

Time Value of Money Equations
BUSI 101B

Present Value Equation - simple

For use with one economic exchange

$$PV = \frac{\beta_t}{(1+r)^t}$$

Solving for r

$$r = \sqrt[t]{\frac{\beta_t}{PV}} - 1 = \left(\frac{\beta_t}{PV}\right)^{\frac{1}{t}} - 1$$

Solving for t

$$t = \frac{\ln\left(\frac{\beta_t}{PV}\right)}{\ln(1+r)}$$

Solving for β_t

$$\beta_t = PV \times (1+r)^t$$

Future Value – simple

For use with one economic exchange
(notice similarity to solution for β_t)

$$FV = PV(1+r)^t$$

Present Value Equation – generalized

For use with multiple economic exchanges

$$PV = \sum \frac{\beta_t}{(1+r)^t}$$

Present Value Annuity

For use with constant payment and rate, with specified periods of time

$$PV = PMT \left[\frac{1 - \frac{1}{(1+r)^t}}{r} \right]$$

Solving for PMT

$$PMT = \frac{PV \times r}{1 - \frac{1}{(1+r)^t}}$$

Solving for t

$$t = \frac{\ln\left(\frac{1}{1 - \frac{PV \times r}{PMT}}\right)}{\ln(1+r)}$$

Future Value Annuity

For use with constant payment and rate, with specified periods of time

$$FV = PMT \left[\frac{(1+r)^t - 1}{r} \right]$$

Solving for PMT

$$PMT = \frac{FV \times r}{(1+r)^t - 1}$$

Effective Annual Rate

$$EAR = \left[1 + \frac{APR}{m} \right]^m - 1$$

Annual Percentage Rate

$$APR = m \left[(1 + EAR)^{\frac{1}{m}} - 1 \right]$$