

## MATH 104: WORKSHEET 6

### 1. Concepts

- (1) Derivatives
- (2) Tangent vector
- (3) Unit tangent vector
- (4) Differentiation rules
- (5) Integrals

### 2. Discussions

*Question 1.* Find the unit tangent vectors of the following curves

(1)

$$\vec{r}(t) = \langle \sqrt{t-2}, 3, 1/t^2 \rangle$$

(2)

$$\vec{r}(t) = \langle e^{-t}, t - t^3, \ln t \rangle$$

*Question 2.* Find the equation of the tangent line to the curve with the given parametric equations at specified point.

(1)  $x = t^2 + 1, y = 4\sqrt{t}, z = e^{t^2-t}$  at  $(2, 4, 1)$

(2)  $x = \ln(t + 1), y = t \cos(2t), z = 2^t$  at  $(0, 0, 1)$

*Question 3.* Find the point of intersection of the tangent lines to the curve  $\vec{r}(t) = \langle \sin(\pi t), 2 \sin(\pi t), \cos(\pi t) \rangle$  at the points where  $t = 0$  and  $t = 1/2$ .

*Question 4.* Evaluate the integral:

(1)  $\int_0^2 (t\vec{i} - t^3\vec{j} + 3t^5\vec{k})$

*Question 5.* Compute

$$\frac{d}{dt}(\vec{u}(t) \cdot \vec{v}(t))$$

where  $\vec{u}(t) = \langle \sin t, \cos t, t \rangle$  and  $\vec{v}(t) = \langle t, \cos t, \sin t \rangle$ .