Math 70 - Quiz #5 TH  Sections 3.2 – 3.4 Solutions

The work that I expect to see on the test is in **blue**. The original problem is in **black** and interpretations and explanations are in **red**. I have [underlined in red](#), the information in the stated problem that tells you which formula to use.

On the test, all non-monetary values should be shown with 3 significant digits to the right of the decimal point. i.e. 0.07028 is 0.0703, 0.1243 is 0.124. Monetary values can be rounded to two places to the right of the decimal point.

There is a blank quiz at the end of the solutions. You should retake this quiz if your grade suggests it. **If you used the correct methods, but got the wrong answer, check your calculator formula.** Even if you do your work without the math solver, I want the setup of the problem as done in class and on this explanation. I will not read through scribbled, crossed-out and scattered calculations trying to find partial credit. I will look for partial credit if your work is neat and readable.

Q1: What is the annual percentage yield for money invested at
A. if it is invested at 7.3% compounded quarterly => APY
B. if it is invested at 7.3% compounded continuously => CAPY

<table>
<thead>
<tr>
<th>A. Formula: APY</th>
</tr>
</thead>
<tbody>
<tr>
<td>E = .07502</td>
</tr>
<tr>
<td>R = .073</td>
</tr>
<tr>
<td>M = 4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Formula: CAPY</th>
</tr>
</thead>
<tbody>
<tr>
<td>E = .07573</td>
</tr>
<tr>
<td>R = .073</td>
</tr>
</tbody>
</table>

A. Ans: .0750 = 7.50%
B. Ans: .0757 = 7.57%

Q2: A company estimates it will need $80,000 in 6 years for replacement equipment. If it establishes a sinking fund by making fixed monthly payments into an account paying 6.5% compounded monthly.

A. How much should each payment be?
B. How much of the final $80,000 is interest?

fixed monthly payments => annuity
Since the annuity is growing, use FV, Future Value

<table>
<thead>
<tr>
<th>A. Formula: FV</th>
</tr>
</thead>
<tbody>
<tr>
<td>F = 80000</td>
</tr>
<tr>
<td>S = 911.461</td>
</tr>
<tr>
<td>R = .06512</td>
</tr>
<tr>
<td>N = 12 * 6 = 72</td>
</tr>
</tbody>
</table>

B. The only ways that money is put into the account are deposits and interest. Therefore, the interest is the final amount minus the total deposits. **If you want partial credit for incorrect answers, the interest calculation should be shown.**

total deposits = 911.46 * 72 = 65,625.12
interest = 80,000 – 65,625.12 = 14,374.88

A. Ans: $911.46
B. Ans: $14,374.88
Q3: A student took out a loan for $20,000 at 7.8% compounded monthly and amortized over 10 years. After four full years of 48 payments, he inherits some money and wants to pay off his loan. How much does he need to pay to retire his loan?

The fixed monthly payments \(=\) annuity

Since the annuity is a loan that is amortized (being depleted to a value of 0), use PV, Present Value. There are two steps to finding the answer to this question.

**Step 1** is to set up the loan, finding the monthly payment.

**Formula:** PV

\[
P = 20,000 \\
S = 240.5467 \\
I = .078/12 = .0065 \\
N = 10*12 = 120
\]

**Step 2** is to determine how much he still owes after making 48 payments, with \(120 - 48 = 72\) payments to go.

The Present Value of the loan gives the unpaid balance.

We get two slightly different answers if we change the payment to the rounded answer. Either answer will be acceptable.

\[
P = 13,796.1828 \\
S = 240.5467 \\
I = .078/12 = .0065 \\
N = 120-48 = 72
\]

\[
P = 13,796.369 \\
S = 240.55 \\
I = .078/12 = .0065 \\
N = 120-48 = 72
\]

Ans: $13,796.18 or $13,796.37

Q4: Ann makes her first $2000 deposit into an annuity earning 6.5% compounded annually on her 24th birthday and her last deposit on her 35th birthday (12 deposits).

