Chapter 4 Suggested Problems Solutions

20. FV = PV(1 + r) ➔ $4 = $3(1 + r) ➔ r = 4/3 – 1 = 33.33% per week

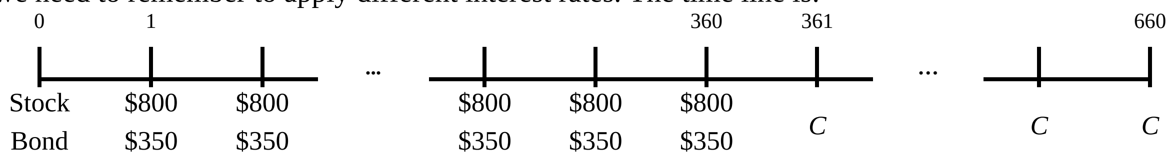
The interest rate is 33.33% per week. To find the APR, we multiply this rate by the number of weeks in a year, so:

APR = (52)33.33% = 1,733.33%

And using the equation to find the EAR:

EAR = $[1 + (\text{APR} / m)]^m - 1 = [1 + .3333]^{52} - 1$ = 313,916,515.69%

23. Although the stock and bond accounts have different interest rates, we can draw one time line, but we need to remember to apply different interest rates. The time line is:



We need to find the annuity payment in retirement. Our retirement savings ends at the same time the retirement withdrawals begin, so the PV of the retirement withdrawals will be the FV of the retirement savings. So, we find the FV of the stock account and the FV of the bond account and add the two FVs.

Stock account: FVA = $\$800[\{[1 + (.11/12)]^{360} - 1\} / (.11/12)]$ = $2,243,615.79

Bond account: FVA = $\$350[\{[1 + (.06/12)]^{360} - 1\} / (.06/12)]$ = $351,580.26

So, the total amount saved at retirement is:

$2,243,615.79 + 351,580.26 = $2,595,196.05

Solving for the withdrawal amount in retirement using the PVA equation gives us:

PVA = $2,595,196.05 = $C[1 - \{1 / [1 + (.08/12)]^{300}\} / (.08/12)]$

C = $2,595,196.06 / 129.5645 = $20,030.14 withdrawal per month

26. This is a growing perpetuity. The present value of a growing perpetuity is:

PV = C / (r – g) = $175,000 / (.10 – .035) = $2,692,307.69

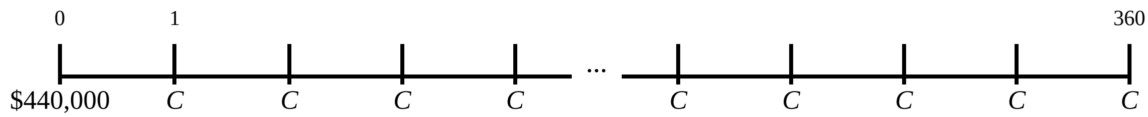
It is important to recognize that when dealing with annuities or perpetuities, the present value equation calculates the present value one period before the first payment. In this case, since the first payment is in two years, we have calculated the present value one year from now. To find the value today, we simply discount this value as a lump sum. Doing so, we find the value of the cash flow stream today is:

PV = FV / $(1 + r)^t$ = $2,692,307.69 / $(1 + .10)^1$ = $2,447,552.45

30. The amount borrowed is the value of the home times one minus the down payment, or:

Amount borrowed = $550,000(1 – .20) = $440,000

The time line is:



The monthly payments with a balloon payment loan are calculated assuming a longer amortization schedule, in this case, 30 years. The payments based on a 30-year repayment schedule would be:
PVA = $440,000 = $C(\{1 – [1 / (1 + .061/12)]^{360}\} / (.061/12))$ ➔ C = $2,666.38

Now, at Year 8 (Month 96), we need to find the PV of the payments which have not been made. The time line is:

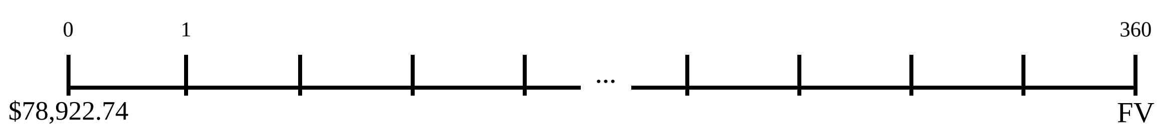
The balloon payment will be:
PVA = $2,666.38(\{1 – [1 / (1 + .061/12)]^{22(12)}\} / (.061/12))$ = $386,994.11

33. The company will accept the project if the present value of the increased cash flows is greater than the cost. The cash flows are a growing perpetuity, so the present value is:
$PV = C\ \{[1/(r – g)] – [1/(r – g)] \times [(1 + g)/(1 + r)]^t\}$
PV = $21,000$\{[1/(.10 – .04)] – [1/(.10 – .04)] \times [(1 + .04)/(1 + .10)]^5\}$ = $85,593.99
The company should accept the project since the cost is less than the increased cash flows.

38. The time line is:

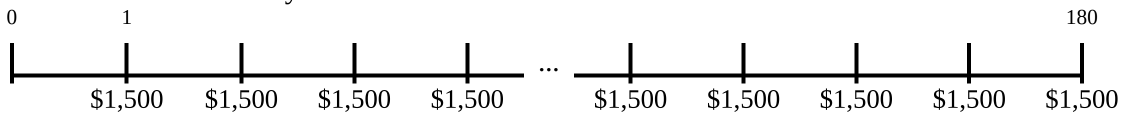
The amount of principal paid on the loan is the PV of the monthly payments you make. So, the present value of the $950 monthly payments is:
PVA = 950[(1 – \{1 / [1 + (.053/12)]\}^{360}) / (.053/12)]$ = $171,077.26

The monthly payments of $950 will amount to a principal payment of $171,077.26. The amount of principal you will still owe is:
$250,000 – 171,077.26 = $78,922.74



