Math 3333 homework
(as of May 7, 2009)

1. (due 2/3) as many as needed from 1.1 # 1-18, including at least 2, 7, 8, 11, 12, 17

2. (2/3) as many as needed from 1.2 # 1, 4-13, 19, including at least 4, 5, 7, 9-12 (for 10, solve $\begin{bmatrix} 3 & 0 \\ 0 & 2 \end{bmatrix} = a \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} + b \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$), 19 ("prove" means verify by applying the general facts listed in problem 17)

3. (2/3) as many as needed from 1.3 # 1-20, including at least 4, 7, 15-17

4. (2/3) 1.3 # 32, 33, 36-38, 44, 45 (for 45, use some of the properties in problem 43 to compute the trace of $AB - BA$). Also, have a go at problem 43— try to do it at least for the case of 2×2 matrices.

5. (2/10) 1.4 # 8-12, 22-23, 25, 32, 34, 37, 38

6. (2/10) 1.5 # 4, 15 (solve $\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix} \begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$), 16, 21 (what is $(AA^T)^T$?), 36, 38, 42, 43, 50, 51

7. (2/10) 1.6 # 2, 6, 9 (does $a \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} + b \begin{bmatrix} 2 \\ 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 1 \\ -1 \\ 2 \end{bmatrix}$ have a solution?), 10, 11, 15, 16 (each is a reflection across a certain line), 17 ("projections"), 20 (use properties of matrix multiplication)

8. (2/19) 2.1 as many as needed from 1-8, including at least 4 and 5

9. (2/19) 2.2 as many as needed from 1-17, including at least 3(a), 4(b), 10, 12, 15

10. (2/19) 2.2 # 20, 22 (work with the augmented matrix $\begin{bmatrix} 4 & 1 & 3 & a \\ 2 & -1 & 3 & b \\ 2 & 2 & 0 & c \end{bmatrix}$), 23, 26

11. (2/19) 2.2 # 29, 2.3 # 2, 3, 5

12. (3/3) 2.3 as many as needed from 7-16, including at least 9, 13-16, 19, 28-29

13. (3/3) 4.1 as many as needed, including at least 18-20

14. (3/3) 4.2 as many as needed from 1-4 and 7-11 and 16-18, including at least 2, 8, 11, 16, and 17

15. (3/12) 2.4 # 2(b)(c), 3(b), 9. For 9, use the fact that A is equivalent to B when $B = PAQ$ for some nonsingular matrices. Note that if P is nonsingular then so is P^T (tell why).

16. (3/12) 4.3 as many as needed from 1-18, including at least 4, 6, 7, 14, 16, 17, 23, 32, 39

17. (3/12) 4.4 # 3(b)(c), 4(b)(d), 7(a)(c), 8(c), 13

18. (3/12) 4.5 # 3, 4, 12(a)(b), 14

19. (4/2) 4.6 as many as needed of 1-6, including at least 2 (save a lot of work by using the theory to rule out three of them as possible bases) and 4(c)(d), 7(a), 13 (remove vectors without decreasing the span until you have a subset that is linearly independent), 16 (it will have six elements)

20. (4/2) 4.6 # 19(c), 21, 22, 28, 33, 34

21. (4/2) 4.7 # 2, 3, 11, 21, 22

22. (4/2) 4.9 # 2 (identify $t^3 + t^2 + 2t + 1$ with the vector $\begin{bmatrix} 1 & 1 & 2 & 1 \end{bmatrix}$ and so on, make these the rows of a matrix A, and put A in REF in order to find the basis), 13 (to find the row and column ranks, put into REF using row ops and into CEF using col ops, then the row/column ranks are just the number of nonzero rows/columns)

23. (4/9) 4.9 # 5(a), 7(a), 16(b), 17, 26, 27, 30 (it spans when the rank of the matrix with these vectors as columns is 3), 36

24. (4/9) review the problems 5.1 # 1-18, 24-28, 30-34, they should be familiar from calculus, and need not be turned in

25. (4/9) 5.3 # 5 (also find the matrix C of Theorem 5.2 for this inner product, using the basis $S = \{i, j\}$), 11, 15(b)(c), 19, 23, 25

26. (4/21) 5.3 # 30, 31, 32, 38 (first check that $C = I_n$ for this case, then use our theorem that says $(a, b) = a^T Cb$, notice that $a_S = a$ for the standard basis), 41

27. (4/21) 6.1 # 2, 7, 11, 13, (find the standard matrix of L and use it to answer the questions), 18, 27 (think about the case $n = 2$ first)

28. (4/21) 6.2 # 3, 5 (for these problems, write the standard matrix representation of L, then $\ker(L)$ is the null space and $\text{range}(L)$ is the column space), 11 (write the matrix of L with respect to the basis $S = \left\{ \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix} \right\}$, and use it to find the kernel and range)

29. (4/21) 6.3 # 1, 4 (to find the standard matrix, you just need to calculate $L\left(\begin{bmatrix} 1 \\ 0 \end{bmatrix}\right)$ and $L\left(\begin{bmatrix} 0 \\ 1 \end{bmatrix}\right)$), 8(a)(d), 13

30. (4/21) 6.3 # 17(c)(d)

31. (4/21) 3.1 # 10 (There should be 24 terms, twelve with plus signs and twelve with minus signs. To make life easier for the grader, please put the terms on four lines corresponding to the four lines in this list of the permutations of four elements:

    1234, 1243, 1324, 1342, 1423, 1432

    2134, 2143, 2314, 2341, 2413, 2431

    3124, 3142, 3214, 3241, 3412, 3421

    4123, 4132, 4213, 4231, 4312, 4321)

32. (these will not be collected, but they will be covered on Exam III and the Final Exam) 3.1 # 13, 3.2 # 2, 5, 8-10, 25, 26, 3.3 # 3, 4(b), 11, 12, 3.4 # 1, 3, 9

33. (these will not be collected, but they will be covered on the Final Exam) 7.1 # 14-16, 21, 26

34. (these will not be collected, but they will be covered on the Final Exam) 7.1 # 5, 7, 17, 18

35. (these will not be collected, but they will be covered on the Final Exam) 7.2 # 10(c)(d)

36. (these will not be collected, but they will be covered on the Final Exam) 7.2 # 12, 15(a)(b)