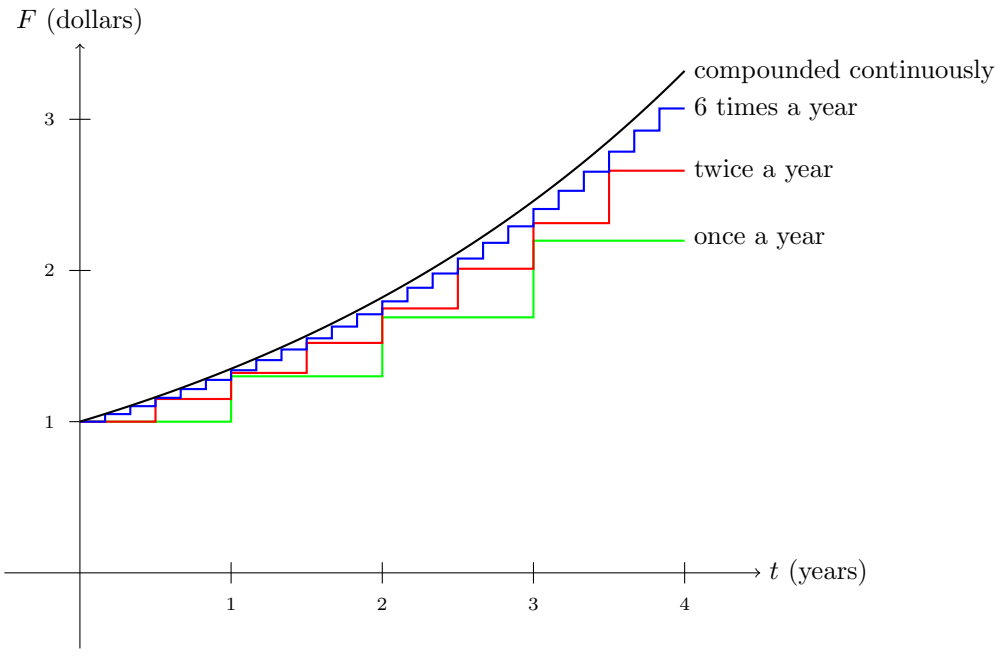
COMPOUND INTEREST

Let P denote the present value of an investment or a loan and let F denote its value after t years. The value F is determined by the interest rate and its type:

- With **effective** annual interest rate i:
$$F = P(1+i)^t \ .$$
- With **nominal** annual interest rate i **compounded** n **times a year**:
$$F = P(1+\frac{i}{n})^{nt} \ .$$
- With **nominal** annual interest rate i **compounded continuously**:
$$F = Pe^{it}$$
Here, e is the constant 2.718281828459....

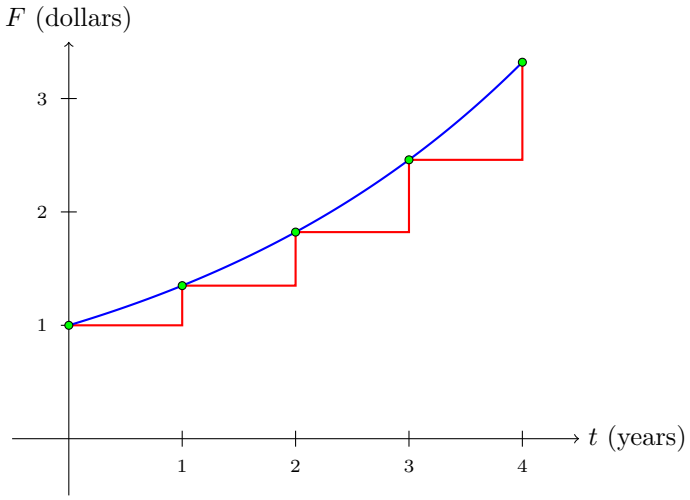
The following graph shows the growth of 1$ invested in a saving account with nominal interest of 30% when compounded once a year (same as having effective annual interest of 30%), twice a year, 6 times a year, and continuously.



Two interest types, say an effective annual interest rate i_1 and a continuously compounded nominal annual interest rate i_2 are called **equivalent** if they produce the same amount of money after t years.

The following graph depicts two **equivalent** interest rates:

- nominal annual interest of 30% compounded continuously,
- effective annual interest of 34.98%.



The following graph depicts two **non-equivalent** interest rates:

- nominal annual interest of 30% compounded continuously,
- nominal annual interest of 30% compounded semiannually.