

**MATH 201 2010/11. Calculus III.**  
**Quiz 2 Questions §10.1 -- §12.4**

**Important note: show your workings out for full marks.**

1. Show that the equation represents a sphere and find its center and radius:

$$x^2 + y^2 + z^2 = 4x - 2y + 6z$$

2. Determine whether the following pairs of vectors are orthogonal, parallel or neither:

(a)  $\mathbf{a} = \langle -5, 3, 7 \rangle$  and  $\mathbf{b} = \langle 6, -8, 2 \rangle$ ;

(b)  $\mathbf{a} = \langle 4, 5, -1 \rangle$  and  $\mathbf{b} = \langle -3, 2, -2 \rangle$ ; and

(c)  $\mathbf{a} = 2\mathbf{i} - 6\mathbf{j} + 4\mathbf{k}$  and  $\mathbf{b} = 3\mathbf{i} - 9\mathbf{j} + 6\mathbf{k}$ .

3. Find the volume of the parallelepiped with adjacent edges, AB, AC, and AD where  $A(2, 0, 1)$ ,  $B(4, 1, 0)$ ,  $C(3, -1, 1)$ ,  $D(2, -2, 2)$ .

4. Find  $\frac{dy}{dx}$  and  $\frac{d^2y}{dx^2}$  at the point  $s=1/2$  for the curve given by  $x = 2s^3$ ,  $y = 6/s$ .

5. Find the area of the region between the two polar curves  $r = 2 \sin 2\theta$ , and  $r = 1$ , in the range  $0 \leq \theta \leq \pi/2$ .

6. If  $\mathbf{a} = \langle 1, 2, 3 \rangle$  and  $\mathbf{b} = \langle 1, 0, 1 \rangle$ , show that, (a)  $\mathbf{u} = \mathbf{b} - \text{Proj}_{\mathbf{a}}\mathbf{b}$  is orthogonal to  $\mathbf{a}$ ; (b)  $\mathbf{a}$  is parallel to  $\text{Proj}_{\mathbf{a}}\mathbf{b}$ .

7. Find the Cartesian (rectangular) equations of the curve given by the parametric equations  $x(t) = \cos t$ ,  $y(t) = \cos 2t - 1$ ;  $-\pi \leq t \leq \pi$ .