# ACCT 101: Liabilities and Time Value of Money

## Session 7

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http://rmc.link/

# Front matter

# Group project

Record your group preferences at https://rmc.link/101groupsG1

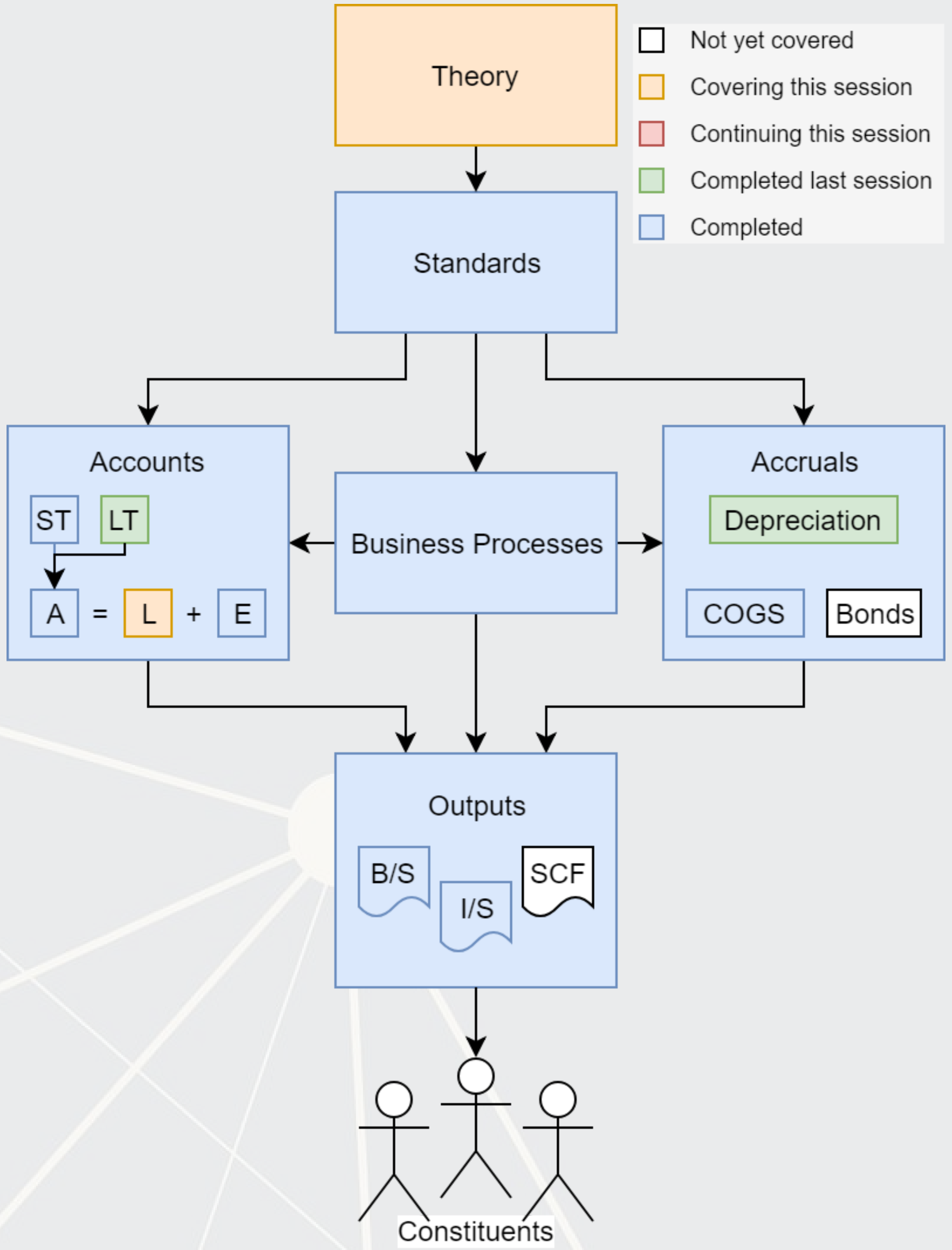
Record your group preferences at https://rmc.link/101groupsG2

- The form asks for your preference of up to 2 classmates to work with
- If you both choose each other, you are highly likely to be allocated to the same group
- Groups of 4-5 will be constructed based on your preferences
  - Based on a **game theory** algorithm for fair group allocation

Timeline

- Project groups will be announced by tomorrow at 7 PM
- At the same time, I will release a form for selecting your project choices
  - Look for the announcement on eLearn!

