IEN255-IE255 Course

Engineering Economy Problems Sheet

1.32 Iselt Welding has extra funds to invest for future capital expansion. If the selected investment pays simple interest, what interest rate would be required for the amount to grow from $60,000 to $90,000 in 5 years?

1.36 If interest is compounded at 20% per year, how long will it take for $50,000 to accumulate to $86,400?

2.48 A perceptive engineer started saving for her retirement 15 years ago by diligently saving $18,000 each year through the present time. She invested in a stock fund that averaged a 12% rate of return over that period. If she makes the same annual investment and gets the same rate of return in the future, how long will it be from now (time zero) before she has $1,500,000 in her retirement fund?

2.49 A mechanical engineering graduate who wanted to have his own business borrowed $350,000 from his father as start-up money. Because he was family, his father charged interest at only 4% per year. If the engineer was able to pay his father $15,000 in year 1, $36,700 in year 2, and amounts *increasing* by $21,700 each year, how many years did it take for the engineer to repay the loan?

3.14 For the cash flows below, find the value of x that makes the equivalent annual worth in *years 1 through 7* equal to $300 per year. Use an interest rate of 10% per year. Show solutions (*a*) by hand and (*b*) using the Goal Seek tool.

Year	Cash Flow, $	Year	Cash Flow, $
0	200	4	x
1	200	5	200
2	200	6	200
3	200	7	200

3.27 For the cash flows shown in the diagram, determine the value of x that will make the future worth in year 8 equal to $\$-70{,}000$.
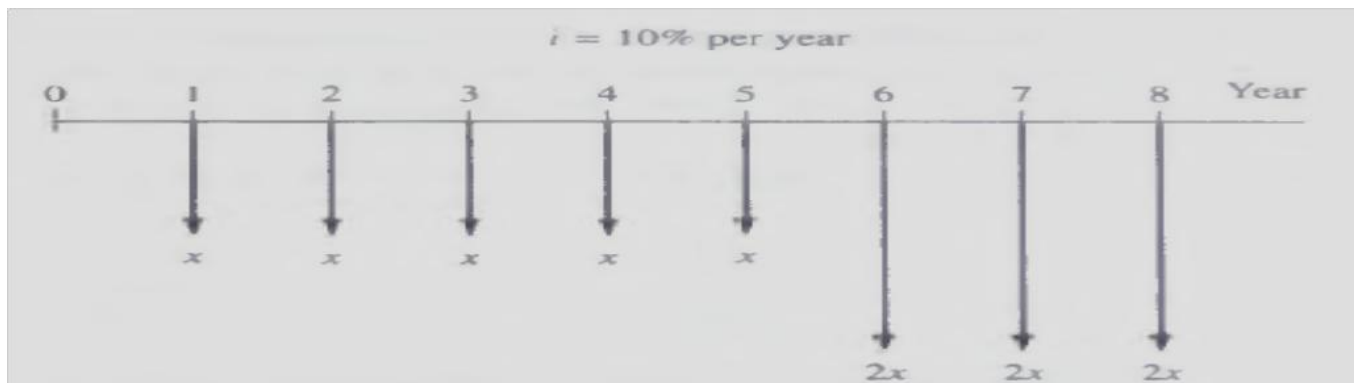
$i = 10\%$ per year

3.31 Use the cash flow diagram to determine the single amount of money Q_4 in year 4 that is equivalent to all of the cash flows shown. Use $i = 10\%$ per year.

