Name (Print): _____

Username.#: _____

Lecturer: _____

Rec. Instructor: _____

Rec. Time: _____

Math 1130
Spring
Sample Midterm 3a

This exam contains 10 pages (including this cover page) and 10 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.
- You are required to show your work on Problems 5, 6, 7, 8, and 9.
  No work is required for Problems 1, 2, 3, 4 or 10.
- **Partial Credit**: Incorrect answers with supporting work may receive partial credit.
  Problems 5, 6, 7, 8, and 9 will receive no credit if there is no supporting work.
  Partial credit may not be awarded on some problems.
- 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	10	
3	8	
4	15	
5	15	
6	16	
7	20	
8	16	
Total:	100	

1. Answer the following multiple choice problems. You do **not** need to show your work.

   (a) (5 points) A manufacturer of dining-room sets produces two styles: early American and contemporary. From past experience, management has determined that 20% more of the early American styles can be sold than the contemporary styles. A profit of \$130 is made on each early American set sold, whereas a profit of \$200 is made on each contemporary set. Let x be the number of early American style set sold and let y be the number of contemporary sets sold.

   Suppose management desires a total profit of \$250,000. Which of the following systems of equations must x and y satisfy? **Circle the correct answer. DO NOT SOLVE THIS SYSTEM OF EQUATIONS!**

   (a) $\begin{cases} x + y = 250,000 \\ \frac{x}{130} + \frac{y}{200} = 1 \end{cases}$

   (b) $\begin{cases} x + y = 250,000 \\ \frac{x}{130} + \frac{y}{200} = 0.20 \end{cases}$

   (c) $\begin{cases} 130x + 200y = 250,000 \\ x - 1.2y = 0 \end{cases}$

   (d) $\begin{cases} 130x + 200y = 250,000 \\ x + 1.2y = 0 \end{cases}$

   (e) $\begin{cases} 130x - 1.2y = 0 \\ -x + 200y = 0 \end{cases}$

   (f) None of the above

   (b) (5 points) To save up for a big purchase, you make deposits of \$50 at the end of each month for 10 years into an account that accumulates interest at 6% compounded monthly. How much do you have at the end of 10 years (rounded to the nearest dollar)?

   (a) \$659 (b) \$4505 (c) \$7908

   (d) \$8194 (e) \$8749 (f) None of the above

2. Answer each of the following short answer questions. You do **not** need to show your work.

   (a) (4 points) Solve the given linear system of equations.

$$\begin{cases} x + 4y & = 4 \\ -2x - 8y & = -8 \end{cases}$$

   Check the correct entry. This system of equations has

   ☐ no solutions

   ☐ exactly one solution which is $x =$ ☐ , $y =$ ☐ (fill in the blank)

   ☐ at least two solutions

   (b) (4 points) Solve the given linear system of equations.

$$\begin{cases} x + 3y = & 7 \\ -x - 5y = & 0 \end{cases}$$

   Check the correct entry. This system of equations has

   ☐ no solutions

   ☐ exactly one solution which is $x =$ ☐ , $y =$ ☐ (fill in the blank)

   ☐ at least two solutions

3. Answer the following multiple choice problems. You do **not** need to show your work.

(a) (5 points) Suppose the following is a geometric sequence. Determine the missing term in this sequence. **Circle the correct answer below.**

$$9, \quad -3, \quad \_\_\_\_$$

(a) -15 (b) -1 (c) 0

(d) 1 (e) 3 (f) None of the above

(b) (5 points) Suppose the following is an arithmetic sequence. Determine the missing term in this sequence. **Circle the correct answer below.**

$$-4, \quad 2, \quad \_\_\_\_$$

(a) -8 (b) -1 (c) 0

(d) 1 (e) 8 (f) None of the above

(c) (5 points) Consider a loan of \$1,020,304 which is repaid by 360 monthly payments of \$4989.46 at the end of each month for the next 30 years. This corresponds to an interest rate of 4.2% compounded monthly. What amount of the first payment is interest (rounded to the nearest dollar)?

(a) \$42,853 (b) \$3,571 (c) \$1418

(d) \$210 (e) \$17 (f) None of the above

4. Answer the following short answer problems. You do **not** need to show work.

   (a) (5 points) Consider a loan of \$55,555 which is repaid by 30 annual payments of \$4,476.98 at the end of each year for the next 30 years. This corresponds to an interest rate of 7% compounded annually. What is the total amount of interest paid over the course of the loan (rounded to the nearest dollar)?

   Answer: ____

   (b) (6 points) The entries of a 2×3 matrix are given by the formula $A_{ij} = i^2 + 4j$. Fill in the blanks in the matrix using the given formula.

$$\begin{pmatrix} \_\_\_\_\_ & \_\_\_\_\_ & \_\_\_\_\_ \\ \_\_\_\_\_ & \_\_\_\_\_ & \_\_\_\_\_ \end{pmatrix}$$

   (c) (4 points) Let $C = \begin{pmatrix} 2 & 0 & 4 & 4 \\ -1 & 0 & 1 & -2 \end{pmatrix}$ and $D = \begin{pmatrix} -2 & 4 & 3 \\ 4 & 1 & -1 \\ 1 & 0 & -2 \\ 0 & -1 & 1 \end{pmatrix}$. Then the product CD is a _____$\times$_____ matrix.

5. (8 points) A manufacturer of a certain product sells all that is produced. Determine the break-even point if the product is sold at \$32 per unit, fixed cost is \$30,000, and variable cost is $y_{VC} = 16q$, where q is the number of units produced.

$q =$ ____

6. (8 points) You borrow 500,000 which will be repaid over the next 15 years with quarterly payments of X. The interest rate charged on the loan is 3% compounded quarterly. Find X rounded to two decimal places. **Write the formula that you use to calculate** X.

$X =$ ____

7. (10 points) You are given the following supply and demand equations:

$$\begin{cases} S(q) &= \frac{q}{60} + 20 \\ D(q) &= \frac{7500}{q} \end{cases}$$

Determine the equilibrium quantity, q. Show all of your work. **No credit will be given to calculator solutions.**

$q =$ ☐

8. (10 points) Solve the given nonlinear system of equations. Give your answers as ordered pairs of integers and/or fractions, and separate multiple solutions with commas. Show all of your work. **No credit will be given to calculator solutions.**

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

$(x, y) =$ ☐

9. (8 points) Multiply the following matrices. Write your result in the space provided.

$$\begin{pmatrix} -3 & 1 \\ 0 & 2 \end{pmatrix} \begin{pmatrix} 3 & 6 \\ -1 & 2 \end{pmatrix} = \begin{pmatrix} \_\_\_\_ & \_\_\_\_ \\ \_\_\_\_ & \_\_\_\_ \end{pmatrix}$$

10. Let $A = \begin{pmatrix} 2 & 0 \\ -2 & 3 \end{pmatrix}$ and $B = \begin{pmatrix} -1 & 1 \\ 2 & 5 \end{pmatrix}$. Find the indicated matrix in the following parts using matrices A and B. **You do not need to show work for this problem.**

(a) (4 points) Find A^T

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

(b) (4 points) Find $A - 3B$

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

Some Useful Formulas

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

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

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

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

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

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

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

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

Scrap work