This remaining principal amount will increase at the interest rate on the loan until the end of the loan period. So the balloon payment in 30 years, which is the FV of the remaining principal will be:
Balloon payment = $78,922.74$[1 + (.053/12)]^{360}$ = $385,664.73

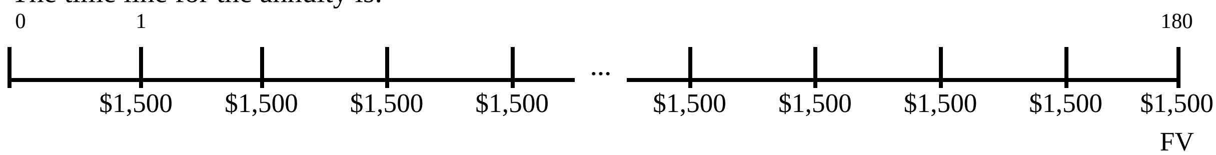
44. The time line for the annuity is:



This question is asking for the present value of an annuity, but the interest rate changes during the life of the annuity. We need to find the present value of the cash flows for the last eight years first. The PV of these cash flows is:
PVA_2 = \$1,500 [{1 – 1 / [1 + (.06/12)]^{96}} / (.06/12)] = \$114,142.83

Note that this is the PV of this annuity exactly seven years from today. Now, we can discount this lump sum to today as well as finding the PV of the annuity for the first 7 years. The value of this cash flow today is:
PV = \$114,142.83 / [1 + (.12/12)]^{84} + \$1,500 [{1 – 1 / [1 + (.12/12)]^{84}} / (.12/12)] = \$134,455.36

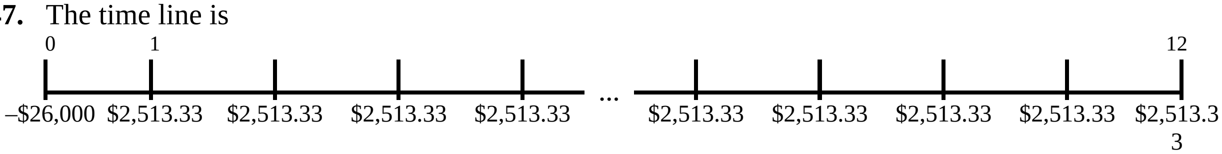
45. The time line for the annuity is:



Here, we are trying to find the dollar amount invested today that will equal the FVA with a known interest rate, and payments. First, we need to determine how much we would have in the annuity account. Finding the FV of the annuity, we get:
FVA = \$1,500 [{[1 + (.087/12)]^{180} – 1} / (.087/12)] = \$552,490.07

Now, we need to find the PV of a lump sum that will give us the same FV. So, using the FV of a lump sum with continuous compounding, we get:
FV = \$552,490.07 = PV$e^{.08(15)}$ = \$552,490.07$e^{-1.20}$ = \$166,406.81

47. The time line is



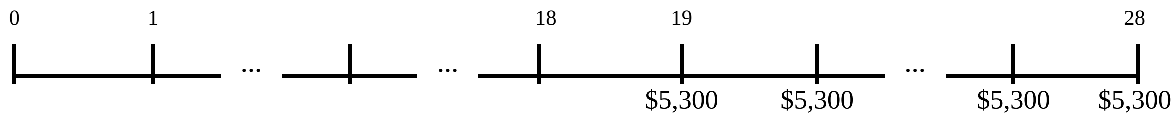
To find the APR and EAR, we need to use the actual cash flows of the loan. In other words, the interest rate quoted in the problem is only relevant to determine the total interest under the terms given. The interest rate for the cash flows of the loan is:
PVA = \$26,000 = \$2,513.33{(1 – [1 / (1 + r)]^{12}) / r }

Again, we cannot solve this equation for r, so we need to solve this equation on a financial calculator, using a spreadsheet, or by trial and error. Using a spreadsheet, we find:
r = 2.361% per month

So the APR is:
APR = 12(2.361%) = 28.33%

And the EAR is:
EAR = (1.02361)^{12} – 1 = 32.31%

48. The time line is:



The cash flows in this problem are semiannual, so we need the effective semiannual rate. The interest rate given is the APR, so the monthly interest rate is:
Monthly rate = .12 / 12 = .01

To get the semiannual interest rate, we can use the EAR equation, but instead of using 12 months as the exponent, we will use 6 months. The effective semiannual rate is:
Semiannual rate = $(1.01)^6 – 1$ = 6.15%

We can now use this rate to find the PV of the annuity. The PV of the annuity is:
PVA @ t = 9: $5,300{[1 – (1 / 1.0615)^{10}] / .0615} = $38,729.05

Note, that this is the value one period (six months) before the first payment, so it is the value at t = 9. So, the value at the various times the questions asked for uses this value 9 years from now.
PV @ t = 5: $38,729.05 / 1.0615^8 = $24,022.10

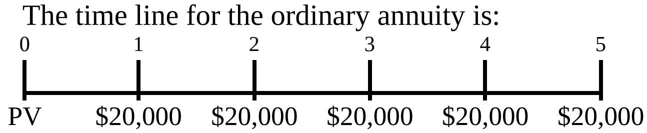
Note, that you can also calculate this present value (as well as the remaining present values) using the number of years. To do this, you need the EAR. The EAR is:
EAR = $(1 + .01)^{12} – 1$ = 12.68%

So, we can find the PV at t = 5 using the following method as well:
PV @ t = 5: $38,729.05 / 1.1268^4 = $24,022.10

The value of the annuity at the other times in the problem is:
PV @ t = 3: $38,729.05 / 1.0615^{12} = $18,918.99
PV @ t = 3: $38,729.05 / 1.1268^6 = $18,918.99

