

**Concordia University**  
**Faculty of Engineering and Computer Science**  
**Midterm Exam ENGR 233**

February 25, 2008.

8:30- 9:45 P.M.

**Note:** Calculators are not allowed.

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[10 points] Problem 1.

Find parametric equation for the line through the indicated point that is parallel to the given planes.

$$x + y - 4z = 2, \quad 2x - y + z = 10, \quad (5, 6, -12)$$

**Hint: The cross product of the normals to the two planes will give the line parallel to the two planes.**

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[10 points] Problem 2.

Suppose  $\vec{r}(t) = t^2 \hat{i} + (t^2 - 2t) \hat{j} + (t^2 - 5t) \hat{k}$  is the position vector of a moving particle. At what points does the particle pass through the xy-plane? What are velocity and acceleration at these points?

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[10 points] Problem 3.

A particle moves in 3-space so that its coordinates at any time are  $x = 4 \cos t$ ,  $y = 4 \sin t$ ,  $z = 5t$ ,  $t \geq 0$ . Use the chain rule to find the rate at which its distance

$$w = \sqrt{x^2 + y^2 + z^2}$$

from the origin is changing at  $t = \frac{5\pi}{2}$  seconds.

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[10 points] Problem 4.

Find the equation of the tangent plane to the graph of the given equation at the indicated point.

$$x^2 - y^2 - 3z^2 = 5; \quad (6, 2, 3)$$

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[10 points] Problem 5.

Find the work done by force  $\vec{F}(x, y) = (x + 2y) \hat{i} + (6y - 2x) \hat{j}$  in moving along a straight line from (1,1) to (3,1).