

Name (Print): \_\_\_\_\_

Username.#: \_\_\_\_\_

Math 1130  
Spring 2019  
Sample Midterm 3a  
4/11/19

Lecturer: \_\_\_\_\_

Rec. Instructor: \_\_\_\_\_

Rec. Time: \_\_\_\_\_

This exam contains 9 pages (including this cover page) and 9 problems. Check to see if any pages are missing. The exam is worth 100 points. The value of each question is listed below.

The following rules apply:

- You have **55 Minutes** to complete this exam.
- You may **not** use your books or notes on this exam.
- Please write clearly.
- **Partial Credit:** You are required to show your work on each problem of this exam. Incorrect answers with supporting work may receive partial credit. Any questions without supporting work will receive no credit. Partial credit might not be awarded on some questions.
- Calculators are permitted with the exception of calculators that have symbolic algebra or calculus capabilities. In particular, the following calculators (and their upgrades) are not permitted: TI-89, TI-92, TI-Nspire CX CAS, and HP-49. In addition, neither PDAs, laptops, nor cell phones are permitted.
- Unless otherwise specified, make sure your answers are in **exact form** (i.e. not a decimal approximation).
- Please write your answers in the boxes provided unless otherwise instructed.
- A random sample of graded exams will be copied before being returned.

Page	Points	Score
2	16	
3	12	
4	20	
5	15	
6	18	
7	19	
Total:	100	

1. You purchase a car using a loan of \$34,799.29. The loan will be repaid with monthly payments of \$600 at the end of every month for 72 months. The interest rate on the loan is a nominal rate of 7.4%, compounded monthly. Round all answers to two decimal places.

(a) (8 points) Fill out the given portion of an amortization schedule for this car loan.

Payment Number	Payment	Interest	Principle Repaid	Balance
0				34,799.29
1	600			
2	600			

(b) (4 points) Compute the Principle in the 44<sup>th</sup> payment.

$$\text{Prin}_{44} = \boxed{\phantom{000000}}$$

(c) (4 points) Compute the Interest in the 52<sup>nd</sup> payment.

$$\text{Int}_{52} = \boxed{\phantom{000000}}$$

2. Determine the indicated values for the following problems.

- (a) (6 points) The entries of a  $2 \times 3$  matrix are given by the formula  $A_{ij} = i(2i - j)$ . Fill in the blanks in the matrix using the given formula.

$$\begin{pmatrix} \underline{\hspace{2cm}} & \underline{\hspace{2cm}} & \underline{\hspace{2cm}} \\ \underline{\hspace{2cm}} & \underline{\hspace{2cm}} & \underline{\hspace{2cm}} \end{pmatrix}$$

- (b) (6 points) Let  $A = \begin{pmatrix} x^2 & y^2 \\ -2z & x + y \end{pmatrix}$  and  $B = \begin{pmatrix} 36 & 9 \\ -8 & -3 \end{pmatrix}$ . Solve for  $x$ ,  $y$ , and  $z$  in the matrix equation  $A = B$ .

$x = \boxed{\phantom{000}}$

$y = \boxed{\phantom{000}}$

$z = \boxed{\phantom{000}}$

3. Let  $A = \begin{pmatrix} 5 & -6 \\ -2 & 3 \end{pmatrix}$  and  $B = \begin{pmatrix} 4 & -7 \\ -1 & 11 \end{pmatrix}$ . Use matrices  $A$  and  $B$  for the following parts.

(a) (4 points) Write the matrix  $A^T$ .

$$A^T = \begin{pmatrix} \underline{\hspace{2cm}} & \underline{\hspace{2cm}} \\ \underline{\hspace{2cm}} & \underline{\hspace{2cm}} \end{pmatrix}$$

(b) (10 points) Compute the matrix  $AB - 3B$ .

$$AB - 3B = \begin{pmatrix} \underline{\hspace{2cm}} & \underline{\hspace{2cm}} \\ \underline{\hspace{2cm}} & \underline{\hspace{2cm}} \end{pmatrix}$$

4. (6 points) Suppose  $a_n$  is a geometric sequence with  $a_1 = -12$  and  $a_4 = \frac{81}{2}$ . What is  $a_3$ ?

$$a_3 = \boxed{\hspace{2cm}}$$

5. Answer the following parts about the given system of equations:

$$\begin{cases} 4x + 2y - z = 12 \\ 3x + 2z = 19 \\ -2y + z = 8 \end{cases}$$

(a) (9 points) Solve for  $x$ ,  $y$ , and  $z$ .

$x = \boxed{\phantom{000}}$

$y = \boxed{\phantom{000}}$

$z = \boxed{\phantom{000}}$

(b) (6 points) Write the given system of equations as one matrix equation of the form  $AX = B$ .

6. (9 points) You wish to start saving for retirement by making deposits into a retirement account at the end of every month for the next 40 years. Your deposits are \$300 each. Assume that your retirement account earns interest at 7.5%, compounded monthly. How much do you have at the end of the 40 year period? *Hint: Your answer should be between \$800,000 and \$1,000,000.*

The account balance is

7. (9 points) You have saved \$800,000 for retirement. You plan to be retired for 30 years, and you would like to use all of your retirement savings by taking equal monthly payments from your retirement account at the end of every month. Assuming that the account earns interest at 9%, compounded monthly, how much are the payments?

The payments are



Scrap work

## Some Useful Formulas

$$A = Ra_{\overline{n}|r} = R \cdot \left[ \frac{1 - (1 + r)^{-n}}{r} \right]$$

$$R = \frac{A}{a_{\overline{n}|r}} = A \cdot \left[ \frac{r}{1 - (1 + r)^{-n}} \right]$$

$$S = Rs_{\overline{n}|r} = R \cdot \left[ \frac{(1 + r)^n - 1}{r} \right]$$

$$R = \frac{S}{s_{\overline{n}|r}} = S \cdot \left[ \frac{r}{(1 + r)^n - 1} \right]$$

$$\text{Int}_k = R \cdot [1 - (1 + r)^{-n+k-1}]$$

$$\text{Prin}_k = R \cdot (1 + r)^{-n+k-1}$$

$$\sum_{i=1}^{\infty} a \cdot r^{i-1} = \frac{a}{1 - r}$$

$$\sum_{i=1}^k a \cdot r^{i-1} = \frac{a(1 - r^k)}{1 - r}$$