

An investment in knowledge pays the best interest.

Ben Franklin

NOTE: Unless otherwise specified, compute all dollar-denominated answers to the nearest dollar (i.e., \$24,325) and returns and interest rates to four decimal places (i.e., .0681, or 6.81%). Annual yield means the Effective Annual Rate (Yield). Unless otherwise stated, all quoted interest rates are annual rates, compounded annually. In brackets following some questions I have indicated Excel functions that you should explore and that could be helpful in answering the questions.

For questions 1-4 assume the interest rate is 6.75%. Like the terminator, inflation is back my friends.

1. How much must you invest today to have \$20,000 in one year? [*Excel: PV*]
2. How much will you have in two years if you deposit \$19,325 in a bank today? (Remember, interest is compounded yearly.) [*Excel: FV*]
3. How much must you invest today to have \$59,375 in 10 years? [*Excel: PV*]
4. You will receive \$29,375 ten years from today. To calculate the PV of \$29,375, what's the *discount factor* you would use?
5. You purchased a share of stock for \$68.00. At the end of a quarter, the stock paid a dividend of \$2.75, and you sold it for \$69.00 right after receiving the dividend. What is your total rate of return on the stock investment?
6. Upon his death on April 17, 1790, the great American, Ben Franklin, bequeathed in trust approximately \$4,500 (it was actually £1,000) to each Boston and Philadelphia. (As a point of comparison, this is equivalent in purchasing power to about \$190,175 in 2024.) Both trusts were required to loan the money at 5% p.a. to married tradesmen who were seeking to establish their own businesses. The cities could not spend the money for 100 years, at which time they could spend £100,000; the remaining balance could not be spent for another 100 years (until 1990). The final balance in the Boston trust was about \$5,000,000, but Philadelphia didn't fare nearly as well as its final balance was only \$2,300,000—apparently the default rate was a bit higher in Philadelphia than in Boston. This should come as no surprise if you have ever been to Philadelphia or met anyone from there. For the questions below, *disregard* the disbursements of funds in 1890 and use the dollar figures. An excellent bibliography of Franklin is Walter Isaacson's [Benjamin Franklin: An American Life](#).
 - (a) What was the 200-year holding period return ($r_{0,200}$) of the Boston trust? Assume that the funds were invested for exactly 200 years. Note, it's a pretty big

return.

- (b) What was the Boston trust's annual rate of return? [*Excel: Rate*]
 - (c) What would have been the Boston trust's final balance if its investments had actually earned 5% p.a. over the 200 years, as envisioned by Ben Franklin? [*Excel: FV*]
7. *This question highlights two of the most important concepts that we cover this semester: (1) the importance of time and returns in compounding wealth, and (2) a very keen appreciation of the utterly devastating effect of fees. You can't control future returns, but you can control amounts invested, time invested, and fees. Your goal should be to maximize amounts and time invested and minimize fees.*

You decide to be generous to your first unborn great-great grandchild: you establish a trust on 1 Jan 2024 and fund it with \$1,000. Under the terms of the trust, when your great-great grandchild turns 18, the trust will distribute all of the trust assets to him or her or them. Assume that you make no other contributions to the trust, and your great-great grandchild turns 18 on 1 Jan 2104.

- (a) What will be the amount distributed to the trust beneficiary if the trust earns 5% per annum? [*Excel: FV*]
 - (b) What will be the amount distributed to the trust beneficiary if instead the trust earns 10% per annum? Although the annual return in this question is twice that in the previous question, notice how many times greater the ending balance is. [*Excel: FV*]
 - (c) Assume that the trust earns 10% per annum on its investments but pays an *administrative fee to helpers* of 2% per year *at year end*. These *helpers* are known as brokers, financial advisers, or financial planners, but you should think of them as basically used car salesmen. Note, the fee of 2% is roughly the average annual administrative costs of an actively managed mutual fund. What's the final balance? [*Excel: FV*]
- Hint: To get the correct "r" in the compounding factor—the $(1 + r)^T$ —it may be useful to write out an algebraic formula for the first year accumulation and reduction for the administrative fee. Remember that in this problem the 2% fee is levied on the year-end balance, after the annual return. Alternatively you can think of the administrative fee as being an annual negative return.*
8. You are an attorney drafting a loan document for the *lender*. Which of the following interest rates should you put in the document? Please show your work. [*Excel: EFFECT*]

- (a) 9.90% compounded annually.

(b) 9.73% compounded semiannually.

(c) 9.67% compounded quarterly.

9. Do Question Q 2.55 (p. 37 in Corp Fin). [*Excel: GOAL SEEK, for the truly lazy*]