



**Formulas
Examples
with Units**

List of 37 Important Population Forecast Method Formulas

1) Arithmetic Increase Method Formulas

1.1) Average Increment for 2 Decade given Future Population by Arithmetic Increase Method Formula

Formula

$$\bar{X} = \frac{P_n - P_o}{2}$$

Example

$$37500 = \frac{350000 - 275000}{2}$$

Evaluate Formula

1.2) Average Increment for 3 Decade given Future Population by Arithmetic Increase Method Formula

Formula

$$\bar{X} = \frac{P_n - P_o}{3}$$

Example

$$25000 = \frac{350000 - 275000}{3}$$

Evaluate Formula

1.3) Average Increment for n Decade given Future Population by Arithmetic Increase Method Formula

Formula

$$\bar{X} = \frac{P_n - P_o}{n}$$

Example

$$37500 = \frac{350000 - 275000}{2}$$

Evaluate Formula

1.4) Future Population at End of 2 Decades by Arithmetic Increase Method Formula

Formula

$$P_n = P_o + 2 \cdot \bar{X}$$

Example

$$350000 = 275000 + 2 \cdot 37500$$

Evaluate Formula

1.5) Future Population at End of 3 Decades by Arithmetic Increase Method Formula

Formula

$$P_n = P_o + 3 \cdot \bar{X}$$

Example

$$387500 = 275000 + 3 \cdot 37500$$

Evaluate Formula

1.6) Future Population at End of n Decades by Arithmetic Increase Method Formula

Formula

$$P_n = P_o + n \cdot \bar{X}$$

Example

$$350000 = 275000 + 2 \cdot 37500$$

Evaluate Formula



1.7) Number of Decades given Future Population by Arithmetic Increase Method Formula

Formula

$$n = \frac{P_n - P_o}{\bar{X}}$$

Example

$$2 = \frac{350000 - 275000}{37500}$$

Evaluate Formula 

1.8) Present Population given Future Population at End of 2 Decades by Arithmetic Increase Method Formula

Formula

$$P_o = P_n - 2 \cdot \bar{X}$$

Example

$$275000 = 350000 - 2 \cdot 37500$$

Evaluate Formula 

1.9) Present Population given Future Population at End of 3 Decades by Arithmetic Increase Method Formula

Formula

$$P_o = P_n - 3 \cdot \bar{X}$$

Example

$$237500 = 350000 - 3 \cdot 37500$$

Evaluate Formula 

1.10) Present Population given Future Population at End of n Decades by Arithmetic Increase Method Formula

Formula

$$P_o = P_n - n \cdot \bar{X}$$

Example

$$275000 = 350000 - 2 \cdot 37500$$

Evaluate Formula 

2) Geometric Increase Method Formulas

2.1) Average Percentage Increase given Future Population from Geometrical Increase Method Formula

Formula

$$r = \left(\left(\frac{P_n}{P_o} \right)^{\frac{1}{n}} - 1 \right) \cdot 100$$

Example

$$12.8152 = \left(\left(\frac{350000}{275000} \right)^{\frac{1}{2}} - 1 \right) \cdot 100$$

Evaluate Formula 

2.2) Average Percentage Increase given Future Population of 2 Decades by Geometrical Method Formula

Formula

$$r = \left(\left(\frac{P_n}{P_o} \right)^{\frac{1}{2}} - 1 \right) \cdot 100$$

Example

$$12.8152 = \left(\left(\frac{350000}{275000} \right)^{\frac{1}{2}} - 1 \right) \cdot 100$$

Evaluate Formula 



2.3) Average Percentage Increase given Future Population of 3 Decades by Geometrical Method Formula

Evaluate Formula 

Formula

$$r = \left(\left(\frac{P_n}{P_o} \right)^{\frac{1}{n}} - 1 \right) \cdot 100$$

Example

$$8.3707 = \left(\left(\frac{350000}{275000} \right)^{\frac{1}{3}} - 1 \right) \cdot 100$$

2.4) Future Population at End of 2 Decades in Geometrical Increase Method Formula

Evaluate Formula 

Formula

$$P_n = P_o \cdot \left(1 + \left(\frac{r}{100} \right) \right)^2$$

Example

$$350029.691 = 275000 \cdot \left(1 + \left(\frac{12.82}{100} \right) \right)^2$$

2.5) Future Population at End of 3 Decades in Geometrical Increase Method Formula

Evaluate Formula 

Formula

$$P_n = P_o \cdot \left(1 + \left(\frac{r}{100} \right) \right)^3$$

Example

$$394903.4974 = 275000 \cdot \left(1 + \left(\frac{12.82}{100} \right) \right)^3$$

2.6) Future Population at End of n Decades in Geometrical Increase Method Formula

