1.10.1.2.6) Proportionality Factor for Geometric Increase Method Post Censal Formula

Evaluate Formula

Formula

$$K_G = \frac{\log10\left(P_M\right) - \log10\left(P_L\right)}{T_M - T_L}$$

Example

$$0.0301 = \frac{\log10\left(40\right) - \log10\left(20.01\right)}{29 - 19}$$

2) Variation In Rate of Demand Formulas

2.1) Percentage of Annual Average Consumption by Goodrich Formula Formula

Evaluate Formula

Formula

$$APR = \left(180 \cdot \left(t\right)^{-0.10}\right)$$

Example with Units

$$142.9791 = \left(180 \cdot \left(10\,\text{d}\right)^{-0.10}\right)$$

Variables used in list of Water Demand and Quantity Formulas above

- **APR** Annual Percentage Rate
- K_A Constant Factor
- K_G Proportionality Factor
- P_E Population at Earlier Census
- P_L Population at Last Census
- P_M Population at Mid Year Census
- **t** Time in days *(Day)*
- T_E Earlier Census Date
- T_L Last Census Date
- T_M Mid-Year Census Date

Constants, Functions, Measurements used in list of Water Demand and Quantity Formulas above

- constant(s): **e**, 2.71828182845904523536028747135266249 *Napier's constant*
- Functions: **exp**, exp(Number) *n an exponential function, the value of the function changes by a constant factor for every unit change in the independent variable.*
- Functions: **log**, log(Base, Number) *Logarithmic function is an inverse function to exponentiation.*
- Functions: **log10**, log10(Number) *The common logarithm, also known as the base-10 logarithm or the decimal logarithm, is a mathematical function that is the inverse of the exponential function.*
- Measurement: **Time** in Day (d) *Time Unit Conversion*

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