# Learning objectives




Current liabilities (Chapter 8)

1. Account for current liabilities
2. Account for contingent liabilities
3. Become familiar with "time value of money"
   - We'll need this for Bonds next session

# Current Liabilities

# Review of liabilities

> Obligation of the enterprise arising from past events, the settlement of which is expected to result in an outflow from the enterprise of resources embodying economic benefits. (FRS 37:10)

- Current liability: Something you owe within the span of one year (the current accounting term)
- Non-Current liability: Something you owe after the current accounting term

# Current liability examples

- Accounts payable
- Unearned revenue
- Salaries payable
- Taxes payable
- Notes payable
- Interest payable
- ________ payable
- Estimated liabilities
  - Provision for Warranty repairs

# Sales tax payable

- Also known as GST
- Generally paid quarterly
  - Can pay monthly as well
- Retailers collect this from customers to pass to tax authorities (IRAS)

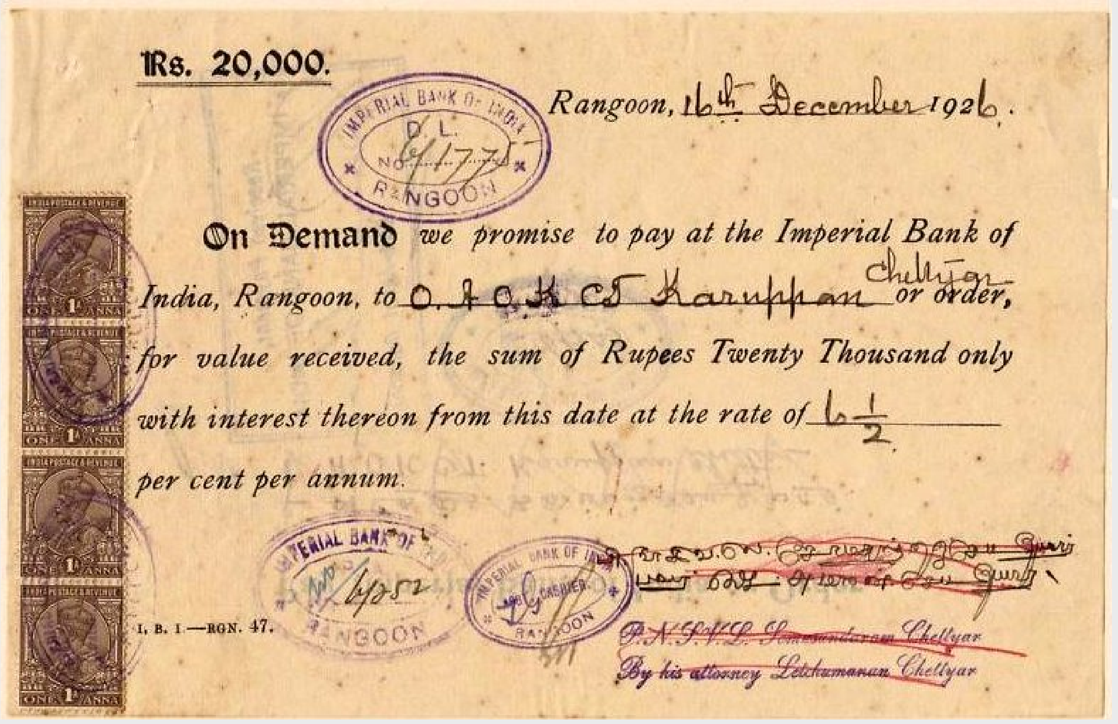
INLAND REVENUE AUTHORITY OF SINGAPORE

**Example: Sales tax**

| Date | Account | DR | CR |
|---|---|---|---|
| 20YY.MM.D1 | Cash | 20,000 | |
| | Revenue | | 18,600 |
| | Sales tax payable | | 1,400 |
| *Recorded sales and sales tax for the day* | | | |
| 20YY.MM.D2 | Sales tax payable | 1,400 | |
| | Cash | | 1,400 |
| *Paid sales tax to IRAS* | | | |

# Notes payable

- Notes payable is a small, short-term loan
- Similar to A/P, but:
  - More formal
  - Has a stated interest rate
- Can be provided by any party
  - Banks
  - Suppliers




This is included in Chapter 5 in the book

# Notes payable terms

- *Creditor*: the lender
- *Debtor*: the party that owes money
- *Term*: length of time of the note
- *Maturity date*: when the note is due
- *Principal*: amount of money borrowed
  - We'll record this at the start
- *Interest*: additional payments for borrowing
  - We'll record these as they occur
    - Or when doing adjusting entries
- *Maturity value*: amount owed at maturity
- Interest is usually all paid at the end
  - The interest rate will be given as the *annual* rate

# Notes payable debtor

> Received a $2,000 note payable with 9% interest due in 3 months payable to our supplier.

