Time Value of Money
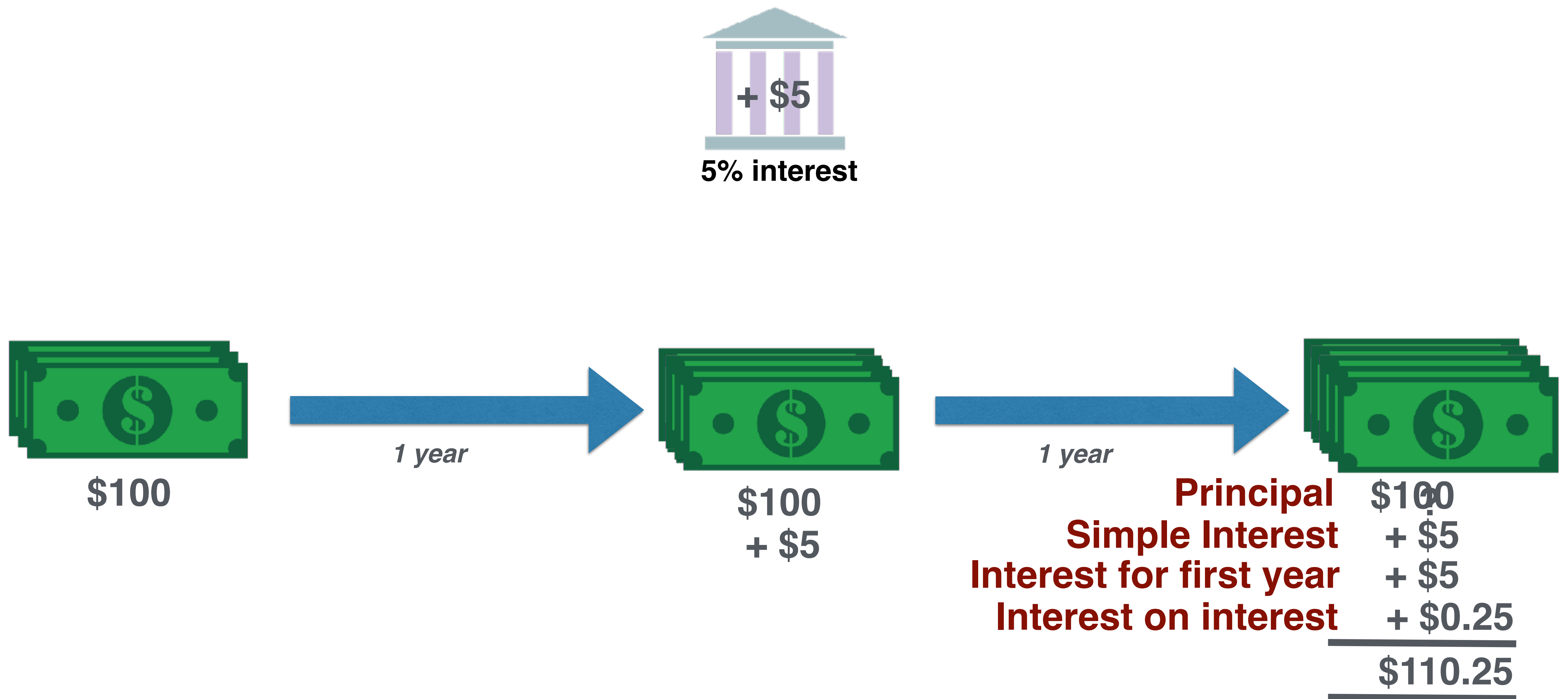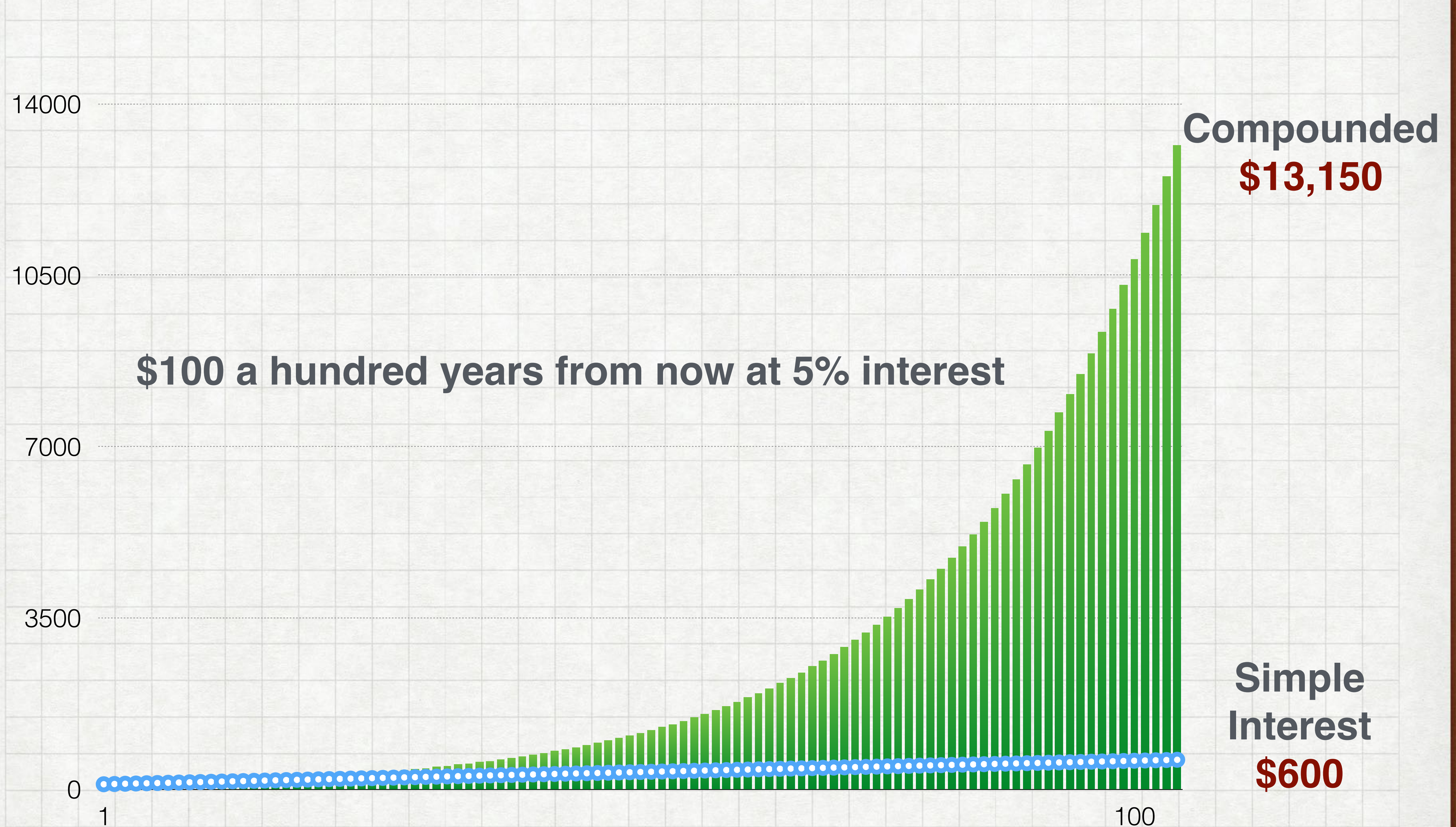## Future Value of A Single Cashflow
