

Sunday 8 am 04/10/2020

Name:

University student number:

**Solve the following problems:**

1. If a Plastics company purchases a new building now for \$1.3 million for its corporate headquarters, what must the building be worth in 10 years? The company expects all expenditures to earn a rate of return at least 18% per year.

Formula  
 $F = P(1+i)^n$   
 $F = 1.3(1+0.18)^{10} = \$6.80394$   
 Tables  
 $F = P(F/P, i, n) = 1.3(F/P, 18\%, 10) = 1.3 * 5.2338 = \$6.80394 M$

2. Metso Automation, which manufactures addressable quarter-turn electric actuators, is planning to set aside \$100,000 now and \$150,000 one year from now for possible replacement of the heating and cooling systems in three of its larger manufacturing plants. If the replacement won't be needed for 4 years, how much will the company have in the account, if it earns interest at a rate of 8% per year?

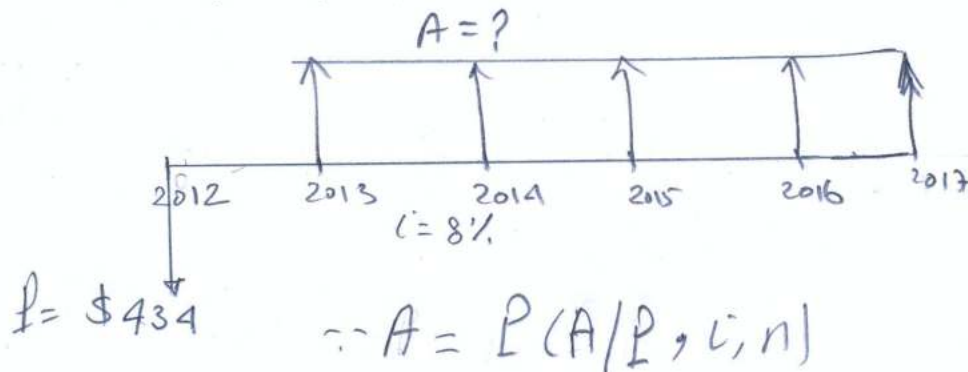
$F = P(F/P, i, n)$   
 $F = 100,000(F/P, 8\%, 4) + 150,000(F/P, 8\%, 3)$   
 $F = 10^5(1.3605) + 150,000(1.2597) = \$325,005$

3. The Public Service Board (PSB) awarded two contracts worth a combined \$1.07 million to improve (i.e., deepen) a retention basin and reconstruct the spillway that was severely damaged in a flood 2 years ago. The PSB said that, because of the weak economy, the bids came in \$950,000 lower than engineers expected. If the projects are assumed to have a 20-year life, what is the annual worth of the savings at an interest rate of 6% per year?

Eq. 1  
 $A = P(P/A, i, n) = 950,000(P/A, 6\%, 20)$   
 $= 950,000(0.08718) = \$82,821$

Eq. 2  
 $A = P \left[ \frac{i(1+i)^n}{(1+i)^n - 1} \right] = 950,000 \left[ \frac{0.06(1.06)^{20}}{(1.06)^{20} - 1} \right] = 950,000(0.08718) = \$82,825$

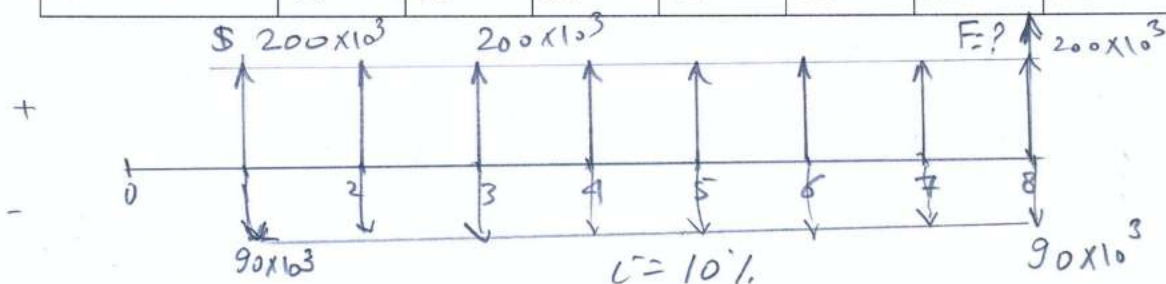
4. The National Highway Traffic Safety Administration raised the average fuel efficiency standard to 35.5 miles per gallon for cars and light trucks by the year 2016. The rules will cost consumers an average of \$434 extra per vehicle in the 2012 model year. If a person purchases a new car in 2012 and keeps it for 5 years, how much must be saved in fuel costs each year to justify the extra cost? Use an interest rate of 8% per year.



$$A = 434(A/P, 8\%, 5) = 434(0.25046) = \boxed{\$108.7}$$

5. Henry Mueller Supply Co. sells tamperproof, normally open thermostats (i.e., thermostat closes as temperature rises). Annual cash flows are shown in the table below. Determine the future worth of the net cash flows at an interest rate of 10% per year.

