4.6 2 points. If $A$ is $4 \times 3$, its rows are in $\mathbb{R}^3$ and there can be at most 3 linearly independent vectors in such a set. Also, it cannot have more than 3 linearly independent rows because there are only 3 rows.

4.8 2 points. a. False. See "warning" after proof of Theorem 5 in section 4.3.
   b. False. See "warning" after Example 2.
   c. True. See the remarks in the proof of the Rank Theorem.
   d. True. See the paragraph before Example 4.
   e. True. See Theorem 13.

2.4 2 points. a. Yes. In this case, there are no free variables, so by the Rank Theorem, the rank of $A$ must equal the number of columns.
   b. No. The rank of $A$ cannot exceed 6, so Col $A$ must be a proper subspace of $\mathbb{R}^7$.
   
   - There exist vectors in $\mathbb{R}^7$ that are not in Col $A$.
   
   For such right-hand sides, $A \mathbf{x} = \mathbf{b}$ have no solution.

5.1 2 points. Yes. $(A-\lambda I)x = 0$ has a non-trivial solution.

1.4 1 point. \[
\begin{bmatrix} 1 \\ 1 \\ 3 \end{bmatrix}
\]

2.4 2 points. General form: \[
\begin{bmatrix} 9 & 6 \\ b & a \end{bmatrix} (41 bonus) \text{ where } b \cdot c = 0
\]

5.2 7 points. Characteristic equation: $\lambda^2 - 9\lambda + 32$. No real eigenvalues.

10 2 points. $-x^2 + 14x + 12$
5.2 (16 points) 5.11-4.

19 points) Note that the given equation holds for all \( A \). Let \( \lambda = 0 \). \( \det (A) = \lambda_1 \lambda_2 \cdots \lambda_n \).

A. \( n^3 \) you should get rough rates of 27 between 100 \& 300, about same from 300 \& 1000.

2. \( A + A^T \) is a random symmetric matrix 

If they vary, by up to factor 2,

3. About \( (n^3)^3 \) times larger than the \( n = 10^3 \) case, i.e., \( 2 \times 10^{10} \) sec 

The is fine.

\( \mathcal{O}(n^3) \) is same scaling as \( \mathcal{O}(n^3) = \frac{2n^3}{2} \) for row reduction.

\( \mathcal{O}(n^3) \)

\( \mathcal{O}(n^3) \) 

If some of you

found \( n = 300 \) was only

10 times slower than

\( n = 100 \), concluding \( \mathcal{O}(n^3) \).

Sorry about that.

But the ratio \( n = (0^3) \text{ to } n = 300 \) should be close to 30 for all computers.