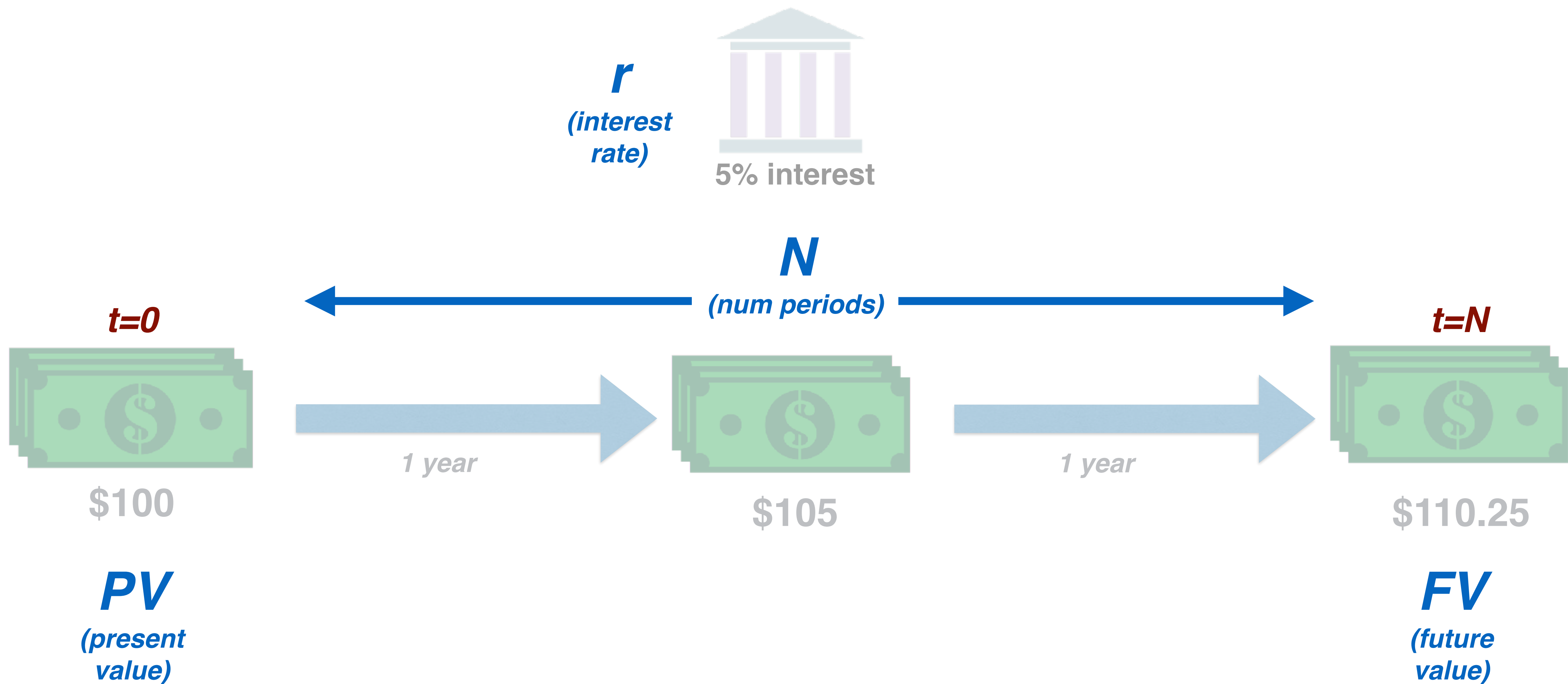
1. Calculate FV of a single CF
2. Effective Annual Rate
3. Continuous compounding