Year	1	2	3	4	5	6	7	8
Income, \$1000	200	200	200	200	200	200	200	200
Cost, \$1000	90	90	90	90	90	90	90	90



$$F = A(F/A, i, n)$$

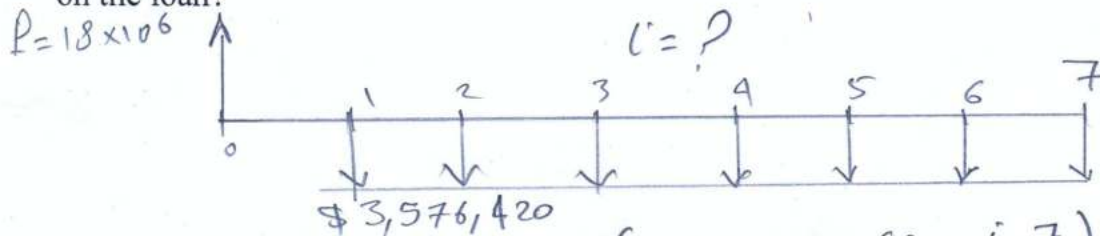
$$F = 10^3(200 - 90)(F/A, 10\%, 8) = 10^3 * 110(11.4359)$$

$$F = \boxed{\$1,257,949}$$

Eqr:

$$\therefore F = A \left[ \frac{(1+i)^n - 1}{i} \right] = (200 - 90) \times 10^3 \left[ \frac{(1.1)^8 - 1}{0.1} \right] = \boxed{\$1,257,948}$$

6. Gesky Industrial Products manufactures brushless blowers for boilers, food service equipment, kilns, and fuel cells. The company borrowed \$18,000,000 for a plant expansion and repaid the loan in seven annual payments of \$3,576,420, with the first payment made 1 year after the company received the money. What was the interest rate on the loan?



$$\therefore P = A(P/A, i, n) = 18 \times 10^6 = 3,576,420 (P/A, i, 7)$$

$(P/A, i, 7) = 5.03296 \Rightarrow$  from table for  $n=7$  years,  $i=9\%$

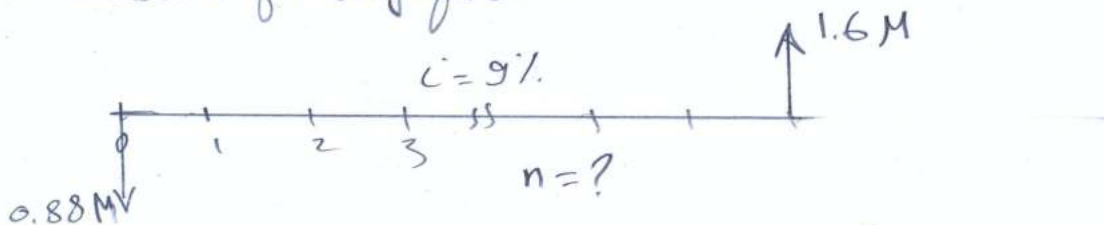
Using Eq:  $P = A \left[ \frac{(1+i)^n - 1}{i(1+i)^n} \right] \Rightarrow 18 \times 10^6 = 3,576,420 \left[ \frac{(1+i)^7 - 1}{i(1+i)^7} \right]$

$\therefore 5.03296 = \frac{(1+i)^7 - 1}{i(1+i)^7}$  By using interpolation  $i = 0.08 \Rightarrow 5.2064 \times$

$\checkmark i = 0.09 \Rightarrow 5.03295$

7. An engineer who was contemplating retirement had \$1.6 million in his investment portfolio. However, a severe recession caused his portfolio to decrease to only 55% of the original amount, so he kept working. If he was able to invest his money at a rate of return of 9% per year after the recession ended, how many years did it take for his account to get back to the \$1.6 million value?

The amount of money after recession =  $0.55 \times 1.6 = \$0.88M$



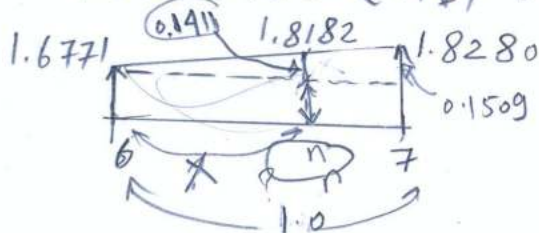
$$\therefore F = P(1+i)^n \Rightarrow 1.6 = 0.88(1+0.09)^n$$

$$\log \frac{20}{11} = n \log 1.09 \Rightarrow \boxed{n \approx 7 \text{ Years}}$$

Using Tables:

$$\therefore F = P(F/P, i, n)$$

$$1.6 = 0.88 (F/P, 9\%, n) \Rightarrow 1.81818 = (F/P, 9\%, n)$$



$$\therefore \frac{x}{1} = \frac{0.1411}{0.1509} \Rightarrow x = 0.935$$

$$\therefore n = 6 + x = 6 + 0.935 = \boxed{6.935 \approx 7 \frac{1}{2}}$$