



Water Demand and Quantity Formulas

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List of 31 Water Demand and Quantity Formulas

Water Demand and Quantity

Determination of Population For Inter Censal and Post Censal Years

1) Constant Factor given Population at Last Census

 $\left| \mathbf{K}_{\mathrm{A}}
ight| \mathrm{K}_{\mathrm{A}} = rac{\mathrm{P_L} - \mathrm{P_E}}{\mathrm{T_L} - \mathrm{T_F}}$

Open Calculator

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

2) Earlier Census Date given Constant Factor

$$egin{aligned} \mathbf{T}_{\mathrm{E}} = \mathbf{T}_{\mathrm{L}} - \left(rac{\mathrm{P}_{\mathrm{L}} - \mathrm{P}_{\mathrm{E}}}{\mathrm{K}_{\mathrm{A}}}
ight) \end{aligned}$$

Open Calculator

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



3) Earlier Census Date given Proportionality Factor 🗗

$$ag{T_{
m E} = T_{
m L} - \left(rac{\log({
m P_L},e) - \log({
m P_E},e)}{{
m K_G}}
ight)}$$

Open Calculator 2

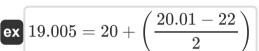
ex $18.65876 = 19 - \left(rac{\log(20.01, e) - \log(22, e)}{0.03}
ight)$

Open Calculator

Open Calculator

Open Calculator

4) Last Census Date given Constant Factor
$$\Gamma$$
 $\Gamma_{\rm L} = T_{\rm E} + \left(\frac{P_{\rm L} - P_{\rm E}}{K_{\Lambda}}\right)$



5) Last Census Date given Proportionality Factor 🗹

$$T_{
m L}=T_{
m E}+\left(rac{\log({
m P_L},e)-\log({
m P_E},e)}{{
m K_G}}
ight)$$
 ex $20.34124=20+\left(rac{\log(20.01,e)-\log(22,e)}{0.03}
ight)$

$$ag{P_{
m E} = P_{
m L} - K_{
m A} \cdot (T_{
m L} - T_{
m E})}$$

$$\texttt{ex} \ 22.01 = 20.01 - 2 \cdot (19 - 20)$$



7) Population at Last Census

fx $P_{
m L}=P_{
m E}+{
m K_A}\cdot({
m T_L}-{
m T_E})$

Open Calculator 2

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

8) Population at Last Census given Proportionality Factor

Open Calculator

 $P_{
m L} = \exp((T_{
m L} - T_{
m E}) \cdot {
m K_G} + \log 10(P_{
m E}))$

9) Proportionality Factor given Population at Last Census

19 - 20

 $ext{K} ext{K}_{ ext{G}} = rac{\log 10(ext{P}_{ ext{L}}) - \log 10(ext{P}_{ ext{E}})}{ ext{T}_{ ext{L}} - ext{T}_{ ext{E}}}$ $= \frac{\log 10(20.01) - \log 10(22)}{0.041176}$ Open Calculator

Arithmetic Increase Method

10) Constant Factor for Inter Censal Period 🗗

 $\left| \mathbf{K}_{\mathrm{A}}
ight| \mathrm{K}_{\mathrm{A}} = rac{\mathrm{P}_{\mathrm{M}} - \mathrm{P}_{\mathrm{E}}}{\mathrm{T}_{\mathrm{M}} - \mathrm{T}_{\mathrm{E}}} \left|
ight|$

Inter Censal Period

Open Calculator

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



11) Earlier Census Date for Inter Censal Period

 $\left| \mathbf{T}_{\mathrm{E}} = \mathbf{T}_{\mathrm{M}} - \left(rac{\mathbf{P}_{\mathrm{M}} - \mathbf{P}_{\mathrm{E}}}{\mathbf{K}_{\mathrm{A}}}
ight)
ight|$

Open Calculator 🗗

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

12) Mid Year Census Date for Inter Censal Period

 $\mathbf{T}_{\mathrm{M}} = \left(rac{\mathrm{P_{\mathrm{M}}} - \mathrm{P_{\mathrm{E}}}}{\mathrm{K_{\Lambda}}}
ight) + \mathrm{T_{\mathrm{E}}}$

Open Calculator

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

13) Population at Earlier Census for Inter Censal Period

 $m{\kappa} \left[ext{P}_{ ext{E}} = ext{P}_{ ext{M}} - ext{K}_{ ext{A}} \cdot \left(ext{T}_{ ext{M}} - ext{T}_{ ext{E}}
ight)
ight]$

Open Calculator 🗗

 $\boxed{22 = 40 - 2 \cdot (29 - 20)}$

14) Population at Mid Year

 $oldsymbol{P}_{
m M} = P_{
m E} + K_{
m A} \cdot (T_{
m M} - T_{
m E})$

Open Calculator

 $\boxed{ 40 = 22 + 2 \cdot (29 - 20) }$



Open Calculator

Open Calculator

Post Censal Period

15) Constant Factor for Post Censal Period

 $oldsymbol{ ext{K}} egin{equation} ext{K}_{ ext{A}} = rac{ ext{P}_{ ext{M}} - ext{P}_{ ext{L}}}{ ext{T}_{ ext{M}} - ext{T}_{ ext{L}}} \end{split}$

D1

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

16) Last Census Date for Post Censal Period

 $ag{T_L = T_M - \left(rac{P_M - P_L}{K_A}
ight)}$

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

17) Mid Year Census Date for Post Censal Period

 $\mathbf{T}_{\mathrm{M}} = \mathbf{T}_{\mathrm{L}} + \left(rac{\mathrm{P}_{\mathrm{M}} - \mathrm{P}_{\mathrm{L}}}{\mathrm{K}_{\mathrm{A}}}
ight)$