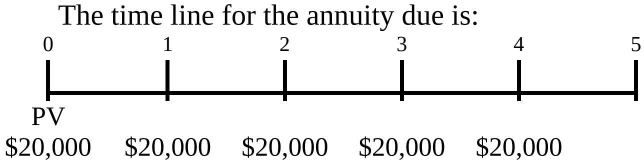
PV @ t = 0: $38,729.05 / 1.0615^{18} = $13,222.95
PV @ t = 0: $38,729.05 / 1.1268^9 = $13,222.95

49. *a.* The time line for the ordinary annuity is:



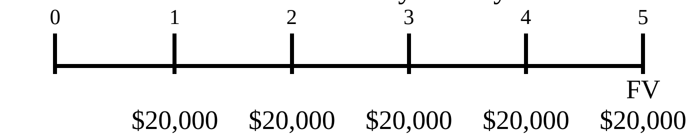
If the payments are in the form of an ordinary annuity, the present value will be:
PVA = $C(\{1 – [1/(1 + r)^t]\} / r))$ = $20,000[{1 – [1 / (1 + .07)]^5}/ .07] = $82,003.95

The time line for the annuity due is:



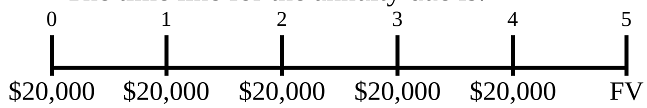
If the payments are an annuity due, the present value will be:
PVA_{due} = (1 + r) PVA = (1 + .07)$82,003.95 = $87,744.23

b. The time line for the ordinary annuity is:



We can find the future value of the ordinary annuity as:
$\text{FVA} = C\{[(1 + r)^t - 1] / r\} = \$20{,}000\{[(1 + .07)^5 - 1] / .07\} = \$115{,}014.78$

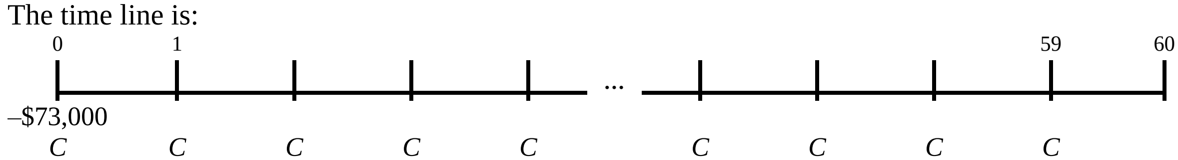
The time line for the annuity due is:



If the payments are an annuity due, the future value will be:
$\text{FVA}_{\text{due}} = (1 + r)\ \text{FVA} = (1 + .07)\$115{,}014.78 = \$123{,}065.81$

c. Assuming a positive interest rate, the present value of an annuity due will always be larger than the present value of an ordinary annuity. Each cash flow in an annuity due is received one period earlier, which means there is one period less to discount each cash flow. Assuming a positive interest rate, the future value of an ordinary due will always higher than the future value of an ordinary annuity. Since each cash flow is made one period sooner, each cash flow receives one extra period of compounding.

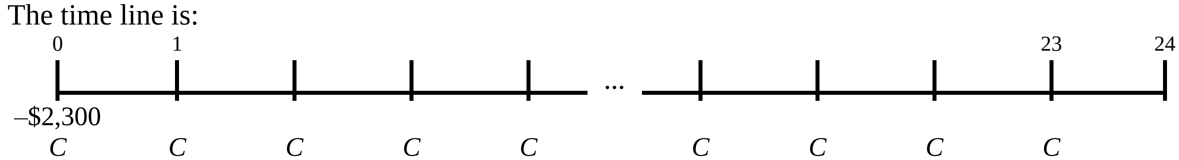
50. The time line is:



We need to use the PVA due equation, that is:
$\text{PVA}_{\text{due}} = (1 + r)\ \text{PVA}$
⇨ $\text{PVA}_{\text{due}} = \$73{,}000 = [1 + (.0645/12)] \times C[\{1 - 1 / [1 + (.0645/12)]^{60}\} / (.0645/12)$
⇨ $C = \$1{,}418.99$

Notice, to find the payment for the PVA due we simply compound the payment for an ordinary annuity forward one period.

51. The time line is:



The monthly interest rate is the annual interest rate divided by 12, or:
Monthly interest rate = .104 / 12 = .00867

Now we can set the present value of the lease payments equal to the cost of the equipment, or $2,300. The lease payments are in the form of an annuity due, so:

$\text{PVA}_{\text{due}} = (1 + r)\, C(\{1 - [1/(1 + r)]^t\ \} / r\ )$
$\$2{,}300 = (1 + .00867)\, C(\{1 - [1/(1 + .00867)]^{24}\ \} / .00867\ )$
⇨ $C = \$105.64$

53. The salary is a growing annuity, so we use the equation for the present value of a growing annuity. The salary growth rate is 3.5 percent and the discount rate is 9 percent, so the value of the salary offer today is:
$\text{PV} = C\ \{[1/(r - g)] - [1/(r - g)] \times [(1 + g)/(1 + r)]^t\}$
$\text{PV} = \$55{,}000\{[1/(.09 - .035)] - [1/(.09 - .035)] \times [(1 + .035)/(1 + .09)]^{25}\} = \$725{,}939.59$

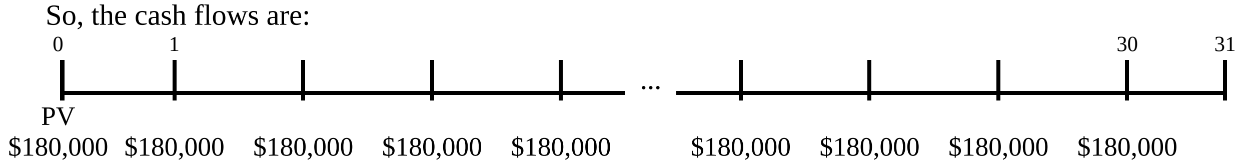
The yearly bonuses are 10 percent of the annual salary. This means that next year's bonus will be:
Next year's bonus = .10($55,000) = $5,500