$Q_4 = ?$

$i = 10\%$ per year
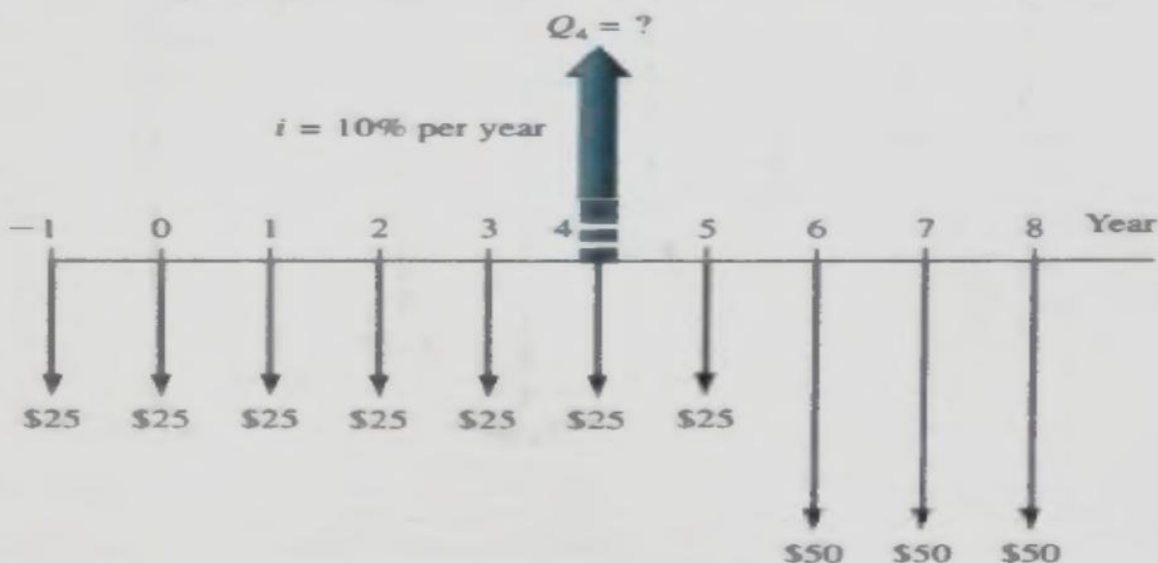
4.18 Julie has a low credit rating, plus she was furloughed from her job 2 months ago. She has a new job starting next week and expects a salary to start again in a couple of weeks. Since she is a little short on money to pay her rent, she decided to borrow $100 from a loan company, which will charge her only $10 interest if the $110 is paid no more than 1 week after the loan is made. What are the (a) nominal annual and (b) effective annual interest rates that she will pay on this loan?

4.40 For the cash flows shown below, determine the equivalent uniform worth in years 1 through 5 at an interest rate of 18% per year, compounded monthly.

Year	1	2	3	4	5
Cash Flow, $	200,000	0	350,000	0	400,000

4.52 U.S. Steel is planning a plant expansion that is expected to cost $13 million. How much money must the company set aside now in a lump-sum investment to have the money in 2 years? Capital funds earn interest at a rate of 12% per year, compounded continuously.

5.19 Machines that have the following costs are under consideration for a robotized welding process. Using an interest rate of 10% per year, determine which alternative should be selected on the basis of a present worth analysis. Show (a) hand and (b) spreadsheet solutions.

	Machine X	Machine Y
First cost, $	−250,000	−430,000
Annual operating cost, $ per year	−60,000	−40,000
Salvage value, $	70,000	95,000
Life, years	3	6

5.28 Compare the alternatives shown below on the basis of a future worth analysis, using an interest rate of 8% per year.

	P	Q
First cost, $	-23,000	-30,000
Annual operating cost, $ per year	-4,000	-2,500
Salvage value, $	3,000	1,000
Life, years	3	6

5.33 Find the capitalized cost of a present cost of $300,000, annual costs of $35,000, and periodic costs every 5 years of $75,000. Use an interest rate of 12% per year.