PREP nuggets

+ $5

5% interest

$100 → *1 year* → $100 + $5 → *1 year* →

Principal	$100
Simple Interest	+ $5
Interest for first year	+ $5
Interest on interest	+ $0.25
	$110.25

r
(interest rate)

5% interest

N
(num periods)

t=0

t=N

1 year

1 year

$100

$105

$110.25

PV
(present value)

FV
(future value)

Future Value of A Single Cashflow

1. Calculate FV of a single CF   2. Effective Annual Rate   3. Continuous compounding

PREP
nuggets

5% interest

t=0

t=N

$100

$105

$110.25

1 year

1 year

Future Value Factor

$$FV = PV\,(1+r)^N$$

$$= 100\,(1+0.05)^2$$

$$= 110.25$$

Future Value of A Single Cashflow

1. Calculate FV of a single CF   2. Effective Annual Rate   3. Continuous compounding

PREP nuggets

Sharon expects to receive $200,000 from a matured bond 2 years from now. She would like to place the proceeds into an investment fund which has an expected 8% rate of return per year. How much money can she expect to have in the investment fund 5 years from now?
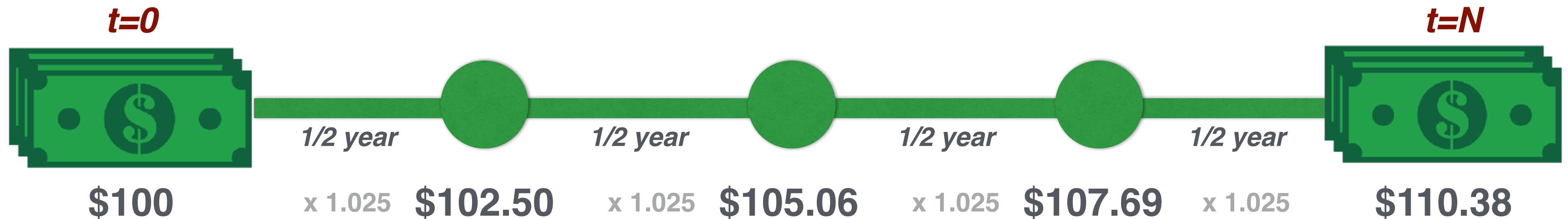
PV=$200,000