Since the salary grows at 3.5 percent, the bonus will grow at 3.5 percent as well. Using the growing annuity equation, with a 3.5 percent growth rate and a 12 percent discount rate, the present value of the annual bonuses is:
$\text{PV} = C\ \{[1/(r - g)] - [1/(r - g)] \times [(1 + g)/(1 + r)]^t\}$
$\text{PV} = \$5{,}500\{[1/(.09 - .035)] - [1/(.09 - .035)] \times [(1 + .035)/(1 + .09)]^{25}\} = \$72{,}593.96$

Notice the present value of the bonus is 10 percent of the present value of the salary. The present value of the bonus will always be the same percentage of the present value of the salary as the bonus percentage. So, the total value of the offer is:
PV = PV(Salary) + PV(Bonus) + Bonus paid today = $725,939.59 + 72,593.96 + 10,000
= $808,533.55

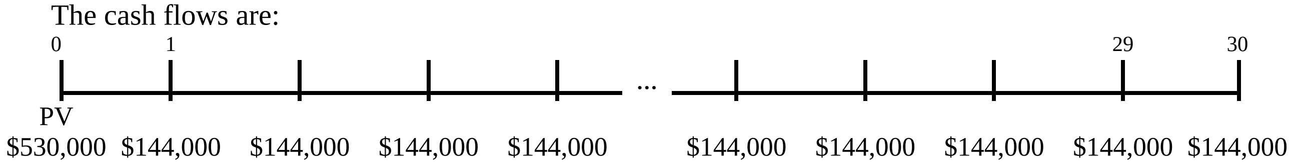
54. Here, we need to compare two options. In order to do so, we must get the value of the two cash flow streams to the same time, so we will find the value of each today. We must also make sure to use the aftertax cash flows, since it is more relevant. For Option A, the aftertax cash flows are:
Aftertax cash flows = Pretax cash flows(1 – tax rate) = $250,000(1 – .28) = $180,000

So, the cash flows are:



The aftertax cash flows from Option A are in the form of an annuity due, so the present value of the cash flow today is:
$\text{PVA}_{\text{due}} = (1 + r)\, C(\{1 - [1/(1 + r)]^t\ \} / r\ ) = (1 + .07)\$180{,}000(\{1 - [1/(1 + .07)]^{31}\ \} / .07\ )$
$\text{PVA}_{\text{due}} = \$2{,}413{,}627.41$

For Option B, the aftertax cash flows are:
Aftertax cash flows = Pretax cash flows(1 – tax rate) = $200,000(1 – .28) = $144,000
The cash flows are:



The aftertax cash flows from Option B are an ordinary annuity, plus the cash flow today, so the present value is:
$PV = C(\{1 - [1/(1 + r)]^t\} / r) + CF_0$
$PV = \$144{,}000\{1 - [1/(1 + .07)]^{30}\} / .07) + \$530{,}000 = \$2{,}316{,}901.93$

You should choose Option A because it has a higher present value on an aftertax basis.

55. We need to find the first payment into the retirement account. The present value of the desired amount at retirement is:
$PV = FV/(1 + r)^t = \$2{,}000{,}000/(1 + .09)^{30} = \$150{,}742.27$

This is the value today. Since the savings are in the form of a growing annuity, we can use the growing annuity equation and solve for the payment. Doing so, we get:
$PV = C\{[1/(r - g)] - [1/(r - g)] \times [(1 + g)/(1 + r)]^t\}$
$\$150{,}742.27 = C\{[1/(.09 - .03)] - [1/(.09 - .03)] \times [(1 + .03)/(1 + .09)]^{30}\}$
⇨ $C = \$11{,}069.69$

This is the amount you need to save next year. So, the percentage of your salary is:
Percentage of salary = $11,069.69/$70,000 = .1581 or 15.81%

Note that this is the percentage of your salary you must save each year. Since your salary is increasing at 3 percent, and the savings are increasing at 3 percent, the percentage of salary will remain constant.

56. Since she put $1,000 down, the amount borrowed will be:
Amount borrowed = $30,000 – 1,000 = $29,000

So, the monthly payments will be:
$PVA = C(\{1 - [1/(1 + r)]^t\} / r)$
$\$29{,}000 = C[\{1 - [1/(1 + .072/12)]^{60}\} / (.072/12)]$
⇨ $C = \$576.98$

The amount remaining on the loan is the present value of the remaining payments. Since the first payment was made on October 1, 2009, and she made a payment on October 1, 2011, there are 35 payments remaining, with the first payment due immediately. So, we can find the present value of the remaining 34 payments after November 1, 2011, and add the payment made on this date. So the remaining principal owed on the loan is:
$PV = C(\{1 - [1/(1 + r)]^t\} / r) + C_0 = \$576.98[\{1 - [1/(1 + .072/12)]^{34}\} / (.072/12)] = \$17{,}697.79$

She must also pay a one percent prepayment penalty and the payment due on November 1, 2011, so the total amount of the payment is:
Total payment = Balloon amount(1 + Prepayment penalty) + Current payment
Total payment = $17,697.79(1 + .01) + $576.98 = $18,451.74

59. To find the quarterly salary for the player, we first need to find the PV of the current contract. The cash flows for the contract are annual, and we are given a daily interest rate. We need to find the EAR so the interest compounding is the same as the timing of the cash flows. The EAR is:
$EAR = [1 + (.05/365)]^{365} - 1 = 5.13\%$

The PV of the current contract offer is the sum of the PV of the cash flows. So, the PV is:

PV = \$8,500,000 + \$3,900,000/1.0513 + \$4,600,000/1.0513^2 + \$5,300,000/1.0513^3
+ \$5,800,000/1.0513^4 + \$6,400,000/1.0513^5 + \$7,300,000/1.0513^6

PV = \$36,075,085.12

The player wants the contract increased in value by \$1,500,000, so the PV of the new contract will be: PV = \$36,075,085.12 + 1,500,000 = \$37,575,085.12

The player has also requested a signing bonus payable today in the amount of \$10 million. We can simply subtract this amount from the PV of the new contract. The remaining amount will be the PV of the future quarterly paychecks.

