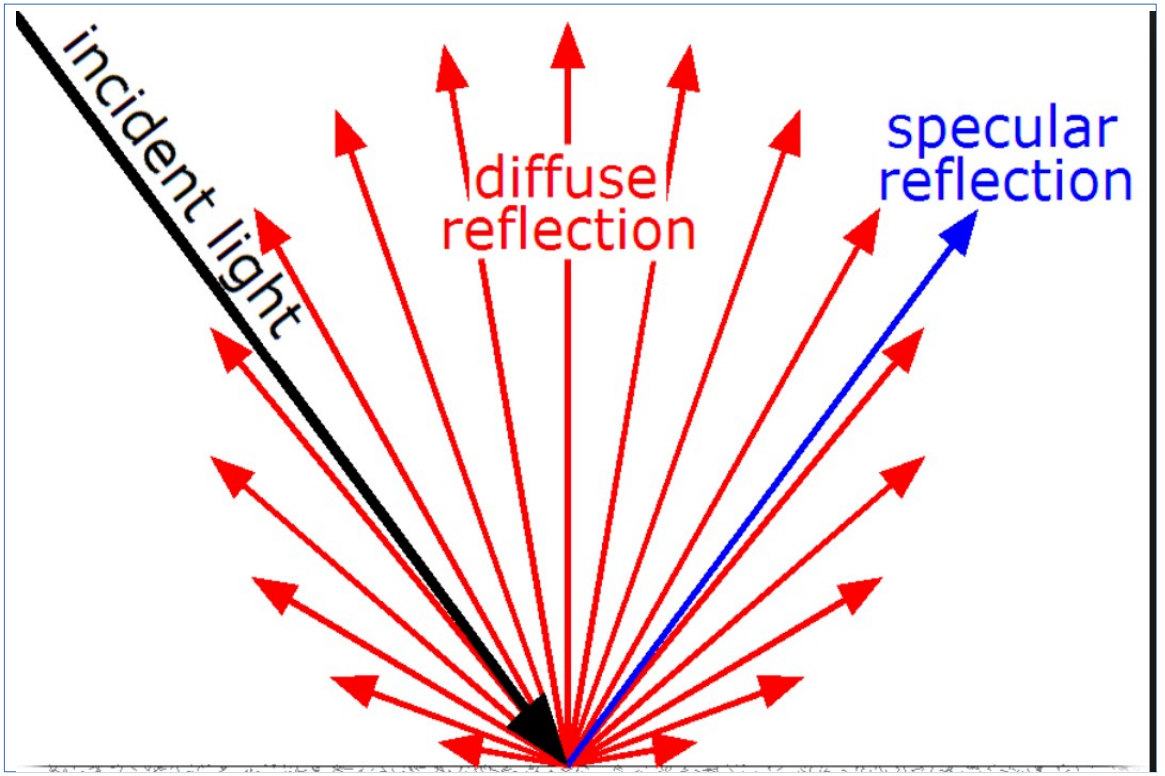
Diffuse Reflection



https://en.wikipedia.org/wiki/Diffuse_reflection

Diffuse Reflection: the reflection of light uniformly in all different directions, the surface of this reflection exhibits Lambert reflection, e.g., equal luminance when viewed from all directions.

Two Key Characteristics:

1. The surface with reflectivity as K_d = (k_r, k_g, k_b), e.g., diffuse coefficients;

2. The decay of incident light is inverse proportional to its distance from the source to the surface point. e.g., 1/(r*r), where r is bing the distance from the light source to the surface.

Specular vs. diffuse reflection

Diffuse Reflection Formulation

Light source I_s(x,y) consists of r, g, b 3 primitive colors as follows, but let's simplify it as white color, so r, g, b all equal and have the highest value (if in graphics, they are 255)

$$\vec{I_s}(x,y,z) = (I_r(x,y,z), I_g(x,y,z), I_b(x,y,z)) \quad \ldots (1)$$

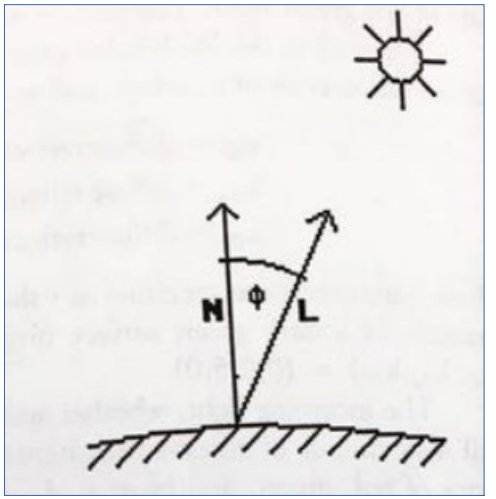
Object surface consists of reflectivity, e.g., coefficient of reflection

$$\vec{K_d} = (K_r, K_g, K_b) \quad \ldots (2)$$

r_d vector in Equation (1) is a ray equation, just like I_s(x,y,z) but has no r, g, b primitive color defined in it for the matter of simplicity.

Diffuse Reflection Equation

Let's consider white color of the point light source, then each primitive color r, g, b of the object surface I(x,y,z) can be computed as follows:



$$I_r = K_{d_r} \frac{\vec{n} \cdot \vec{r}}{\|\vec{n}\| \|\vec{r}\|} \frac{1}{\|\vec{r}\|_2^2} \quad \ldots (1.1)$$

