

Name (Print): _____

Username.#: _____

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

Lecturer: _____

Rec. Instructor: _____

Rec. Time: _____

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 8 and 9.
No work is required for Problems 1, 2, 3, 4, 5, 6, 7 or 10.
- **Partial Credit:** Incorrect answers with supporting work may receive partial credit. Problems 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	14	
3	15	
4	20	
5	8	
6	13	
7	20	
8	10	
Total:	100	

1. (6 points) You are given the following matrix equation:

$$\begin{bmatrix} -5 & 1 \\ 3 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2 \\ -4 \end{bmatrix}$$

Write the matrix equation as a system of two equations in the unknowns x and y in the space provided. **DO NOT SOLVE THIS SYSTEM OF EQUATIONS!**

2. (8 points) Multiply the following matrices. Write your result in the space provided.

$$\begin{pmatrix} -3 & 4 \\ 0 & 2 \end{pmatrix} \begin{pmatrix} -1 & 8 \\ 1 & 5 \end{pmatrix} = \begin{pmatrix} \underline{\hspace{1cm}} & \underline{\hspace{1cm}} \\ \underline{\hspace{1cm}} & \underline{\hspace{1cm}} \end{pmatrix}$$

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

(a) (5 points) Solve the given linear system of equations.

$$\begin{cases} 2x - y = 5 \\ 3x + y = 0 \end{cases}$$

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

(b) (5 points) Solve the given linear system of equations.

$$\begin{cases} 2x - y = 5 \\ -4x + 2y = 10 \end{cases}$$

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

(c) (5 points) You borrow 10,000 which is repaid by 30 annual payments of 640.12 which corresponds to an annual interest rate charged of 4%. What is the total interest paid (also known as the finance charge) for the loan rounded to the nearest dollar?

The finance charge is

4. You purchase a car using a loan of \$13,392.56. The loan will be repaid with monthly payments of \$300 at the end of every month for 48 months. The interest rate on the loan is a nominal rate of 3.6%, compounded monthly.

- (a) (10 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				13,392.56
1	300			
2	300			

- (b) (5 points) Find the principle in the 30th payment, rounded to the nearest dollar. **Circle the correct answer.**

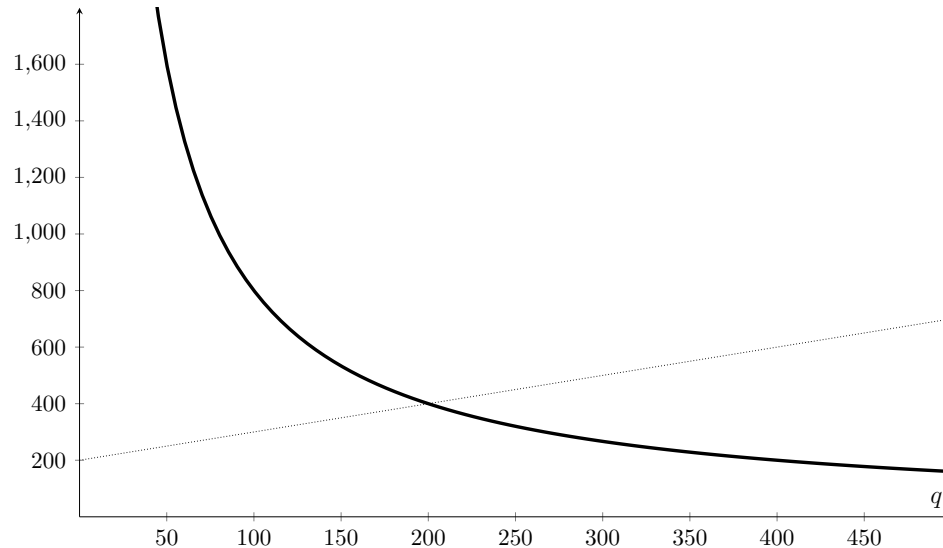
- (a) \$273 (b) \$153 (c) \$12652
 (d) \$283 (e) \$6840 (f) None of the above

- (c) (5 points) Find the interest in the 22nd payment, rounded to the nearest dollar. **Circle the correct answer.**

- (a) \$8238 (b) \$1041 (c) \$185
 (d) \$25 (e) \$23 (f) None of the above

5. Answer the following short answer and multiple choice question.

- (a) (4 points) The graph below represents the supply equation (the straight line) and demand equation (the bolded line) for some product. The horizontal axis represents quantity of units sold, and the vertical axis represents price in dollars.



Use the plot to estimate all equilibrium points.

$$(q, p) = \boxed{}$$

- (b) (4 points) A chemical manufacturer wishes to fill an order for 1000 gallons of a 25% acid solution. Solutions of 20% and 35% are in stock. Let x be the amount (in gallons) of 20% solution and y be the amount (in gallons) of 35% solution that must be mixed to fill the order. Which of the following systems of equations must x and y satisfy? **Circle the correct answer. DO NOT SOLVE THIS SYSTEM OF EQUATIONS!**

(a)
$$\begin{cases} .20x + .35y = .25 \\ x + y = 1000 \end{cases}$$

(b)
$$\begin{cases} .20x + y = 1000 \\ x + .35y = 250 \end{cases}$$

(c)
$$\begin{cases} .20x + .35y = .25 \\ x - y = 0 \end{cases}$$

(d)
$$\begin{cases} .20x + .35y = 250 \\ x + y = 1000 \end{cases}$$

(e)
$$\begin{cases} x = .20(1000 - y) \\ y = .35(1000 - x) \end{cases}$$

(f) None of the above

6. Let $A = \begin{pmatrix} 3 & 2 \\ -1 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & -4 \\ -4 & 1 \end{pmatrix}$. Find the indicated matrix in the following parts using matrices A and B .

(a) (3 points) Find A^T

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

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

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

(c) (3 points) Find $A - B$

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

7. (4 points) Let $C = \begin{pmatrix} 3 & 2 & 4 \\ -1 & 0 & 2 \end{pmatrix}$ and $D = \begin{pmatrix} 2 & -4 & 3 & 1 \\ -4 & 1 & 2 & 0 \\ 4 & 3 & 5 & -1 \end{pmatrix}$. Then the product CD is a $\underline{\hspace{1cm}} \times \underline{\hspace{1cm}}$ matrix.

8. (10 points) You borrow \$250,000 which will be repaid over the next 15 years with monthly payments of X . The interest rate charged on the loan is 4.2% compounded monthly. Find X rounded to two decimal places. **Write the formula that you use to calculate X .**

The monthly payment is

9. (10 points) Solve the given nonlinear system of equations. Give your answers as ordered pairs, and separate multiple solutions with commas. Show all of your work. No credit will be given to calculator solutions.

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

$(x, y) =$

10. For each of the following multiple choice questions, **circle the correct answer**.
You do **not** need to show your work.

(a) (5 points) A company invests X (in dollars) at the end of each year for 8 years, and the invested amount earns interest at a rate of 5%, compounded annually. At the end of the 8th year, the company's total investment is worth \$100,000. Find X , rounded to the nearest dollar.

- (a) \$10,472 (b) \$12,500 (c) \$15,472
(d) \$646,321 (e) \$954,911 (f) None of the above

(b) (5 points) Find the term a_4 of the sequence defined recursively as follows:

$$a_1 = 1 \quad \text{and} \quad a_{k+1} = k - a_k \quad \text{for } k \geq 1.$$

- (a) 0 (b) 1 (c) 2
(d) 3 (e) 4 (f) None of the above

Some Useful Formulas

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

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

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

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

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

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

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

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

Scrap work