Q1: A radio commercial for a loan company states: "Your will only pay 19¢ a day for each $200 borrowed." If you borrow $1000 for 120 days:

A. What amount must you repay the end of the 120 days?

\[ .19 \times 5 = 95 \text{¢ day} \]
\[ .95 \times 120 = 114 \text{¢ interest} \]
\[ \$1,114 \]

B. What annual interest rate is the company actually charging?

\[ I = Prt \]
\[ 114 = 1000 \times r \times \frac{1}{3} \]
\[ r = \frac{114 \times 3}{1000} = .342 \]

Q2: A credit union wants to offer a CD at an APY of 7.5%.

A. Find the equivalent annual nominal rate compounded quarterly.

\[ APY = \left(1 + \frac{r}{m}\right)^m \]
\[ .075 = \left(1 + \frac{r}{4}\right)^4 \]
\[ .075 = \left(1 + \frac{r}{4}\right)^4 \]
\[ r = .04 \]

B. Find the equivalent continuously compounded rate.

\[ APY = e^r - 1 \]
\[ .075 = e^r - 1 \]
\[ 1.075 = e^r \]
\[ r = \ln 1.075 \]

→ Q3: How long will it take money to double if it is invested at 8.2% compounded continuously?

\[ A = Pe^{rt} \]
\[ 2 = 1 e^{.082t} \]
\[ \ln 2 = .082t \]
\[ t = \frac{\ln 2}{.082} \]
\[ t = 8.453 \]
Q4: Rental cost for office space is measured in dollars per square foot. Rental costs have been going up at a rate of 4.8% per year compounded annually for the past 5 years. If office space is now $25 per square foot, what was the rental cost 5 years ago?

\[\text{\textbf{Formula}} \quad CI\]
\[A = P(1 + \frac{r}{m})^{mt}\]
\[25 = P(1 + .048)^5\]
\[P = \frac{25}{1.048^5}\]
\[P = 19.775\]

Q5: If $1,000 is deposited each quarter into an ordinary annuity paying 8% compounded quarterly,

A. Complete the balance sheet for the first three quarters.

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<th>period</th>
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<th>interest</th>
<th>balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,000.00</td>
<td>0.00</td>
<td>1,000.00</td>
</tr>
<tr>
<td>2</td>
<td>1,000.00</td>
<td>100.00</td>
<td>2,020.00</td>
</tr>
<tr>
<td>3</td>
<td>1,000.00</td>
<td>200.00</td>
<td>3,040.40</td>
</tr>
</tbody>
</table>

\[0.08/4 = 0.02\]
\[30,000 = 1000 \left(\frac{(1.02)^n - 1}{0.02}\right)\]
\[1.02^5 = 1.02^n\]
\[\ln 1.02 = \ln 1.02^n\]
\[N = \frac{\ln 1.02}{\ln 1.02} = 23.73\]

B. When will the account have a value of $30,000?

\[\text{\textbf{Formula}} \quad FV\]
\[F = 30,000\]
\[S = 1,000\]
\[I = 0.08/4 = 0.02\]
\[N = 23.73\]

Q6: A retiree has an annuity that pays 5.6% compounded semi-annually with a current balance of $50,000. He wants to make equal, semi-annual withdrawals so that at the end of 5 years the account balance is $0. What is the amount of each withdrawal?

\[\text{\textbf{Formula}} \quad PV\]
\[PV = PMT \left(\frac{1 - (1 + \frac{I}{S})^{-N}}{I}\right)\]
\[50,000 = PMT \left(\frac{1 - (1.028)^{-10}}{0.028}\right)\]
\[P = \frac{50,000}{\left(\frac{1 - (1.028)^{-10}}{0.028}\right)}\]
\[P = 5801.85\]
Q7: Joe takes out a $20,000 loan at 8.4% compounded monthly for 10 years.

Before you start this problem, be sure you set it up in your calculator and verify the monthly payment that is listed in the amortization table.

A. Complete the amortization table for the first two monthly payments.

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<th>Payment</th>
<th>interest</th>
<th>reduction on unpaid balance</th>
<th>unpaid balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>20,000</td>
</tr>
<tr>
<td>1</td>
<td>246.90</td>
<td>141.00</td>
<td>105.90</td>
<td>19893.10</td>
</tr>
<tr>
<td>2</td>
<td>246.90</td>
<td>139.25</td>
<td>107.65</td>
<td>19785.45</td>
</tr>
</tbody>
</table>

Formula

\[
P \times \frac{I}{12} \times (1 + \frac{I}{12})^N \cdot \frac{1}{(1 + \frac{I}{12})^N} = PV
\]

\[
\begin{align*}
P &= 20,000 \\
S &= 246.90 \\
I &= 0.007 \\
N &= 120
\end{align*}
\]

Answer:

B. After 3 full years of payments, Joe receives an inheritance and decides to pay off the balance on the loan.

A. What is Joe’s one-time payment that will retire the loan after 3 full years of payments?

Let \( N = 120 - 36 = 84 \) more payments

Then \( PV = 15,640.39 \)

