

**Math 1130**  
**Spring**  
**Sample Midterm 3b**

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

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

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

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

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

This exam contains 10 pages (including this cover page) and 6 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, 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.

Question	Points	Score
1	14	
2	12	
3	18	
4	22	
5	18	
6	16	
Total:	100	

1. Circle the best answer to the following problems.

(a) (4 points) What is the fifth term in the arithmetic sequence  $-3, 1, a_3, a_4, a_5, \dots$ ?

(i) 5

(ii) 9

(iii) 13

(iv) 17

(b) (4 points) What is the fourth term in the geometric sequence  $54, 18, b_3, b_4, b_5, \dots$ ?

(i) 9

(ii) 6

(iii) 3

(iv) 2

(c) (6 points) Determine the value of the sum  $\sum_{i=1}^{\infty} 12 \left(\frac{1}{3}\right)^{i-1}$ . Make sure you write the formula you use for this part!

(i) 36

(ii) 24

(iii) 18

(iv) 4

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  $A_{ij} = 3i - 2j$ . 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  $A = \begin{pmatrix} x & 3 \\ x+y & -2z \end{pmatrix}$  and  $B = \begin{pmatrix} 2 & 1 \\ -5 & 2 \end{pmatrix}$ . Solve for  $x, y$  and  $z$  in the matrix equation  $A = 3B$ .

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

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

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

3. (a) (10 points) Compute the matrix

$$3AB - B^T$$

where  $A = \begin{pmatrix} 0 & -3 \\ -1 & 2 \end{pmatrix}$  and  $B = \begin{pmatrix} 4 & -7 \\ 4 & -3 \end{pmatrix}$ .

$$3AB - B^T =$$

- (b) (8 points) An investment of \$12,000 today will guarantee the following cash flows: \$1,000 in one year, \$4,000 in two years, and \$9,000 in three years. What is the net present value assuming an effective rate of 5%? Round your answer to the nearest penny.

$$\text{Net Present Value} =$$

4. (a) (8 points) An individual makes deposits of \$1000 at the end of every quarter into an account that pays 5.7% compounded quarterly. Determine the balance,  $S$ , of the account after ten years. Round to the nearest penny. Make sure to write down the formula that you use for your computations!

$$S = \boxed{\phantom{0000000000}}$$

- (b) (8 points) A car loan of \$22,000 is amortized over four years at a rate of 4.2% compounded monthly. Determine the monthly payment,  $R$ , rounded to the nearest penny. Make sure to write down the formula that you use for your computations!

$$R = \boxed{\phantom{0000000000}}$$

- (c) (6 points) In the same loan as part (b), determine the interest portion of the first payment. Give your answer to the nearest dollar.

$$\text{Interest} = \boxed{\phantom{0000000000}}$$

5. (a) (10 points) A company has taxable income of \$1,070,000. The federal tax is 32% of the portion left after the state tax has been paid. The state tax is 12% of the portion left after the federal tax has been paid. Let  $x$  denote the federal taxes and  $y$  denote the state taxes owed by the company. Set up a system of two equations that will solve for  $x$  and  $y$ . Do not solve for  $x$  and  $y$ !

- (b) (8 points) Solve the given nonlinear system of equations. Give your answer as an ordered pair with each fraction rounded to one decimal place. Make sure to give all solutions, and separate your ordered pairs with a comma.

$$\begin{cases} x^2 + y^2 = 2 \\ 3x + y = 4 \end{cases}$$

$$(x, y) = \boxed{\phantom{000000}}$$

6. (a) (8 points) A manufacturer sells a product at \$7.32 per unit, selling all units produced. The fixed cost is \$3205, and the variable cost is \$6.07 per unit. At what level of production,  $q$ , will the break even point occur?

$$q = \boxed{\phantom{000000}}$$

- (b) (8 points) The supply and demand equations for a certain product are

$$\begin{cases} 4q - 200p + 1749 = 0 \\ 4q + 100p - 1749 = 0 \end{cases}$$

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

$$p = \boxed{\phantom{000000}}$$

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Scrap work

## Some Useful Formulas

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

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

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

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

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

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

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

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