\$37,575,085.12 – 10,000,000 = \$27,575,085.12

To find the quarterly payments, first realize that the interest rate we need is the effective quarterly rate. Using the daily interest rate, we can find the quarterly interest rate using the EAR equation, with the number of days being 91.25, the number of days in a quarter (365 / 4). The effective quarterly rate is:

Effective quarterly rate = $[1 + (.05/365)]^{91.25} – 1$ = .01258 or 1.258%

Now, we have the interest rate, the length of the annuity, and the PV. Using the PVA equation and solving for the payment, we get:

PVA = \$27,575,085.12 = $C\{[1 – (1/1.01258)^{24}] / .01258\}$

⇨ C = \$1,338,243.52

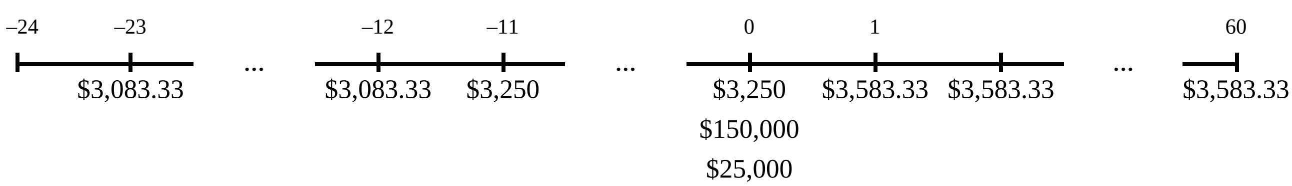
60. The time line for the cash flows is:

To find the APR and EAR, we need to use the actual cash flows of the loan. In other words, the interest rate quoted in the problem is only relevant to determine the total interest under the terms given. The cash flows of the loan are the \$20,000 you must repay in one year, and the \$17,200 you borrow today. The interest rate of the loan is:

\$20,000 = \$17,000(1 + r) ➔ r = (\$20,000 / 17,000) – 1 = .1765 or 17.65%

Because of the discount, you only get the use of \$17,000, and the interest you pay on that amount is 17.65%, not 15%.

61. The time line is:



Here, we have cash flows that would have occurred in the past and cash flows that would occur in the future. We need to bring both cash flows to today. Before we calculate the value of the cash flows today, we need to calculate the APR from the given information on EAR -

APR = $12[(1.09)^{1/12} - 1] = 8.65\%$

To find the value today of the back pay from two years ago, we will find the FV of the annuity (salary), and then find the FV of the lump sum value of the salary. Doing so gives us:

FV = $(\$37,000/12)\ [\{[\ 1 + (.0865/12)]^{12} - 1\}\ /\ (.0865/12)]\ (1 + .09) = \$41,967.73$

Notice we found the FV of the annuity with the periodic monthly rate, and then found the FV of the lump sum with the EAR. Alternatively, we could have found the FV of the lump sum with the periodic monthly rate as long as we used 12 periods. The answer would be the same either way.

Now, we need to find the value today of last year's back pay:

FVA = $(\$39,000/12)\ [\{[\ 1 + (.0865/12)]^{12} - 1\}\ /\ (.0865/12)] = \$40,583.72$

Next, we find the value today of the five year's future salary:

PVA = $(\$43,000/12)\{[\{1 - \{1\ /\ [1 + (.0865/12)]^{12(5)}\}]\ /\ (.0865/12)\} = \$174,046.93$

The value today of the jury award is the sum of salaries, plus the compensation for pain and suffering, and court costs. The award should be for the amount of:

Award = \$41,967.73 + 40,583.72 + 174,046.93 + 150,000 + 25,000
Award = \$431,598.39

As the plaintiff, you would prefer a lower interest rate. In this problem, we are calculating both the PV and FV of annuities. A lower interest rate will decrease the FVA, but increase the PVA. So, by a lower interest rate, we are lowering the value of the back pay. But, we are also increasing the PV of the future salary. Since the future salary is larger and has a longer time, this is the more important cash flow to the plaintiff.

66. We need to find the FV of the premiums to compare with the cash payment promised at age 65. We have to find the value of the premiums at year 6 first since the interest rate changes at that time. So:
$FV_1 = \$500(1.11)^5 = \$842.53$
$FV_2 = \$600(1.11)^4 = \$910.84$
$FV_3 = \$700(1.11)^3 = \$957.34$
$FV_4 = \$800(1.11)^2 = \$985.68$
$FV_5 = \$900(1.11)^1 = \$999.00$

Value at year six = \$842.53 + 910.84 + 957.34 + 985.68 + 999.00 + 1,000.00 = \$5,695.39

Finding the FV of this lump sum at the child's 65th birthday:
FV = $\$5,695.39(1.07)^{59} = \$308,437.08$

The policy is not worth buying; the future value of the policy is \$308,437.08, but the policy contract will pay off \$275,000. The premiums are worth \$33,437.08 more than the policy payoff.

Note, we could also compare the PV of the two cash flows. The PV of the premiums is:
PV = $500/1.11 + $600/$1.11^2$ + $700/$1.11^3$ + $800/$1.11^4$ + $900/$1.11^5$ + $1,000/$1.11^6$ = $3,044.99

And the value today of the $275,000 at age 65 is:
PV = $275,000/$1.07^{59}$ = $5,077.97
⇨ PV = $5,077.97/$1.11^6$ = $2,714.89

The premiums still have the higher cash flow. At time zero, the difference is $330.10. Whenever you are comparing two or more cash flow streams, the cash flow with the highest value at one time will have the highest value at any other time.

