MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

ASSIGNMENT 7	**Math 3202**	SPRING 2019

Due: Friday, July 26th, 2019 at 1:00pm. SHOW ALL WORK.

Note: The following textbook problems are useful practice for the topics covered on this assignment:

- Section 15.7, #s 1–10, 17–26, 29–30
- Section 15.8, #s 1–10, 21–27, 35, 36, 41–43
- Section 16.2, #s 19–22
- Section 16.7, #s 21–32

1. Let E be the solid which lies between the elliptic paraboloid $z = x^2 + y^2$ and the hyperbolic paraboloid $z = 2 - x^2 - y^2$. Use cylindrical coordinates to find the volume of E.

2. Evaluate the triple integral

$$\int_0^2 \int_0^{\sqrt{2x-x^2}} \int_0^{\sqrt{x^2+y^2}} \sqrt{x^2+y^2}\, dz\, dy\, dx$$

by rewriting it in cylindrical coordinates.

3. Let E be the solid which lies between the upper hemisphere $x^2 + y^2 + z^2 = 1$ and the cone $x^2 + y^2 = z^2$. Use spherical coordinates to evaluate the triple integral

$$\iiint_E z^3\, dV.$$

4. Evaluate the triple integral

$$\int_{-2}^2 \int_0^{\sqrt{4-x^2}} \int_{-\sqrt{4-x^2-y^2}}^{\sqrt{4-x^2-y^2}} \sqrt{x^2+y^2}\, dz\, dy\, dx$$

by rewriting it in spherical coordinates.

PLEASE TURN OVER

5. For each of the following, evaluate the line integral directly (without using the Fundamental Theorem of Line Integrals or any other such result).

   (a) $\displaystyle\int_C \mathbf{F} \cdot d\mathbf{r}$ where $\mathbf{F} = \langle 2x - y,\ -z,\ x + 3y + z \rangle$ and C is the line segment from $(0, 1, -3)$ to $(2, 1, 3)$

   (b) $\displaystyle\int_C \nabla f \cdot d\mathbf{r}$ where $f(x, y) = xy^2$ and C is the quarter-circle $x^2 + y^2 = 4$ from $(2, 0)$ to $(0, 2)$

6. For each of the following, evaluate the surface integral directly.

   (a) $\displaystyle\iint_S \mathbf{F} \cdot d\mathbf{S}$ where $\mathbf{F} = \langle y,\ -xy,\ 2y \rangle$ and S is the portion of the plane $2x + y + z = 6$ in the first octant (oriented upward)

   (b) $\displaystyle\iint_S \mathbf{F} \cdot d\mathbf{S}$ where $\mathbf{F} = \langle x,\ y,\ e^z \rangle$ and S is the portion of the cylinder $x^2 + y^2 = 4$ between the planes $z = 0$ and $z = 3$ (oriented outward)