MATH 231: Calculus of Several Variables
Section 1, 107 Ag Sc & Ind Bldg,
TR 9:05 AM - 9:55 AM

Homework 11: Due Tuesday, Oct 10

Do each problem without any aids. There may be more than one solution for any problem. Then try to check your work to determine if you were correct. If you were not, try to find your mistake.

1. Which of the following surfaces is a hyperboloid of two sheets?

   (a) $x^2 - 4x + 2y^2 - 4y - 4z^2 = -6$

   (b) $-x^2 - 2x + 2y^2 - 4y + 4z^2 = -5$

   (c) $-x^2 + 2x - 2y^2 + 4y - 4z^2 = 7$

   (d) $-x^2 + 2x + 2y^2 - 4y + 4z^2 = 3$

   (e) None of the above

2. Which of the following could be a tangent vector for the equation below?

$$x = t, \quad y = e^{-t}, \quad z = 2t - t^2$$

   (a) $\vec{v} = \langle 1, -1, 1 \rangle$

   (b) $\vec{v} = \langle 0, -1, 2 \rangle$

   (c) $\vec{v} = \langle 0, e, 0 \rangle$

   (d) $\vec{v} = \langle 1, -e^{-2}, 6 \rangle$

   (e) None of the above

3. Consider the three lines:

   I. $\vec{q}(t) = \langle t - 1, 4t + 2, 3t - 12 \rangle$

   II. $\vec{r}(t) = \langle 2t + 1, 8t, 6t - 1 \rangle$

   III. $\vec{s}(t) = \langle 4t - 2, -t, 12 \rangle$

   Which of the following is true?

   (a) $\vec{s}$ is perpendicular to $\vec{r}$ but not $\vec{q}$

   (b) $\vec{s}$ is parallel to $\vec{r}$ but not $\vec{q}$

   (c) $\vec{q}$ is perpendicular to $\vec{r}$ but not $\vec{s}$

   (d) $\vec{q}$ is parallel to $\vec{r}$ but not $\vec{s}$

   (e) None of the above

4. Which of the following functions has the same domain as

$$\vec{r}(t) = \left\langle \frac{\ln(t)}{t^2-2}, \frac{t^2-9}{t+3}, \frac{t-1}{2} \right\rangle$$

(a)
$$\vec{r}(t) = \left\langle \frac{\sqrt{t}}{t-\sqrt{2}}, \frac{t-3}{t-\sqrt{2}}, \frac{7-t}{2t} \right\rangle$$

(b)
$$\vec{r}(t) = \left\langle \frac{\ln(t)}{\sqrt{t}}, t-3, t-1 \right\rangle$$

(c)
$$\vec{r}(t) = \left\langle \frac{\ln(t-3)}{t+\sqrt{2}}, \frac{t^2-9}{t}, \frac{t-1}{2} \right\rangle$$

(d)
$$\vec{r}(t) = \left\langle \frac{\ln(t)}{t}, \frac{t}{t-\sqrt{2}}, 7 \right\rangle$$

(e) None of the above

5. At which point(s) does the plane intersect the line?

$$x = t, \quad y = 2+t, \quad z = 9+7t; \qquad x - 8y + z = 0$$

(a) Only $(0, 0, 0)$

(b) Only $(0, 2, 16)$

(c) The line and plane do not intersect

(d) The line is contained in the plane

(e) None of the above

6. Zero is the answer to which of the following expressions?

(a) The cross product of perpendicular vectors

(b) The sum of two perpendicular vectors

(c) The dot product of the slope vector of a line with the normal vector of a plane, where the line and plane are perpendicular.

(d) The dot product of the slope vector of a line with the normal vector of a plane, where the line and plane are parallel.

(e) None of the above