Full Name: ..... **UoB Username: .....**

Question 1: Colour Representation

You are using a drawing library that requires pixels colours to be packed into 32 bit integers. This library is slightly unusual in that it requires colour channels to be ordered: Green, Alpha, Red, Blue (GARB) (i.e. the Green value should occupy the most significant bits, followed by the Alpha, Red and then Blue). You wish to draw pixels using the following colour combination (numbers in range 0-255): Red= `53` , Green= `226` , Blue= `111` , Alpha= `255`

Providing your answer as a single decimal integer (for example: `1234567890`), what is the GARB value required to draw the specified colour ?

[ ] [2 marks]

Question 2: OBJ File Content

Answer the following questions regarding the content and formatting of OBJ files:

a) What token indicates a line containing the [x,y,z] coordinates of a vertex ? [ ]

[1 mark]

b) What token indicates a line that contains the name of a 3D object ? [ ]

[1 mark]

c) What is the numerical range for each RGB colour channel ? [ ]

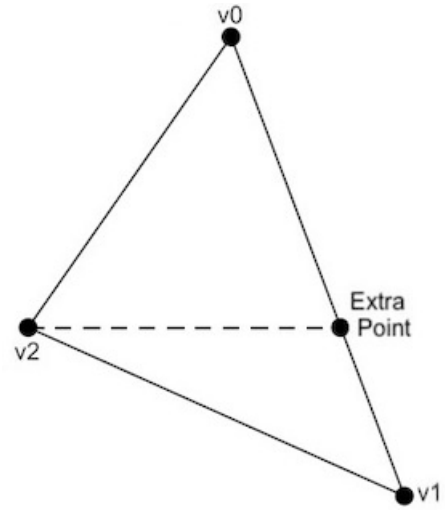
[1 mark]

d) What marker indicates a line containing the definition of a new material ? [ ]

[1 mark]

Question 3: Extra Point

The 2D triangle shown in the diagram below has vertices:
`v0=[303,36] v1=[485,591] v2=[47,387]`

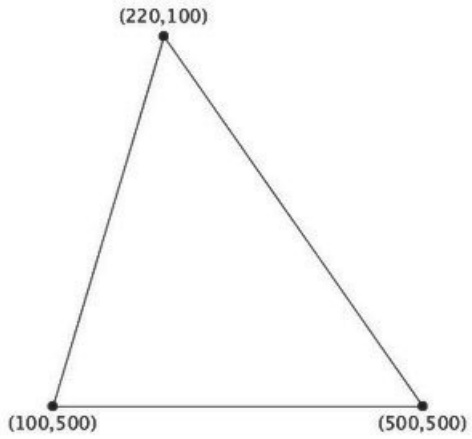


The filled rendering of this triangle can be achieved by first splitting it into a flat bottom and flat top triangle by the addition of an "Extra Point", as illustrated in the diagram. Giving your answer to the nearest whole number, what are the coordinates of this extra point ?

[ ] [ ] [2 mark]

Question 4: Rasterising

Consider the triangle illustrated below:



When filling this triangle by rasterisation:

a) Calculate the x coordinate (rounded to the *nearest* whole number) of the *left-most* filled pixel of the row at y position 296 [ ] [2 mark]

b) Calculate the x coordinate (rounded to the *nearest* whole number) of the *right-most* filled pixel of the row at y position 296 [ ] [2 mark]

Question 5: Camera Orientation

A camera is at a position of `[-53,7,73]` relative to the scene/world origin. We wish to orient the camera so that it points directly towards the position `[74,31,-6]` with the camera in the vertical (i.e. with no roll to its orientation). Ensuring that you normalise your vectors where appropriate and rounding all values in your final answer to the nearest two decimal places, provide the following:

a) The required *forward* camera orientation vector [ ] [ ] [ ] [2 mark]

b) The associated *right* camera orientation vector [ ] [ ] [ ] [2 mark]

Helpful hints:

Dot Product: $a \bullet b = (a_1\, b_1) + (a_2\, b_2) + (a_3\, b_3)$

Cross Product: $a \times b = \begin{bmatrix} a_2b_3 - a_3b_2 \\ a_3b_1 - a_1b_3 \\ a_1b_2 - a_2b_1 \end{bmatrix}$