Here is a question for you: Suppose you invest $330.10, the difference in the cash flows at time zero, for six years at an 11 percent interest rate, and then for 59 years at a seven percent interest rate. How much will it be worth? Without doing calculations, you know it will be worth $33,437.08, the difference in the cash flows at time 65!

67. Since the payments occur at six month intervals, we need to get the effective six-month interest rate. We can calculate the daily interest rate since we have an APR compounded daily, so the effective six-month interest rate is:
Effective six-month rate = (1 + Daily rate)^{180} – 1= (1 + .09/360)^{180} – 1 = .0460 or 4.60%

Now, we can use the PVA equation to find the present value of the semi-annual payments. Doing so, we find:
PVA = $C(\{1 - [1/(1 + r)]^t \} / r)$ = $1,250,000({1 – [1/(1 + .0460]^{40} } / .0460) = $22,670,253.86

This is the value six months from today, which is one period (six months) prior to the first payment. So, the value today is:
PV = $22,670,253.86 / (1 + .0460) = $21,672,827.50

This means the total value of the lottery winnings today is:

Value of winnings today = $21,672,827.50 + 2,500,000 = $24,172,827.50

You should not take the offer since the value of the offer is less than the present value of the payments.

Calculator Solutions

1.

Enter	10	8%	$5,000		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$10,794.62

$10,794.62 – 9,000 = $1,794.62

2.

Enter	10	5%	$1,000		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$1,628.89

Enter	10	10%	$1,000		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$2,593.74

Enter	20	5%	$1,000		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$2,653.30

3.

Enter	6	7%			$13,827
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$9,213.51		

Enter	9	15%			$43,852
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$12,465.48		

Enter	18	11%			$725,380
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$110,854.15		

Enter	23	18%			$590,710
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$13,124.66		

4.

Enter	4		$242		±$307
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for		6.13%			

Enter	8		$410		±$896
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for		10.27%			

Enter	16		$51,700		±$162,181
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for		7.41%			

Enter	27		$18,750		±$483,500
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for		12.79%			

5.

Enter		9%	$625		±$1,284
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for	8.35				

Enter		11%	$810		±$4,341
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for	16.09				

Enter		17%	$18,400		±$402,662
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for	19.65				

Enter		8%	$21,500		±$173,439
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for	27.13				

6.

Enter		8%	$1		±$2
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for	9.01				

Enter		8%	$1		±$4
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for	18.01				

7.

Enter	20	7.1%			$630,000,000
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$159,790,565.17		

8.

Enter	4		±$1,680,000		$1,100,000
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for		–13.17%			

11.

CFo	$0	**CFo**	$0	**CFo**	$0
C01	$960	**C01**	$960	**C01**	$960
F01	1	**F01**	1	**F01**	1
C02	$840	**C02**	$840	**C02**	$840
F02	1	**F02**	1	**F02**	1
C03	$935	**C03**	$935	**C03**	$935
F03	1	**F03**	1	**F03**	1
C04	$1,350	**C04**	$1,350	**C04**	$1,350
F04	1	**F04**	1	**F04**	1
I = 10		I = 18		I = 24	
NPV CPT		NPV CPT		NPV CPT	
$3,191.49		$2,682.22		$2,381.91	

12.

Enter	9	5%		$4,500	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$31,985.20		

Enter	5	5%		$7,000	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$30,306.34		

Enter	9	22%		$4,500	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$17,038.28		

Enter	5	22%		$7,000	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$20,045.48		

13.

Enter	15	8%		$4,900	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$41,941.45		

Enter	40	8%		$4,900	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$58,430.61		

Enter	75	8%		$4,900	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$61,059.31		

15.

Enter	7%		4
	NOM	**EFF**	**C/Y**
Solve for		7.19%	

Enter	16%		12
	NOM	**EFF**	**C/Y**
Solve for		17.23%	

Enter	11%		365
	NOM	**EFF**	**C/Y**
Solve for		11.63%	

16.

Enter		9.8%	2
	NOM	**EFF**	**C/Y**
Solve for	9.57%		

Enter		19.6%	12
	NOM	**EFF**	**C/Y**
Solve for	18.03%		

Enter		8.3%	52
	NOM	**EFF**	**C/Y**
Solve for	7.98%		

17.

Enter	11.2%		12
	NOM	**EFF**	**C/Y**
Solve for		11.79%	

Enter	11.4%		2
	NOM	**EFF**	**C/Y**
Solve for		11.72%	

18. 2nd BGN 2nd SET

Enter	12		$108	±$10	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for		1.98%			

APR = 1.98% $\times$ 52 = 102.77%

Enter	102.77%		52
	NOM	**EFF**	**C/Y**
Solve for		176.68%	

19.

Enter		1.3%	$21,500	±$700	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for	39.46				

20.

Enter	1,733.33%		52
	NOM	**EFF**	**C/Y**
Solve for		313,916,515.69%	

21.

Enter	6	9%	$1,000		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$1,677.10

Enter	6 × 2	9%/2	$1,000		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$1,695.88

Enter	6 × 12	9%/12	$1,000		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$1,712.55

23. Stock account:

Enter	360	11% / 12		$800	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$2,243,615.79

Bond account:

Enter	360	6% / 12		$350	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$351,580.26

Savings at retirement = $2,243,615.79 + 351,580.26 = $2,595,196.05

Enter	300	8% / 12	$2,595,196.05		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for				$20,030.14	

24.

	N	I/Y	PV	PMT	FV
Enter	12 / 3		±$1		$4
Solve for		41.42%			

25.

	N	I/Y	PV	PMT	FV
Enter	6		±$65,000		$125,000
Solve for		11.51%			

	N	I/Y	PV	PMT	FV
Enter	10		±65,000		$185,000
Solve for		11.03%			

28.

