Gabriel Chen, 50895168
Assignment 1, ELEC 481 – Summer 2020

Question 1:

Marginal Cost: Variable cost for more than one unit
Average Cost: Total cost divided by number of units
100 free service hours, $75 per hour additional time cost

$1a)\ Number\ of\ Hours = 75 < 100\ hours$
$Less\ than\ 100\ free\ service\ hours.$

$$\boxed{\frac{Average\ Cost}{hour} = \$0, \frac{Marginal\ Cost}{hour} = \$0}$$

$1b)\ Number\ of\ Hours = 125 > 100\ hours$
$More\ than\ 100\ free\ service\ hours.$

$$\boxed{\frac{Average\ Cost}{hour} = \frac{\$75 * (125 - 100)}{125} = \$15, \frac{Marginal\ Cost}{hour} = \$75}$$

$1c)\ Number\ of\ Hours = 250 > 100\ hours$
$More\ than\ 100\ free\ service\ hours.$

$$\boxed{\frac{Average\ Cost}{hour} = \frac{\$75 * (250 - 100)}{250} = \$45, \frac{Marginal\ Cost}{hour} = \$75}$$

Question 2:

Book cost: Current Cost effect of past decisions that are recorded down
Opportunity Cost: potential loss in money of using a resource in a chosen activity over other potential resources

$2a)\ Book\ Cost\ = \ \mathbf{\$7000}$
$2b)\ If\ we\ use\ the\ pump\ for\ the\ installation, we\ lose\ the\ potential\ of\ an\ opportunity\ cost\ of\ \$4{,}000$

$, because\ we\ are\ not\ selling\ it$

$2c)\ Stainless\ Steel = \$4000 + \$500 = \$4500$
$Brass\ Pump = \$6000$
$\$6000 - \$4500 = \$1500$
$Stainless\ steel\ is\ \$1500\ cheaper\ than\ the\ brass\ pump\ if\ it\ is\ installed$

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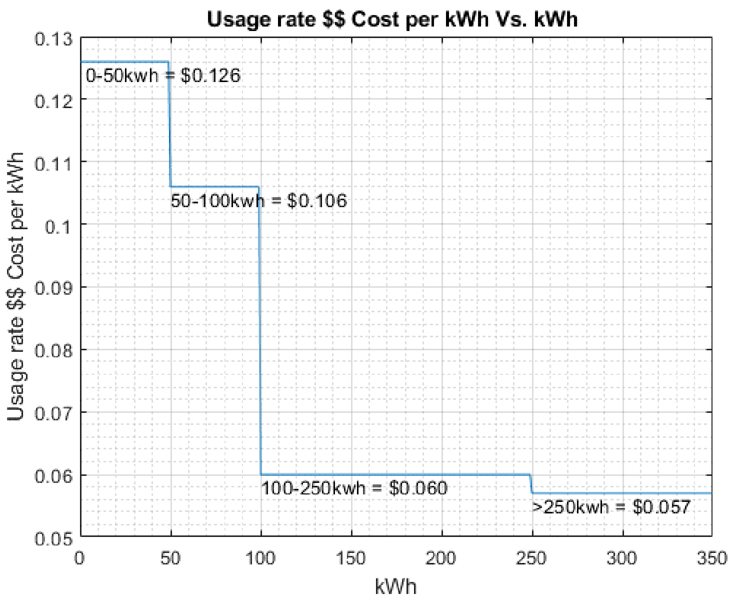
Question 3:



Matlab Generated …

Question 3a)					
Usage (kWh)		Usage Rate ($/kWh)	Range applicable to:		Demand Cost
2800		$ 0.126	0-50		$ 6.30
		$ 0.106	50-100		$ 5.30
		$ 0.060	100-250		$ 9.00
		$ 0.057	>250		$ 145.35
				Total ->	$ 165.95
Peak (kW)		Demand Rate ($/kW)	Range applicable to:		Usage Cost
70		$ -	0-35		$ -
		$ 4.18	35-115		$ 146.30
		$ 8.02	>115		$ -
				Total ->	$ 146.30
					Total Monthly Bill Cost
					$ 312.25
average usage:		$ 0.059			
marginal usage:		$ 0.057			
blended rate:		$ 0.112			

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Q3b)

$Usage\ is\ past\ the\ 250kWh\ mark$

$$\therefore 1200kWh \times \frac{\$0.057}{kWh} = \boxed{\$68.4} = monthly\ bill\ increase$$

$$Marginal\ usage\ falls\ in\ the (> 250kWh)\ usage\ range = \boxed{\frac{\$0.057}{kWh}}$$