With no additional deposits, the money in the IRA continues to earn 6.5% compounded annually until she retires thirty years later on her 65th birthday.

A. How much is in the IRA when she retires?

B. When she retires, how much of the money in the account is interest?

Annuity that is growing \(\Rightarrow\) FV, Future Value for 12 deposits

A single deposit (i.e. no additional deposits) \(\Rightarrow\) CI, compound interest. This is done in two steps.

**Step 1.** Calculate amt she has after the 12th deposit.

**Formula:** FV

\[
F = 34,741.42 \\
S = 2000 \\
I = .065 \\
N = 12
\]

**Step 2.** Calculate the amt she has after 30 more years making no further Deposits

**Formula:** CI

\[
A = 229,792.47 \\
P = 34741.42 \\
I = .065 \\
N = 30
\]

During the 42 years, she has deposited:

\[
\text{deposits} = 2,000 \times 12 = 24,000
\]

Therefore, all other money in the account is interest.

\[
\text{interest} = 229,792.47 - 24,000 = 205,792.47
\]

A. Ans: $229,792.47

B. Ans: $205,792.47
Q5: A couple takes out a $120,000 mortgage at 6.24% compounded monthly amortized over 30 years. Fill in the blanks on the amortization table:

amortized mortgage \( \Rightarrow \) PV, Present value
First, the monthly payment must be calculated:
Formula: PV

\[
P = 120,000
\]

\[
S = 738.08
\]

Except for the last payment, all payments are $738.08

\[
I = \frac{.0624}{12} = .0052
\]

\[
N = 30\times12 = 360
\]

Interest = Unpaid Balance * Monthly Interest Rate (I) = Unpaid Balance \( \times .0052 \)

Reduction on the Unpaid Balance = Payment – Interest = 738.08 – Interest

Unpaid Balance = Unpaid Balance – Reduction on Unpaid Balance

<table>
<thead>
<tr>
<th>Payment number</th>
<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>120,000</td>
</tr>
<tr>
<td>1</td>
<td>738.08</td>
<td>120,000 * 0.0052</td>
<td>738.08 – 624.00</td>
<td>120,000-114.08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>624.00</td>
<td>114.08</td>
<td>119,885.92</td>
</tr>
<tr>
<td>2</td>
<td>738.08</td>
<td>119,885.92 * 0.0052</td>
<td>738.08 – 623.41</td>
<td>119,885.92 – 114.67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>623.41</td>
<td>114.67</td>
<td>119,771.25</td>
</tr>
</tbody>
</table>
Show all of your calculator calculations. List the abbreviation of the formula you used and the values of the variables, with a box around the variable you solved for. In the box provided, list and label your final answers.

Q6: What is the annual percentage yield for money invested at
A. if it is invested at 7.3% compounded quarterly
B. if it is invested at 7.3% compounded continuously

A. Ans: ____________________
B. Ans: ____________________

Q7: A company estimates it will need $80,000 in 6 years for replacement equipment. If it establishes a sinking fund by making fixed monthly payments into an account paying 6.5% compounded monthly.
A. How much should each payment be?
B. How much of the final $80,000 is interest?

A. Ans: ____________________
B. Ans: ____________________

Q8: A student took out a loan for $20,000 at 7.8% compounded monthly and amortized over 10 years. After four full years of 48 payments, he inherits some money and wants to pay off his loan. How much does he need to pay to retire his loan?

Ans: ____________________
Q9: Ann makes her first $2000 deposit into an annuity earning 6.5% compounded annually on her 24th birthday and her last deposit on her 35th birthday (12 deposits in all). With no additional deposits, the money in the IRA continues to earn 6.5% compounded annually until she retires thirty years later on her 65th birthday.

A. How much is in the IRA when she retires?
B. When she retires, how much of the money in the account is interest?

Q10: A couple takes out a $120,000 mortgage at 6.24% compounded monthly amortized over 30 years. Fill in the blanks on the amortization table:

<table>
<thead>
<tr>
<th>Payment number</th>
<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>120,000</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A. Ans: __________________
B. Ans: __________________