where

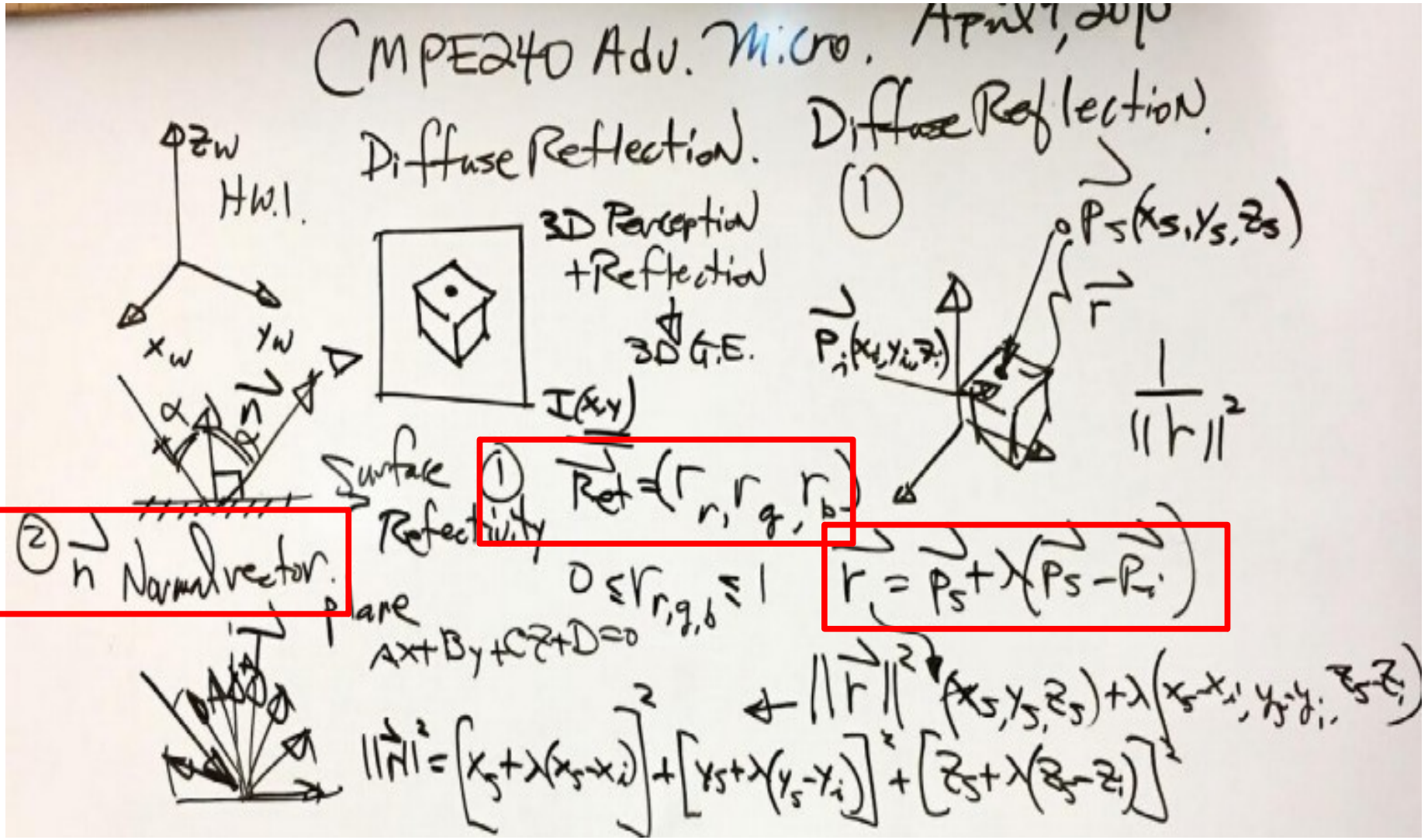
$$\|\vec{r}\|_2^2 = x_r^2 + y_r^2 + z_r^2$$

$$I_g = K_{d_g} \frac{\vec{n} \cdot \vec{r}}{\|\vec{n}\| \|\vec{r}\|} \cdot \frac{1}{\|\vec{r}\|_2^2} \quad \ldots (1.2)$$

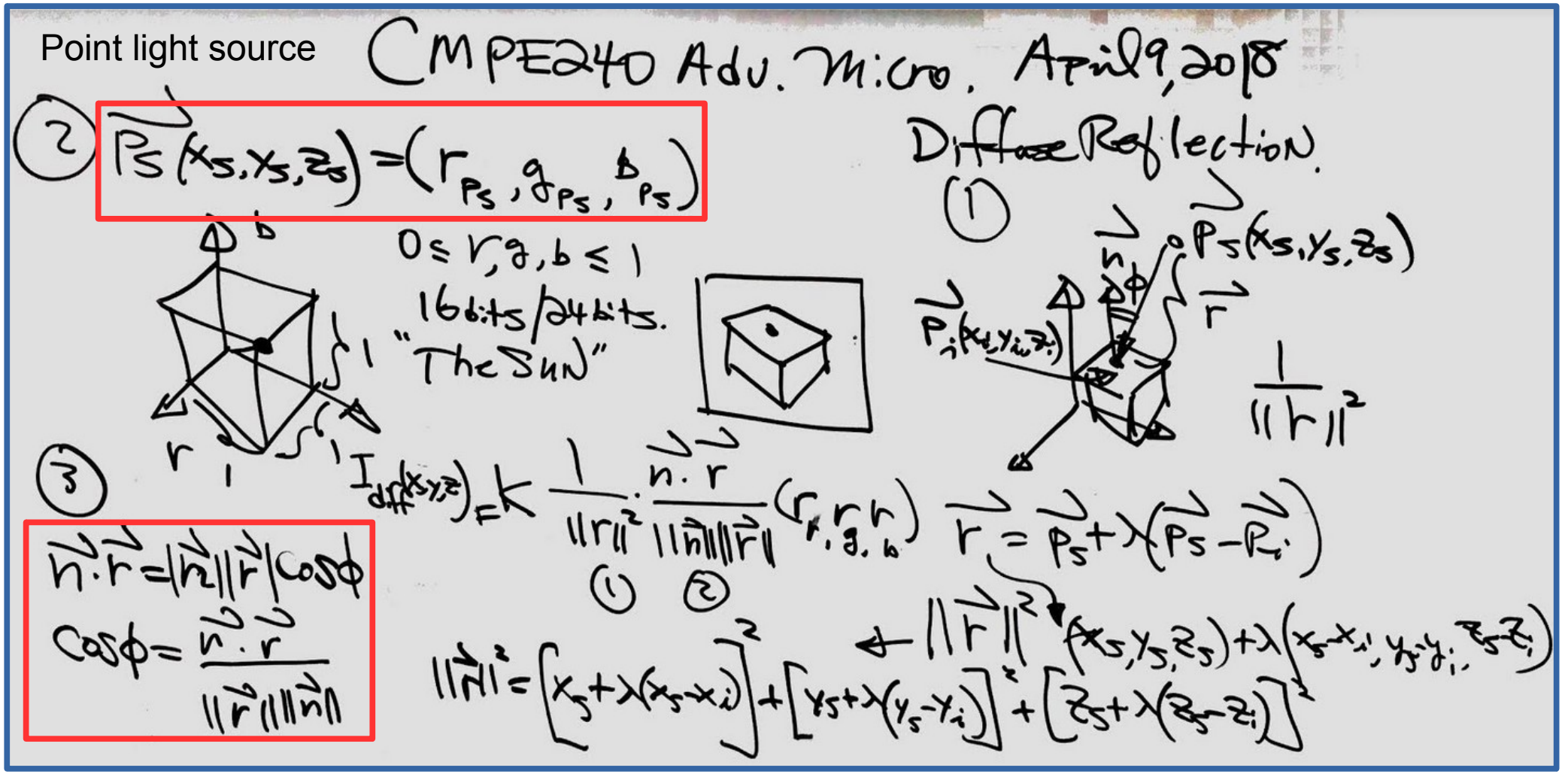
$$I_b = K_{d_b} \frac{\vec{n} \cdot \vec{r}}{\|\vec{n}\| \|\vec{r}\|} \cdot \frac{1}{\|\vec{r}\|_2^2} \quad \ldots (1.3)$$

