CHE374F - 2022 Problem Set #1

Question 1
A new steel stirred tank reactor costs $8,000, plus $1,200 for installation. Currently, the company you work for has a stainless steel unit in the warehouse, and it could be used in this application. The old reactor was used for 4 years but will last the same length of time as new steel one, its cost when purchased was $16,000. Cost of installing the old reactor would be $2,500. The old reactor has a used market value of $6,800.
  a) Determine the best alternative.
  b) You are not quite sure of the market value of $6,800 for the old reactor. What value would it need to have for you to be indifferent to the decision?

Question 2
A small take-out restaurant is looking to upgrade its cash registers and money handling systems. Company X provided the restaurant owner a quote of $7500 for the initial system and installation cost, but implementation would save the owner $1700 annually. Alternatively, the system from Company Y was priced to be $9000 upfront, and although more expensive its improved technology would save the company $2200 annually.
  a) How long will it take to recover the capital (i.e. the initial up-front investment) for each alternative?
  b) There are two main issues with this type of project comparison – can you list at least one, based on our discussions so far?

Question 3
Find $\lim_{n\to\infty}\left(1+\dfrac{r}{n}\right)^n$.

Question 4:
The Student Bank of Canada charges an effective 3.4% interest per year on an 8 year $100,000 loan. Calculate the loan's nominal annual interest rate for:
  a) Semi-annual compounding
  b) Monthly compounding
  c) Daily compounding
  d) Continuous compounding
  e) How much money would be owed by the end of the fourth year in each case?

Question 5:
A $100 T-bill (recall that a T-bill is a government bond that pays the face value, $100 in this case, at time of maturity, and has no coupon payments) is selling at an annual continuously compounding yield rate of 2.3%.
  a) What is the effective annual yield rate assuming yearly compounding?
  b) What is the price of the T-bill if it matures in 6 months?
  c) What is the price of the T-bill if it matures in 9 months?
  d) If the continuously compounding yield rate drops by 30 basis points (i.e. from 2.3% to 2%) how does the price of the bond change in b and c?

Question 6:
Assume 252 trading days per year, where applicable

Given	Calculate	Answer
8 % interest per year (effective)	Monthly interest rate based on monthly compounding	
3.5% interest per year based on daily compounding	Interest per year (effective)	
4% interest per year, with quarterly compounding	Continuously compounding interest rate per year	
1.5% interest per month compounded monthly	Continuously compounding interest rate per quarter	
1.2% interest per quarter with monthly compounding	Interest per **three** years based on semi-annual compounding	