201-203-RE - Practice Set #20: Applications of Geometric Series

(1) A deposit of 35 dollars is made at the beginning of each month, for a period of 4 years, in an account that pays 1.5% interest, compounded monthly. Find the balance in the account at the end of the 4 years.

(2) The annual net profit for a company, from 1995 to 2005, can be approximated by the model $a_n = 10e^{0.2n}$, $n = 1, 2, 3, \cdots, N$, where a_n is the annual net profit in millions of dollars, and n represents the year, with $n = 1$ corresponding to 1995. Estimate the total net profit during this period.

(3) A deposit of 15 dollars is made at the beginning of each month, for a period of 5 years, in an account that pays 0.9% interest, compounded monthly. Find the balance in the account at the end of the 5 years.

(4) A deposit of 20 dollars is made every 3 months, for a period of 10 years, in an account that pays 1% interest, compounded quarterly. Find the balance in the account at the end of the 10 years.

(5) A deposit of $500 can be made with two options: earn 2% interest, compounded quarterly for 3 years, or earn 1.5%, compounded monthly for 3 years. Find the balance after 3 years of both options.

(6) A deposit of $1200 can be made with two options: earn 1.6% interest, compounded every 2 months for 5 years, or earn 2.3% interest, compounded semi-anually for 5 years. Find the balance after 5 years of both options.

(7) The annual net profit for a company, from 1995 to 2000, can be approximated by the model $a_n = 5e^{0.1n}$, with $n = 1, 2, 3, \cdots, N$, where a_n is the annual net profit (in millions of dollars), and n represents the year, with $n = 1$ corresponding to 1995. Estimate the total net profit earned during this period.

(8) To create a scholarship of $600 that is to be awarded every year, we can use the series $\displaystyle\sum_{n=1}^{+\infty} 600e^{-0.05n}$ to determine the sum of money that has to be deposited in an account that earns 5% interest, compounded continuously. Find the amount of money that must be deposited.

(9) To create a scholarship of $1200 that is to be awarded every year, we can use the series $\displaystyle\sum_{n=1}^{+\infty} 1200e^{-0.03n}$ to determine the sum of money that has to be deposited in an account that earns 3% interest, compounded continuously. Find the amount of money that must be deposited.

(10) A patient is given 50mg of a drug daily, for a long period of time. The amount of drug left in the patient's body after n years is given by $\displaystyle\sum_{k=1}^{n} 50e^{-k/2}$. Find the amount of drug in the patient's system after 4 years and after 15 years.

(11) A deposit of 10 dollars is made at the beginning of each month, for a period of 6 years, into an account that pays 1% yearly interest, compounded 12 times per year. Find the bablance in the account at the end of the 6 years.

(12) The annual net profit for a company, from 1997 to 2003, can be approximated by the model $a_n = 15e^{0.3n}$, with $n = 1, 2, 3, \cdots, N$, where a_n is the annual net profit (in millions of dollars), and n represents the year, with $n = 1$ corresponding to 1997. Estimate the total net profit earned during this period.

(13) A deposit of 30 dollars is made at the beginning of each month, for a period of 7 years, into an account that pays 1.1% yearly interest, compounded 12 times per year. Find the bablance in the account at the end of the 7 years.

(14) The annual net profit for a company, from 1996 to 2001, can be approximated by the model $a_n = 6e^{0.05n}$, with $n = 1,\ 2,\ 3,\ \cdots,\ N$, where a_n is the annual net profit (in millions of dollars), and n represents the year, with $n = 1$ corresponding to 1996. Estimate the total net profit earned during this period.

(15) A deposit of 50 dollars is made bi-weekly, for a period of 8 years, into an account that pays 1.3% yearly interest, compounded every two weeks. Find the balance inthe account at the end of the 8 years.

(16) A deposit of \$700 can be made with two options: account A earns 1.8% yearly interest, compounded every two weeks, and account B earns 2.1% yearly interest, compounded monthly. The amount will stay in the account for a period of 4 years. What would the balance be after the 4 years, for both accounts?

(17) A deposit of \$1500 can be made with two options: account A earns 1.4% yearly interest, compounded quarterly, and account B earns 1.9% yearly interest, compounded monthly. The amount will stay in the account for a period of 6 years. What would the balance be after the 6 years, for both accounts?

