1. Define computer graphics, and how does it differ from traditional graphics or visual arts? (2 marks)
   It is the use of computers to create and manipulate pictures on a display device. It comprises of software techniques to create, store, modify, represents pictures.
2. List the significance of the size attribute of output primitives. How does the size affect the visual representation and prominence of objects in the scene? (2 marks)
   1. Line Attributes
   2. Curve Attributes
   3. Color and Grayscale Levels
   4. Area Fill Attributes
   5. Character Attributes
   6. Bundled Attributes
3. Discuss the following key features in Computer Graphics. (2 marks)

   i) Persistence

   Persistence is defined as the time it takes the emitted light from the screen to decay to one- tenth of its original intensity. Lower-persistence phosphors require higher refresh rates to maintain a picture on the screen without flicker.

   ii) Aspect ratio.

   Aspect ratio is generally used to determine the relative horizontal and vertical sizes of computer graphics. For example, if a computer graphic has an aspect ratio of 3:1, this means the width of the graphic is three times of the height of the image. Aspect ratio plays an important role in resizing.
4. How does the RGB color model differ from the YIQ model, and how can we convert between these two representations? (2 marks)

$$\begin{bmatrix} Y \\ I \\ Q \end{bmatrix} = \begin{bmatrix} 0.299 & 0.587 & 0.114 \\ 0.596 & -0.275 & -0.321 \\ 0.212 & -0.523 & 0.311 \end{bmatrix} * \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

5. Describe rotation in 2D graphics. How does it alter the orientation of an object around a fixed point? (2 marks)
   It is a process of changing the angle of the object. Rotation can be clockwise or anticlockwise. For rotation, we have to specify the angle of rotation and rotation point. Rotation point is also called a pivot point
6. Define 2D translation in computer graphics and describe how it moves an object from its original position to a new position in the coordinate plane. (2 marks)
   A translation is applied to an object by repositioning it along a straight line path from one coordinate location to another. We translate a two-dimensional point by adding translation distances, tx and ty, to original coordinate position (x,y) to move the point to a new position (x', y'). $x'=x+tx$, $y'=y+ty$. The translation distance pair (tx, ty) called a translation vector or shift vector.
7. Define scaling in 2D graphics and explain how it changes the size of an object while preserving its shape. Provide an example of scaling a simple geometric shape. (2 marks)
   In computer graphics, scaling is a process of modifying or altering the size of objects. Scaling may be used to increase or reduce the size of the object. Scaling subjects the coordinate points of the original object to change. The scaling factor determines whether the object size is to be increased or reduced.

8. Given a point P(x, y) in a 2D coordinate system and shear factors Shx and Shy, write the mathematical representation of the 2D shear operation and find the new position P'(x', y') of the point after applying the shear transformation. (2 marks)

Horizontal Shear:

The mathematical representation of the horizontal shear transformation is:

$x' = x + Shx * y$

$y'=y$

Here, x' and y' are the new coordinates of the point P'(x', y') after applying horizontal shear. Shx is the shear factor along the x-axis, and x and y are the original coordinates of the point P(x, y).

Vertical Shear:

The mathematical representation of the vertical shear transformation is:

$x' = x$

$y' = y + Shy * x$

9. Discuss the advantages of using polygon meshes in 3D modelling and rendering. (2 marks)

A polygon mesh is a collection of edges, faces and connecting points that is used to provide a polygon model for 3-D modeling and computer animation. Its geometric makeup can be stored in order to facilitate various kinds of simulation of three-dimensional renderings.

10. Define a plane equation in 3D space and explain how it represents a flat surface with the help of its coefficients and normal vector. (2 marks)

A plane equation in 3D space is a mathematical representation that defines a flat, two-dimensional surface. The equation for a plane in 3D space is often written in the form:

$Ax + By + Cz + D = 0$

Where:

- **A**, **B**, and **C** are the coefficients of the equation.
- **x**, **y**, and **z** are the coordinates of a point on the plane.
- **D** is the constant term.

11. List any two applications of computer graphics. (2 marks)

- Medicine – to model and study physical functions
- Computer Aided surgery

12. Give the discussion parameter for Bresenham's Line Algorithm at K and K+1. (2 marks)

Decision Parameter at K is

$P_k=2\ \Delta_y . x_k - 2\ \Delta_x . y_k + C$

Decision Parameter at K+1 is

$P_{k+1}=2\ \Delta_y . x_{k+1} - 2\ \Delta_x . y_{k+1} + C$

13. Discuss the following key features in Computer Graphics. (2 marks)

iii) Persistence

Persistence is defined as the time it takes the emitted light from the screen to decay to one- tenth of its original intensity. Lower-persistence phosphors require higher refresh rates to maintain a picture on the screen without flicker.

iv) Aspect ratio.

Aspect ratio is generally used to determine the relative horizontal and vertical sizes of computer graphics. For example, if a computer graphic has an aspect ratio of 3:1, this means the width of the graphic is three times of the height of the image. Aspect ratio plays an important role in resizing.

14. Define Ambient Light. (2 marks)

The ambient light (available light or background light) is natural daylight, and the term usually refers to sources of light that are already available naturally (e.g. the sun, moon, lightening) or artificial light already used (e.g. to light a room).

Illumination equation for ambient light is

$I = k_a I_a$

I- is the resulting intensity

I_a – is the incident ambient light intensity

K_a - is the object's basic intensity, ambient – reflection coefficient

15. Describe rotation in 2D graphics. How does it alter the orientation of an object around a fixed point? (2 marks)

It is a process of changing the angle of the object. Rotation can be clockwise or anticlockwise. For rotation, we have to specify the angle of rotation and rotation point. Rotation point is also called a pivot point

16. Define 2D translation in computer graphics and describe how it moves an object from its original position to a new position in the coordinate plane. (2 marks)

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17. Define scaling in 2D graphics and explain how it changes the size of an object while preserving its shape. Provide an example of scaling a simple geometric shape. (2 marks)

In computer graphics, scaling is a process of modifying or altering the size of objects. Scaling may be used to increase or reduce the size of the object. Scaling subjects the coordinate points of the original object to change. The scaling factor determines whether the object size is to be increased or reduced.

18. Given a point P(x, y) in a 2D coordinate system and shear factors Shx and Shy, write the mathematical representation of the 2D shear operation and find the new position P'(x', y') of the point after applying the shear transformation. (2 marks)

Horizontal Shear:

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Vertical Shear:

The mathematical representation of the vertical shear transformation is:

$x' = x$

$y' = y + Shy * x$

19. Discuss the advantages of using polygon meshes in 3D modelling and rendering. (2 marks)

A polygon mesh is a collection of edges, faces and connecting points that is used to provide a polygon model for 3-D modeling and computer animation. Its geometric makeup can be stored in order to facilitate various kinds of simulation of three-dimensional renderings.

20. Define a plane equation in 3D space and explain how it represents a flat surface with the help of its coefficients and normal vector. (2 marks)

A plane equation in 3D space is a mathematical representation that defines a flat, two-dimensional surface. The equation for a plane in 3D space is often written in the form:

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