Name (Print): _____

Username.#: _____

Lecturer: _____

Rec. Instructor: _____

Rec. Time: _____

Math 1130
Autumn
Sample Final B

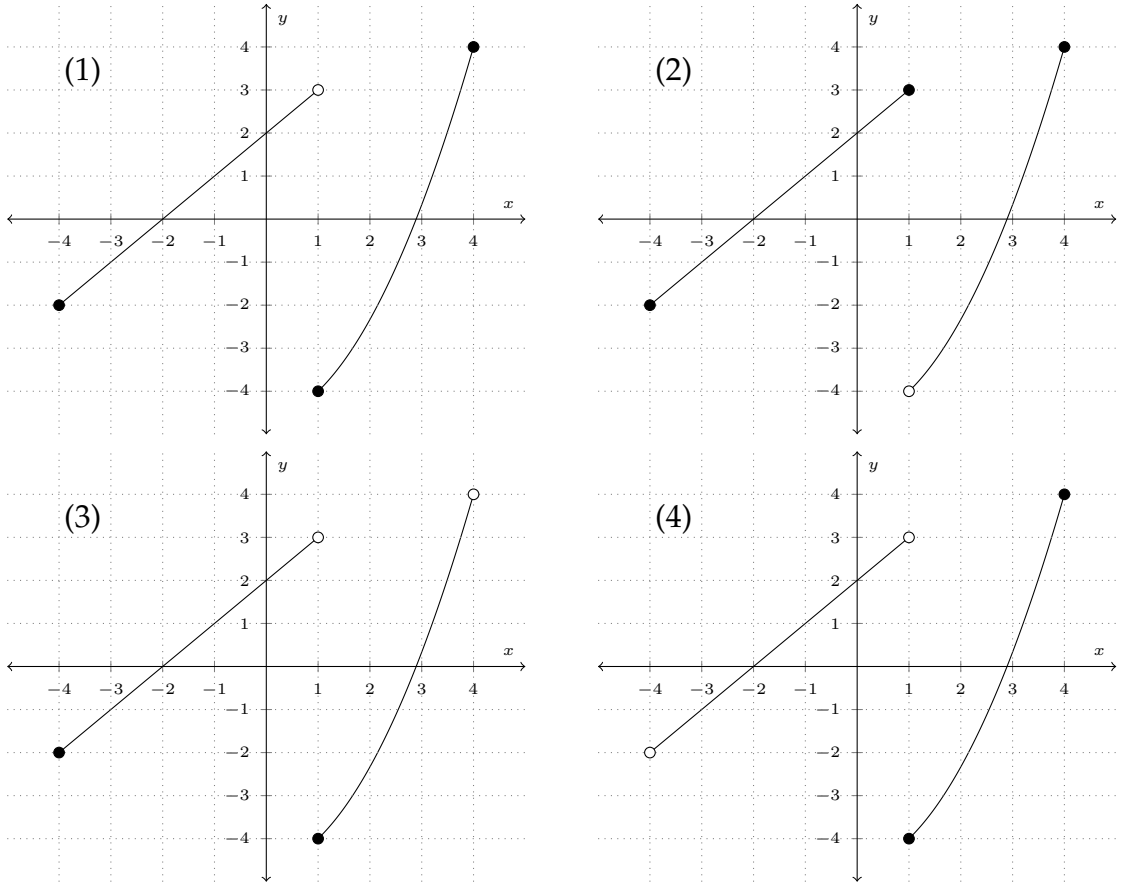
This exam contains 11 pages (including this cover page) and 10 problems. Check to see if any pages are missing. The exam is worth 200 points. The value of each question is listed below.

The following rules apply:

- You have **105 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, 9 and 10.
  No work is required for Problems 1, 2, 3 or 4.
- **Partial Credit**: Incorrect answers with supporting work may receive partial credit.
  Problems 5, 6, 7, 8, 9 and 10 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.

Page:	2	3	4	5	6	7	8	9	Total
Points:	18	26	28	14	30	36	24	24	200
Score:									

1. The graphs shown here (labeled (1)-(4)) satisfy certain characteristics. Match the description given in each part with one of the graphs shown here. Graphs may be used more than once.



(a) (6 points) This graph represents a function with domain $(-4, 4]$.

The answer to part (a) is ☐

(b) (6 points) This graph represents a function with range $(-4, 4]$.

The answer to part (b) is ☐

(c) (6 points) This graph represents the piecewise function

$$f(x) = \begin{cases} x + 2 & \text{if } -4 \leq x \leq 1 \\ \frac{1}{2}x^2 + \frac{1}{6}x - \frac{14}{3} & \text{if } 1 < x \leq 4 \end{cases}$$

The answer to part (c) is ☐

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

   (a) (8 points) An investor will invest a total of \$25,000 into two accounts for one year. One account accumulates interest at 4% compounded annually and the other account accumulates interest at 5% compounded annually. She wants to earn \$1100 interest in total over the year. Let x be the amount that is invested in the 4% interest account and let y be the amount that is invested in the 5% interest account. Set up the system of two equations that can be solved for x and y. **DO NOT SOLVE THIS SYSTEM OF EQUATIONS.**

   (b) (6 points) If $A = \begin{pmatrix} 2 & -4 & 3 & 1 \\ -4 & 1 & 2 & 0 \\ 4 & 3 & 5 & -1 \end{pmatrix}$ and B is a 4×2 matrix, then the product AB is a _____×_____ matrix.

