Linear Growth

If a quantity starts at size P_0 and grows by d every time period, then the quantity after n time periods can be determined using either of these relations:

Recursive form:

$P_n = P_{n-1} + d$

Explicit form:

$P_n = P_0 + d\,n$

In this equation, d represents the **common difference** – the amount that the population changes each time n increases by 1

Exponential Growth

If a quantity starts at size P_0 and grows by $R\%$ (written as a decimal, r) every time period, then the quantity after n time periods can be determined using either of these relations:

Recursive form:

$P_n = (1+r)\,P_{n-1}$

Explicit form:

$P_n = (1+r)^n\,P_0$ or equivalently, $P_n = P_0\,(1+r)^n$

We call r the **growth rate**.

The term $(1+r)$ is called the **growth multiplier**, or common ratio.

Logistic Growth

If a population is growing in a constrained environment with carrying capacity K, and absent constraint would grow exponentially with growth rate r, then the population behavior can be described by the logistic growth model:

$$P_n = P_{n-1} + r\left(1 - \frac{P_{n-1}}{K}\right)P_{n-1}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$A = lw$$

$$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

$$P = 2l + 2w$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$V = lwh$$

$$y = mx + b$$

$$a^2 + b^2 = c^2$$

$$y - y_1 = m(x - x_1)$$

$$d = rt$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$A = P\left(1 + \frac{r}{m}\right)^{tm}$$

$$y = a(x - h)^2 + k$$

$$I = Prt$$

$$h = \frac{-b}{2a} \qquad k = f(h)$$

$$(f \circ g)(x) = f[g(x)]$$

$$(x - h)^2 + (y - k)^2 = r^2$$

$$i = \sqrt{-1}$$

$$x^3 + y^3 = (x + y)(x^2 - xy + y^2)$$

$$i^2 = -1$$

$$x^3 - y^3 = (x - y)(x^2 + xy + y^2)$$

$$\frac{1}{a}(x) + \frac{1}{b}(x) = 1$$

$$\log_b x = y \Leftrightarrow b^y = x$$

$$\frac{1}{a} + \frac{1}{b} = \frac{1}{x}$$

$$\log_b xy = \log_b x + \log_b y$$

$$A = Pe^{rt}$$

$$\log_b \frac{x}{y} = \log_b x - \log_b y$$

$$\log_b x^r = r\log_b x$$

Difference Quotient=

$$\frac{f(x + h) - f(x)}{h}$$

$$\log_b x = \frac{\log x}{\log b} \quad \text{or} \quad \log_b x = \frac{\ln x}{\ln b}$$