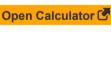
18) Population at Last Census for Post Censal Period 🖒

- $ag{P_{
 m L} = P_{
 m M} K_{
 m A} \cdot (T_{
 m M} T_{
 m L})}$
 - $20 = 40 2 \cdot (20 10)$

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



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Open Calculator





19) Population at Mid Year for Post Censal Period $oldsymbol{oldsymbol{oldsymbol{oldsymbol{A}}}}$ fx $P_{M}=P_{L}+K_{A}\cdot(T_{M}-T_{L})$

Open Calculator

Geometric Increase Method

Inter Censal Period 🖸

20) Earlier Census Date for Geometric Increase Mo

20) Earlier Census Date for Geometric Increase Method

 $T_{\rm E}=T_{
m M}-\left(rac{\log 10(P_{
m M})-\log 10(P_{
m E})}{K_{
m G}}
ight)$ ex $20.34542=29-\left(rac{\log 10(40)-\log 10(22)}{0.03}
ight)$

Open Calculator 🗗

21) Mid Year Census Date for Geometric Increase Method 🗗

2.7 mild Teal Gensus Date for Geometric increase Method

 $T_{
m M}=T_{
m E}+\left(rac{\log 10({
m P_M})-\log 10({
m P_E})}{{
m K_G}}
ight)$

Open Calculator 🗗

ex $28.65458 = 20 + \left(\frac{\log 10(40) - \log 10(22)}{0.03} \right)$

22) Population at Earlier Census for Geometric Increase Method

 $ext{FE} = \exp(\log 10(ext{P}_{ ext{M}}) - ext{K}_{ ext{G}} \cdot (ext{T}_{ ext{M}} - ext{T}_{ ext{E}}))$

Open Calculator



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23) Population at Mid Year for Geometric Increase Method 🗗

 $\mathbf{E} \left[\mathrm{P_{M}} = \exp(\log 10 (\mathrm{P_{E}}) + \mathrm{K_{G}} \cdot (\mathrm{T_{M}} - \mathrm{T_{E}}))
ight]$

Open Calculator

 $= 5.014946 = \exp(\log 10(22) + 0.03 \cdot (29 - 20))$

24) Proportionality Factor for Geometric Increase Method 🗗 Open Calculator

 $extbf{K}_{ ext{G}} = rac{\log 10(ext{P}_{ ext{M}}) - \log 10(ext{P}_{ ext{E}})}{ ext{T}_{ ext{M}} - ext{T}_{ ext{E}}}$

 $\boxed{ \begin{array}{c} \textbf{ex} \\ 0.028849 = \frac{\log 10(40) - \log 10(22)}{29 - 20} \end{array} }$

Post Censal Period

25) Last Census Date for Geometric Increase Method Post Censal 🖸

Open Calculator

 $egin{aligned} \mathbf{K} \mathbf{T}_{\mathrm{L}} = \mathbf{T}_{\mathrm{M}} - \left(rac{\log 10(\mathrm{P_{\mathrm{M}}}) - \log 10(\mathrm{P_{\mathrm{L}}})}{\mathrm{K_{\mathrm{C}}}}
ight) \end{aligned}$

ex $18.9729 = 29 - \left(\frac{\log 10(40) - \log 10(20.01)}{0.03}\right)$

26) Mid Year Census Date for Geometric Increase Method Post Censal 🗗

 $egin{aligned} \mathbf{T}_{\mathrm{M}} = \mathrm{T_L} + \left(rac{\log 10(\mathrm{P_M}) - \log 10(\mathrm{P_L})}{\mathrm{K_G}}
ight) \end{aligned}$

Open Calculator

 $extbf{ex} 29.0271 = 19 + \left(rac{\log 10(40) - \log 10(20.01)}{0.03}
ight)$





27) Population at Earlier Census given Proportionality Factor 🗗

 $\mathbf{E} \left[\mathrm{P_E} = \exp(\log 10 (\mathrm{P_L}) - (\mathrm{T_L} - \mathrm{T_E}) \cdot \mathrm{K_G})
ight]$

Open Calculator 2

Open Calculator

(20.01) = (20.

 $\mathbf{E} \left[\mathrm{P_L} = \exp(\log 10 (\mathrm{P_M}) - \mathrm{K_G} \cdot (\mathrm{T_M} - \mathrm{T_L}))
ight]$

28) Population at Last Census for Geometric Increase Method Post Censal

29) Population at Mid Year for Geometric Increase Method Post Censal

$$ag{P_{
m M}} = \exp(\log 10({
m P_L}) + {
m K_G} \cdot ({
m T_M} - {
m T_L}))$$
 Open Calculator $m{\mathcal{C}}$

30) Proportionality Factor for Geometric Increase Method Post Censal

$$K_{
m G}=rac{\log 10(P_{
m M})-\log 10(P_{
m L})}{T_{
m M}-T_{
m L}}$$
 Open Calculator G

 $= \frac{\log 10(40) - \log 10(20.01)}{0.030081}$

29 - 19



Variation In Rate of Demand

31) Percentage of Annual Average Consumption by Goodrich Formula







Variables Used

- APR Annual Percentage Rate
- K_▲ Constant Factor
- K_G Proportionality Factor
- PE Population at Earlier Census
- PI Population at Last Census
- P_M Population at Mid Year Census
- t Time in days (Day)
- TE Earlier Census Date
- T_I Last Census Date
- T_M Mid-Year Census Date





Constants, Functions, Measurements used

- Constant: e, 2.71828182845904523536028747135266249
 Napier's constant
- Function: 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.
- Function: log, log(Base, Number)
 Logarithmic function is an inverse function to exponentiation.
- Function: 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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