Name: Solns

Directions:
This exam has 7 pages, including this page. Please make sure you have all 7 pages.

You have 75 minutes to complete this exam.

Please answer the following questions and make sure your answer are legible. If you don’t show work and/or I can’t follow it, I won’t give partial credit. You may use a calculator (not the calculator function on other technology) and the Formula Sheet that I provide you, nothing else. Good Luck.

There are 100 points on this test.

<table>
<thead>
<tr>
<th>Score</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out Of</td>
<td>10</td>
<td>13</td>
<td>21</td>
<td>25</td>
<td>15</td>
<td>16</td>
<td>100</td>
</tr>
</tbody>
</table>

Short Answer: This section is short answer. You should be able to answer these questions without doing any work (other than possibly addition or subtraction). You don’t need to show work for these questions.

1. (1 point) Rewrite \( \frac{1}{4} \% \) as a decimal. 
   \[ \text{.0025} \]

2. (1 point) One of these scenarios is best described as a (regular) loan the other is best described as a discount loan. Identify which is which.
   - *(Regular) Loan* George needs $713.50 for text books for the semester. So he borrows $713.50 in September and repays $763.50 in December.
   - *(Discount Loan)* Izzy is expecting a $763.50 royalty check from a small modeling job in December, but she could use the cash now. So she borrows $713.50 in September and signs over her $763.50 check in December.

3. (5 points) Identify each of the following in the scenario below:
   *Owen loans Teddy $1,500 on Monday, and Teddy repays Owen $1,505 on Friday.*
   (a) Creditor Owen
   (b) Debtor Teddy
   (c) Interest $5 \rightarrow 1505 - 1500 = 5$
   (d) Principal $1500$
   (e) Term 5 days [there are other reasonable answers here]

4. (3 points) Identify each of the following in the scenario below:
   *Preston bought a $5,000 Treasury bill for $4,940.*
   (a) Discount $60 \leftarrow 5000 - 4940$
   (b) Face Value $5000$
   (c) Proceeds $4,940$
5. (1 point) The following tables show the quarterly balance of 2 accounts that earn 8% annual interest. Identify which account is earning simple interest and which is earning compound interest:

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Balance at end of Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$2040.00</td>
</tr>
<tr>
<td>2</td>
<td>$2080.80</td>
</tr>
<tr>
<td>3</td>
<td>$2122.42</td>
</tr>
<tr>
<td>4</td>
<td>$2164.87</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$2040.00</td>
</tr>
<tr>
<td>2</td>
<td>$2080.00</td>
</tr>
<tr>
<td>3</td>
<td>$2120.00</td>
</tr>
<tr>
<td>4</td>
<td>$2160.00</td>
</tr>
</tbody>
</table>

6. (2 points) The Arizona Bank offers a CD with 2.5% interest compounded weekly an an APY of 2.53%
(a) What is the Effective Interest Rate of this account? 2.53%
(b) What is the Nominal Rate of this account? 2.5%

7. (3 points) Circle the best answer for each of the following. (Circle the answer that makes the statement true)
(a) A borrower will prefer a loan with a (Higher / Lower) Effective Interest Rate.
(b) A savings account will grow faster if the interest compounds (More Often / Less Often).
(c) The (Present Value / Future Value) is the ending amount of a loan.

Long Answer: The questions in this section require you to show work.

8. (7 points) The Seattle Grace Hospital needed to borrow money to replace some equipment that was damaged in flood. They borrowed $300,000 for 70 days at 10.5% simple interest, using the Banker’s Rule.
(a) What is the total amount the Hospital will repay?
(b) How much will the hospital pay in interest?

\[ I = PRT \]
\[ I = 300,000 \times 0.105 \times \frac{70}{360} \]
I = \$6,125

Total Amnt repayed = \$300,000 + \$6,125
\]

a) \$306,125.00 Hospital will repay
b) \$6,125.00 in interest
9. (7 points) Alex loaned Jo $700. Twenty weeks later Jo gave Alex $720 to pay off the loan. What simple interest rate did Jo pay?

\[ I = PRT \]
\[ I = 720 - 700 = 20 \]
\[ P = 700 \]
\[ R = \text{??} \]
\[ T = \frac{20}{62} \]

\[ 20 = 700 \cdot R \cdot \frac{20}{62} \]

\[ 0.074285714 = R \]

\[ 7.43\% \text{ is simple interest rate Jo paid} \]

10. (14 points) In 8 months, Mark is expecting a $68,400 insurance payout from an accident he was in, however Mark could really use the money now. He finds a discount loan with a simple discount rate of \( 8\frac{3}{4}\% \).