**Example: Note payable**

| Date | Account | DR | CR |
|---|---|---|---|
| 20Y8.12.01 | Cash | 2,000 | |
| | Notes payable | | 2,000 |
| *Received a $2,000 note payable from supplier* | | | |
| 20Y8.12.31 | Interest expense | 15 | |
| | Interest payable | | 15 |
| *Recorded accrued interest owed on note payable; 2,000 x 9% x 1/12* | | | |
| 20Y9.02.28 | Notes payable | 2,000 | |
| | Interest expense | 30 | |
| | Interest payable | 15 | |
| | Cash | | 2,045 |
| *Paid off note payable, including interest of 2,000 x 9% x 3/12 (1 month recorded prior)* | | | |

# The other side: Notes receivable

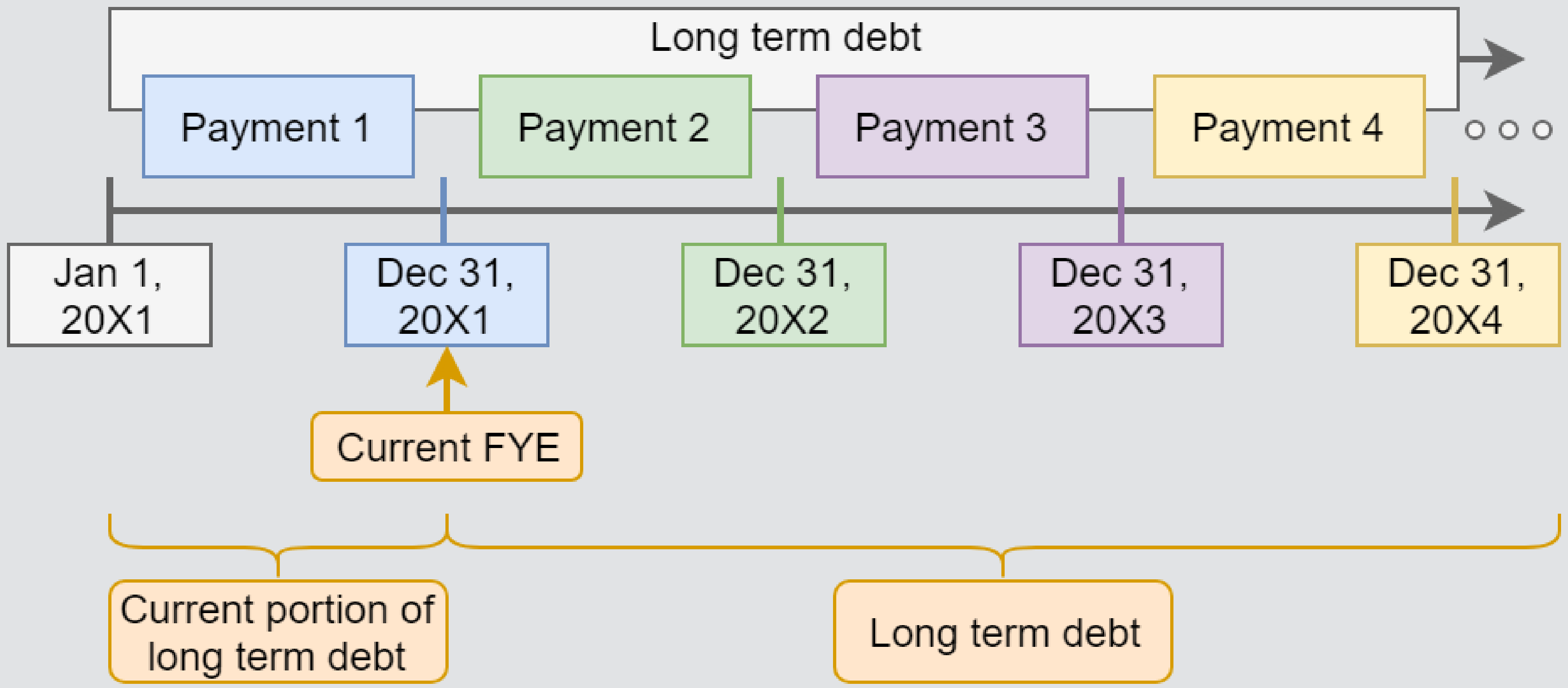
> Gave $2,000 with 9% interest due in 3 months payable to our customer as a note receivable.