Reference: Computer Graphics, C. K. Pokorny, C. F. Gerald, pp. 514

Formulation Of Diffuse Reflection Equation

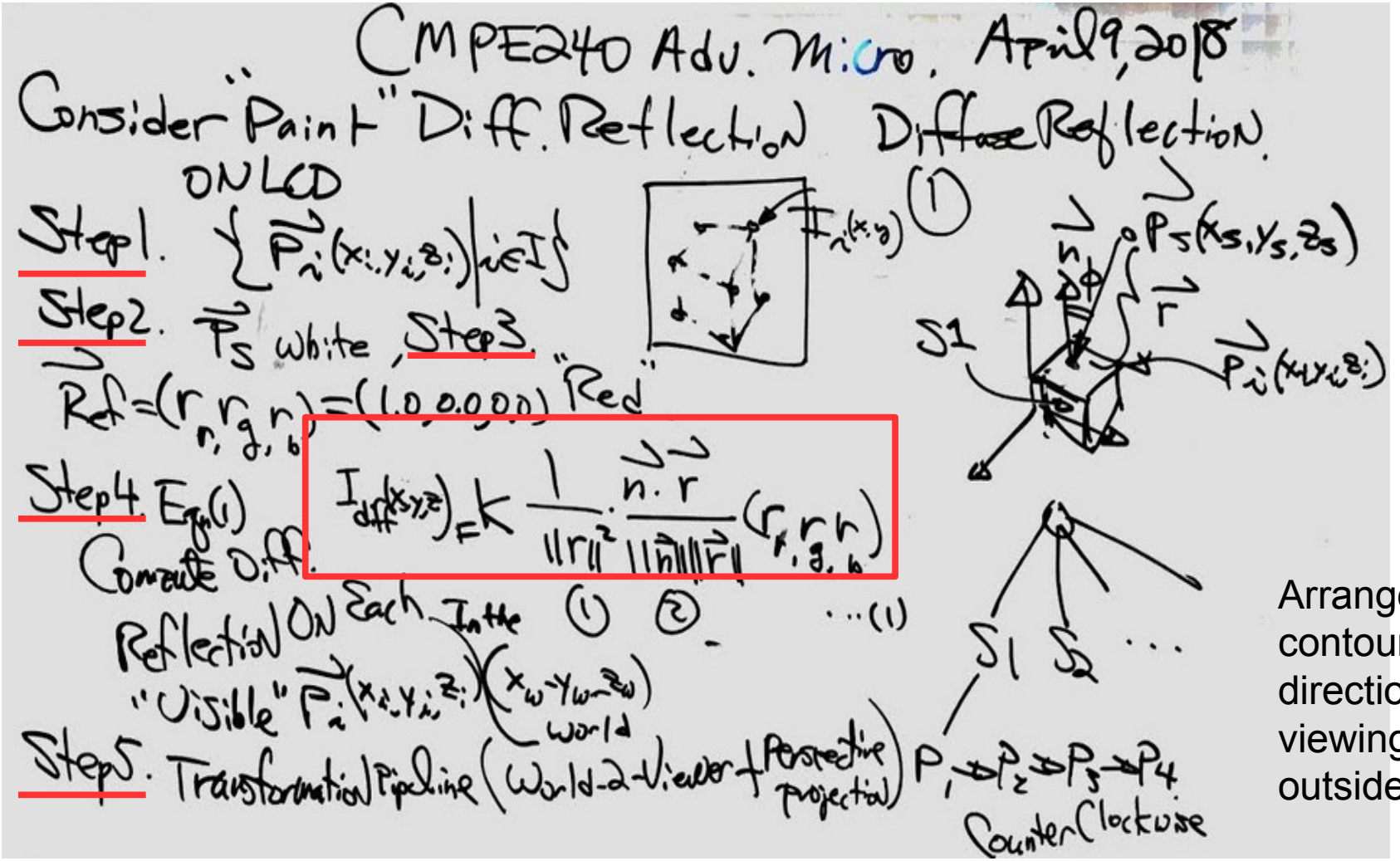


Point Light Source And Incident Angle



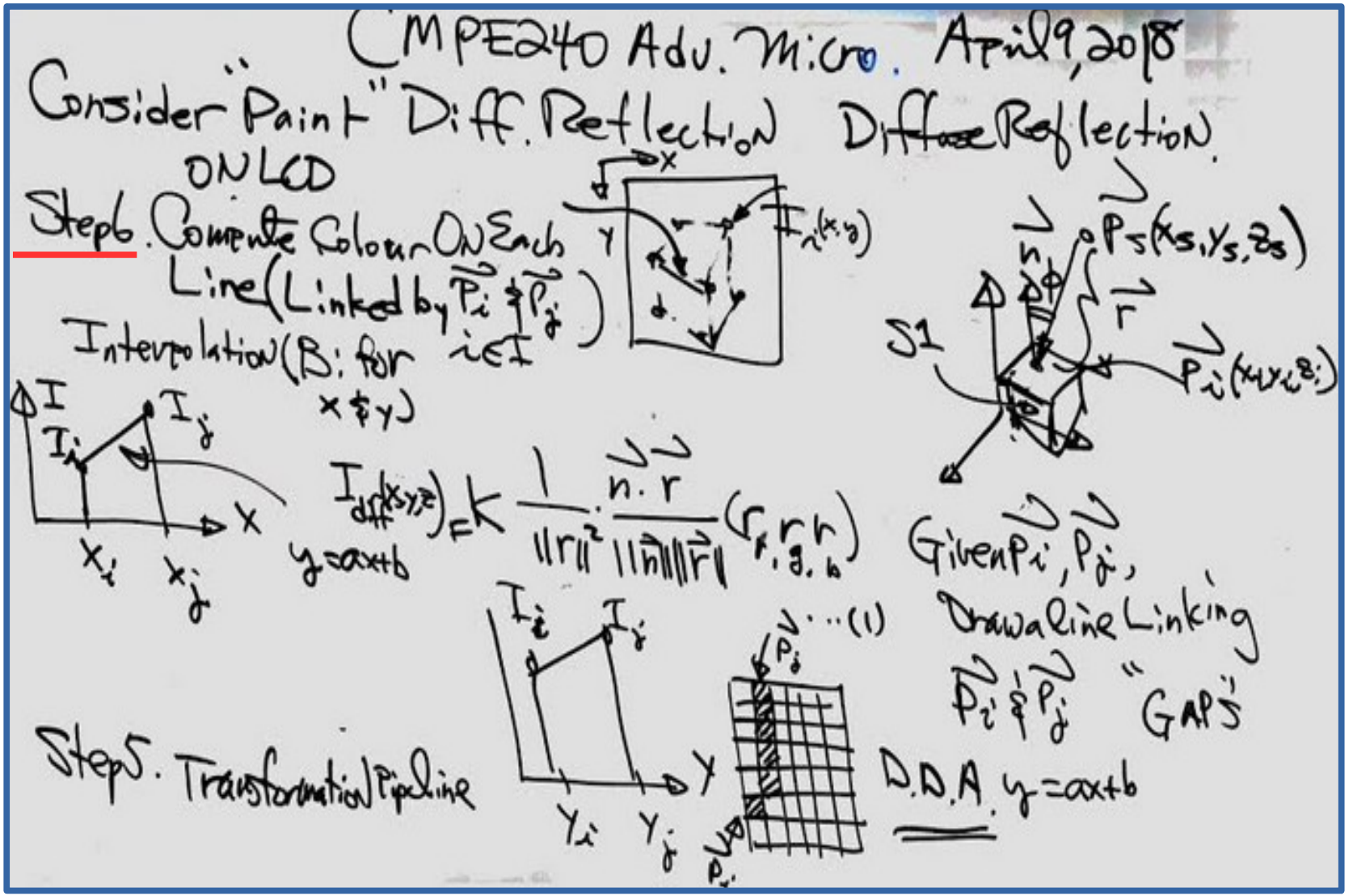
Angle of incident light

Step 1-5 For Diffuse Reflection Computation

