Question 1

While writing your Monte Carlo path tracer, you decide to implement support for meshes as light sources. In order to cast rays specifically at this light source, you need to be able to **sample random points on a triangle**. Given an arbitrary triangle *ABC* and two random numbers *s* and *t* in the range [0, 1), propose a method for obtaining a random point on this triangle using the two random numbers.

Point P = A + (A - B) * s
Point Q = C + (P - C) * t
Q is our random point

Question 2

What is **importance sampling** in the context of path tracing? Provide one example of importance sampling.

Importance sampling is the process of influencing the random reflection of rays such that the chosen reflection directions have a higher influence on the color reflected at their point of origin compared to any random ray. For example, one could specifically cast rays of light from a point to the light sources in a scene, ensuring that some portion of rays reflected at a point are tested for direct illumination, increasing the overall brightness of an image (especially if the light sources have a very small surface area)

Question 3

For the following materials, describe the set of directions in which a ray is likely to be reflected when that ray hits a surface with that material.

1. Perfectly diffuse material (e.g. matte paint)
2. Perfectly specular reflective material (e.g. chrome)
3. Glossy specular material (e.g. shiny paint)

1. The ray is equally likely to be reflected in any direction in the hemisphere aligned with the surface normal
2. It will only be reflected around the surface normal
3. It is more likely to be reflected in a direction approximating the perfectly specular reflected direction, but is not locked to this reflected direction.