

### Math 254 Exam 0: 9/5/6

Please read the exam instructions.

Notes, books, papers, calculators and electronic aids are all forbidden for this exam. Please write your answers on **separate paper**, indicate clearly what work goes with which problem, and put your name on every sheet. Cross out work you do not wish graded; incorrect work can lower your grade, even compared with no work at all. Keep this list of problems for your records. Show all necessary work in your solutions; if you are unsure, show it. Extra credit may be earned by handing in revised work in class on Thursday 9/7; for details see the syllabus. Each problem is worth 10 points. You have approximately 30 minutes.

1. Carefully state the definition of “linear function”. Give two examples.
2. Carefully state the definition of “nondegenerate linear function”. Give two examples.
3. Consider the vector space  $\mathbb{R}^3$ . Show that the following set is dependent:  $\{(2, 0, 0), (0, 3, 0), (0, 0, 1), (8, 9, 10)\}$ .
4. Consider the vector space  $\mathbb{R}^3$ . Show that  $\{(4, 2, 6), (6, 3, 9)\}$  is dependent.
5. Consider the vector space  $\mathbb{R}^3$ . Consider the function  $f((x_1, x_2, x_3)) = (x_2, x_1 + x_3, 0)$  on this vector space, together with the linear function  $g(u, v) = 2u - 3v$ . Determine whether or not the composition of  $f, g$  can be performed in either order.  
BONUS: Determine whether or not  $f$  is a linear transformation (prove your answer).