(a) What is the discount for Mark’s simple discount loan?

\[ D = M \cdot d \cdot T \]
\[ D = ? \]
\[ M = 68,400 \]
\[ d = 0.0875 \]
\[ T = \frac{8}{12} \]

\[ D = 68,400 \cdot 0.0875 \cdot \frac{8}{12} \]

\[ D = 3990 \]

(b) What is the equivalent simple interest rate for Mark’s simple discount loan?

\[ I = PRT \]
\[ I = 3990 \text{ use discount} \]
\[ P = 68,410 \text{ use proceeds} \]
\[ R = \text{??} \]
\[ T = \frac{8}{12} \]

\[ 3990 = 68,410 \cdot R \cdot \frac{8}{12} \]

\[ 0.09292... = R \]

\[ 9.29\% \text{ equiv simple interest} \]

(c) Instead of the simple discount loan, Callie found a bank that would give Mark a loan with a simple interest rate of 9%. Which is a better option for Mark (his simple discount loan or Callie’s loan)? You must explain/justify your answer.

\[ \boxed{\text{Mark is the borrower, so he chooses lower equiv simp. int. rate.} \quad \text{so he chooses 9% (not 9.29%)} \}

Mark will choose Callie’s Loan.
11. (7 points) Christina has just been named the godmother to 3 year old Zoia. Christina would like to give Zoia $5,000 when she goes away to college in 15 years. Christina finds an investment that is paying 4.58% annually compounded interest. How much should Christina invest today to reach her $5,000 goal?

\[ FV = PV (1 + i)^n \]
\[ FV = 5,000 \]
\[ 5,000 = PV (1 + .0458)^{15} \]

Christina should invest $2,554.11

12. (18 points) Richard has $3,020 that he wants to invest for a big anniversary surprise for his wife Adele in 3 years. Richard found an account with an interest rate of 4.2%, but he forgot to write down the rest of the information about the account (he was too stressed out from his job). How much will be in Richard's account after 3 years if...

(a) the interest is simple interest?
(b) the interest is compounded quarterly?
(c) the interest is compounded continuously?

(a) \( I = PRT \)
\[ I = 3020 \times .042 \times 3 \]
\[ I = 380.52 \]
Total Amount = 3020 + 380.52 = $3400.52

(b) \( FV = PV (1 + i)^n \)
\[ FV = 3020(1 + .042/4)^{12} \]
\[ FV = 3423.28 \]

* makes sense, compound interest should earn more than simple interest... same rate & time

(c) \( FV = PV e^{rt} \)
\[ FV = 3020 e^{(.042 \times 3)} \]
\[ FV = 3425.53 \]

* makes sense, continuously compounding interest should earn a little more than compound interest
13. (2 points) This question asks you for an approximate answer. You do not need to find an exact answer. Approximately how long will it take you to double your money at 3.84% compounded daily?

Doubling Time \( \approx \frac{72}{3.84} = 18.75 \) 

About 18.75 years
(you could have said about 19 years or a little less than 19 years)

14. (9 points) The Avery Foundation has a large sum of money to invest. Investment 1 will earn them 8.1% compounded monthly. Investment 2 will earn them 8.3%, compounded annually.

(a) What is the Effective Interest Rate of Investment 1? 8.41%
(b) What is the Effective Interest Rate of Investment 2? 8.3%
(c) Where should the Avery Foundation invest their money? You must explain/justify your answer.

\[ \text{Investment 1} \]
\[ FV = PV(1 + r)^n \]
\[ FV = 100 \left(1 + \frac{0.081}{12}\right)^{12} \]
\[ FV = 108.4075 \ldots \]
\[ \text{Int} = 8.4075 \ldots \]
\[ \text{8.41%} \]

\[ \text{Investment 2} \]
\[ \text{Eff. Int} = (1 + \frac{r}{n})^n - 1 \]
\[ \text{Eff. Int} = (1 + \frac{0.081}{12})^{12} - 1 \]
\[ \text{Eff. Int} = 0.084075 \ldots \]

\[ \text{8.3% is already an annual rate, so 8.3% is the eff. int. rkt} \]

\[ \text{The Avery Foundation is the lender, so they pick the higher eff. int. rkt (APY).} \]

\[ \text{Avery Foundation should choose Investment 1 (w/ eff. int. rkt 8.41%)} \]

15. (4 points) For the sequence \( a_n = 10 - 3n \), where the index starts with \( n = 1 \)

(a) Write out the first 3 terms of the sequence.

\[ 7, 4, 1, \ldots \]

(b) Find \( S_3 \) for this sequence.

\[ a_1 = 10 - 3 \cdot 1 = 7 \]
\[ a_2 = 10 - 3 \cdot 2 = 4 \]
\[ a_3 = 10 - 3 \cdot 3 = 1 \]

\[ S_3 = 7 + 4 + 1 = 12 \]

\[ \text{or Arith } a_1 = 7, d = 3 \]
\[ S_3 = \frac{n}{2} (a_1 + a_3) \]
\[ S_3 = \frac{3}{2} (7 + 1) = 12 \]
The last two questions (#16 and #17) should both be solved with sequences. One is Arithmetic, the other is Geometric. Make sure you make a correct decision about which is which.