**Example: Note receivable**

| Date | Account | DR | CR |
|---|---|---|---|
| 20Y8.12.01 | Notes receivable | 2,000 | |
| | Cash | | 2,000 |
| *Gave $2,000 to a customer as a note receivable from supplier* | | | |
| 20Y8.12.31 | Interest receivable | 15 | |
| | Interest revenue | | 15 |
| *Recorded accrued interest revenue on note receivable; 2,000 x 9% x 1/12* | | | |
| 20Y9.02.28 | Cash | 2,045 | |
| | Interest revenue | | 30 |
| | Interest receivable | | 15 |
| | Notes receivable | | 2,000 |
| *Got paid for note receivable, with interest of 2,000 x 9% x 3/12 (1 month recorded prior)* | | | |

# Current long term debt

- We consider any payment owed in the coming fiscal year as a current liability
  - This includes payments on long term debt
- We shift these payments to short term debt when we do our balance sheet
  - Call it “current portion of long term debt”



# Check

> Coffee Co. gives $1,000 to Latte Inc. on November 1st, 20X8 as a note with 6% interest over 6 months. Record the journal entries for *both companies*, i.e., the note receivable and the note payable. Assume December 31st is both companies' fiscal year end.

- Hints:
  - Money changes hands on November 1
  - Interest accrues on December 31
  - The note is paid back on April 30th

# Estimated liabilities

# Provision for warranty repairs

- Manufacturers need to factor in liabilities from warranties
- Estimate this *provision for warranty repairs* at year end

**Example: Warranty repairs**

| Date | Account | DR | CR |
|---|---|---|---|
| 20YY.MM.D1 | Warranty expense | 1,000 | |
| | Provision for warranty repairs | | 1,000 |
| *Accrued warranty expense for estimated warranty repairs* | | | |

| | | | |
|---|---|---|---|
| 20YY.MM.D2 | Provision for warranty repairs | 50 | |
| | Inventory | | 50 |
| *Replaced a defective product sold under warranty* | | | |

# What does contingent mean?

- Contingent liabilities are not presently liabilities, but could become liabilities in the future.
- Listed in the financial statement notes, but not journalized
- To note all 3 must be true:
  1. Must depend on a future outcome of past events
  2. May, *but probably will not*, require an outflow of resources
  3. Must not have a sufficiently reliable estimate of the amount owed.

> Contingent liabilities are obligations you might or might not have

# Recognizing liabilities

- If chance of owing is very low
  - Ignore
- If chance is reasonably possible
  - *Contingent liability* $\Rightarrow$ Make a note to your financial statements, but don't include it in the statements themselves
- If a sufficiently reliable estimation can be made
  - This is a *real liability* $\Rightarrow$ Include it in your adjusting entries
    - Not as a contingent liability
  - Ex.:
    - Provision for warranty repairs

# Time value of money

# Source

This section is based on:

**Corporate Finance: An Introduction**

by Ivo Welch

Pearson: Boston, MA. 2009.

> It’s a good finance textbook!

# The perfect market

- No taxes
- No transaction costs
  - Can find buyers/sellers costlessly
  - Can deliver costlessly
- Everyone has identical beliefs
- Many buyers and sellers (liquid)

> We'll use these assumptions in this class

# Basic perspectives: Why we have *time value of money*

1. You can earn interest on $1 today, so it's worth more than $1 tomorrow.
2. Inflation means that $1 tomorrow can buy less than $1 today.
3. $1 today gives me the option to spend today or tomorrow, but $1 tomorrow can only be spent tomorrow. If that option to use the $1 today is valuable to me, $1 today is worth more than $1 tomorrow.

> All three of these are equivalent: a dollar today is worth more than a dollar tomorrow

