Problem 1

(a)

The net cost from installing the brass pump is

$$\text{installation} - \text{money earned from selling old pump} = \$6500 - \$4500 = \$2000$$

The net cost from installing the stainless-steel pump is

$$\text{reconfiguration cost} = \$1500$$

(b)

The net cost from installing the stainless-steel pump is lower, thus installing the stainless-steel pump is a better option.

(c)

The opportunity cost would be the cost from installing the brass pump, therefore \$2000.

(d)

By comparing the costs from (a), it costs \$500 less for installing the stainless-steel pump.

Problem 2

When a nominal interest is compounded 4% semi-annually, the semi-annual interest, i, is 2%. Given the annuity of \$2000, the total amount that should be purchased by the engineer's 50th birthday would be

$$\$2000 \cdot \frac{1.02^{30} - 1}{0.02 \cdot 1.02^{30}} = \$44792.9111$$

The value of this money at the time of the engineer's 40th birthday would be then,

$$\frac{\$44792.9111}{1.02^{19}} = \$30747.232$$

Hence, \$30747.

Problem 3

Starting 2017 in order to accommodate \$12000 a year for 4 years at $i = 0.0575$, the total amount needed in terms of 2017 would be

$$\$12000 + \$12000 \cdot \frac{1.0575^3 - 1}{0.0575 \cdot 1.0575^3} = \$12000 + \$32225.08837 = \$44225.08837 \approx \$44225$$

Let the annuity provided from the year 2000 be A and let's calculate the amount of money that would be accumulated starting this year with the same interest rate

$$A = \$44225.08837 \cdot \frac{0.0575}{1.0575^{18} - 1} = \$1465.197253$$

Therefore, \$1465.

Problem 4

(a)

Given growth rate $g = 0.03$ and interest $i = 0.05$ with $A = \$6000$. The present value would be

$$\$6000 \cdot \frac{1 - 1.03^{39} \cdot 1.05^{-39}}{0.05 - 0.03} = \$158293.3098$$

This converted to the future worth would be

$$\$158293.3098 \cdot (1.05)^{39} = \$1061317.252$$

(b)

Given the future worth from (a), we can calculate the amount of money withdrawable for 25 years starting the 40th year.

$$\$1061317.252 \cdot \frac{0.05 \cdot 1.05^{25}}{1.05^{25} - 1} = \$75,303$$

Problem 5

Given that the money put in the first year is \$25000, at year 9 we can compute the present worth of total as

$$\frac{\sum_{i=0}^{9} \$25000 \cdot (1.03)^{9-i} \cdot (1.07)^i}{1.05^9} = \$25000 \cdot (\frac{1.03}{1.05})^9 \cdot \sum_{i=0}^{9} (\frac{1.07}{1.03})^i$$

$$= \$21026.7107 \cdot \frac{1 - \frac{1.07}{1.03}^{10}}{1 - \frac{1.07}{1.03}} = \$251089.2648$$

Therefore, \$251089.

Problem 6

Let's consider the two cases for buying each muffler, Case (1) \$400 option: By applying the interest as a discount rate ($i = 0.06$), we would have to replace the muffler after two years. The total cost in presents worth would be

$$\$400 + \frac{\$400}{1.06^2} = \$756$$

Case (2) \$700 option: Since it lasts 4 years we would not need to replace it and the cost would be \$700.

We can see that it would cost an extra \$56 for the \$400 option, I would advise him to install the \$700 muffler.

Problem 7

(a) 8% interest rate

Let's compare the presents benefit of all alternatives,

(1) :

$$-\$500 - \frac{\$500}{1.08^5} + \$135 \cdot \frac{1.08^{10} - 1}{0.08 \cdot 1.08^{10}} = \$65.57$$

(2) :

$$-\$600 - \frac{\$600}{1.08^5} + \$100 \cdot \frac{1.08^{10} - 1}{0.08 \cdot 1.08^{10}} + \frac{\$250}{1.08^5} + \frac{\$250}{1.08^{10}} = -\$51.4$$

(3) :

$$-\$700 + \$100 \cdot \frac{1.08^{10} - 1}{0.08 \cdot 1.08^{10}} + \frac{\$180}{1.08^{10}} = \$54.38$$

(4) :

$$\$0$$

Alternative 1 should be chosen.

(b) 12% interest rate

(1) :

$$-\$500 - \frac{\$500}{1.12^5} + \$135 \cdot \frac{1.12^{10} - 1}{0.12 \cdot 1.12^{10}} = -\$20.93$$

(2) :

$$-\$600 - \frac{\$600}{1.12^5} + \$100 \cdot \frac{1.12^{10} - 1}{0.12 \cdot 1.12^{10}} + \frac{\$250}{1.12^5} + \frac{\$250}{1.12^{10}} = -\$153.08$$

(3) :

$$-\$700 + \$100 \cdot \frac{1.12^{10} - 1}{0.12 \cdot 1.12^{10}} + \frac{\$180}{1.12^{10}} = -\$77.02$$

(4) :

$$\$0$$

Alternative 4 should be chosen.