Evaluate Formula 

Formula

$$P_n = P_o \cdot \left(1 + \left(\frac{r}{100} \right) \right)^n$$

Example

$$350029.691 = 275000 \cdot \left(1 + \left(\frac{12.82}{100} \right) \right)^2$$

2.7) Present Population given Future Population from Geometrical Increase Method Formula

Evaluate Formula 

Formula

$$P_o = \frac{P_n}{\left(1 + \left(\frac{r}{100} \right) \right)^n}$$

Example

$$274976.6733 = \frac{350000}{\left(1 + \left(\frac{12.82}{100} \right) \right)^2}$$

2.8) Present Population given Future Population of 2 Decades by Geometrical Increase Method Formula

Evaluate Formula 

Formula

$$P_o = \frac{P_n}{\left(1 + \left(\frac{r}{100} \right) \right)^2}$$

Example

$$274976.6733 = \frac{350000}{\left(1 + \left(\frac{12.82}{100} \right) \right)^2}$$



2.9) Present Population given Future Population of 3 Decades by Geometrical Increase Method

Formula

Formula

$$P_o = \frac{P_n}{\left(1 + \left(\frac{r}{100}\right)\right)^3}$$

Example

$$243730.432 = \frac{350000}{\left(1 + \left(\frac{12.82}{100}\right)\right)^3}$$

Evaluate Formula 

3) Growth Composition Analysis Method Formulas

3.1) Average Birth Rate Per Year given Future Population Formula

Formula

$$B.R. = \frac{P_n - P_o}{N} + D.R. - M.R.$$

Evaluate Formula 

Example with Units

$$10000 \text{ 1/Year} = \frac{350000 - 275000}{10 \text{ Year}} + 5000 \text{ 1/Year} - 2500 \text{ 1/Year}$$

3.2) Average Death Rate Per Year given Future Population Formula

Formula

$$D.R. = B.R. + M.R. - \frac{P_n - P_o}{N}$$

Evaluate Formula 

Example with Units

$$5000 \text{ 1/Year} = 10000 \text{ 1/Year} + 2500 \text{ 1/Year} - \frac{350000 - 275000}{10 \text{ Year}}$$

3.3) Future Population at End of n Year given Migration Formula

Formula

$$P_n = P_o + (B.R. - D.R. + M.R.) \cdot N$$

Evaluate Formula 

Example with Units

$$350000 = 275000 + (10000 \text{ 1/Year} - 5000 \text{ 1/Year} + 2500 \text{ 1/Year}) \cdot 10 \text{ Year}$$

3.4) Migration given Future Population at End of n Year Formula

Formula

$$M.R. = \frac{P_n - P_o}{N} - B.R. + D.R.$$

Evaluate Formula 

Example with Units

$$2500 \text{ 1/Year} = \frac{350000 - 275000}{10 \text{ Year}} - 10000 \text{ 1/Year} + 5000 \text{ 1/Year}$$



3.5) Natural Increase given Design Period Formula

Formula

$$\text{N.I.} = \frac{P_n - P_o}{N} - \text{M.R.}$$

Example with Units

$$5000 = \frac{350000 - 275000}{10\text{Year}} - 2500_{1/\text{Year}}$$

Evaluate Formula 

3.6) Present Population given Forecasted Population Formula

Formula

$$P_o = P_n - (\text{B.R.} - \text{D.R.} + \text{M.R.}) \cdot N$$

Example with Units

$$275000 = 350000 - (10000_{1/\text{Year}} - 5000_{1/\text{Year}} + 2500_{1/\text{Year}}) \cdot 10\text{Year}$$

Evaluate Formula 

4) Incremental Increase Method Formulas

4.1) Average Arithmetic Increase Per Decade given Future Population from Incremental Increase Method Formula

Formula

$$\bar{x} = \frac{P_n - P_o - \left(n \cdot \frac{n+1}{2}\right) \cdot \bar{y}}{n}$$

Example

$$25500 = \frac{350000 - 275000 - \left(2 \cdot \frac{2+1}{2}\right) \cdot 8000}{2}$$

Evaluate Formula 

4.2) Average Arithmetic Increase Per Decade given Future Population of 2 Decades by Incremental Method Formula

Formula

$$\bar{x} = \frac{P_n - P_o - \left(2 \cdot \frac{2+1}{2}\right) \cdot \bar{y}}{2}$$

Example

$$25500 = \frac{350000 - 275000 - \left(2 \cdot \frac{2+1}{2}\right) \cdot 8000}{2}$$

Evaluate Formula 

4.3) Average Arithmetic Increase Per Decade given Future Population of 3 Decades by Incremental Method Formula

Formula

$$\bar{x} = \frac{P_n - P_o - \left(3 \cdot \frac{3+1}{2}\right) \cdot \bar{y}}{3}$$

