TOTAL MARKS: 100

Enclose your final answer in a box and write it in ink. The value of each written-answer question is indicated beside it. If you encounter a question that asks for a written-answer question, present your response in the space provided. The value of each written-answer question is worth 0. For the written-answer questions, present your response in the space provided. Each correct answer is worth 4 marks; a question is worth 3 marks. If you have any incorrect answers, a score of 0 will be awarded. Each correct answer is worth 5 marks, and each incorrect answer is worth 0 marks. For the multiple choice questions, you can work out your work in the test booklet, but you must record your answer by outlining the appropriate letter on the answer sheet. Note: You must record your answer by outlining the appropriate letter on the answer sheet. This test consists of 10 multiple-choice questions, and each multiple-choice question is worth 4 marks. In addition, you should have a multiple-choice answer sheet, on which you should fill in your answers. Instructions: Fill in the information on this page and mark your test booklet. Do not use a calculator, unless instructed to do so.
\[
\begin{align*}
X &= 1000(1.02)^8 + 2000(1.02)^{-4} \\
&= 3019.35
\end{align*}
\]

A person owes $1,000 in 3 years and $2,000 in 6 years. If the interest rate is 8% compounded quarterly, then to pay off both debts in 5 years, he must then pay $\_$$\_$$\_$$\_$$.

\[\text{(marks)}\]

How many years will it take an investment to triple in value at an effective rate of 7%?

\[\text{(marks)}\]

\[\text{PART A. Multiple Choice}\]

\[\text{STUDENT NO.}\]

\[\text{NAME}\]
In the account will be closest to

\[ \text{E. 8,973.06} \]
\[ \text{D. 8,978.08} \]
\[ \text{C. 8,984.98} \]
\[ \text{B. 8,997.27} \]
\[ \text{A. 9,017.59} \]

The amount that will be earned in an account earning 6% compounded quarterly if the first deposit is made right away, then at the end of 10 years, the amount of $2000 is added, is closest to:

A. $4,875.05

At the beginning of the first year, $2000 is added to the account, and the interest rate is 6% compounded quarterly. If payments are made at the end of each month, then the principal repaid in the first payment is $500.

A loan of $22,000 is amortized over 10 years at an interest rate of 6% compounded monthly.

\[ R = \frac{1}{120} \times \left( 1 + \frac{.05}{120} \right) \]

\[ 25000 = R \times 120 \]

\[ 500 = \frac{120}{120} \times \frac{120}{120} \]
If a 5% bond has 5 years to maturity, semiannual coupons worth $5 each, and an annual yield of 7%, then its market price is $83.96.

\[ P = 100 \left( 1.035 \right)^{-1} + 3 \times 100 \left( 1.035 \right)^{-2} + \cdots + 3 \times 100 \left( 1.035 \right)^{-10} \]

6. [marks]

\[ \frac{1 - (1.01)^{-10}}{1 - (1.01)^{-2.5}} \times 500,000 = \frac{0.785}{0.785} \times 500,000 = 500,000 \times 1.01 \times (1.01)^{-2.5} \]

\[ R = $1,010,711 \]

If a $500,000 mortgage has monthly payments at the end of each month for 5 years and interest is 8% compounded semiannually, then the amount of each payment is $1,010.71.

5. [marks]
If \( a \neq h \), no solution.

If \( a = h \), unique solution:

\[
\begin{pmatrix}
0 & a - h & -2 \\
2 & 1 & 2 \\
4 & 2 & 3
\end{pmatrix}
\]

has no solution if the constant \( c \) is equal to:

\[
\begin{cases}
v = 2z + 4y \\
x = 3z + ay
\end{cases}
\]

The system of equations:

8. [matrices]

\[
\text{closest} \
\begin{pmatrix}
2.8 \\
2.767
\end{pmatrix}
\]

\[
\frac{[b_0 - 100(1.04)^h - 10]}{[b_0 - 100(1.04)^h - 10]}
\]

\[
\text{comp} = \frac{104}{90}
\]

where \( r = \text{semi-annual} \)

10. [multi]

\[
\text{floor} = 90 - 100(1.04)^{h-10}
\]

\[
\text{comp} = \text{semi-annual}
\]

If a $900 bond has 6 years until maturity, an annual yield rate of 8% and sells for $890, then

8. [matrices]

\[
\begin{pmatrix}
2.8 \\
2.767
\end{pmatrix}
\]

\[
\frac{[b_0 - 100(1.04)^h - 10]}{[b_0 - 100(1.04)^h - 10]}
\]

\[
\text{comp} = \frac{104}{90}
\]

where \( r = \text{semi-annual} \)

10. [multi]

\[
\text{floor} = 90 - 100(1.04)^{h-10}
\]
4 variables - 3 non-zero rows = 1 parameter

