MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

ASSIGNMENT 4 | **Math 3202** | SPRING 2019

Due: Friday, June 21st, 2019 at 1:00pm. SHOW ALL WORK.

> **Note:** The following textbook problems are useful practice for the topics covered on this assignment:
> - Section 13.4, #s 3–19, 22–31, 37–42
> - Section 12.5, #s 23–40
> - Section 12.6, #s 9–20, 31–38
> - Section 14.4, #s 1–6
> - Section 16.6, #s 1–6

1. Consider a particle moving along the curve traced out by $\mathbf{r}(t) = \langle e^t \sin(t),\ e^t \cos(t),\ 2\rangle$. Find each of the following.

   (a) the velocity vector function $\mathbf{v}(t)$

   (b) the speed function $v(t)$

   (c) the acceleration vector function $\mathbf{a}(t)$

   (d) the tangential component of the acceleration $a_T(t)$

   (e) the normal component of the acceleration $a_N(t)$

2. Let's return to the paintball game introduced in class, being played by Jodie and Peter. At one point, Peter returns to the platform, 5 metres above the ground, and spies Jodie lying on the ground next to a blue box 50 metres away. He shoots a paintball at Jodie with a speed of 20 metres per second at an angle of 30°. Determine how far the paintball travels along the ground, to one decimal place. Is this an undershoot, an overshoot, or a direct hit?

3. Find an equation of the plane that passes through the point $(2, 0, -1)$ and is parallel to plane with equation $9x + 2y + 6z = -8$.

4. Determine the equations of the $x = 0$, $y = 0$ and $z = 0$ traces of the quadric surface $x^2 - 4y + 9z^2 = 1$ and identify the shape of their graphs.

PLEASE TURN OVER

5. In a recent lecture, Dr. Sullivan incorrectly referred to one of the following as an ellipsoid. This was, of course, not a mistake but rather a cunning set-up for an assignment problem. Yes, definitely. Ahem. So... For each of the following, either justify why it is an ellipsoid (or a portion of an ellipsoid), or identify the non-ellipsoid and classify it properly.

   (a) $\dfrac{x^2}{5} + \dfrac{y^2}{6} + \dfrac{z^2}{7} = 1$

   (b) $z = \sqrt{1 - x^2 - 3y^2}$

   (c) $z = x^2 + 3y^2$

   (d) $6x^2 + 48x + 12y^2 + 4z^2 - 4z + 85 = 0$

   (e) $R(u, v) = \left\langle 3\cos(u)\sin(v),\ \frac{1}{2}\sin(u)\sin(v),\ 2\cos(v)\right\rangle$

6. Find an equation of the plane tangent to the surface

$$f(x, y) = x^2\sqrt{y} - \frac{1}{2y^5}$$

   at the point $(x, y) = (3, 1)$.