16. (8 points) The Denny Duquette Memorial Clinic is keeping tracking of how much they’re spending on supplies. The first week of the year they spent $2,000 on supplies. The second week of the year the cost of their supplies went up by 1%. They assume that their expenses will continue to increase by 1% each week.

(a) How much will they spend on supplies the 52nd week of the year?

(b) How much will the Denny Duquette Memorial Clinic spend on supplies over the whole year?

\[
\begin{align*}
\text{index} & \quad \text{week} & \quad \text{amt on supplies} \\
0 & \quad 1 & \quad 2000 \\
1 & \quad 2 & \quad 2020 \\
2 & \quad 3 & \quad 2040.20 \\
\end{align*}
\]

(a) \[ a_n = a_0 \cdot r^n \]

\[
\begin{align*}
\text{amt on supplies} &= a_{52} = 2000 \cdot (1.01)^{51} \\
&= 3322.16
\end{align*}
\]

(b) \[ S_n = a_0 \cdot \frac{(1 - r^n)}{(1 - r)} \]

\[
\begin{align*}
\text{amt added whole year} &= S_{52} = \frac{2000 \cdot (1 - 1.01^{51})}{(1 - 1.01)} \\
&= 537.78
\end{align*}
\]

17. (8 points) Meredith’s mother is in an assisted living facility. In January 2015 she paid $3,800 to the assisted living facility. In February, the price increased by $50. Meredith assumes that the assisted living facility’s costs will continue to increase by $50 per month.

(a) How much will Meredith spend on the assisted living facility in August 2016 (her mother’s 20th month there)?

(b) How much will Meredith spend on the assisted living facility in the 20 month period from January 2015 to August 2016?

\[
\begin{align*}
\text{month} & \quad \text{amt on supplies} \\
1 & \quad \text{Jan} & \quad 3800 \\
2 & \quad \text{Feb} & \quad 3850 \\
3 & \quad \text{Mar} & \quad 3900 \\
\end{align*}
\]

(a) \[ a_{20} = 3800 + (20 - 1) \cdot 50 \\
= 3800 + 950 \\
= 4750 \quad \text{amt she will spend in Aug 2016} \\
\]

(b) \[ S_n = \frac{(3800 + 4750) \cdot 20}{2} \\
= 455000 \quad \text{total she will spend over 20 months} \\
\]

\[
\begin{align*}
\text{index} & \quad \text{Jan} & \quad \text{Feb} & \quad \text{Mar} & \quad \text{Apr} & \quad \text{May} & \quad \text{Jun} & \quad \text{Jul} & \quad \text{Aug} & \quad \text{Sep} & \quad \text{Oct} \\
\text{month} & \quad 1 & \quad 2 & \quad 3 & \quad 4 & \quad 5 & \quad 6 & \quad 7 & \quad 8 & \quad 9 & \quad 10 & \quad 11 & \quad 12 & \quad 13 & \quad 14 & \quad 15 & \quad 16 & \quad 17 & \quad 18 & \quad 19 & \quad 20
\end{align*}
\]
BONUS (2 pts): The following is a bonus question. IF YOU HAVE FINISHED THE ENTIRE TEST
you may choose ONE of these three parts to do.

(a) A simple discount note has a maturity value of $5,000 and a simple discount rate of 5%. If the proceeds
of the note are $4,897.26, what is the term of the note?

(b) Approximately how long will it take for $6,000 to grow to $24,000 in an account that earns 8.4% interest,
compounded quarterly? After you find your approximation, check it and determine how much will be in
the account after that length of time.

(c) Miranda has $10,000 invested in an investment that compounds quarterly. The investment has a APY
of 5.87%, what will her investment be worth in 2.5 years?

\[
\begin{align*}
\text{(a) } & D = M d T \\
& D = 102.74 = 5000 - 4197.26 \\
& M = 5000 \\
& d = 0.05 \\
& T = ? \\
& 102.74 = 5000 + 0.05 T \\
& 102.74 - 5000 = 0.05 T \\
& 509.74 = 0.05 T \\
& 10194.8 = T \\
& \text{check after 17 years.} \\
& 6000 \left(1 + \frac{0.084}{4}\right)^{6x} = 24,654.81 \\
& \text{amount in account after 17 years.} \\
& \text{try 16 years} \\
& 6000 \left(1 + \frac{0.084}{4}\right)^{6x} = 22,688.13 \quad \text{amount in account after 16 years.} \\
& \text{So the answer is just under 17 years.} \\
\end{align*}
\]

\[
\begin{align*}
\text{(c) APY of 5.87 means} \\
\text{treat } 5.87\% \text{ as annual} \\
\text{interest rate.} \\
10,000 \left(1 + \frac{0.087}{1}\right)^{42.5} = 11,532.73
\end{align*}
\]