A. 3-parameter family of infinitely many solutions
B. 2-parameter family of infinitely many solutions
C. 1-parameter family of infinitely many solutions
D. no solutions

B has a 1-parameter family of infinitely many solutions
D has a 2-parameter family of infinitely many solutions

10. (6 marks)

The system of equations:

\[
\begin{pmatrix}
0 & 1 & 2 & 0 \\
1 & -1 & 0 & 1 \\
0 & -2 & 3 & -3
\end{pmatrix} \rightarrow 
\begin{pmatrix}
-2z + x &= 0 \\
-x + 2z &= 0 \\
3z - 3y &= 0
\end{pmatrix} \\
\rightarrow 
\begin{pmatrix}
x &= 0 \\
y &= \frac{2}{3}z \\
z &= z
\end{pmatrix}
\]

then continue as before.

Note: \(2\begin{pmatrix}0 & 1 & 0 \end{pmatrix} \rightarrow \begin{pmatrix}2 & -2 & 0 \end{pmatrix}\)

\[X = \begin{pmatrix}0 & 1 & 0 \end{pmatrix}^{-1} \begin{pmatrix}2 & -2 & 0 \end{pmatrix} \Rightarrow \begin{pmatrix}0 & 1 & 0 \end{pmatrix}X = \begin{pmatrix}0 & 1 & 0 \end{pmatrix} \begin{pmatrix}2 & -2 & 0 \end{pmatrix} \Rightarrow X = \begin{pmatrix}0 & 1 & 0 \end{pmatrix} \begin{pmatrix}2 & -2 & 0 \end{pmatrix} \Rightarrow X = \begin{pmatrix}0 & 1 & 0 \end{pmatrix} \begin{pmatrix}2 & 0 & 0 \end{pmatrix} \Rightarrow X = \begin{pmatrix}2 & 0 \end{pmatrix}\]
(a) The value of the semi-annual payment for the new annuity is

\[
\frac{[1 - (1.05)^{-15}]}{1 - (1.05)^{-15}} \times 500 = 500 \times \frac{[1 - (1.05)^{-15}]}{1 - (1.05)^{-15}}
\]

(b) The value of each of the two old annuities on January 1, 2005 (right after the payments were received)

\[
\begin{align*}
\text{Compo: } & \frac{0.05 \times 0.97628}{0.05 + 0.05} \approx 0.46567 \\
& \approx \frac{0.05 \times 0.97565}{0.05 + 0.05} \\
\text{per year} & \approx \frac{0.05 \times 0.97628}{0.05 + 0.05} \\
& \approx \frac{0.05 \times 0.97628}{0.05 + 0.05} \\
\end{align*}
\]

(c) The rate of the semi-annual period for each of the above two annuities

\[
\begin{align*}
\text{Compo: } & \frac{0.05 \times 0.97628}{0.05 + 0.05} \approx 0.46567 \\
& \approx \frac{0.05 \times 0.97565}{0.05 + 0.05} \\
\text{per year} & \approx \frac{0.05 \times 0.97628}{0.05 + 0.05} \\
& \approx \frac{0.05 \times 0.97628}{0.05 + 0.05} \\
\end{align*}
\]

1. Part B: Written Answer Questions

Name: 
Student No: 

[15 marks]
As we'll see, the monthly payment for a mortgage (let's call it $P$) is

\[ P = \frac{L \times r}{1 - (1 + r)^{-n}} \]

where:

- $L$ is the loan amount
- $r$ is the monthly interest rate
- $n$ is the number of payments

If the monthly payment is 34% of the mortgage (let's call it $M$), so we accept the monthly payment of

\[ M = P = 34\% \times M \]

Therefore, the monthly payment is

\[ P = 34\% \times M \]

Also, if the monthly payment is less than 0.05 of the mortgage, so we accept the monthly payment of

\[ P < 0.05 \times M \]

If we accept the monthly payment of $P$, then $P$ would be

\[ P = 34\% \times M \]

If the monthly payment is 30% of the mortgage, then $P$ would be

\[ P = 30\% \times M \]

If the monthly payment is 32% of the mortgage, then $P$ would be

\[ P = 32\% \times M \]

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\[ P = 32\% \times M \]

If the monthly payment is 30% of the mortgage, then $P$ would be

\[ P = 30\% \times M \]
Can check to see if soln. Is:

\[
\begin{bmatrix}
1 \\
-3 \\
5
\end{bmatrix}
\]

unique.

