Questions to consider
Chapter 13, Sect's 7.1–7.2, 7.4–7.7
MA 2160, T. Olson

1. What is a vector? How do you represent one graphically (in 2 or 3 dimensions)? How do you represent one symbolically? How do you go from graphical to symbolic, or vice-versa?
2. How do you find the displacement vector between two points? How do you find the length (magnitude) of a vector?
3. If you depict vectors by arrows, compare the vector $\vec{v}$ to $2\vec{v}$ and $-5\vec{v}$ and $\frac{1}{\|\vec{v}\|}\vec{v}$. If you write the vectors in terms of components, how are $2\vec{v}$ and $-5\vec{v}$ and $\frac{1}{\|\vec{v}\|}\vec{v}$ computed from $\vec{v}$?
4. How do you show the sum of two vectors graphically? How do you add two vectors symbolically (in terms of components)?
5. How do you compute the dot product of two vectors in terms of components? What is the geometric definition of the dot product (in terms of norms and/or angles)? What's a dot product used for?
6. Give the equation of a plane (in terms of x,y,z), how can you identify the normal (perpendicular) vector to the plane? How can you identify a point on the plane?
7. How do you find the equation of a plane, if you know a perpendicular vector and a point on the plane?
8. How can you tell if two vectors are perpendicular? If two vectors are not perpendicular, how can you find the angle between them? If you have two vectors which are not parallel, how can you find a vector which is perpendicular to both?
9. Give a vector, how can you find a unit vector which points in the same direction? ... the opposite direction? How can you find a vector which is parallel to it? ... perpendicular to it?
10. Given two vectors, how can you find the area of the parallelogram they make?
11. How do you find the projection of one vector in the direction of another? What does it mean?
12. Given two vectors $\vec{u}$ and $\vec{v}$, how can you write $\vec{v}$ as a sum of one vector parallel to $\vec{u}$ and another vector perpendicular to $\vec{u}$? Graphically, what have you computed? How do you check your answer?
13. Vector or Scalar?: dot product, length, displacement, cross product, angle, area, scalar-times-vector?
14. How does $\vec{u} \cdot \vec{v}$ compare to $\vec{v} \cdot \vec{u}$? How does $\vec{u} \times \vec{v}$ compare to $\vec{v} \times \vec{u}$?
15. Look at the integrals on pages 385–387 and plan a method of attack to evaluate each by hand.
    - If you use a substitution, what would be your "w" and "dw"?
    - If you use integration by parts, what's "u" and "dv"?
    - If the first two methods fail, would it make sense to use a sine or tangent substitution trick? How can you tell which might be useful?
    - Can the fraction be split up into pieces that can be integrated ("partial fractions")? If so, how do you do it?
    - How would you check your integration?
16. If you evaluate a definite integral by substitution, how do you handle the limits?
17. How do you estimate an integral from a graph? How do you estimate an integral from a table of values?
18. For each of the **numerical approximations** for definite integrals (LEFT, RIGHT, MID, TRAP, SIMP) ... Graphically, what do they represent? How is each computed (from a table of values or a formula)? How are they related to each other? How can you tell which will be an overestimate and which will be an underestimate? How does the error decrease as you make n larger?
19. What is an "improper" integral?
20. What does it mean for an improper integral to converge?
21. What is the graphical interpretation of an improper integral?
22. What are the two basic kinds of improper integrals, and how do you evaluate each?
23. If $f(x)$ is continuous and increasing, does $\int_3^\infty f(x)\,dx$ necessarily converge? Does it necessarily diverge?
24. If $f(x)$ is continuous and decreasing to zero, does $\int_3^\infty f(x)\,dx$ necessarily converge? Does it necessarily diverge? (Can you give examples of both cases?)

Besides thinking about the questions on the other side, here are some other ways to study for the test:

- For each section in the text, try to summarize the BIG IDEA and list the skills you need. (See examples below.)
- Review the worksheets and in-class examples covering this material.
- Read through your old lab notebooks, concentrating on the ideas rather than the computations. Ask yourself: "What did we do here? Why?"
- Review any quizzes on this material.
- Review your homework on this material.
- Read through the examples in the book, and after going through each try to summarize the procedure or idea in a few sentences.
- Memorize formulas that you will need.
- Read through the review problems in the book and decide how you would approach each one.

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MA 2160 Review – examples to get you started

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- **Section 7.1**
  - **Main Idea :** Substitution comes from the chain rule. If you want to change variables, you have to change the "dx", too.
  - **Skills :** Deciding which substitutions to try, recognizing when they work and when they don't. Let w be an inside function and look for dw on the outside.
  - **Formulas/Definitions :** $dw = \frac{dw}{dx}dx$
- **Section 7.2**
  - **Main Idea :** Integration by parts comes from the product rule for derivatives.
  - **Skills :** Choosing u and v so that you can find an antiderivative for v and hope to make the resulting integral simpler than what you started with.
  - **Formulas/Definitions :** $\int u\,dv = uv - \int v\,du$, with $dv = \frac{dv}{dx}dx$.
- **Section 7.5**
  - **Main Idea :** Approximating definite integrals using rectangles (left, right, and midpoint sums) and trapezoids.
  - **Skills :** Sketching rectangles/trapezoids for a graphical interpretation of the various rules. How increasingness and/or concavity affect left/right sums trap/mid rules.
  - **Formulas/Definitions :** $TRAP(n) = (LEFT(n) + RIGHT(n))/2$
- **Section 7.6**
  - **Main Idea :** Simpson's rule is a weighted average of TRAP and MID. Errors behave differently for different rules. Simpson's rule improves faster than TRAP/MID which improves faster than LEFT/RIGHT as n increases.
  - **Skills :** Estimating errors
  - **Formulas/Definitions :** As n gets large, error is proportional to $1/n$ for LEFT/RIGHT, proportional to $1/n^2$ for MID/TRAP, and proportional to $1/n^4$ for Simpson's rule. So multiplying n by 10 improves LEFT/RIGHT by about one decimal place, TRAP/MID by about 2 decimal places, and SIMP by about 4 decimal places. Formula for Simpson's rule . . . ?

HEY! What about section 7.4? And 7.7? And Chapter 13?
Write your own summary of the "big idea" and skills/formulas.