Review For Final

The directions for the exam are as follows:

"WRITE YOUR NAME CLEARLY. Do as many problems as you can for a maximal score of 100. Note that you must do at least 10 problems correctly to get 100. Write neatly and legibly in the space provided. SHOW YOUR WORK!"

1. In other words, the exam consists of 10 core problems and 3 extra-credit problems. If you wish, you can do all the 13 problems, but your score will only add up to 100 points. Partial credit will be given.
2. The exam can roughly be divided into 3 sections. Section 1 consists of material covered on the first exam. Section 2 refers to material from the second exam, etc.
3. Each section is about 3 problems in length. Don't over-study one topic at the cost of the rest.
4. Many of the questions are subdivided into 2 parts worth 5 pts each, so you will have to budget your time.

5. Also remember that you are allowed to use a scientific calculator.

Exam 1

1. Be able to identify lines, line-segments, triangles, parallelograms, and parallelepipeds from their representation as sets (see problems 6-17 of HW 1).
2. What is the motivation behind 2 by 2 and 3 by 3 determinants (see chapter 1.3)?
3. What is the volume of a parallelepiped spanned by the vectors **a** = 2**i** + 2**j**, **b** = -3**i** –3**k**, and **c** = 5**j** + 5**k**? (see Review for Exam 1, Section 1.3, problem 2)
4. Find the area of the parallelogram with sides $a = i - 2j + k$ and $b = 2i + j + k$ (see problems 7, 8 of HW 3 and relevant notes)
5. Let n be any number. Compute $\begin{vmatrix} n & n+1 & n+2 \\ n+3 & n+4 & n+5 \\ n+6 & n+7 & n+8 \end{vmatrix}$ (see Review for Exam 1, Section 1.3, problem 3).
6. Suppose $\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix} = -4$ and $\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ b_{31} & b_{32} & b_{33} \end{vmatrix} = 1$. What is $\begin{vmatrix} 3a_{21} & 3a_{22} & 3a_{23} \\ a_{11} & a_{12} & a_{13} \\ b_{31} - a_{31} & b_{32} - a_{32} & b_{33} - a_{33} \end{vmatrix}$? (see Review for Exam 1, Section 1.3, problem 4)

7. What is the area of a triangle with vertices (1, 1), (3, 3) and (2, 6)? (see Review for Exam 1, Section 1.3, problem 5)
8. What is the motivation behind the cross product?
9. Be able to sketch and describe surfaces. Two problems on the exam relate to graphing and are almost exactly the same as the ones from the review sheet for the first exam (see HW 5, Chapter 2.1 (lecture notes), and Review for Exam 1)
10. Be able to determine whether limits exist and to justify your assertion. Two problems relate to limits and are almost exactly the same as the ones on the review sheet for the first exam. Make sure to solve all of them! (see HW 7, Chapter 2.2 (lecture notes, and Review for Exam 1).
11. Be able to prove that a limit exists using delta-epsilon (see Review for Exam 1)

Exam 2

1. Be able to parameterize curves using path functions (see HW 8, problems 1-9 and lecture notes on Chapter 2.4)
2. Parameterize a cycloid that is generated by a circle of radius 4 that is rolling on the positive x-axis (see problem 11 of HW 8).
3. Parameterize a hypocycloid with large radius R = 6 and small radius r = 1 (see notes on Chapter 2.4, pages 3-4).
4. Parameterize an epicycloids with large radius R = 6 and small radius r = 1 (see solutions to Exam 2)
5. An object traveling along the path c(t) = ($t^2 - 2t + 5$, $3t^2 + 4$, $2t^2 + t$) suddenly, at time t = 1, begins traveling in the direction of its velocity v(1) with speed $\|v(1)\|$. What is its position 2 time units later? How long after time 1 will the object pass through the plane z = 23? (see HW 8, problem 15)
6. Know what is meant by a derivative in Calc III. Is the Total Derivative a scalar? Is it a vector? Is it a function? What is the relationship between the Total Derivative, the Jacobian, and partial derivatives? What is the connection between the Total Derivative and linear maps? (see lecture notes on Chapter 2.3)
7. If T is a linear map, what is its Total Derivative? (see HW 9, problem 27).
8. Be able to use chain rule to find the Jacobian and the Total Derivative of a composition of two or more functions (see HW 10, problems 14-17, lecture notes on Chapter 2.5, and problem 4 of Exam 2).
9. Be able to solve problems like the ones given in HW 10 (problems 6-13).
10. Be able to differentiate implicitly (see HW 10, problems 21-24, Exam 2, problem 5, and lecture notes on Chapter 2.5, pages 20-21)
11. Given a function, be able to identify critical points and local extrema using the second derivative test (see HW 12, problems 1-6 and HW 13, problems 8-13).

Exam 3

1. Know how to set up a double integral over x-simple or y-simple regions (see HW 14, problems 11-17).
2. Be able to reverse the order of integration of iterated double integrals (see HW 14, problems 25-30).
3. Recognize when reversing the order of integration is useful (see lecture notes on Chapter 5.3, pages 10-13, Chapter 5.4 of your textbook, and question 2 on your 3rd exam).
4. Be able to evaluate double integrals using the change of variables theorem (see lecture notes on Chapter 6.2 and HW 16)
5. Know when to switch to polar coordinates and when to use other coordinate transformations.
6. Be sure to solve problems 10-14 of HW 16. There is going to be a similar problem on the exam.
7. Know how to set up and evaluate triple integrals over simple regions (see HW 15, problems 6-16).
8. Be able to change the order of integration for triple integrals (see HW 15, problems 17-20).
9. Be able to evaluate triple integrals by switching to spherical or cylindrical coordinates (see HW 17, problems 1-12).
10. You must be able to decide when switching coordinates is useful and what set of coordinates is most appropriate without my instructions.