r=8%

N=3

t=0   1   2   3   4   5

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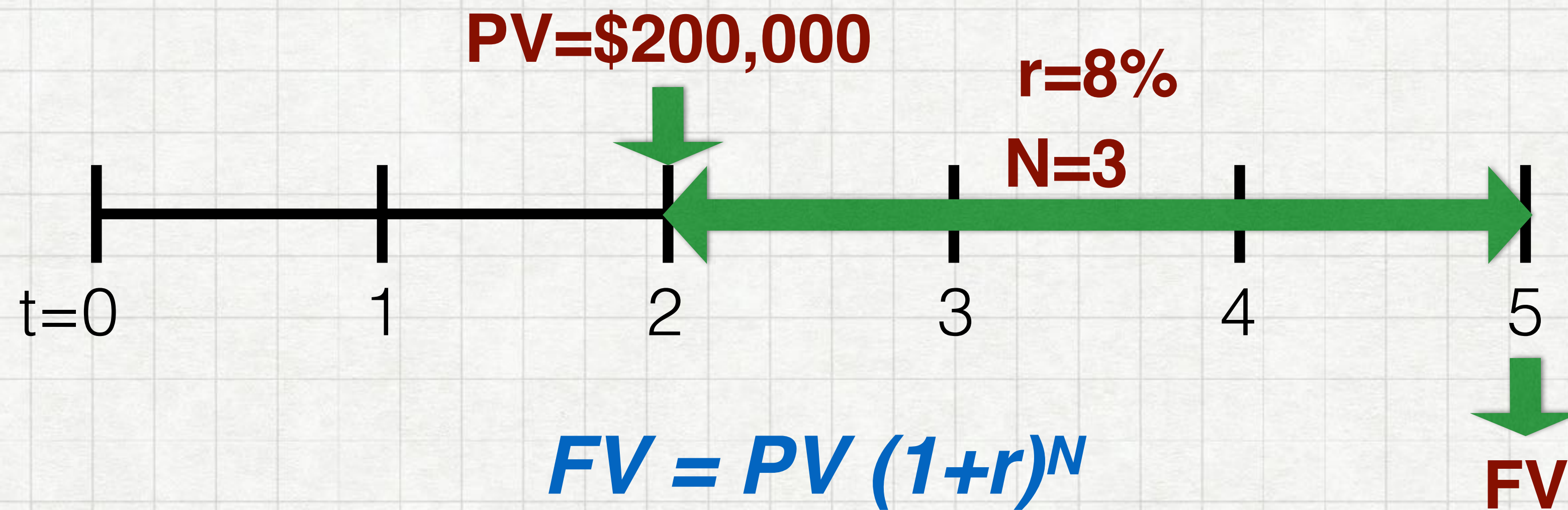
$$FV = PV (1+r)^N$$

$$= \$200000 (1+0.08)^3$$

$$= \$251942$$

Piggy Bank

4.95% p.a

*** Interest paid monthly**

Which bank has the better deal?

