

Honors Advanced Math

Review 4

Name _____

Topics for Review

sections are from the Demana textbook unless otherwise noted.

Exponential and Logarithmic Functions

3.3-3.5, 3.6 (omit Annual Percentage Yield and Present/Future Value)

Matrices

7.1-7.3, 7.4 (only the simplest kind of decomposition, as in Example 1),

14.5 (Brown), Transformation Matrices (Handouts)

Problems

1. The half-life of radium is about 1600 years. Suppose that an archeological sample is found to contain 200 milligrams of radium. How many milligrams of radium were there 5,000 years ago?
2. Let $a = \log_3 2$ and $b = \log_3 5$. Express $\log_3 450$ in terms of a and/or b .
3. What transformations are needed to transform the graph of $f(x) = 4^x$ into the graph of $g(x) = \left(\frac{1}{8}\right)^x$?
4. For the function $F(x) = \ln(x^2 - 4)$:
 - a. Identify the domain and the range.
 - b. Write limits describing any asymptotes.
5. Prove that $\log_b c = \frac{1}{\log_c b}$.

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6. Any linear transformation T can be expressed as either a pair of *transformation equations*

$$T : \begin{cases} x' = ax + cy \\ y' = bx + dy \end{cases} \text{ or, equivalently, as a } \textit{transformation matrix equation}:$$

$$T : \begin{bmatrix} a & c \\ b & d \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} x' \\ y' \end{bmatrix}.$$

- a. Find the image of each of the following points under a linear transformation T :
- (1,0) →
(0,1) →
- b. True/False: A linear transformation maps the origin to itself.
7. Write a pair of transformation equations that describes the following geometric transformations:
- a. a reflection over the line $y = -x$
- b. a rotation clockwise by θ .
8. a. Find the image of the point (2,3) under a rotation counter-clockwise by 60° .
- b. Find a point (x,y) whose image under R_{120° is (4,3).
9. Using any matrix method, find a cubic polynomial passing through the points (-2,3), (0,3), (2,3), and (4,15). Clearly describe your procedure.

10. Show a sequence of algebraic steps *involving only addition and multiplication* that

manipulate the equation $\begin{bmatrix} 2 \\ 3 \end{bmatrix} - \begin{bmatrix} 1 & 2 \\ 3 & -2 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -2 \\ 4 \end{bmatrix}$ into the form $\begin{bmatrix} x \\ y \end{bmatrix} = \dots$.

11. Find the partial fraction decomposition of $\frac{3x + 4}{x^2 + 14x + 48}$.