

Math 126, Sections D and E, Autumn 2008, Midterm I

October 21, 2008

Name \_\_\_\_\_

TA/Section \_\_\_\_\_

**Instructions.**

- There are 4 questions. The exam is out of 40 points.
- You are allowed to use one page of notes written only on one side of the sheet in your own handwriting.
- You may use a calculator which does not graph and which is not programmable. Even if you have a calculator, give me exact answers. ( $\frac{2\ln 3}{\pi}$  is exact, 0.7 is an approximation for the same number.)
- **Show your work.** If I cannot read or follow your work, I cannot grade it. You may not get full credit for a right answer if your answer is not justified by your work. If you continue at the back of a page, make a note for me. Please BOX your final answer.

Question	points
1	
2	
3	
4	
Total	

1. Let  $f(x) = x^{\frac{1}{3}}$ .

(a) Find the second Taylor polynomial for  $f(x)$  based at  $b = 8$ . (4 points)

(b) Use Taylor's inequality to find an upperbound for the error  $|f(x) - T_2(x)|$  on the interval  $[7, 9]$ . (4 points)

(c) Use you answer in part (a) to estimate the cube root of 9. (2 points)

2. Find the Taylor series for

$$f(x) = \frac{1 - 5x}{(4 - 3x)(7 - x)}$$

based at  $b = 0$ . Give your answer with one sigma ( $\Sigma$ ) sign and write the the first 3 non-zero terms  $a_0 + a_1(x - b) + a_2(x - b)^2 + \dots$  explicitly. Also, give the interval  $I$  where the Taylor series converges. (10 points)

3. Given the points  $P(1, 0, -1)$ ,  $Q(0, 0, 3)$ ,  $R(0, 1, 4)$  and  $S(2, 0, 0)$ :

(a) Find the equation of the plane containing the three points  $P$ ,  $Q$ , and  $R$ . (4 points)

(b) Find the parametric equations of the line through  $S$  which is perpendicular to the plane you found in part (a). (3 points)

(c) Find the coordinates of the point where the line intersects the plane. (3 points)

(d) Find the distance of the point  $S$  to the plane in part (a). (2 points)

4. Determine if the following are TRUE or FALSE. You need not explain your answer. (1 point each)

(a) For any vectors  $\mathbf{u}$  and  $\mathbf{v}$ ,  $\mathbf{u} \times \mathbf{v} = \mathbf{v} \times \mathbf{u}$ .

(b) For any vectors  $\mathbf{u}$  and  $\mathbf{v}$ ,  $(\mathbf{u} \times \mathbf{v}) \cdot \mathbf{u} = 0$ .

(c) The cross product of two unit vectors is a unit vector.

(d) The lines  $\mathbf{r}_1 = \langle 7 - 3t, 2 + t, 2 - 2t \rangle$  and  $\mathbf{r}_2 = \langle -1 + 6t, 5 - 2t, 2 + 4t \rangle$  are parallel.

(e) The planes  $2x + 3y - 2z = 3$  and  $4x - 6y - 2z = 6$  are parallel.

(f) The planes  $x + 3y - 6z = 3$  and  $4x - 2y - z = 6$  are perpendicular.

(g) The line  $\mathbf{r} = \langle 1 - 2t, 5 + t, 2 + 3t \rangle$  is on the plane  $-x + 4y - 2z = 15$ .

(h) The lines  $\mathbf{r}_1 = \langle 2 + 3t, -t, 4 + 2t \rangle$  and  $\mathbf{r}_2 = \langle 1 - 2t, 5 + t, 2 + 3t \rangle$  are skew.