First Examination

11:00 a.m. Edition

50 minutes. Closed book. No notes. No calculators.
80 points, 20 per question.
Partial credit may be available, but only if you show your working.
Begin each of the four questions on a new page and number it clearly in the margin.
Make sure your T.A.'s name is on each book, as well as your name.
Do not evaluate square roots, trigonometric functions and such.
Use only the officially provided blue books.

11. Let C be the curve given parametrically by

$$\mathbf{r}(t) = (t^3/3)\mathbf{i} + (t^2+1)\mathbf{j} + (2t+1)\mathbf{k}.$$

Find the arc length along C between the points $(0,1,1)$ and $(9,10,7)$. [*Hint:* No difficult integrals are needed.]

12. Let p be the plane that contains the points $(0,2,-1)$, $(1,3,2)$ and $(2,5,1)$.
(a) Find a normal to the plane p.
(b) Find the equation of the plane p in cartesian coordinates x, y, z.

13. (a) Find the angle between the vectors $\mathbf{a} = \mathbf{i} + 2\mathbf{j} + 2\mathbf{k}$ and $\mathbf{b} = \mathbf{i} + \mathbf{j} + 3\mathbf{k}$.
(b) Find the norm of the vector $2\mathbf{a} - \mathbf{b}$.

14. The curve E is given parametrically by

$$\mathbf{r}(t) = (t^2 - t + 1)\mathbf{i} + (-t^3 + t + 1)\mathbf{j} + (2t-1)\mathbf{k}.$$

(a) Find the *unit* tangent vector to E at the point $P = (1,1,1)$.
(b) Find a parametric equation for the tangent line to E at the point P.