

## Single Period (Year)



$$\text{HPR} = (120 - 100) / 100 = 20\% \text{ (Tie to PV/FV)}$$

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## With Div.



$$\text{Holding Period Return} = \frac{(\text{End Price} - \text{Beg. Price} + \text{Cash Flow})}{\text{Beg. Price}} = \frac{(120 - 100 + 5)}{100} = 25\%$$
$$= 20\% (\text{cap gain}) + 5\% (\text{div yield})$$

Cash flow of dividends for stocks, and coupons for bonds.

## Annualizing Rates of Return (APR and EAR).

Say you borrow \$9900 promising to repay \$10,000 in one month. The \$100 interest for the month can be converted into a one-month holding period return HPR of 1.01%. How do you convert it into an annual rate of return?

For the APR you simply multiply by 12.

For the EAR you compound it over 12 months. (interest is paid on interest unless you repay)

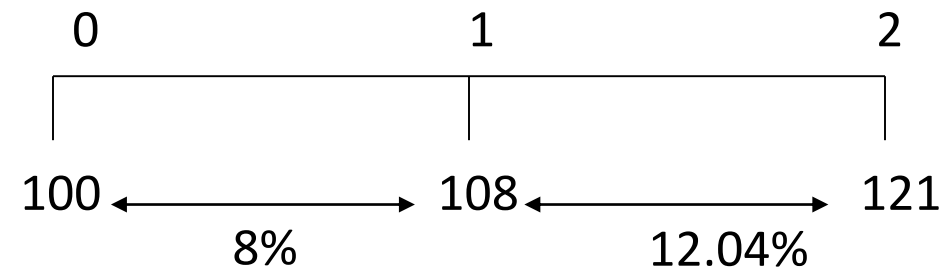
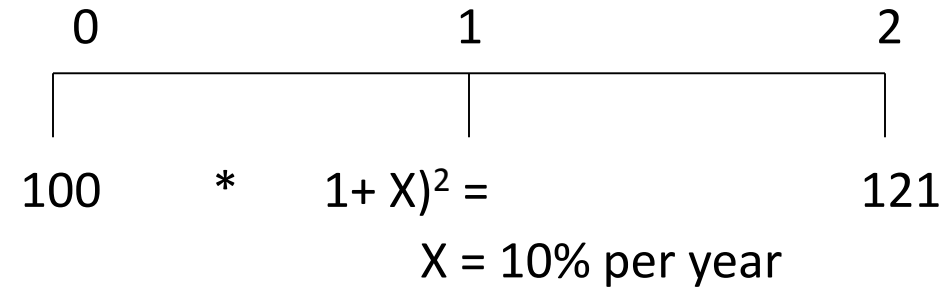
$$\text{HPR} = (10000 - 9900) / 9900 = 1.01\%$$

$$\text{APR} = 1.01 * 12(\text{months}) = 12.12\%$$

$$\text{EAR} = (1.01)^{12} - 1 = 12.68\%$$

## Multiple Periods (Years)

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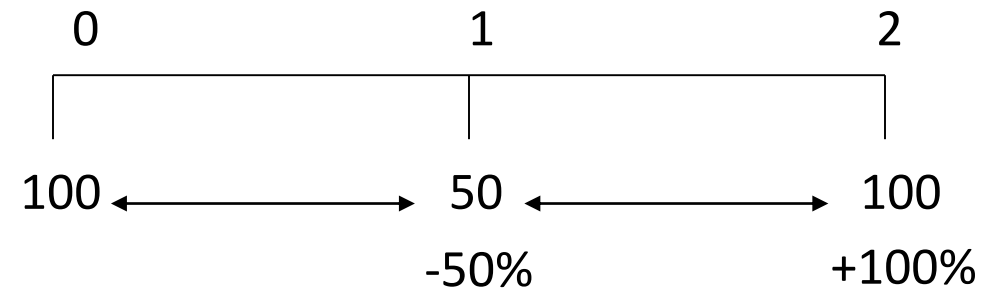
Total Return = 21% for 2-periods (years)

## To Average 8% and 12.04% Returns Above?

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- Arithmetic Average =  $(8 + 12.04)/2 = 10\%$
- Geometric Average =  $[(1.08)(1.1204)]^{(1/2)} - 1 = 10\%$

When averaging returns over time, use **Geometric**.



- Arith. Avg = 25%
- Geom Avg = 0% (which is correct).

PV/FV calculations implicitly use the **geometric average**.

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