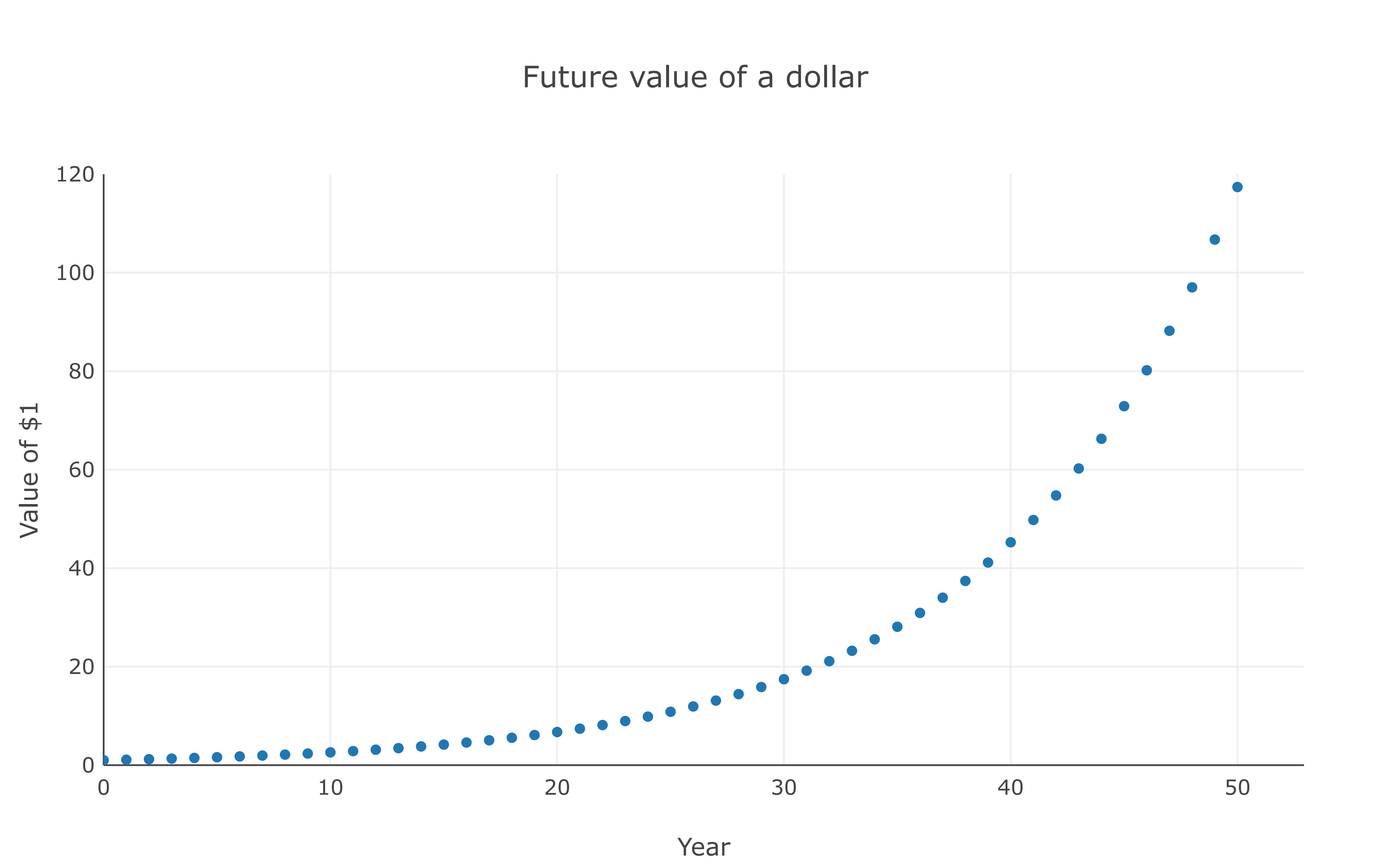
# Consequences

- When we talk about returns, we'll talk about *compounded* returns
  - If \$1 today is \$1.10 next year…
    - then \$1.00 in two years is \$1.21, not \$1.20
      - Return scales with capital
- More explicitly: if the interest rate, $r$ is 10%, and the principal, $P_0$ is \$1, then:
  - Tomorrow $P_0$ is worth $P_1 = P_0 \cdot (1 + r) = 1 \cdot 1.10 = 1.10$
  - Flipping the equation implies: $P_0 = \frac{P_1}{(1+r)} = \frac{1.10}{1.1} = 1$

# Extension: Going forward

- What is $1 worth in two years? Three years? …
  - $P_2 = (1 \cdot 1.1) \cdot 1.1 = 1.21$
  - $P_3 = ((1 \cdot 1.1) \cdot 1.1) \cdot 1.1 = 1.331$
  - $\ldots$
  - $P_{50} = (\ldots(1 \cdot 1.1) \cdot 1.1 \ldots) \cdot 1.1 \approx 106.72$
  - $\ldots$
  - $P_n = P_0 \cdot (1+r)^n$

