MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

ASSIGNMENT 3 | **Math 3202** | SPRING 2019

Due: Friday, June 7th, 2019 at 1:00pm. SHOW ALL WORK.

> **Note:** The following textbook problems are useful practice for the topics covered on this assignment:
> - Section 16.2, #s 1–4, 9–12
> - Section 13.3, #s 17–25, 27–31, 47–50

1. Find the area under the curve $f(x,y) = x^{-1}y$ and above the curve C traced out by $\mathbf{r}(t) = \langle t^3, \frac{1}{4}t^4 \rangle$ for $3 \leq t \leq 4$.

2. Consider the curve C which consists of the portion of the unit circle measured counterclockwise from $(1,0)$ to $(0,1)$, together with the portion of the parabola $y = x^2 + 1$ from $(0,1)$ to $(2,5)$. Determine $\displaystyle\int_C x\,ds$.

3. Evaluate the line integral $\displaystyle\int_C (x - yz)\,ds$ over each of the following curves C.

   (a) C is the line segment from $(2,-3,0)$ to $(8,0,-2)$

   (b) C is the portion of the helix traced out by $\mathbf{r}(t) = \langle \sin(2t), 2t, \cos(2t) \rangle$ for $0 \leq t \leq \frac{\pi}{4}$

4. For the curve traced out by $\mathbf{r}(t) = \langle 3\sin(t), 5\cos(t), -4\sin(t) \rangle$, determine each of the following.

   (a) the unit tangent vector $\mathbf{T}(t)$

   (b) the curvature $\kappa(t)$

   (c) the unit normal vector $\mathbf{N}(t)$

   (d) the binormal vector $\mathbf{B}(t)$

   (e) the equation of the osculating plane at $t = 0$

5. Given $\mathbf{r}(t) = \langle t^2, 2\sqrt{2}t^2, t \rangle$ find $\mathbf{r}'(t)$ and $\mathbf{r}''(t)$ and use them to determine the curvature of the corresponding space curve.

6. Find the curvature of the graph of $f(x) = e^{3x}$. Determine the value of x at which the curvature is a maximum.