7.9 Determine the rate of return for the cash flows shown in the diagram. (If requested by your instructor, show both hand and spreadsheet solutions.)
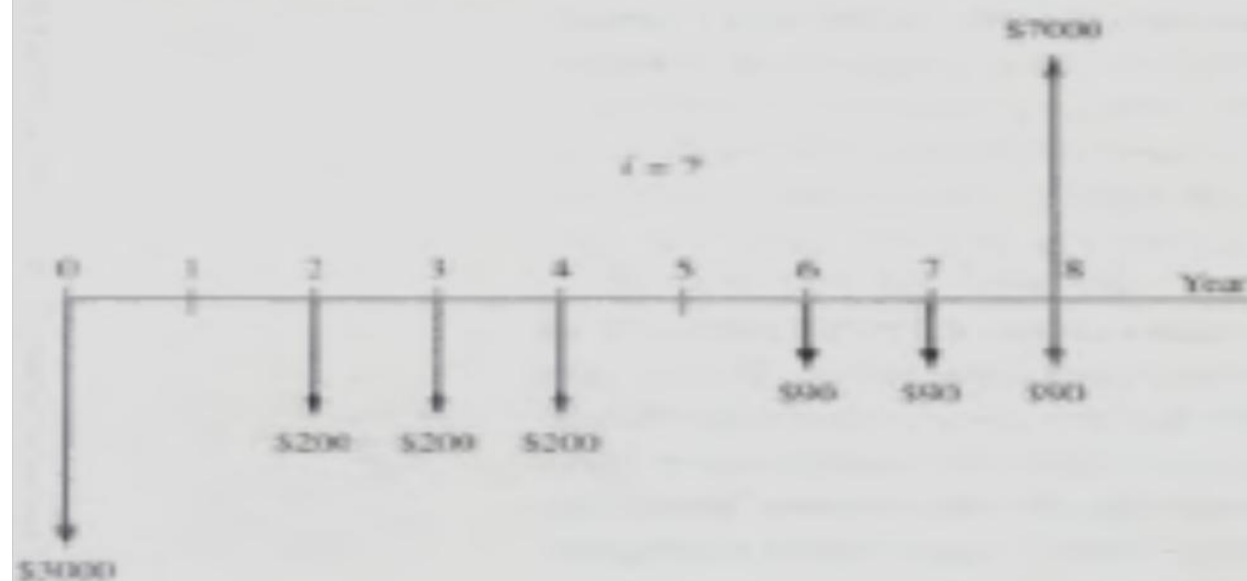
7.32 Julie received a $50 bill for her birthday at the end of January. At the end of February, she spent this $50 and an additional $150 to buy clothes. Her parents then gave her $50 and $125 at the end of March and April, respectively, as she prepared to go to summer school and needed the clothes. Her conclusion was that over the 4 months, she had received $25 more than she spent. Determine if Julie has a multiple rate of return situation for these cash flows. If so, determine the multiple rates and comment on their validity. The cash flow values are as follows:

Month	Jan (0)	Feb (1)	Mar (2)	Apr (3)
Cash Flow, $	50	−200	50	125

8.20 Chem-Tex Chemical is considering two additives for improving the dry-weather stability of its low-cost acrylic paint. Additive A has a first cost of $110,000 and an annual operating cost of $60,000. Additive B has a first cost of $175,000 and an annual operating cost of $35,000. If the company uses a 3-year recovery period for paint products and a MARR of 20% per year, which process is economically favored? Use an incremental ROR analysis.

9.24 For the data shown, calculate the *conventional* B/C ratio at $i = 6\%$ per year.

Benefits:	$20,000 in year 0 and $30,000 in year 5
Disbenefits:	$7000 in year 3
Savings (to government):	$25,000 in years 1–4
Cost:	$100,000 in year 0
Project life:	5 years

9.34 The two alternatives shown are under consideration for improving security at a county jail in Travis County, New York. Determine which one should be selected, based on a B/C analysis, an interest rate of 7% per year and a 10-year study period.

	Extra Cameras (EC)	New Sensors (NS)
First cost, $	38,000	87,000
Annual M&O, $/year	49,000	64,000
Benefits, $/year	110,000	160,000
Disbenefits, $/year	26,000	—

9.41 Comparison of five mutually exclusive alternatives is shown. One *must* be accepted. According to the B/C ratio, which alternative should be selected (costs increase from A to E).

Comparison	ΔB/C Ratio
A versus B	0.75
B versus C	1.4
C versus D	1.3
A versus C	1.1
A versus D	0.2
B versus D	1.9
C versus E	1.2
D versus E	0.9