	N	I/Y	PV	PMT	FV
Enter	23	7%		$6,500	
Solve for			$73,269.22		

	N	I/Y	PV	PMT	FV
Enter	2	7%			$73,269.22
Solve for			$63,996.17		

29.

	N	I/Y	PV	PMT	FV
Enter	15	13%		$650	
Solve for			$4,200.55		

	N	I/Y	PV	PMT	FV
Enter	5	11%			$4,200.55
Solve for			$2,492.82		

30.

	N	I/Y	PV	PMT	FV
Enter	360	6.1%/12	.80($550,000)		
Solve for				$2,666.38	

	N	I/Y	PV	PMT	FV
Enter	22 × 12	6.1%/12		$2,666.38	
Solve for			$386,994.11		

31.

	N	I/Y	PV	PMT	FV
Enter	6	2.40% / 12	$7,500		
Solve for					$7,590.45

Enter	6	18% / 12	$7,590.45		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$8,299.73

$8,299.73 – 7,500 = $799.73

35.

Enter	15	10%		$6,800	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$51,721.34		

Enter	15	5%		$6,800	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$70,581.67		

Enter	15	15%		$6,800	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$39,762.12		

36.

Enter		10% / 12		±$350	$35,000
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for	73.04				

37.

Enter	60		$65,000	±$1,320	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for		0.672%			

0.672% × 12 = 8.07%

38.

Enter	360	5.3% / 12		$950	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$171,077.26		

$250,000 – 171,077.26 = $78,922.74

Enter	360	5.3% / 12	$78,922.74		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$385,664.73

39.

CFo	$0
C01	$1,500
F01	1
C02	$0
F02	1
C03	$2,700
F03	1
C04	$2,900
F04	1

I = 8%
NPV CPT
$5,663.82

PV of missing CF = $7,300 – 5,663.82 = $1,636.18
Value of missing CF:

Enter	2	8%	$1,636.18		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$1,908.44

40.

CFo	$1,000,000
C01	$1,275,000
F01	1
C02	$1,550,000
F02	1
C03	$1,825,000
F03	1
C04	$2,100,000
F04	1
C05	$2,375,000
F05	1
C06	$2,650,000
F06	1
C07	$2,925,000
F07	1
C08	$3,200,000
F08	1
C09	$3,475,000
F09	1
C010	$3,750,000

I = 9%
NPV CPT
$15,885,026.33

41.

Enter	360		.80($4,500,000)	±$27,500	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for		0.702%			

APR = 0.702% × 12 = 8.43%

Enter	8.43%		12
	NOM	**EFF**	**C/Y**
Solve for		8.76%	

42.

Enter	3	13%			$115,000
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$79,700.77		

Profit = $79,700.77 – 76,000 = $3,700.77

Enter	3		±$76,000		$115,000
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for		14.81%			

43.

Enter	20	7%		$5,000	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$52,970.07		

Enter	5	7%			$52,970.07
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$37,766.93		

44.

Enter	96	6% / 12		$1,500	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$114,142.83		

Enter	84	12% / 12		$1,500	$114,142.83
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$134,455.36		

45.

Enter	15 × 12	8.7%/12		$1,500	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$552,490.07

FV = $522,490.07 = PV $e^{.08(15)}$; PV = $552,490.07$e^{-1.20}$ = $166,406.81

46. PV@ t = 14: $2,500 / 0.061 = $40,983.61

Enter	7	6.1%			$40,983.61
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$27,077.12		

47.

Enter	12		$26,000	±$2,513.33	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for		2.361%			

APR = 2.361% × 12 = 28.33%

Enter	28.33%		12
	NOM	**EFF**	**C/Y**
Solve for		32.31%	

48. Monthly rate = .12 / 12 = .01; semiannual rate = $(1.01)^6 - 1$ = 6.15%

Enter	10	6.15%		$5,300	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$38,729.05		

Enter	8	6.15%			$38,729.05
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$24,022.10		

Enter	12	6.15%			$38,729.05
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$18,918.99		

Enter	18	6.15%			$38,729.05
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$13,222.95		

49.

a.

Enter	5	7%		$20,000	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$82,003.95		

2nd BGN 2nd SET

Enter	5	7%		$20,000	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$87,744.23		

b.

Enter	5	7%		$20,000	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$115,014.78

2nd BGN 2nd SET

Enter	5	7%		$20,000	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$123,065.81

50. 2nd BGN 2nd SET

Enter	60	6.45% / 12	$73,000		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for				$1,418.99	

51. 2nd BGN 2nd SET

Enter	2×12	10.4% / 12	$2,300		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for				$105.64	

52. PV of college expenses:

Enter	4	7.5%		$45,000	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$150,719.68		

Cost today of oldest child's expenses:

Enter	14	7.5%			$150,719.68
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$54,758.49		

Cost today of youngest child's expenses:

Enter	16	7.5%			$150,719.68
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$47,384.31		

Total cost today = $54,758.49 + 47,384.31 = $102,142.80

Enter	15	7.5%	$102,142.80		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for				$11,571.48	

54. Option A:
Aftertax cash flows = Pretax cash flows(1 – tax rate)
Aftertax cash flows = $250,000(1 – .28)
Aftertax cash flows = $180,000

2^{ND} BGN 2^{nd} SET

Enter	31	7%		$180,000	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$2,413,627.41		

Option B:
Aftertax cash flows = Pretax cash flows(1 – tax rate)
Aftertax cash flows = $200,000(1 – .28)
Aftertax cash flows = $144,000

2^{ND} BGN 2^{nd} SET

Enter	30	7%		$144,000	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$1,786,901.93		

$1,786,901.93 + 530,000 = $2,316,901.93

56.