B. How much in interest payments did Joe save by paying off the loan early?

\[
\text{Would have paid} \quad \frac{246.90}{84} \times 20,739.60 = 20,739.60
\]

\[
\text{Paid} \quad 15,640.39
\]

\[
\text{Saved} \quad 5099.21
\]
Q1: A radio commercial for a loan company states: "You will only pay 15¢ a day for each $200 borrowed."
If you borrow $1000 for 120 days:

A. What amount must you repay the end of the 120 days?

\[
\text{Rate per day} = 15\text{¢} = 0.15\% \\
\text{Total repayment} = 0.15\% \times 120 \times 1000 = 180 \\
\text{Repay} \quad 1800
\]

B. What annual interest rate is the company actually charging?

\[
\text{Formula: } \frac{\text{final amount}}{\text{principal}} = (1 + \text{rate})^\text{time} \\
\text{final amount} = 1.15 \\
\text{rate} = \frac{1.15 - 1}{\text{time}} = \frac{0.15}{120} = \frac{1}{800} \\
\text{Answer: } 0.1875\% \\
\]

Q2: A credit union wants to offer a CD at an APY of 6.9%.

A. Find the equivalent annual nominal rate compounded quarterly.

\[
\text{Formula: } \text{APY} = (1 + \text{rate})^\text{quarterly} - 1 \\
\text{rate} = \frac{0.069}{4} = 0.01625 \\
\text{Answer: } 6.728\%
\]

B. Find the equivalent continuously compounded rate.

\[
\text{Formula: } \text{CAPY} = \ln(1 + \text{rate}) \\
\text{rate} = \ln(1.069) \\
\text{Answer: } 0.0672\%
\]

Q3: How long will it take money to double if it is invested at 7.2% compounded continuously?

\[
\text{Formula: } \frac{A}{P} = e^{RT} \\
A = 2 \\
P = 1 \\
R = 0.072 \\
T = \ln\left(\frac{2}{1}\right) = 0.6270 \\
\text{Answer: } 9.627\text{ years.}
\]
Q4: Rental cost for office space is measured in dollars per square foot. Rental costs have been going up at a rate of 4.8% per year compounded annually for the past 5 years. If office space is now $30 per square foot, what was the rental cost 5 years ago?

\[
\text{Formula: } CI \\
P = 30 \\
P = 28.73 \\
I = .048 \\
N = 5 \\
\text{Answer: } $23.73
\]

Q5: If $1,000 is deposited each quarter into an ordinary annuity paying 12% compounded quarterly,

A. Complete the balance sheet for the first three quarters.

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<td>1,000.00</td>
</tr>
<tr>
<td>2</td>
<td>1,000.00</td>
<td>30.00</td>
<td>20,30.00</td>
</tr>
<tr>
<td>3</td>
<td>1,000.00</td>
<td>60.90</td>
<td>30,90.90</td>
</tr>
</tbody>
</table>

B. When will the account have a value of $30,000?

\[
\text{Formula: } FV \\
F = 30,000 \\
S = 1,000 \\
I = .12/4 = .03 \\
N = ? \\
\text{Answer: } 22 \text{ quarters } 5.5 \text{ years}
\]

Q6: A retiree has an annuity that pays 6.4% compounded semi-annually with a current balance of $40,000. He wants to make equal, semi-annual withdrawals so that at the end of 5 years the account balance is $0. What is the amount of each withdrawal?

\[
\text{Formula: } PV \\
P = 40,000 \\
S = 47,37.21 \\
I = .064/2 \\
N = 5.2 = 10 \\
\text{Answer: } $47,37.21
\]
Q7: Joe takes out a $20,000 loan at 9.6% compounded monthly for 10 years.

Before you start this problem, be sure you set it up in your calculator and verify the monthly payment that is listed in the amortization table.

A. Complete the amortization table for the first two monthly payments.

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<tr>
<td>1</td>
<td>259.89</td>
<td>160</td>
<td>99.89</td>
<td>19,900.10</td>
</tr>
<tr>
<td>2</td>
<td>259.98</td>
<td>159.20</td>
<td>100.78</td>
<td>19,799.32</td>
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B. After 3 full years of payments, Joe receives an inheritance and decides to pay off the balance on the loan.

A. What is Joe's one-time payment that will retire the loan after 3 full years of payments?

Let \( N = 7 \times 12 = 84 \) remaining payments

\[
P \cdot V = 15,851.64
\]

retrieves the loan with one payment of \( $15,851.64 \)

B. How much in interest payments did Joe save by paying off the loan early?

Would have made \( 84 \) payments of \( $259.89 \)

\[
259.89 \times 84 = 21,830.76 \quad \text{remaining payments paid}
\]

\[
15,851.64 \quad \text{amount saved}
\]

\[
5,979.12
\]
Q1: A radio commercial for a loan company states: "You will only pay 19¢ a day for each $200 borrowed."
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B. When will the account have a value of $30,000?

Formula: 

Answer: 

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<td></td>
<td></td>
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