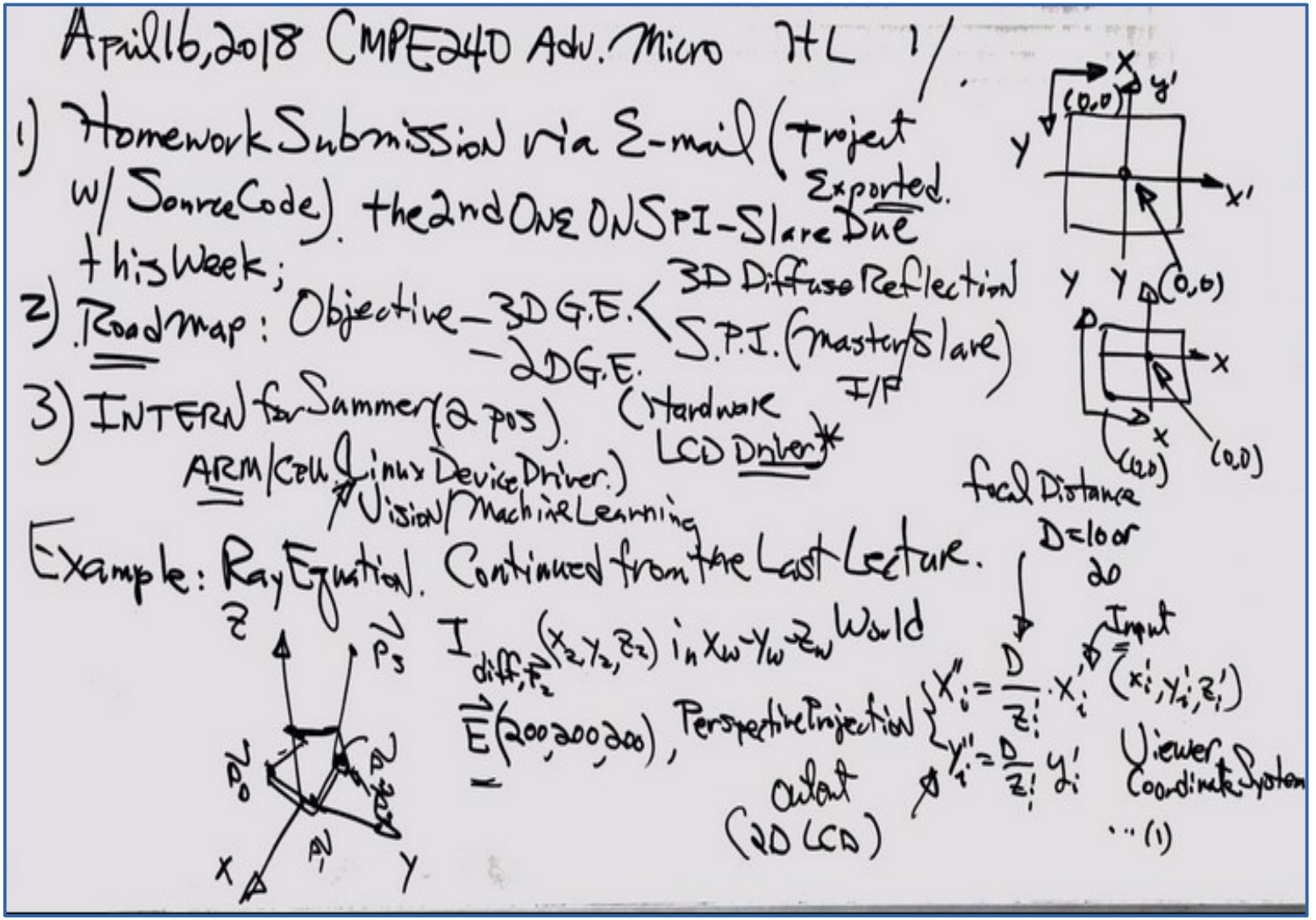


Arrange vertex in contour clock wise direction when viewing from outside

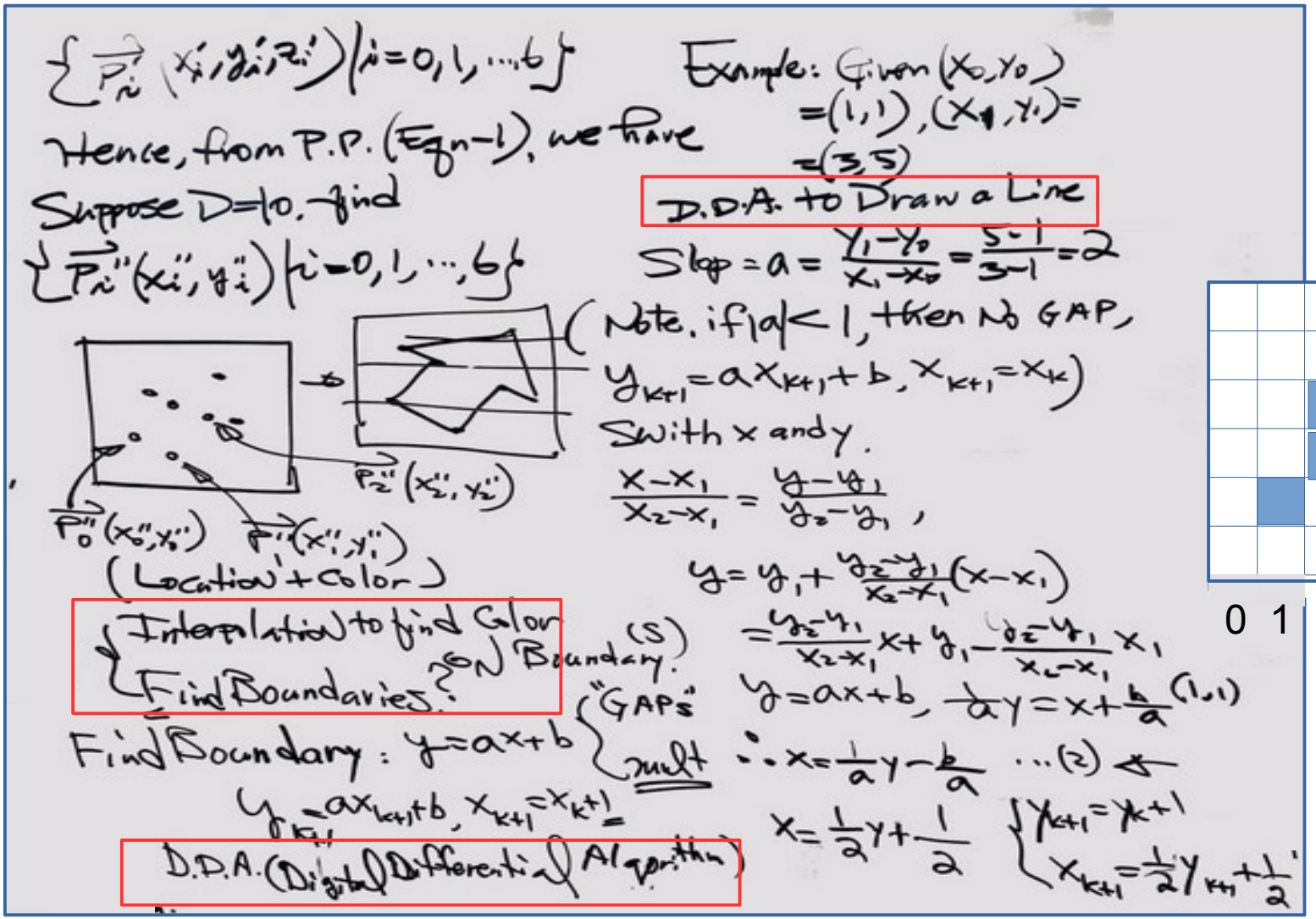
Step 6 For Diffuse Reflection Computation



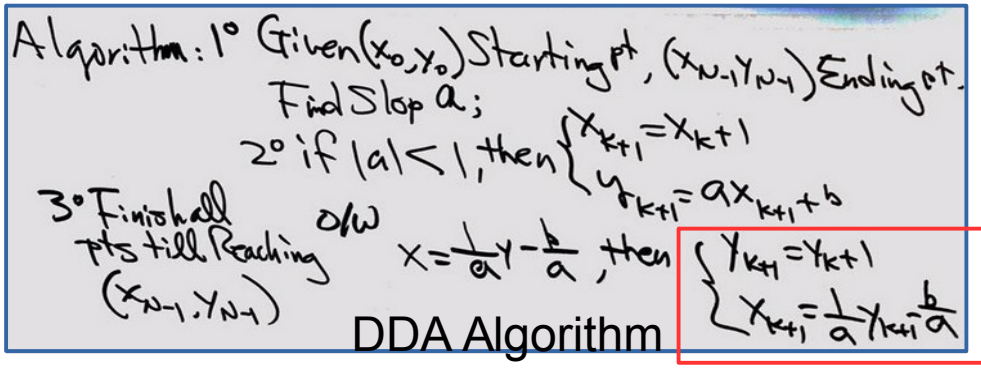
Example On Diffuse Reflection Computation (1)

