Math 1130
Autumn
Sample Exam 3a

This exam contains 9 pages (including this cover page) and 8 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	14	
3	14	
4	12	
5	18	
6	20	
7	22	
Total:	100	

1. You plan to buy a home valued at $200,000. To do so, you take out a 30 year loan. The interest on the loan is charged at a nominal rate of 4.5%, compounded monthly. Round answers to two decimal places.

    (a) (7 points) What is your monthly payment?

    The monthly payment is

    (b) (2 points) What is the finance charge on the loan?

    The finance charge is

2. (5 points) Determine A and B in the matrix equation $AX = B$, with A as the coefficient matrix of the system and $X = \begin{pmatrix} x \\ y \end{pmatrix}$

$$\begin{cases} 2x + 3y & = 7 \\ -2x + 5y & = -3 \end{cases}$$

$$A = \begin{pmatrix} \underline{\quad} & \underline{\quad} \\ \underline{\quad} & \underline{\quad} \end{pmatrix}$$

$$B = \begin{pmatrix} \underline{\quad} \\ \underline{\quad} \end{pmatrix}$$

3. You purchase a car using a loan of $21,144.91. The loan will be repaid with monthly payments of $400 at the end of every month for 60 months. The interest rate on the loan is a nominal rate of 5.1%, compounded monthly.

   (a) (7 points) Fill out the given portion of an amortization schedule for this car loan. Make sure to round entries to two decimal places.

Payment Number	Payment	Interest	Principle Repaid	Balance
0				$21,144.91$
1	400			
2	400			

   (b) (3 points) Compute the Principle in the 47th payment.

$$\text{Prin}_{47} = \boxed{}$$

   (c) (4 points) Compute the Interest in the 32nd payment.

$$\text{Int}_{32} = \boxed{}$$

4. Determine the indicated values for the following problems.

   (a) (5 points) The entries of a 2×3 matrix are given by the formula $A_{ij} = i^2 \times j - i \times j$. Fill in the blanks in the matrix using the given formula.

$$\begin{pmatrix} \underline{\hphantom{xx}} & \underline{\hphantom{xx}} & \underline{\hphantom{xx}} \\ \underline{\hphantom{xx}} & \underline{\hphantom{xx}} & \underline{\hphantom{xx}} \end{pmatrix}$$

   (b) (7 points) Let $A = \begin{pmatrix} x^2 & y^2 \\ -z & x+y \end{pmatrix}$ and $B = \begin{pmatrix} 16 & 25 \\ -2 & -1 \end{pmatrix}$. Solve for $x, y,$ and z in the matrix equation $A = B$.

$x = \boxed{}$

$y = \boxed{}$

$z = \boxed{}$

5. Let $A = \begin{pmatrix} 4 & 6 \\ -3 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & -7 \\ -1 & 10 \end{pmatrix}$. Compute the indicated matrix operations in the following parts using matrices A and B.

   (a) (9 points) Compute $A^T A$.

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

   (b) (9 points) Compute the matrix $2A - 3B$.

$$2A - 3B = \begin{pmatrix} \underline{} & \underline{} \\ \underline{} & \underline{} \end{pmatrix}$$

6. Perform the indicated augmented coefficient matrix operations. Circle your answer in both parts.

   (a) (9 points) Put the following system of equations into an augmented coefficient matrix.

   $$\begin{cases} 3x - 2y + z & = 23 \\ 2x + 3z & = 8 \\ 2y - z & = -2 \end{cases}$$

   (b) (11 points) Row reduce your result from part (a).

7. (10 points) Solve the given nonlinear system of equations. Give your answers as or-
   dered pairs, and separate multiple solutions with commas. Round any repeating
   decimals to two places.

$$\begin{cases} 2x^2 + y^2 & = 3 \\ 3x + y & = 2 \end{cases}$$

$$(x, y) = \boxed{}$$

8. (12 points) The supply and demand equations for a certain product are

$$\begin{cases} 3q - 230p + 1588 = & 0 \\ 3q + 220p - 2651 = & 0 \end{cases}$$

p is given in dollars. Determine the equilibrium price, p, to the nearest penny.

$$p = \boxed{}$$

Scrap work

Some Useful Formulas

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

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

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

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

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

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