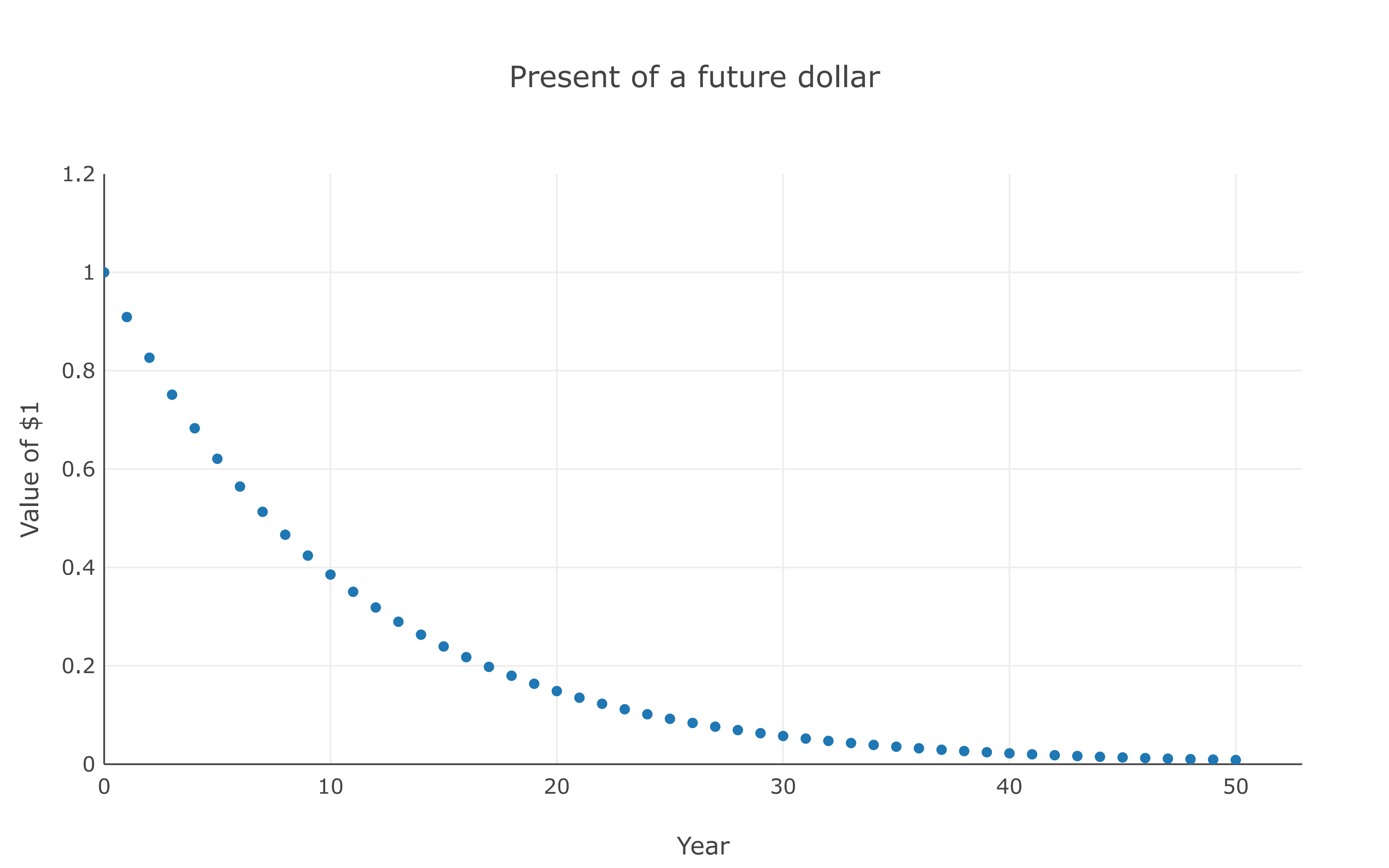
# Extension: Going forward



# Extension: Going backward

- What is the current value of $1 in two years? Three years? …
  - $P_0'' = (1/1.1)/1.1 = 0.83$
  - $P_0''' = ((1/1.1)/1.1)/1.1 = 0.75$
  - $\ldots$
  - $P_0^{(50)} = (\ldots(1/1.1)/1.1\ldots)/1.1 \approx 0.0085$
  - $\ldots$
  - $P_0^{(n)} = \frac{P_n}{(1+r)^n}$

# Extension: Going backward



# Check

1. What is $10 worth in 20 years, if the interest rate is 5%?

2. What is $10 received 20 years from now worth today, if the interest rate is 5%?

Answers:

1. $10 \times (1 + 0.05)^{20} = \$26.53$
2. $\frac{10}{(1+0.05)^{20}} = \$3.76$

# Net Present Value

# What is Net Present Value? (NPV)

- What we just did!
- Determine the price *today* of some future (expected) cash flows
- Numerator is the future cash flow, $CF$
- Denominator is the *discount factor*, $R$
  - That is, we discount cash flows by the return to get today's value

$$NPV_0 = CF/R$$

- What if there are multiple cash flows?

