

*If people do not believe that mathematics is simple, it is only because they do not realize how complicated life is.*

Name and section: \_\_\_\_\_

1. (5 points) Find a basis for the subspace of  $\mathbb{R}^4$  consisting of vectors  $(a, b, c, d)$  such that  $c = a + b$  and  $d = b + c$ , and state the dimension of this subspace.

2. Label the following statements as true or false. (You do not need to justify your answers.)
- (a) (1 point) A  $4 \times 6$  matrix  $A$  has rank at most 4.
  - (b) (1 point) A  $7 \times 3$  matrix  $A$  must satisfy  $\dim \text{Nul}(A) \geq 4$ .
  - (c) (1 point) If  $m \times n$  matrices  $A$  and  $B$  are row equivalent, then they have the same column space.
  - (d) (1 point) The row space of a  $4 \times 5$  matrix can have dimension 5.
  - (e) (1 point) If  $A$  is an  $m \times n$  matrix, then  $\dim \text{Nul}(A) = \dim \text{Nul}(A^T)$ .