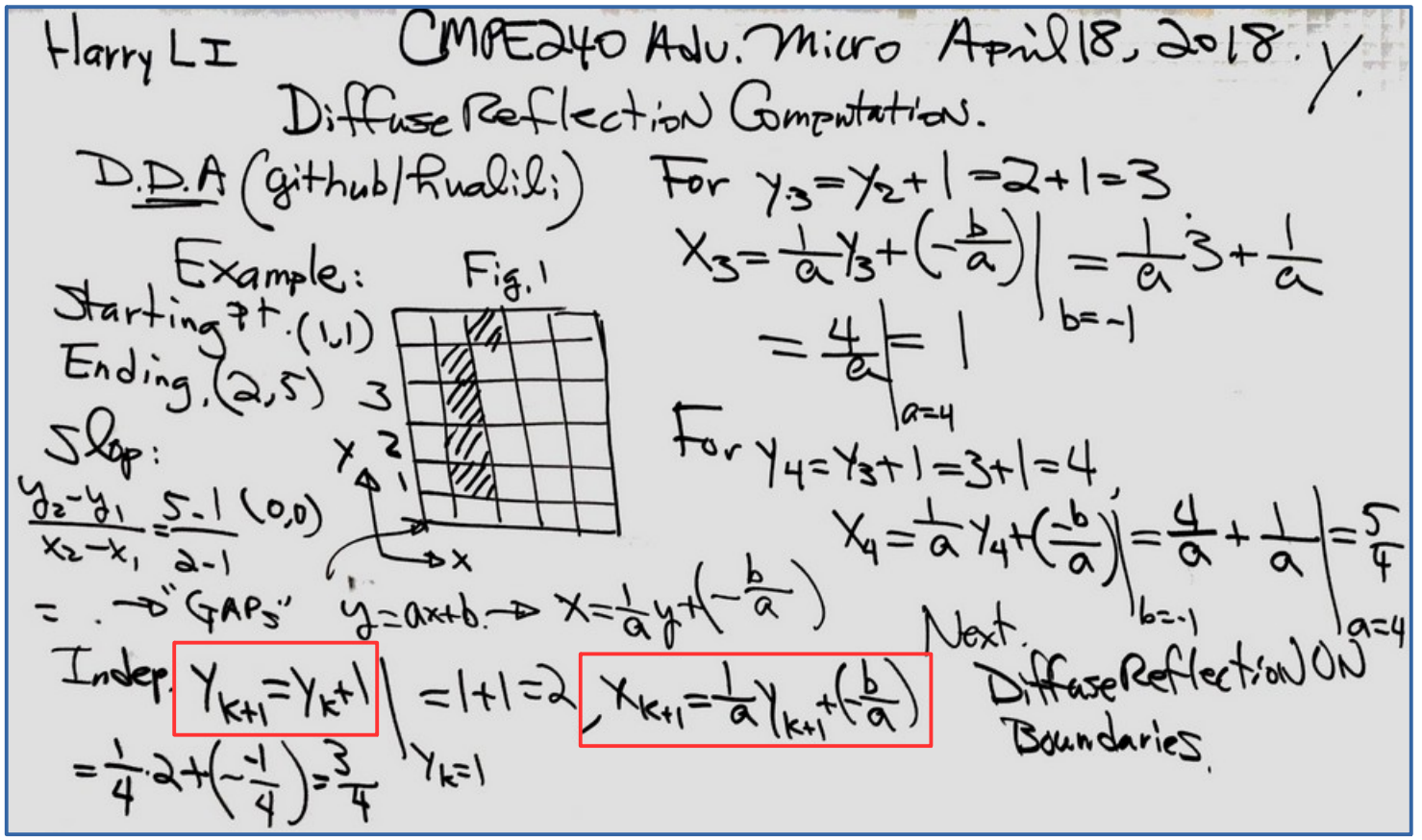


Example On Diffuse Reflection Computation (2)

