

## 微積分(二) 第二次作業

上課老師：翁志文

2009 年三月二十日

請同學以活頁紙整齊且詳細作答後用訂書機訂起來，  
於三月三十一日課堂上交給我

1. Find the indicated derivative.
  - (a)  $\frac{d}{dt}(e^{\cos t} \mathbf{i} + e^{\sin t} \mathbf{j})$ ;
  - (b)  $\frac{d^2}{dt^2}[(e^t \mathbf{i} + e^{-t} \mathbf{j}) \cdot (e^t \mathbf{i} - e^{-t} \mathbf{j})]$ ;
  - (c)  $\frac{d}{dt}[(\ln t \mathbf{i} + t \mathbf{j} - (t^2 + 1) \mathbf{k}) \times (\frac{1}{t} \mathbf{i} + t^2 \mathbf{j} - t \mathbf{k})]$ .
2. Find the angle between a diagonal (對角線) of a cube (正立方體) and one of its edges.
3. Find the volume of the parallelepiped (平行六面體) determined by the three vectors  $\langle 6, 3, -1 \rangle$ ,  $\langle 0, 1, 2 \rangle$ ,  $\langle 4, -2, 5 \rangle$ .
4. Find the unit tangent vector  $\mathbf{T}(t)$  of  $\cos t \mathbf{i} + 3t \mathbf{j} + 2 \sin 2t \mathbf{k}$  at  $t = 0$ .
5. Find  $\int_1^4 (\sqrt{t} \mathbf{i} + e^{-t} \mathbf{j} + \frac{1}{t^2} \mathbf{k}) dt$ .
6. Evaluate the integral  $\int (e^t \mathbf{i} + 2t \mathbf{j} + \frac{1}{t} \mathbf{k}) dt$ .
7. Find the arc length of the graph determined by the vector equation  $\mathbf{r}(t) = \cos t \mathbf{i} + \sin t \mathbf{j} + t \mathbf{k}$  from the point  $(1, 0, 0)$  to the point  $(1, 0, 2\pi)$ .
8. Find the length of the curve  $\mathbf{r}(t) = \sqrt{2}t \mathbf{i} + e^t \mathbf{j} + e^{-t} \mathbf{k}$  for  $0 \leq t \leq 1$ .
9. Find the unit tangent vector  $\mathbf{T}(t)$ , principal unit normal vector  $\mathbf{N}(T)$  and binormal vector  $\mathbf{B}(t)$  of  $\cos t \mathbf{i} + 3t \mathbf{j} + 2 \sin 2t \mathbf{k}$  at  $t = 0$ .
10. Find the curvature of  $\mathbf{r}(t) = \langle t, t^2, t^3 \rangle$  at the point  $(1, 1, 1)$ .