\[
\begin{pmatrix}
0 \\
1 \\
2
\end{pmatrix} \begin{pmatrix}
1 & 1 & 1 \\
-4 & 5 & -6 \\
2 & 4 & 3
\end{pmatrix} =
\begin{pmatrix}
1 \\
2 \\
3
\end{pmatrix} \begin{pmatrix}
y \\
x \\
2
\end{pmatrix} =
\begin{pmatrix}
z \\
y \\
x
\end{pmatrix}
\]

\[
\begin{cases}
0 = 2x - y + x \\
1 = 2x + 2y + x \\
2 = 2x + 2y + x
\end{cases}
\]

Find the solution(s) of the following system (if there are any):

Check only

\[
\begin{pmatrix}
1 & 0 & 0 \\
0 & 1 & 0 \\
0 & 0 & 1
\end{pmatrix} =
\begin{pmatrix}
1 & 1 & 1 \\
2 & 3 & 0 \\
1 & 2 & 3
\end{pmatrix}
\begin{pmatrix}
1 & 1 & 1 \\
4 & 5 & -6 \\
3 & 4 & 2
\end{pmatrix}
\]

The inverse is:

\[
\begin{pmatrix}
1 & 0 & 0 \\
0 & 1 & 0 \\
0 & 0 & 1
\end{pmatrix} =
\begin{pmatrix}
1 & 1 & 1 \\
2 & 3 & 0 \\
1 & 2 & 3
\end{pmatrix} \begin{pmatrix}
1 & -1 & 0 \\
0 & 1 & -1 \\
0 & 0 & 1
\end{pmatrix}
\begin{pmatrix}
1 & 1 & 1 \\
4 & 5 & -6 \\
3 & 4 & 2
\end{pmatrix}
\]

\[
\begin{pmatrix}
1 & 1 & 1 \\
0 & 1 & 0 \\
0 & 0 & 1
\end{pmatrix} =
\begin{pmatrix}
1 & 1 & 1 \\
2 & 3 & 0 \\
1 & 2 & 3
\end{pmatrix} \begin{pmatrix}
1 & 1 & 1 \\
0 & 1 & 0 \\
0 & 0 & 1
\end{pmatrix}
\begin{pmatrix}
1 & 1 & 1 \\
4 & 5 & -6 \\
3 & 4 & 2
\end{pmatrix}
\]

\[
\begin{pmatrix}
1 & 1 & 1 \\
0 & 1 & 0 \\
0 & 0 & 1
\end{pmatrix} =
\begin{pmatrix}
1 & 1 & 1 \\
2 & 3 & 0 \\
1 & 2 & 3
\end{pmatrix} \begin{pmatrix}
1 & 1 & 1 \\
0 & 1 & 0 \\
0 & 0 & 1
\end{pmatrix}
\begin{pmatrix}
1 & 1 & 1 \\
4 & 5 & -6 \\
3 & 4 & 2
\end{pmatrix}
\]

Find the inverse of the following matrix (if it exists):

\[
\begin{pmatrix}
1 & 0 & 0 \\
0 & 1 & 0 \\
0 & 0 & 1
\end{pmatrix}
\]

[15 marks]
First (the last) variable is obtained first in
was chosen so that D would be solved for.
Equations are possible. The order of the variables
Of course, many more options for the variables are
\[ W + D + H = 30 \]
\[ W + H + 100 = 0 \]
\[ W + H = 0 \]
\[ W = 0 \]
\[ H = 30 \]
\[ D = 0 \]
\[ W = 100 \]
\[ 330 - 2D = H \]
\[ 330 - 140 - 90 = 100 \]
\[ W = 330 - 2D - 3H \]
\[ 310 - 140 - 90 = 100 \]
\[ W = 100 \]
\[ H = 30 \]
\[ D = 0 \]
\[ D = \boxed{70} \]
\[ \begin{bmatrix} 0 & 1 & 0 & 0 \\ 69 & 2 & 1 & 0 \\ 39 & 0 & 2 & 1 \end{bmatrix} \]
\[ \begin{bmatrix} 10 & 0 & 0 & 1 \\ 390 & 1 & 2 & 0 \\ 200 & 1 & 2 & 0 \end{bmatrix} \]
\[ \begin{bmatrix} 0 & 0 & 0 & 1 \\ 300 & 0 & 2 & 1 \\ 330 & 0 & 2 & 1 \end{bmatrix} \]
\[ D + H = W \]
\[ W = 0 \]
\[ D = -1 \]
\[ H = -1 \]
\[ W = 200 \]
\[ W + D + H = 330 \]

How many hot dogs did she sell?

Together (each) bottle sold was the same as the number of hot dogs and hamburgers sold added
bottles of water sold was the same as the number of hot dogs and hamburgers sold that the number of
a total of 330. She also knows that she sold a total of 200 bottles and that the number of
of water, $5 for a hot dog and $3 for a hamburger. All the ends of the day she has made

A person is selling hot dogs, hamburgers and bottles of water. The prices are $5 for a bottle of

\[ \text{NAME} \]

STUDENT NO.