$$NPV_0 = \sum_{i=0}^{n} \frac{CF_i}{R_i}$$

NPV at time 0 (today) is the sum of all discounted cash flows

# Discount factors

- The discount factor is the amount of *cumulated* return or interest you would expect to receive between two period of time.
- We often assume a fixed discount rate for each year of $1+r$
- Let $R_i$ denote the discount factor from time $0$ to time $i$
  - $R_1 = 1+r$
  - $R_2 = (1+r) \cdot (1+r)$
  - $R_3 = (1+r) \cdot (1+r) \cdot (1+r)$
  - $\ldots$
  - $R_n = (1+r)^n$

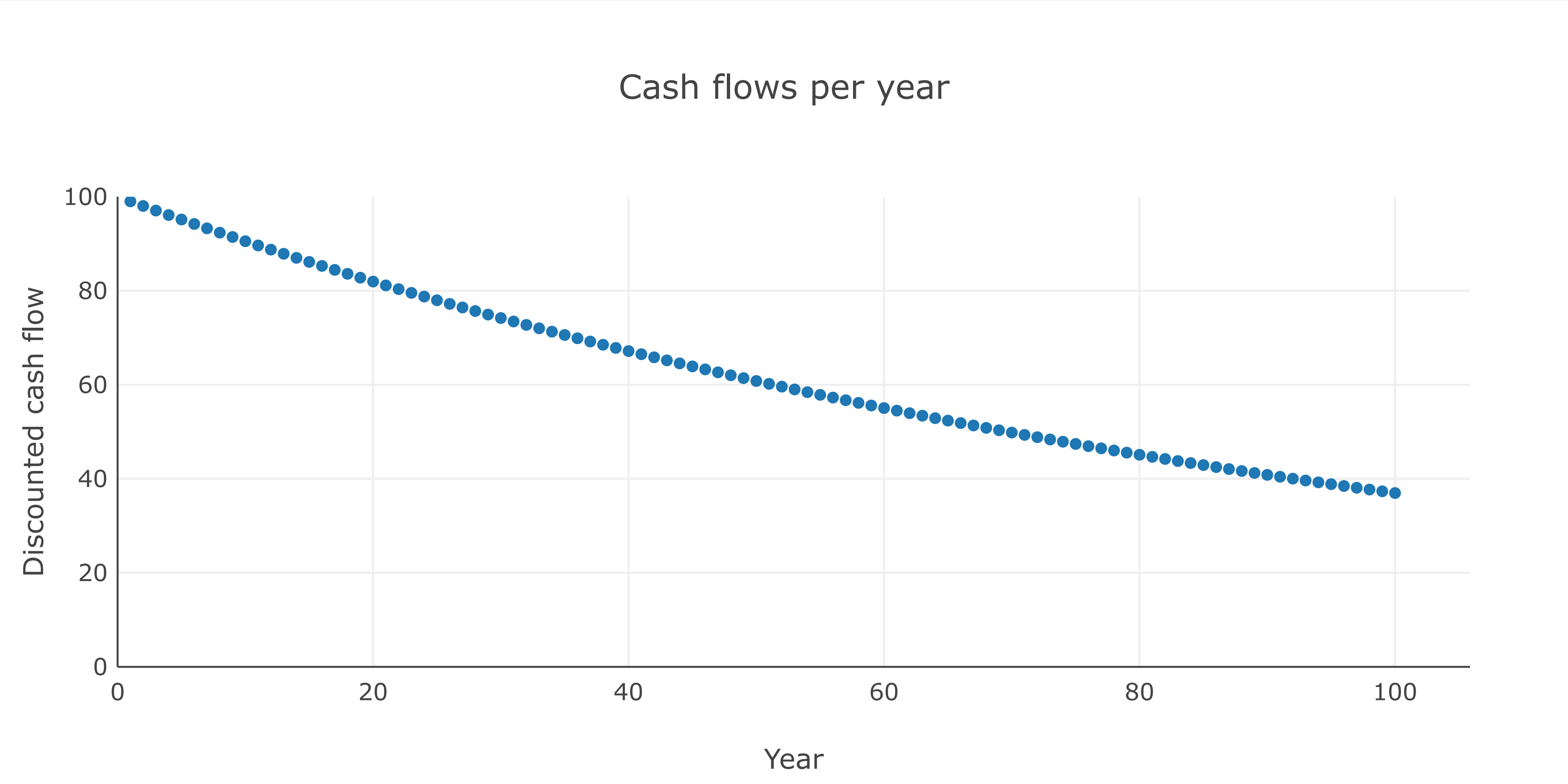
# Simple Example

- A project costs $500 today, and is expected to pay out the following:
  - $100 in one year
  - $600 in two years.
- If the interest rate is 10%, what is the NPV of the project?