   (c) (6 points) The sequence below is arithmetic. Determine the missing term.

   $$98 \quad , \quad \_\_\_\_\_ \quad , \quad 56 \quad , \quad 35$$

   (d) (6 points) Suppose f is a function with domain $(3, 10]$ and range $[-2, 4)$. In addition, f is one-to-one. What is the range of the inverse function of f? Give your answer in interval notation.

Answer:

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

   (a) (6 points) Determine the composition $(f \circ g)(x)$ for $f(x) = x^2 - 3$ and $g(x) = \ln(x)$.

   $$(f \circ g)(x) = \boxed{}$$

   (b) (6 points) Give an equation of the line that passes through the point (2,-3) that is parallel to the line $y = 4x - 6$. Write the equation in either point-slope form or slope-intercept form. **Circle your answer.**

   (c) (8 points) A manufacturer of a certain product sells all that is produced. The product is sold at \$40 per unit, the fixed cost is \$25,000 and the variable cost is $y_{VC} = 14q$ where q is the number of units produced. Set up the equation to determine the break-even point. **DO NOT SOLVE THIS EQUATION.**

   (d) (8 points) You are given the following matrix equation:

   $$\begin{bmatrix} 3 & -4 \\ 1 & -2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 5 \\ 11 \end{bmatrix}$$

   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.**

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

(a) (8 points) Let

$$A = \begin{bmatrix} 0 & -8 \\ 3 & 2 \end{bmatrix} \qquad B = \begin{bmatrix} 1 & -1 \\ 2 & 5 \end{bmatrix}$$

Determine the product AB

$$AB = \begin{bmatrix} \_\_\_\_\_ & \_\_\_\_\_ \\ \_\_\_\_\_ & \_\_\_\_\_ \end{bmatrix}$$

(b) (6 points) Let

$$F(x) = \begin{cases} 2x - 3 & x < 1 \\ x^2 - 5 & x \geq 1 \end{cases}$$

i. Find $F(-2)$.

$$F(-2) = \boxed{}$$

ii. Find $F(1)$.

$$F(1) = \boxed{}$$

5. Answer the following interest theory questions.

   (a) (10 points) Suppose \$2500 is deposited into an account that gains interest at a rate of 4% compounded continuously. At time t (in years), the account has \$4000. Find t (in years), rounded to two decimal places (e.g. t=12.34 years). **Write the formula that you use to calculate t.**

   $t =$ _____

   (b) (10 points) You deposit \$400 into an investment fund that accumulates interest at an annual effective interest rate r. After 5 years, the fund has grown to \$575. Determine r as a percent rounded to two decimal places (e.g. 12.34%). **Write the formula that you use to calculate r.**

   $r =$ _____

   (c) (10 points) To purchase a new car, you borrow \$22,000 which will be repaid over the next 5 years with monthly payments of Y. The interest rate charged on the loan is 4.2% compounded monthly. Find Y, rounded to two decimal places. **Write the formula that you use to calculate Y.**

   $Y =$ _____

6. Solve the equations. Separate multiple solutions with a comma. Show all of your work. **Solutions by calculator will receive no credit.**

(a) (12 points)

$$\frac{-6}{x+1} + x = 4$$

$x =$ [ ]

(b) (12 points)

$$\log_5(x-4) + \log_5(x+2) = \log_5(16)$$

$x =$ [ ]

(c) (12 points)

$$\log_x\left(x^3 + 2x - 5\right) = 3$$

$x =$ [ ]

7. (12 points) The **revenue** for selling q units of a product is given by $R = 20q$. The **cost** equation for producing q units is $C = 44 + 14q$. Determine q so that the profit is 10.

$q =$ ____

8. (12 points) You are given the following supply and demand equations:

$$\begin{cases} S(q) &= q + 3 \\ D(q) &= \sqrt{29 - 2q} \end{cases}$$

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

$q =$ ____

9. (12 points) Let $f(x) = -2x^2 + 3$. Determine the expression for $\dfrac{f(x+h) - f(x)}{h}$. You must simplify your result.

$$\frac{f(x+h) - f(x)}{h} = \boxed{}$$

10. (12 points) Use an augmented matrix, $[C|I]$, and elementary row operations to find the inverse of the following matrix:

$$C = \begin{bmatrix} -5 & 3 \\ 2 & -1 \end{bmatrix}$$

$$C^{-1} = \begin{bmatrix} \_\_\_\_\_ & \_\_\_\_\_ \\ \_\_\_\_\_ & \_\_\_\_\_ \end{bmatrix}$$

Scrap work

Some Useful Formulas

$$S = P(1+r)^n$$

$$P = S(1+r)^{-n}$$

$$r_e = \left(1+\frac{r}{n}\right)^n - 1$$

$$S = Pe^{rt}$$

$$P = Se^{-rt}$$

$$r_e = e^r - 1$$

$$A = Ra_{\overline{n}|r} = R\frac{1-(1+r)^{-n}}{r}$$

$$R = \frac{A}{a_{\overline{n}|r}} = A\frac{r}{1-(1+r)^{-n}}$$

$$S = Rs_{\overline{n}|r} = R\frac{(1+r)^n - 1}{r}$$

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

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

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