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# Population Forecast Method Formulas

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# List of 37 Population Forecast Method Formulas

## Population Forecast Method

### Arithmetic Increase Method

#### 1) Average Increment for 2 Decade given Future Population by Arithmetic Increase Method

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

[Open Calculator !\[\]\(de95854c7ee024cfadc48187bbb781b2\_img.jpg\)](#)

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

#### 2) Average Increment for 3 Decade given Future Population by Arithmetic Increase Method

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

[Open Calculator !\[\]\(6a9b39b98eb945faa14c645ec99e4eaa\_img.jpg\)](#)

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



### 3) Average Increment for n Decade given Future Population by Arithmetic Increase Method

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

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235\_img.jpg\)](#)

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

### 4) Future Population at End of 2 Decades by Arithmetic Increase Method

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

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0\_img.jpg\)](#)

$$\text{ex } 350000 = 275000 + 2 \cdot 37500$$

### 5) Future Population at End of 3 Decades by Arithmetic Increase Method

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

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f\_img.jpg\)](#)

$$\text{ex } 387500 = 275000 + 3 \cdot 37500$$

### 6) Future Population at End of n Decades by Arithmetic Increase Method

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

[Open Calculator !\[\]\(b64b40baaee5acddc1eab8538ba84754\_img.jpg\)](#)

$$\text{ex } 350000 = 275000 + 2 \cdot 37500$$



## 7) Number of Decades given Future Population by Arithmetic Increase Method

$$\text{fx } n = \frac{P_n - P_o}{X}$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95\_img.jpg\)](#)

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

## 8) Present Population given Future Population at End of 2 Decades by Arithmetic Increase Method

$$\text{fx } P_o = P_n - 2 \cdot X$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2\_img.jpg\)](#)

$$\text{ex } 275000 = 350000 - 2 \cdot 37500$$

## 9) Present Population given Future Population at End of 3 Decades by Arithmetic Increase Method

$$\text{fx } P_o = P_n - 3 \cdot X$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7\_img.jpg\)](#)

$$\text{ex } 237500 = 350000 - 3 \cdot 37500$$

## 10) Present Population given Future Population at End of n Decades by Arithmetic Increase Method

$$\text{fx } P_o = P_n - n \cdot X$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b\_img.jpg\)](#)

$$\text{ex } 275000 = 350000 - 2 \cdot 37500$$



## Geometric Increase Method

### 11) Average Percentage Increase given Future Population from Geometrical Increase Method

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

[Open Calculator !\[\]\(74d4806277d7e73349d8e8c0897931e9\_img.jpg\)](#)

$$\text{ex } 12.81521 = \left( \left( \frac{350000}{275000} \right)^{\frac{1}{2}} - 1 \right) \cdot 100$$

### 12) Average Percentage Increase given Future Population of 2 Decades by Geometrical Method

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

[Open Calculator !\[\]\(8bba887393ca45b761e5cb49e755e762\_img.jpg\)](#)

$$\text{ex } 12.81521 = \left( \left( \frac{350000}{275000} \right)^{\frac{1}{2}} - 1 \right) \cdot 100$$



### 13) Average Percentage Increase given Future Population of 3 Decades by Geometrical Method

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

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0\_img.jpg\)](#)

$$\text{ex } 8.370676 = \left( \left( \frac{350000}{275000} \right)^{\frac{1}{3}} - 1 \right) \cdot 100$$

### 14) Future Population at End of 2 Decades in Geometrical Increase Method

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

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5\_img.jpg\)](#)

$$\text{ex } 350029.7 = 275000 \cdot \left( 1 + \left( \frac{12.82}{100} \right) \right)^2$$

### 15) Future Population at End of 3 Decades in Geometrical Increase Method

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

[Open Calculator !\[\]\(ab4e2b3fc7e7887b7a72f548aa6f5e60\_img.jpg\)](#)

$$\text{ex } 394903.5 = 275000 \cdot \left( 1 + \left( \frac{12.82}{100} \right) \right)^3$$



## 16) Future Population at End of n Decades in Geometrical Increase Method

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

[Open Calculator !\[\]\(9dfdaff1d86ba3c1f8353b4d1b61b8c5\_img.jpg\)](#)

$$\text{ex } 350029.7 = 275000 \cdot \left(1 + \left(\frac{12.82}{100}\right)\right)^2$$