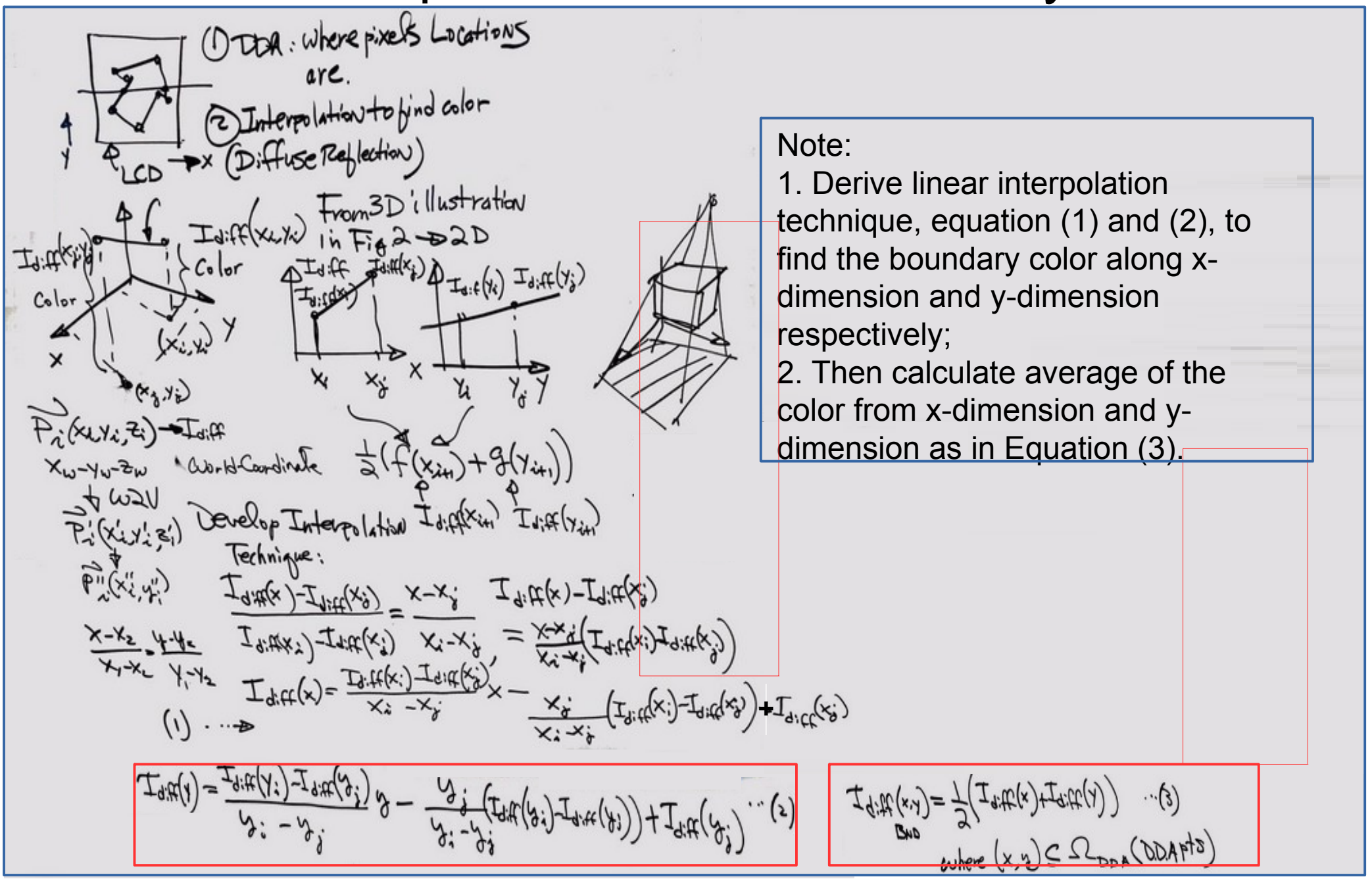


Use DDA Algorithm To Find Boundary Points



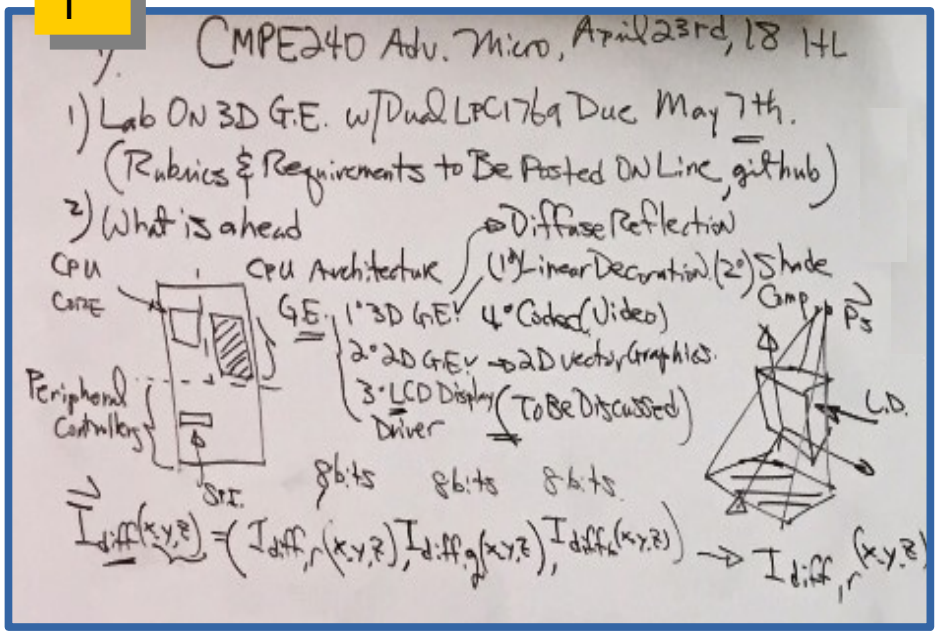


Bilinear Interpolation To Find Boundary Color

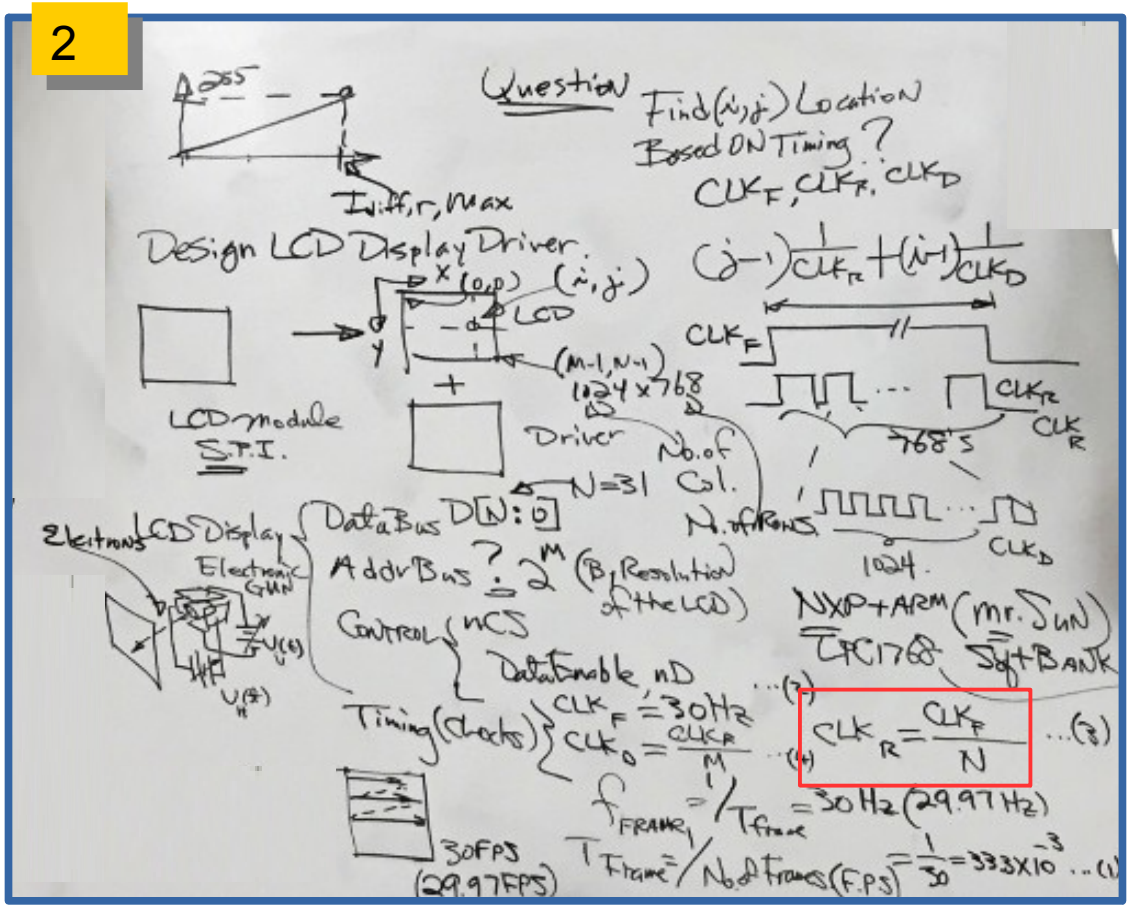


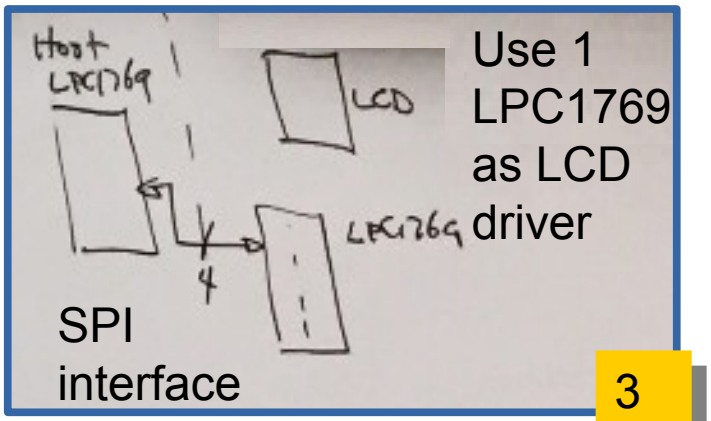
GE (Graphics Engine) Aspects

1