(18) To create a scholarship of \$750 that is to be awarded every year, we can use the series $\sum_{n=1}^{+\infty} 750e^{-0.04n}$ to determine the sum of money that has to be deposited in an account that earns 4% interest, compounded continuously. Find the amount of money that must be deposited.

(19) To create a scholarship of \$1500 that is to be awarded every year, we can use the series $\sum_{n=1}^{+\infty} 1500e^{-0.035n}$ to determine the sum of money that has to be deposited in an account that earns 3.5% interest, compounded continuously. Find the amount of money that must be deposited.

(20) A patient is given 40mg of a drug daily, for a long period of time. The amount of drug left in the patient's body after n years is given by $\sum_{k=1}^{n} 40e^{-k/5}$. Find the amount of drug in the patient's system after 6 years and after 20 years.

In problems 21 - 34, geometric series to write the following repeating decimals as fractions.

(21) $4.\overline{13}$	(23) $3.\overline{09}$	(25) $5.\overline{011}$	(27) $7.3\overline{4}$	(29) $1.\overline{06}$	(31) $8.\overline{01}$	(33) $5.\overline{25}$
(22) $6.\overline{04}$	(24) $2.\overline{02}$	(26) $10.2\overline{3}$	(28) $20.0\overline{21}$	(30) $2.\overline{03}$	(32) $2.\overline{22}$	(34) $12.30\overline{2}$

(35) Valery would like to save \$1 400 000 for her retirement. Her account has an annual interest rate of 2.7%, compounded semi-annually. If Valery wants to retire in 40 years, how much should she be saving semi-annually?

(36) When she retires, Liu Zhang purchases an annuity which pays her \$ 3 000 per month for 40 years. If the annuity earns 3.1% interest compounded monthly, what was the initial value of the investment?

(37) Sobolev would like to buy a \$20 000 car, but he cannot afford to do so outright. He goes on the automaker's website and sees that he can expect to finance it at 3.5% interest compounded twice a month. If he chooses to finance the car for a six year term, what will his payments be, if he is paying twice per month?

(38) Suzana would like to save a \$40 000 down payment for a house. If she can invest at 1.6% interest compounded weekly over ten years, how much should she save each week?

(39) Lewis-Charles is at the car dealership and is being told his new car will cost him \$1000 every two months for four years. If he financed at 0.9% interest compounded every two months, how much is the car (not including interest)?

(40) Chef Tony bought a commercial building that is worth \$3 000 000. He finances it on a 25 year term at 3.2% annual interest compounded semi-annually. What is his mortgage payment every 6 months?

(41) Jennifer wants to save \$15 000 for a new car in eight years. If she can save at 1.1% interest compounded monthly, what should be her monthly deposit?

(42) Ichiban has \$1 800 000 saved when he retires. He uses all that money to purchase an annuity earning 2.6% interest compounded every two weeks that will pay him a lump sum every two weeks for 30 years. How much will he receive every two weeks?

ANSWERS:

(1) \$1732.47

(2) \$442.712 millions

(3) \$920.89

(4) \$842.36

(5) \$530.84 or \$523.00

(6) \$1299.81 or \$1345.36

(7) \$43.195 millions

(8) \$11 702.50

(9) \$39 403.00

(10) 66.64mg and 77.03mg

(11) \$742.34

(12) \$414.738 millions

(13) \$2620.71

(14) \$43.041 millions

(15) \$10 962.64

(16) \$752.24 or \$761.28

(17) \$1631.20 or \$1680.98

(18) \$18 377.50

(19) \$42 111.52

(20) 126.25mg and 177.36mg

(21) 409/99

(22) 598/99

(23) 34/11

(24) 200/99

(25) 5006/999

(26) 307/30

(27) 661/90

(28) 6607/330

(29) 35/33

(30) 67/33

(31) 793/99

(32) 20/9

(33) 520/99

(34) 2768/225

(35) \$9695.05

(36) \$824 693.47

(37) \$154.08

(38) \$70.92

(39) \$23 555.79

(40) \$87 620.56

(41) \$149.41

(42) \$3 324.62