## 17) Present Population given Future Population from Geometrical Increase Method

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

[Open Calculator !\[\]\(2b376d1a92330ab09dad2665d2f89bf5\_img.jpg\)](#)

$$\text{ex } 274976.7 = \frac{350000}{\left(1 + \left(\frac{12.82}{100}\right)\right)^2}$$

## 18) Present Population given Future Population of 2 Decades by Geometrical Increase Method

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

[Open Calculator !\[\]\(c444627dab9fee9a1550c053ffaaaae2\_img.jpg\)](#)

$$\text{ex } 274976.7 = \frac{350000}{\left(1 + \left(\frac{12.82}{100}\right)\right)^2}$$



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

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

[Open Calculator !\[\]\(6605b201d6f14d9b3bcb8ab5f274d107\_img.jpg\)](#)

$$\text{ex } 243730.4 = \frac{350000}{\left(1 + \left(\frac{12.82}{100}\right)\right)^3}$$

## Growth Composition Analysis Method

### 20) Average Birth Rate Per Year given Future Population

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

[Open Calculator !\[\]\(f95dab70c751fda7d824b8b03650f7aa\_img.jpg\)](#)

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

### 21) Average Death Rate Per Year given Future Population

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

[Open Calculator !\[\]\(e9474ce1d70442456f8fe9c393ea149c\_img.jpg\)](#)

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



## 22) Future Population at End of n Year given Migration

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

[Open Calculator !\[\]\(71ceb62b681518c82e95d615e7265d66\_img.jpg\)](#)

ex

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

## 23) Migration given Future Population at End of n Year

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

[Open Calculator !\[\]\(0ac73c45806a78de248a19d9a2dbe7a6\_img.jpg\)](#)

ex

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

## 24) Natural Increase given Design Period

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

[Open Calculator !\[\]\(3b2dcacf48e43c80086616b9c3042b47\_img.jpg\)](#)

ex

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

## 25) Present Population given Forecasted Population

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

[Open Calculator !\[\]\(ab45609bcd3346fe6539308be8d5cbb8\_img.jpg\)](#)

ex

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



## Incremental Increase Method

### 26) Average Arithmetic Increase Per Decade given Future Population from Incremental Increase Method

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

[Open Calculator !\[\]\(4cafc60cd39da821525d7c6589540296\_img.jpg\)](#)

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

### 27) Average Arithmetic Increase Per Decade given Future Population of 2 Decades by Incremental Method

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

[Open Calculator !\[\]\(8a8ea273bba45b658cf4779d37ab61e8\_img.jpg\)](#)

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

### 28) Average Arithmetic Increase Per Decade given Future Population of 3 Decades by Incremental Method

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

[Open Calculator !\[\]\(07e95c4c760ed8b72579d140ce510c89\_img.jpg\)](#)

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



## 29) Average Incremental Increase given Future Population from Incremental Increase Method

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

[Open Calculator !\[\]\(f4349ea867b307dd2675269f68d0971f\_img.jpg\)](#)

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

## 30) Average Incremental Increase given Future Population of 2 Decades by Incremental Method

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

[Open Calculator !\[\]\(4d25d87d94191bbe34f0046ad604e903\_img.jpg\)](#)

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

## 31) Average Incremental Increase given Future Population of 3 Decades by Incremental Method

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

[Open Calculator !\[\]\(7453c0f29ed3a7dcecf77fe714fbbf84\_img.jpg\)](#)

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



**32) Future Population at End of 2 Decades in Incremental Increase Method****Open Calculator**

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

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

**33) Future Population at End of 3 Decades in Incremental Increase Method****Open Calculator**

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

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

**34) Future Population at End of n Decades in Incremental Increase Method****Open Calculator**

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

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



### 35) Present Population given Future Population from Incremental Increase Method

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

[Open Calculator !\[\]\(b3131996c2d47980618867ba93d92313\_img.jpg\)](#)

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

### 36) Present Population given Future Population of 2 Decades by Incremental Increase Method

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

[Open Calculator !\[\]\(99af31d6d7b9b738106c66bf7ffde536\_img.jpg\)](#)

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

### 37) Present Population given Future Population of 3 Decades by Incremental Increase Method

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

[Open Calculator !\[\]\(51c8b64a0f70f0b96d4cbd0a65299579\_img.jpg\)](#)

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





## Variables Used

- **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<sub>n</sub>** Forecasted Population
- **P<sub>o</sub>** 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

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



## Check other formula lists

- **Population Forecast Method Formulas** 

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