Calculus III *Fall 2004*
MA213:007–008 *Russell Brown*

The first hour exam will be in class on Wednesday, 29 September 2004. The exam will cover the topics discussed up through §12.2. See the assignment sheets that have been handed out for more detail.
Below are some sample examination problems.
Yes, class will meet on Thursday after the examination.

1. The following homework problems would make nice examination problems: §11.1 # 25. §11.2 #33, §11.3 # 55, §11.4 #23, §11.5 #51, 57, §11.7 #51, §11.8 #37, §11.9 # 23, §12.1 #44, §12.2 #10, 12.
2. Give the geometric description of the dot product.
3. Give a geometric description of the vector triple product.
4. Give a geometric description of the cross product.
5. Can you find a plane that contains the points $(1, 2, 3)$ and $(3, 4, 5)$?
6. A sphere has radius 2 and center $(1, 2, 3)$. Find the equation of the sphere. Find a point on the sphere. Find the equation of the tangent plane at some point on the sphere.
7. Find a plane which contains $(1, 0, 0)$ and $(0, 1, 0)$ and $(0, 0, 1)$. $\mathbf{r}$
8. Write the vectors $\langle 4, 2\rangle$ as a linear combination of the vectors $\mathbf{a} = \langle 2, 2\rangle$ and $\mathbf{b} = \langle 1, 2\rangle$.
9. Find the angle between a side of a cube and the longest diagonal of a cube.
10. Compute $\mathbf{a} \times \mathbf{b}$ where $\mathbf{a} = \langle 1, 2, 3\rangle$ and $\mathbf{b} = \langle 4, 1, 2\rangle$.
11. Find the length of the curve $\mathbf{r}(t) = \langle t, \cos t, \sin t\rangle$ for $0 \leq t \leq \pi$.
12. Suppose that a vector function $\mathbf{r}(t)$ satisfies $|\mathbf{r}(t)| = 2$. Show that $|\mathbf{r} \times \mathbf{r}'| = 2|\mathbf{r}'|$.
13. Find the tangent, normal and binormal vectors for the curve $\mathbf{r}(t) = \langle \cos t, \sin t, t\rangle$.
14. Give the definition of curvature.
15. Use the definition to find the curvature of the curve $\langle \cos t, \cos t + \sin t, \sin t\angle$.
16. You will not need to memorize the formula for curvature from Theorem 10 on page 736 or equation 11 on the next page.
17. Consider the curve $\mathbf{r}(t) = \langle t^2, t \cos t, e^t\rangle$. Find a plane which contains the point $\mathbf{r}(0)$ and which is parallel to the normal and binormal to the curve at $t = 0$.
18. Compute the limit,
$$\lim_{(x,y)\to(1,1)} \frac{x^2 - y^2}{x + y}$$

19. Does the limit exist?

$$\lim_{(x,y)\to(0,0)} \frac{(x+y)}{x^2-y^2}.$$

20. If $\mathbf{r}'' = 3\mathbf{r}$ show that $\mathbf{r} \times \mathbf{r}'$ is constant.