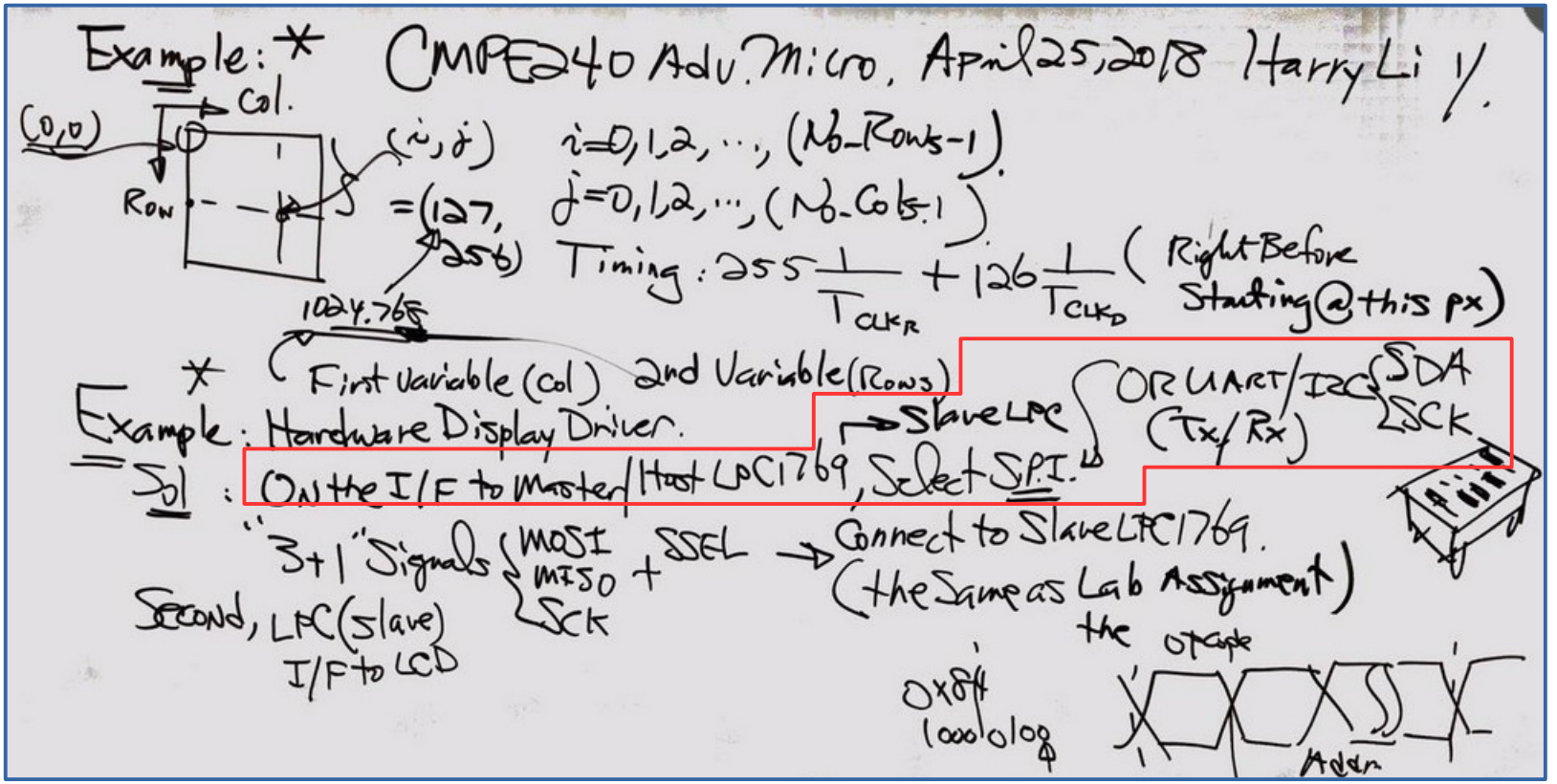


2

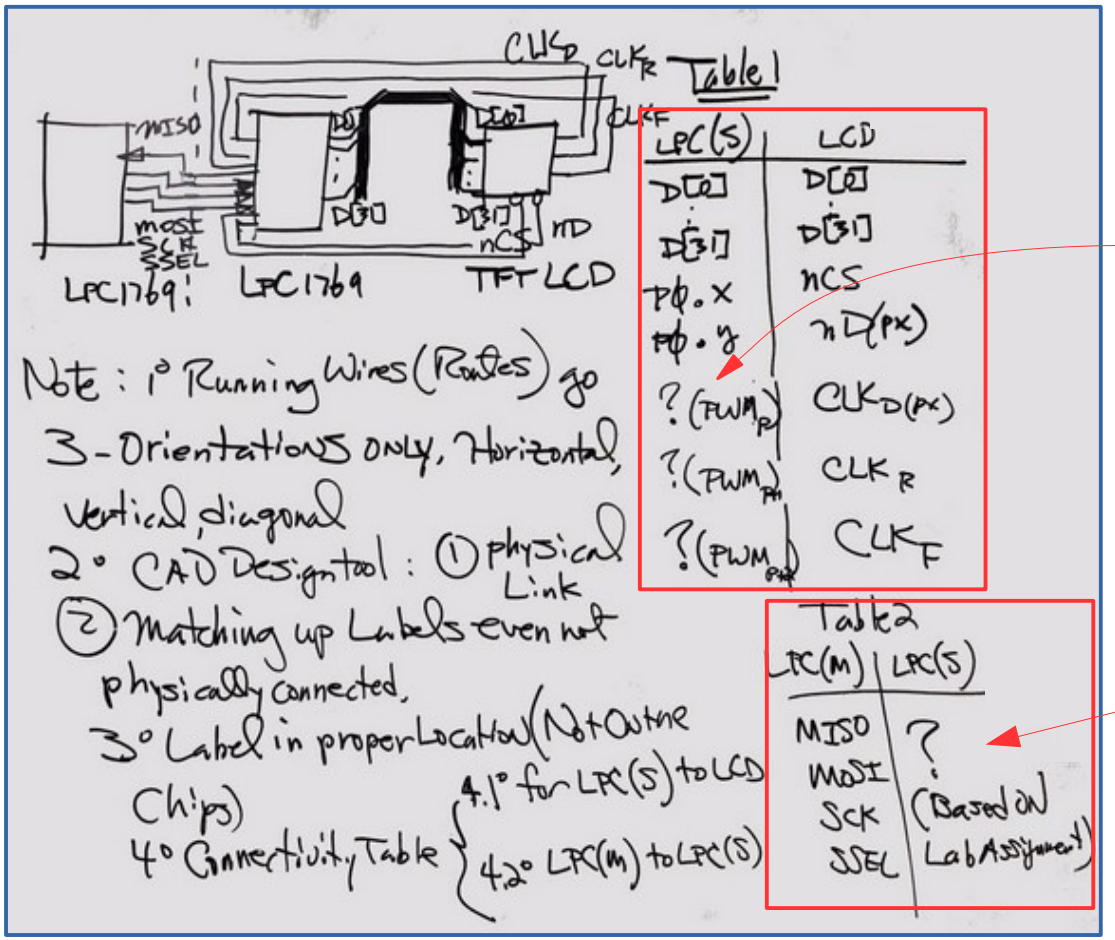




Design LCD Drive Unit
LPC Master SPI To LPC Slave SPI



Slave LPC I/F To LCD



Look up the SCH from the pdf doc of the LPC CPU module to finish the pin selection

Look up the SCH from the pdf doc of the LPC CPU module to finish the pin selection (as in the lab)

Example: 160 x 120 Resolution, For LCD Display,
30FPS, Px Depth (color Depth) 24 bits. Design LPC Driver
Find (1) CLK_D, (2) Software Driver for SPI Clock on LPC (Master) – Non Blocking
$CLK_F \rightarrow CLK_R \rightarrow CLK_D$
(1/120) (/60) CPSR[15:8] = ? (CPSDVSR is given)
2-254