# SET08116 Computer Graphics
# Lighting Tutorial 2 Worksheet

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In this tutorial you will practice calculating the colour of a quad when lit by a point light and a spot light. This tutorial follows on from the previous tutorial and will use the same general information.

Our quad in the scene has the following initial data defined.

**Vertex 1** -

    **Position** - $(-10, 10, -10)$

    **Normal** - $(-0.577, 0.577, 0.577)$

**Vertex 2** -

    **Position** - $(10, 10, 0)$

    **Normal** - $(0.577, 0.577, 0.577)$

**Vertex 3** -

    **Position** - $(10, -5, 0)$

    **Normal** - $(0, 0, 1)$

**Vertex 4** -

    **Position** - $(-5, -5, -5)$

    **Normal** - $(0.577, -0.577, 0.577)$

The diffuse material colour of the quad ($\mathcal{D}$) is Cyan $(0, 1, 1)$. The specular material is white and shininess is 0.5.

This tutorial will focus on calculating the colours of these four vertexes using both a point light and a spot light.

## 1  Point Light

Our point light equation does not take into account the ambient component. The general equation is the same as that for standard lighting.

$$\mathcal{K} = (\mathcal{D}\mathcal{C})\max(\mathbf{N} \cdot \mathbf{L}, 0) + (\mathcal{S}\mathcal{C})\max(\mathbf{N} \cdot \mathbf{H}, 0)^m$$

Now however we calculate the colour component using attenuation factors:

$$\mathcal{C} = \frac{1}{k_c + k_l d + k_q d^2}\mathcal{C}'$$

Out light vector ($\mathbf{L}$) is calculated as:

$$\mathbf{L} = \frac{light\_pos - p}{\|light\_pos - p\|}$$

The value $d$ is the distance from the vertex and the light.

Given the four vertexes above calculate the light colour for each. For this you will need details on the point light. These are:

**Colour** - Full yellow

**Position** - (0, 0, 20)

**Attenuation** - (5, 2, 1)

## 2  Spot Light

For spot light we modify our colour calculation to the following:

$$\mathcal{C} = \frac{\max(-\mathbf{R} \cdot \mathbf{L}, 0)^p}{k_c + k_l d + k_q d^2} \mathcal{C}'$$

where $\mathbf{R}$ is the direction the spot light is facing and $p$ is the spot light power.

For this tutorial you should consider the light to be facing $(0, -0.707, -0.707)$ and the spot light power to be 0.1. Calculate the colours of the four vertexes using the spot light definition.

## 3  Practice

As with normal lighting, practice using these equations initially with some values you know the answer for. Then try combining the point and spot light equations to see the result.