Porky Bank

5.0% p.a

*** Interest paid half yearly**

Interest per mth = 4.95 / 12 = 0.4125%

Effective Annual Rate = (1 + 0.004125)^{12} - 1
= 0.05064
= 5.064%

Interest per half yr = 5 / 2 = 2.5%

Effective Annual Rate = (1 + 0.025)^{2} - 1
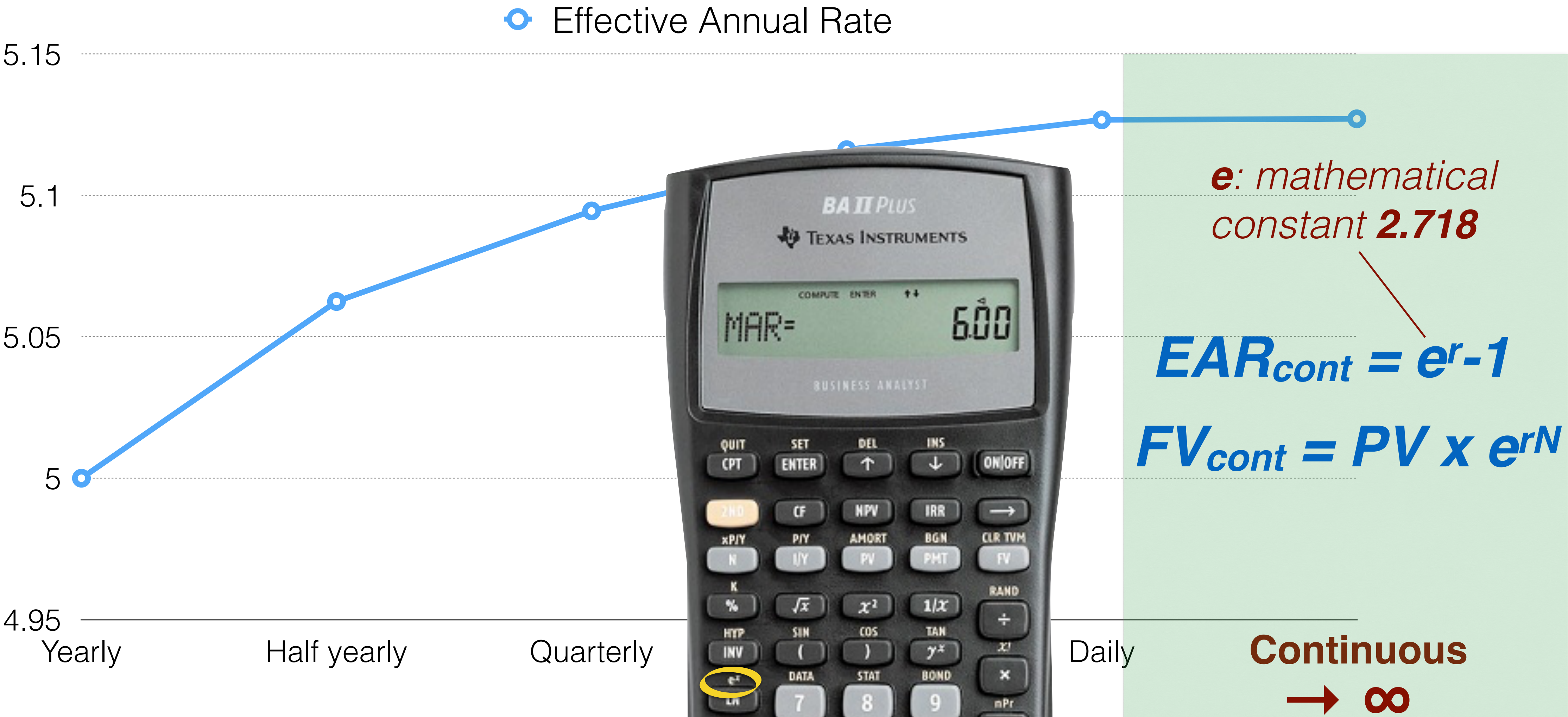*= 0.05063*
= 5.063%

Effective Annual Rate
how much interest is effectively being paid in a whole year

Future Value Factor

$$EAR = (1+r)^N - 1$$

Effective Annual Rate of quoted 5% interest at varying payout frequencies

○ Effective Annual Rate

5.15

5.1

5.05

5

4.95

Yearly   Half yearly   Quarterly   Daily   **Continuous**
→ ∞

e: *mathematical constant **2.718***

$EAR_{cont} = e^r - 1$

$FV_{cont} = PV \times e^{rN}$

Future Value of A Single Cashflow

1. Calculate FV of a single CF   2. Effective ...ous compounding

PREP nuggets

Lee placed $50,000 into an account which practises continuous compounding. The interest per year is a guaranteed 4%. How much total interest can Lee expect to earn by the end of 6 years?

$$FV_{cont} = PV \times e^{rN}$$

$$Total\ interest\ earned = FV_{cont} - PV$$

$$= PV \times (e^{rN} - 1)$$

$$= \$50,000 \times (e^{0.04 \times 6} - 1)$$

$$= \$13,562$$

Future Value of A Single Cashflow

1. Calculate FV of a single Cf

2. Effective Annual Rate

3. Continuous compounding

$$EAR_{cont} = e^r - 1$$

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

$$EAR = (1+r)^N - 1$$

$$FV_{cont} = PV \times e^{rN}$$

r and N must correspond to the correct time period!

PREP
nuggets

prepnuggets.com