- $NPV = \frac{-500}{(1+0.1)^0} + \frac{100}{(1+0.1)^1} + \frac{600}{(1+0.1)^2}$
- $NPV = -500 + 90.91 + 495.87$
- $NPV = 86.78$
- What if the interest rate was 5%?
- $NPV = \frac{-500}{(1+0.05)^0} + \frac{100}{(1+0.05)^1} + \frac{600}{(1+0.05)^2}$
- $NPV = -500 + 95.24 + 544.22$
- $NPV = 139.46$

# Calculating

- Easy to do a few cash flows with a calculator
- Easy to do any number of cash flows with spreadsheets
- What is the NPV of a project that pays out $100 each year for 100 years, assuming the interest rate is 1%?
  - Value is 6302.8878767



# What about for…

- 10 years? 100 years? 1,000 years? 10,000 years?
- Pretty hard by hand
- Trivial to brute force on a computer

In R:

```
NPV <- data.frame(Years=c(10, 100, 1000, 10000),
                  NPVs=c(sum(c(100/1.01^(1:10))),
                         sum(c(100/1.01^(1:100))),
                         sum(c(100/1.01^(1:1000))),
                         sum(c(100/1.01^(1:10000)))))
html_df(NPV)
```

| Years | NPVs |
|---|---|
| 10 | 947.1305 |
| 100 | 6302.8879 |
| 1000 | 9999.5229 |
| 10000 | 10000.0000 |

# What about by hand?

Formulas!

- Perpetuity: The same cash flow and discount rate forever:
  - $Perpetuity\ NPV = \frac{CF}{r}$
- Growing perpetuity: perpetuity but with a growth in cash flows of $g$:
  - $GP\ NPV = \frac{CF}{r-g}, g < r$
- *Annuity*: same cash and discount rate for only $T$ periods
  - $Annuity\ NPV = \frac{CF}{r}\left[1 - \frac{1}{(1+r)^T}\right]$

*We'll need this annuity NPV formula next class*

# Revisiting the 10,000 figures

$$NPV = \frac{100}{0.01} \cdot \left[1 - \frac{1}{(1+0.01)^{10,000}}\right]$$
$$\approx 10,000 \cdot 1$$
$$\approx 10,000$$

- What about for 70 periods?
  - $NPV = \frac{100}{0.01} \cdot \left[1 - \frac{1}{(1+0.01)^{70}}\right]$
  - $NPV = 5,016.85$

# The last formula…

> A note to those in finance, from the textbook: “I am not a fan of memorization, but you must remember the growing perpetuity formula. It would likely be useful if you could also remember the annuity formula. These formulas are used in many different contexts. There is also a fourth formula, which nobody remembers, but which you should know to look up if you need it.” (p53)

- Growing annuity

$$PV = \frac{C}{r-g}\left[1 - \frac{(1+g)^T}{(1+r)^T}\right], g < r$$

# Derivation – for those interested in the math

You can derive the other 3 formulas from the fourth:

- Growing perpetuity:
  - $\lim_{T\rightarrow\infty} \frac{CF}{r-g}\left[1-\frac{(1+g)^T}{(1+r)^T}\right] = \frac{CF}{r-g}[1-0] = \frac{CF}{r-g}$
- Annuity:
  - $\frac{C}{r-g}\left[1-\frac{(1+g)^T}{(1+r)^T}\right]\Bigg|_{g=0} = \frac{C}{r}\left[1-\frac{1}{(1+r)^T}\right]$
- Perpetuity
  - $\lim_{T\rightarrow\infty} \frac{CF}{r-g}\left[1-\frac{(1+g)^T}{(1+r)^T}\right]\Bigg|_{g=0} = \frac{CF}{r-0}[1-0] = \frac{CF}{r}$

> You don't need to know this for this class

# In class work

1. An investment costs $100 today, and pays out $10 per year for the next 10 years. In the 10th year, it also pays back the original $100. If the interest rate is 10%, what is the NPV?
2. What if the interest rate was 8% instead of 10% in #1?
3. Go back to #1, but assume there is a 20% chance you'll never get any money after paying 100. How much extra needs to be added to the yearly payments for the NPV to remain at 0?
   - I.e., if you pay 100 now:
     - There's a 20% chance you get nothing in return
     - There's a 80% chance you get the yearly payments and the final payout.

# Stock markets

- Are stock prices NPVs?

# End matter

# Wrap up

- For two weeks from now
  1. Reading
     - Chapter 9 (Liabilities)
     - Tricky subject, reading highly recommended
  2. Extra practice available
     - Time value of money
  3. Have a great break!

# Packages used for these slides

- DT
- kableExtra
- knitr
- revealjs