

Review Problems

Announcements

Our final examination will take place in LS 107, on Wednesday, May 2, from 4-6 pm.

Problems

1. Use the matrices

$$\begin{bmatrix} 1 & 5 & 2 \\ -2 & 0 & -1 \end{bmatrix}, \quad \begin{bmatrix} 0 & 6 \\ 2 & -1 \end{bmatrix}, \quad \begin{bmatrix} 1 & -2 \\ 0 & 2 \end{bmatrix}, \quad \begin{bmatrix} 1 & 1 & 0 \\ 0 & 0 & -2 \\ 0 & 1 & 0 \end{bmatrix},$$

to perform the indicated operations if possible. If an operation is not possible, explain why.

- AB
 - BA
 - $3B - 2C$
 - D^{-1}
2. Determine if the system of equations below has any solutions. If a solution exists, find it. Show all work.

$$\begin{cases} x + y + z = 3 \\ 3x - 5y + 4z = 2 \\ x + 2y + z = 4 \end{cases}$$

3. If $f(x) = x^2 + x$, find and simplify the expression

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

4. Find the equation of the line passing through the point $(3, 5)$ and parallel to the line $5x - 7y = 3$.
5. A firm has the following cost and revenue functions:

$$C(x) = 3600 + 25x + \frac{1}{2}x^2, \quad R(x) = \left(175 - \frac{1}{2}x\right)x.$$

- Is there a maximum or minimum profit (or neither)?
 - Find this maximum or minimum profit (if there is one) and what level of productions gives it.
6. The demand function for a product is given by $p = 100 - 4q - q^2$ and the supply is given $p = q^2 + 8q + 20$. Find the equilibrium quantity and price.
7. A hat maker has a little business that has fixed costs \$550 and additional costs of \$7 per unit. Each hat is sold for \$15. Find

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- a) the profit function,
b) the marginal profit,
c) the break-even point.
8. A small firm makes two types of watches. The fancy watch takes 2 hours and \$60 to make, and the calculator watch takes 3 hours and \$30 to make. Suppose the firm has 120 hours and \$2400 for the production of the watches. Proceed as follows to find the maximum number of watches that can be made each day:
- a) Write down the inequalities that describe the above constraints.
b) Write down the objection function to maximize.
DO NOT SOLVE the problem; just set it up.

9. Consider the objective function $C = 5x + 4y$, subject to the constraints:

$$\begin{cases} 3x + 2y \leq 6 \\ 2y - x \geq 2 \\ x \geq 0 \end{cases}$$

- a) Graph and shade the feasible region described by the constraints.
b) Solve for and label the corner points of the feasible region.
c) Find the minimum value of the objective function C .
10. a) Find a decimal approximation for $\log_{82} 9876$.
b) Find a decimal approximation for $-(-0.3)^{\frac{2}{5}}$.
c) Simplify $\left(\frac{5x^{-2} \cdot^{-2}}{3x^3y^{-1}}\right)$.
d) Given the following information:

$$\log_b 2 = 0.279, \quad \log_b 3 = 0.442, \quad \log_b 7 = 0.783,$$

evaluate $\log_b \left(\frac{14}{3b}\right)$.

11. Suppose the amount of aspirin in the bloodstream after t hours of a certain dosage is given by $A(t) = 500(0.944)^t$.
- a) What is initial amount of aspirin?
b) How long would it take for the amount of aspirin to drop down to 200 mg in the bloodstream?
12. Solve the following equations exactly (without using a calculator):
- a) $2 \log_3 x = 15$.
b) $t + 2 = \ln(e^{2t})$.
c) $\log(10^{2z}) = 2(\log_5 5) - z^2(\log_9 1) - 4z$.

13. Suppose that the size y of a deer herd t years after being introduced onto an island is given by:

$$y(t) = 2500 - 2490 e^{-0.1t}.$$

How long will it take for the herd to reach the size of 1500?

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14. The percentage p of high school seniors who have tried marijuana can be modelled by $p(t) = 49.813783 + 2.7783t - 0.228596t^2$, where t is the number of years past since 1975. In what year(s) did 27% of high school seniors try marijuana?
15. You invest \$12500 at 8% annual interest for 15 years. Find the future value of this investment if the interest is compounded
- bi-annually,
 - monthly,
 - continuously.
16. Which of the following offers the best interest? Substantiate your answer quantitatively.
- 8.76% annual interest compounded annually,
 - 8.52% annual interest compounded quarterly,
 - 8.41% annual interest compounded continuously.
17. You take out a loan of \$8000 that you are to pay back over 5 years. You make equal payments at the end of every 3 months. The annual interest rate is 7% compounded quarterly. How much are the payments?
18. a) Suppose you start saving for your retirement by putting \$300 into an account at the *end* of every two months. This account pays 9% annual interest compounded 6 times a year. How much is this retirement fund worth in 20 years?
- b) Repeat the question with *end* replaced by *beginning*.
19. a) A woman buying a house agrees to make 20 quarterly payments of \$1000 with the first payment being at the *beginning* of the first quarter. If money is worth 8% compounded quarterly, how much would the house cost if she paid in cash at the time of purchase?
- b) Repeat the question with *beginning* replaced by *end*.