Example

$$9000 = \frac{350000 - 275000 - \left(3 \cdot \frac{3+1}{2}\right) \cdot 8000}{3}$$

Evaluate Formula 

4.4) Average Incremental Increase given Future Population from Incremental Increase Method Formula

Formula

$$\bar{y} = \frac{P_n - P_o - n \cdot \bar{x}}{n \cdot \frac{n+1}{2}}$$

Example

$$8000 = \frac{350000 - 275000 - 2 \cdot 25500}{2 \cdot \frac{2+1}{2}}$$

Evaluate Formula 



4.5) Average Incremental Increase given Future Population of 2 Decades by Incremental Method Formula

Formula

$$\bar{y} = \frac{P_n - P_o - 2 \cdot \bar{x}}{2 \cdot \frac{2+1}{2}}$$

Example

$$8000 = \frac{350000 - 275000 - 2 \cdot 25500}{2 \cdot \frac{2+1}{2}}$$

Evaluate Formula 

4.6) Average Incremental Increase given Future Population of 3 Decades by Incremental Method Formula

Formula

$$\bar{y} = \frac{P_n - P_o - 3 \cdot \bar{x}}{3 \cdot \frac{3+1}{2}}$$

Example

$$-250 = \frac{350000 - 275000 - 3 \cdot 25500}{3 \cdot \frac{3+1}{2}}$$

Evaluate Formula 

4.7) Future Population at End of 2 Decades in Incremental Increase Method Formula

Formula

$$P_n = P_o + 2 \cdot \bar{x} + \left(2 \cdot \frac{2+1}{2}\right) \cdot \bar{y}$$

Example

$$350000 = 275000 + 2 \cdot 25500 + \left(2 \cdot \frac{2+1}{2}\right) \cdot 8000$$

Evaluate Formula 

4.8) Future Population at End of 3 Decades in Incremental Increase Method Formula

Formula

$$P_n = P_o + 3 \cdot \bar{x} + \left(3 \cdot \frac{3+1}{2}\right) \cdot \bar{y}$$

Example

$$399500 = 275000 + 3 \cdot 25500 + \left(3 \cdot \frac{3+1}{2}\right) \cdot 8000$$

Evaluate Formula 

4.9) Future Population at End of n Decades in Incremental Increase Method Formula

Formula

$$P_n = P_o + n \cdot \bar{x} + \left(n \cdot \frac{n+1}{2}\right) \cdot \bar{y}$$

Example

$$350000 = 275000 + 2 \cdot 25500 + \left(2 \cdot \frac{2+1}{2}\right) \cdot 8000$$

Evaluate Formula 



4.10) Present Population given Future Population from Incremental Increase Method Formula



Formula

$$P_o = P_n - n \cdot \bar{x} - \left(n \cdot \frac{n+1}{2} \right) \cdot \bar{y}$$

Evaluate Formula

Example

$$275000 = 350000 - 2 \cdot 25500 - \left(2 \cdot \frac{2+1}{2} \right) \cdot 8000$$

4.11) Present Population given Future Population of 2 Decades by Incremental Increase Method Formula

Formula

$$P_o = P_n - 2 \cdot \bar{x} - \left(2 \cdot \frac{2+1}{2} \right) \cdot \bar{y}$$

Example

$$275000 = 350000 - 2 \cdot 25500 - \left(2 \cdot \frac{2+1}{2} \right) \cdot 8000$$

Evaluate Formula

4.12) Present Population given Future Population of 3 Decades by Incremental Increase Method Formula

Formula

$$P_o = P_n - 3 \cdot \bar{x} - \left(3 \cdot \frac{3+1}{2} \right) \cdot \bar{y}$$

Example

$$225500 = 350000 - 3 \cdot 25500 - \left(3 \cdot \frac{3+1}{2} \right) \cdot 8000$$



Evaluate Formula



Variables used in list of Population Forecast Method Formulas above









- **B.R.** Average Birth Rate Per Year (*1 Per Year*)
- **D.R.** Average Death Rate Per Year (*1 Per Year*)
- **M.R.** Average Migration Rate per Year (*1 Per Year*)
- **n** Number of Decades
- **N** Number of Years (*Year*)
- **N.I.** Natural Increase
- **P_n** Forecasted Population
- **P_o** Last Known Population
- **r** Average % Growth Rate
- **\bar{X}** Average Arithmetic Increase in Population
- **\bar{X}** Average Arithmetic Increase
- **\bar{y}** Average Incremental Increase in Population

Constants, Functions, Measurements used in list of Population Forecast Method Formulas above



- **Measurement: Time** in Year (*Year*)
Time Unit Conversion 
- **Measurement: Time Inverse** in 1 Per Year (*1/Year*)
Time Inverse Unit Conversion 



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