Enter	5 × 12	7.2% / 12	$29,000		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for				$576.98	

Enter	34	7.2% / 12		$576.98	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$17,697.79		

Total payment = Amount due(1 + Prepayment penalty) + Last payment
Total payment = $17,697.79(1 + .01) + $576.98
Total payment = $18,451.74

57. Pre-retirement APR:

Enter		11%	12
	NOM	**EFF**	**C/Y**
Solve for	10.48%		

Post-retirement APR:

Enter		8%	12
	NOM	**EFF**	**C/Y**
Solve for	7.72%		

At retirement, he needs:

Enter	240	7.72% / 12		$23,000	$1,000,000
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$3,022,336.00		

In 10 years, his savings will be worth:

Enter	120	10.48% / 12		$2,100	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$442,239.69

After purchasing the cabin, he will have: $442,239.69 – 320,000 = $122,239.69

Each month between years 10 and 30, he needs to save:

Enter	240	10.48% / 12	$122,239.69 ±		$3,022,336.00
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for				–$2,519.10	

58. PV of purchase:

Enter	36	6% / 12			$20,000
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$16,712.90		

$31,000 – 16,712.90 = $14,287.10

PV of lease:

Enter	36	6% / 12		$405	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$13,312.76		

$13,312.76 + 1,500 = $14,812.76

Buy the car.

You would be indifferent when the PV of the two cash flows are equal. The present value of the purchase decision must be $14,812.76. Since the difference in the two cash flows is $31,000 – 14,812.76 = $16,187.24, this must be the present value of the future resale price of the car. The break-even resale price of the car is:

Enter	36	6% / 12	$16,187.24		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$19,370.95

59.

Enter	5%		365
	NOM	**EFF**	**C/Y**
Solve for		5.13%	

CFo	$8,500,000
C01	$3,900,000
F01	1
C02	$4,600,000
F02	1
C03	$5,300,000
F03	1
C04	$5,800,000
F04	1
C05	$6,400,000
F05	1
C06	$7,300,000
F06	1

I = 5.13%
NPV CPT
$36,075,085.12

New contract value = $36,075,085.12 + 1,500,000 = $37,575,085.12

PV of payments = $37,575,085.12 – 10,000,000 = $27,575,085.12
Effective quarterly rate = $[1 + (.05/365)]^{91.25} – 1 = 1.258\%$

Enter	24	1.258%	$27,575,085.12		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for				$1,338,243.52	

60.

Enter	1		$17,000		±$20,000
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for		17.65%			

61.

Enter		9%	12
	NOM	**EFF**	**C/Y**
Solve for	8.65%		

Enter	12	8.65% / 12		$37,000 / 12	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$38,502.50

Enter	1	9%	$38,502.50		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$41,967.73

Enter	12	8.65% / 12		$39,000 / 12	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$40,583.72

Enter	60	8.65% / 12		$43,000 / 12	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$174,046.93		

Award = $41,967.73 + 40,583.72 + 174,046.93 + 150,000 + 25,000 = $431,598.39

62.

Enter	1		$9,700		±$10,800
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for		11.34%			

Enter	1		$9,800		±$11,100
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for		13.27%			

63. Refundable fee: With the $2,400 application fee, you will need to borrow $202,400 to have $200,000 after deducting the fee. Solve for the payment under these circumstances.

Enter	30 × 12	5.39% / 12	$202,400		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for				$1,123.94	

Enter	30 × 12		$200,000	±$1,123.94	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for		0.4506%			

APR = 0.4506% × 12 = 5.41%

Enter	5.41%		12
	NOM	**EFF**	**C/Y**
Solve for		5.54%	

Without refundable fee: APR = 5.30%

Enter	5.30%		12
	NOM	**EFF**	**C/Y**
Solve for		5.43%	

64.

Enter	36		$1,000	±$45.64	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for		2.98%			

APR = 2.98% × 12 = 35.71%

Enter	35.71%		12
	NOM	**EFF**	**C/Y**
Solve for		42.18%	

65. Without fee:

Enter		18.6% / 12	$10,000	±$200	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for	96.98				

Enter		8.2% / 12	$10,000	±$200	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for	61.39				

With fee:

Enter		8.2% / 12	$10,200	±$200	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for	62.92				

66. Value at Year 6:

Enter	5	11%	$500		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$842.53

Enter	4	11%	$600		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$910.84

Enter	3	11%	$700		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$957.34

Enter	2	11%	$800		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$985.68

Enter	1	11%	$900		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$999.00

So, at Year 6, the value is: $842.53 + 910.84 + 957.34 + 985.68 + 999.00
+ 1,000 = $5,695.39

At Year 65, the value is:

Enter	59	7%	$5,695.39		
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for					$308,437.08

The policy is not worth buying; the future value of the payments is $308,437.08 but the policy contract will pay off $275,000.

67. Effective six-month rate = $(1 + \text{Daily rate})^{180} - 1$
Effective six-month rate = $(1 + .09/360)^{180} - 1$
Effective six-month rate = .0460 or 4.60%

Enter	40	4.60%		$1,250,000	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$22,670,253.86		

Enter	1	4.60%			$22,670,253.86
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for			$21,672,827.50		

Value of winnings today = $22,670,253.86 + 2,500,000
Value of winnings today = $24,172,827.50

68.

CFo	±$11,000
C01	±$11,000
F01	5
C02	$25,000
F02	4

IRR CPT
8.54%

72.

a. APR = 7% × 52 = 364%

Enter	364%		52		
	NOM	**EFF**	**C/Y**		
Solve for		3,272.53%			

b.

Enter	1		$9.30		±$10.00
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for		7.53%			

APR = 7.53% × 52 = 391.40%

Enter	391.40%		52		
	NOM	**EFF**	**C/Y**		
Solve for		4,253.98%			

c.

Enter	4		$68.92	±$25	
	N	**I/Y**	**PV**	**PMT**	**FV**
Solve for		16.75%			

APR = 16.75% × 52 = 871.00%

Enter	871.00%		52		
	NOM	**EFF**	**C/Y**		
Solve for		314,215.72%			