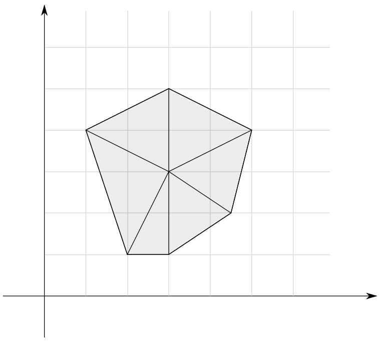
Norwegian University of Science and Technology
Institute of mathematics

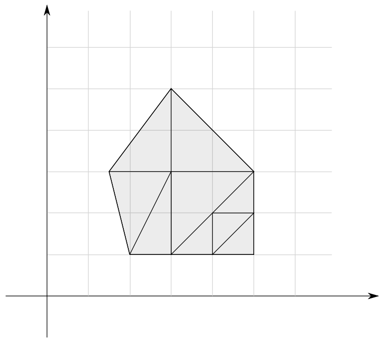
TMA4220 Finite Element Method Fall 2016

Exercise set 5

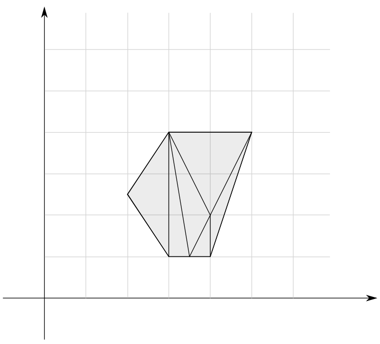
$\boxed{1}$ Which of the following meshes constitute a Delaunay triangulation? What changes would need to be done to make it a proper Delaunay mesh?



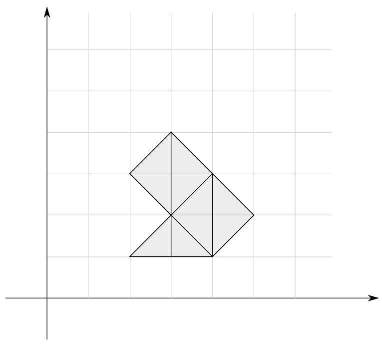
(a)



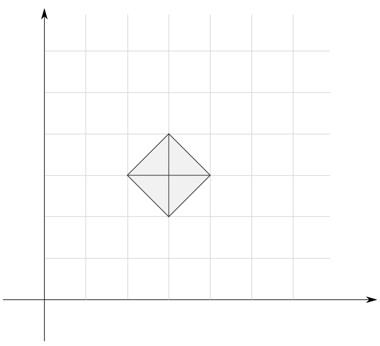
(b)



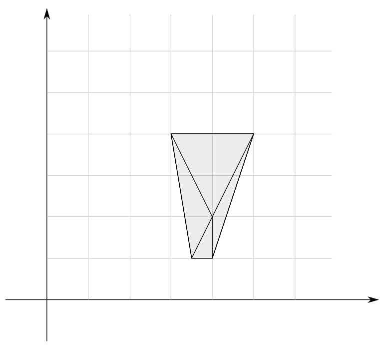
(c)



(d)

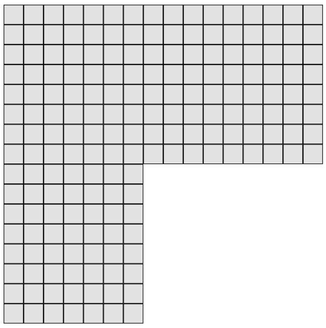


(e)

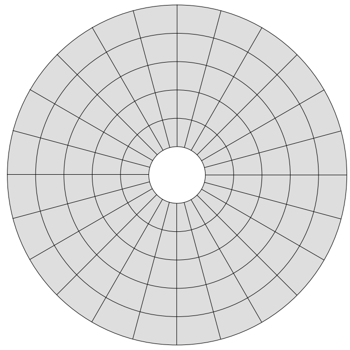


(f)

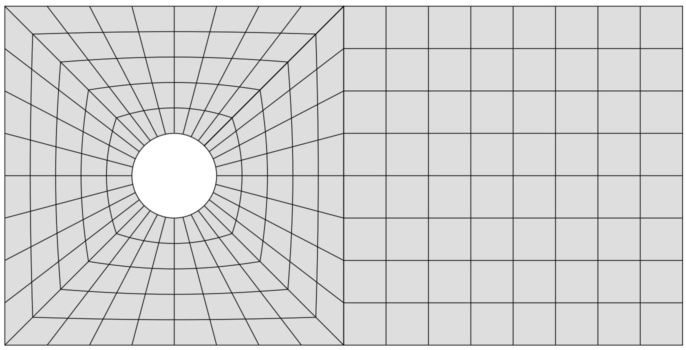
$\boxed{2}$ Which of the following meshes are structured quad meshes. What changes (if any) would need to be done to make a proper structured mesh on these domains.



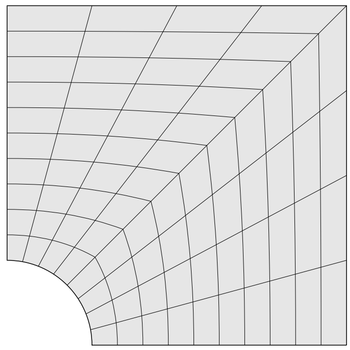
(a)



(b)

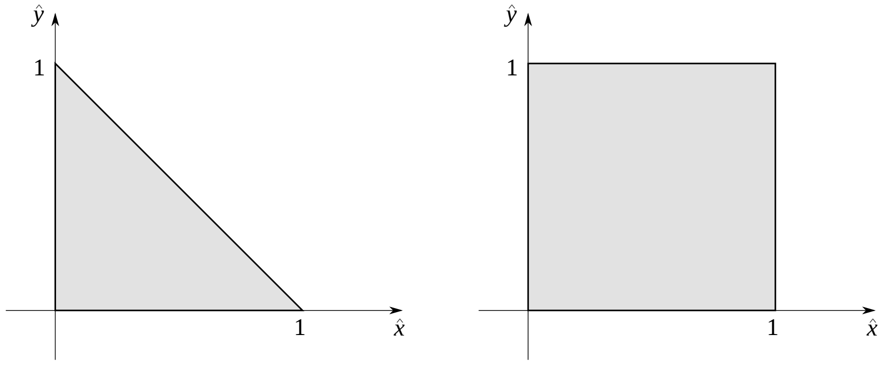


(c)



(d)

3 What is the sphericity ρ_K and diameter h_K for



(a) The reference triangle (b) The reference square

4 A family of meshes $\mathcal{T}_h$ is said to be quasi-uniform if there exist some $\tau > 0$

$$\frac{\min\limits_{K\in\mathcal{T}_h} h_K}{\max\limits_{K\in\mathcal{T}_h} h_K} \geq \tau, \quad \forall h > 0$$

Let $x_i, i = \{0, 1, ..., n\}$ be the nodes in a 1D-partitioning of some interval $I = [x_0, x_n]$. Let the element size be $h_i = x_i - x_{i-1}$. Are the following family of meshes quasi-uniform?

(Hint: Consider the case $\lim\limits_{h\to 0} \mathcal{T}_h$ *by letting* $\lim\limits_{n\to\infty} \mathcal{T}_h$*).*

a)

$$x_i = 0.5\frac{i}{n}$$

b)

$$x_i = 0.5\left(\frac{i}{n}\right)^2$$

c)

$$x_i = \sin\left(\frac{i}{n}\cdot\frac{\pi}{2}\right)$$

d)

$$x_i = \sin\left(\frac{i}{n}\cdot\frac{\pi}{4}\right)$$