Q3c)

Question 3c)							
New Usage (kWh) [+100]		Usage Rate ($/kWh)	Range applicable to:		Demand Cost		
2900		$ 0.126	0-50		$ 6.30		
		$ 0.106	50-100		$ 5.30		
		$ 0.060	100-250		$ 9.00		
		$ 0.057	>250		$ 151.05		
				Total ->	$ 171.65		
New Peak (kW) [+50]		Demand Rate ($/kW)	Range applicable to:		Usage Cost		
120		$ -	0-35		$ -		
		$ 4.18	35-115		$ 334.40		
		$ 8.02	>115		$ 40.10		
				Total ->	$ 374.50		
					Total Monthly Bill Cost (new)	Previous Monthly Total Bill	Difference (Increase)
					$ 546.15	$ 312.25	$ 233.90

Q4)

$$\frac{Cost\ of\ 4.5\ litres\ capacity\ centrifuge\ 5\ years\ ago}{Cost\ of\ 1.5\ litres\ capacity\ centrifuge\ 5\ years\ ago} = \left(\frac{4.5\ litres}{1.5\ litres}\right)^{0.75}$$

$$Cost\ of\ 4.5\ litres\ capacity\ centrifuge\ 5\ years\ ago = \left(\frac{4.5\ litres}{1.5\ litres}\right)^{0.75} * \$40{,}000 = \$91180.283$$

$$Round\ off\ to\ 3\ significant\ figure \rightarrow \$91{,}200 = Cost\ of\ 4.5\ litres\ capacity\ centrifuge\ 5\ years\ ago$$

$$Cost\ of\ 4.5\ litres\ capacity\ now =$$

$$Cost\ of\ 4.5\ litres\ capacity\ centrifuge\ 5\ years\ ago * \frac{Index\ Value\ today}{Index\ Value\ five\ years\ ago}$$

$$Cost\ of\ 4.5\ litres\ capacity\ now = (\$91{,}200) * \frac{300}{120} = \boxed{\$228{,}000}$$

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Q5)

The time value of money is the concept where although the numerical price of an item or cash amount is the same in the present, past or future, the intrinsic value is not the same. This means that a certain amount of cash could be used over time to invest in more money, which results in a larger overall net gain of the actual amount, compared to the amount being acquired later. In order words, it also means that acquiring cash in the present creates a "future value" or time- space to invest in more money.

For example, when I was working in my co-op, I had an option of getting either paid per two weeks or per month. I chose getting paid per 2 weeks, as having access to my cash earlier gave me the opportunity to plan on my money usage for the next 2 weeks, also possibly putting it into some GIC fund or engage in day-trading for stock market opportunities. Receiving the same value but at an earlier rate increases my future value of the current investment.

Q6)

$$Equation : PV_{n-years} = \frac{\$_n}{(1+r)^n}$$

$\$_n - current\ value\ of\ inheritance\ right\ now$

$n - years\ received$

$r - interest\ rate$

$$PV_{5years} = \frac{\$20,000}{(1+0.07)^5} = \boxed{\$14259.724}$$

$$PV_{10years} = \frac{\$20,000}{(1+0.07)^{10}} = \boxed{\$10166.98585}$$

$$PV_{20years} = \frac{\$20,000}{(1+0.07)^{20}} = \boxed{\$5168.38}$$

$$PV_{50years} = \frac{\$20,000}{(1+0.07)^{50}} = \boxed{\$678.955}$$

Q7)

$$(1 + i) = \frac{Payment\ with\ Interest}{Original\ payment} = \frac{\$85}{\$75} = 1.13333$$

$i = interest = 0.1\overline{333}\ or\ 13.\overline{333}\%$

$compounded\ 2\ times\ per\ year\ \ldots.$

$\therefore\ Nominal\ annual\ interest = r_{percent} = 13.\overline{333}\% \times 2 = \boxed{26.\overline{666}\ \%}$

$$Effective\ annual\ interest\ rate: i_a = \left(1 + \frac{r}{m}\right)^m - 1$$

$r = 0.2\overline{666}$

$m = \#\ of\ compounding\ periods\ per\ year = 2$

$$\therefore\ i_a = \left(1 + \frac{0.2\overline{666}}{2}\right)^2 - 1 \approx \boxed{0.284444 \rightarrow 28.444\%}$$