

DAE Maths Level Test (Lab)

-answers lab bundle-

Full Name:

Date:

Lab question1 / 6p

A farmer plans to construct a rectangular pen for his sheep. He has 60 m fence to cover three sides with the remaining side being a brick wall. Advise him in using his amount of fence in a way which maximizes the space for his sheep. How should the farmer choose length l and width x from the wall, for this pen to achieve maximum area?

1. Draw such a fencing as described above.
2. Retrieve the (quadratic) function $f(x)$ which describes the area corresponding to x in a mathematical way: **trial and error will not score**. Graph this function $f(x)$ for x running from 0 to 30.
3. Find the required width x_{max} which yields the largest area, and its corresponding length l as well.
4. Calculate this largest possible area up to 1 m^2 precise.

Lab question2 / 7p

1. Draw the tetrahedron $AOBC$ through vertices $A(1, 0, 0)$, the origin $O(0, 0, 0)$, $B(0, 2, 0)$ and $C(0, 0, 3)$ in the standard cartesian 3D-frame.

2. Calculate the outward unit normal \vec{n}_{ABC} on polygon ABC obligatory by using its two edges $[AB]$ and $[BC]$, respectively captured by their corresponding free vectors \vec{AB} and \vec{BC} . **Simplify your result as far as possible by pen and paper.**

Answer the requested unit normal vector overhere as \vec{n}_{ABC}

3. Finally also give the outward unit normals \vec{n}_{AOC} , \vec{n}_{AOB} and \vec{n}_{COB} on the remaining polygons by purely geometric *reasoning* instead of calculating.

Extra unit normals: \vec{n}_{AOC}	\vec{n}_{AOB}	\vec{n}_{COB}

4. Now, complete your above drawing (see answer 1.) by adding this tetrahedron's so called 'normal map' to it.

Lab question3 / 7p

We want to resize the cube defined by the vertices $A(2, 2, 1)$, $B(5, 1, 2)$, $C(5, 1, -1)$, $D(2, 2, -1)$, $E(2, 5, 1)$, $F(5, 4, 2)$, $G(5, 1, 4)$ and $H(2, 5, 4)$ into a cuboid by applying scale factor 2 along the x -axis, factor 4 along the y -axis and factor 3 along the z -axis, with respect to its corner vertex A .

1. Determine the appropriate matrix operator.

2. Calculate all image vertices of the returned cuboid. **Only answers based on your previously found matrix operator may score.**