

Exam: Vector Calculus for BMT, CE, CSE, ME

October 4th, 2019 , 13.45 - 15.45 hrs

Give a suitable explanation of your answers!

The use of electronic devices is *not* allowed. A formula sheet is not handed out.

1. Compute the mass of the rod that is described by the curve $C : y = x^2$ joining the points $(0, 0)$ and $(3, 9)$, and which has mass density $f(x, y) = 3x$.
2. Consider the triangle S cut from the plane $2x + 6y + 3z = 6$ in the first octant: $x \geq 0, y \geq 0, z \geq 0$. Let C be the boundary curve of S .
Let $\mathbf{F} = 2xz\mathbf{i} + (2x + 3z)\mathbf{j} + x^2\mathbf{k}$ be a vector field.
 - a) Determine the corner points of S and sketch S .
 - b) Compute the counterclockwise circulation of $\mathbf{F}$ along C when viewed from above by using a parametrization of C .
 - c) Compute the counterclockwise circulation of $\mathbf{F}$ along C when viewed from above by using an integration theorem (Gauß, Green, or Stokes).
3. Let S be the unit sphere in 3-space: $x^2 + y^2 + z^2 = 1$. Let $\mathbf{F} = y\mathbf{i} + z\mathbf{j} + x\mathbf{k}$ be a vector field.
 - a) Compute the outward flux of $\mathbf{F}$ through S using a parametrization of S .
 - b) Compute the outward flux of $\mathbf{F}$ through S using an integration theorem (Gauß, Green, or Stokes).

Points:

1.	3	2.a)	1.5	3.a)	3
		b)	5	b)	2
		c)	3.5		

Total: $18 + 2 = 20$ points