(a)

When plotting a circle starting from $P(x_p, y_p)$ and moving y by 1,
we can pick from two possible pixels:

$N = P(x_p, y_p + 1)$ or $NW = P(x_p - 1, y_p + 1)$.

Using the midpoint(M between N and NW) as the decision parameter,
we can decide which pixel to proceed.

$$M = (x_p - 1/2, y_p + 1)$$
$$D = F(M) = F(x_p - 1/2, y_p + 1)$$
$$= (x_p - 1/2)^2 + (y_p + 1)^2 - r^2$$

If $D < 0, M$ is inside the circle and we can proceed to N.
Otherwise, if $D \geq 0, M$ is outside/on the circle and we can proceed to NW.

To find out D_{new}, we should consider two scenarios:

1) D_{new} after proceeding with N
2) D_{new} after proceeding with NW

1) D_{new} after proceeding with N $(x_p, y_p + 1)$:

$$D_{new} = (x_p - 1/2)^2 + (y_{p+1} + 1)^2 - r^2$$
$$D_{old} = (x_p - 1/2)^2 + (y_p + 1)^2 - r^2$$
$$D_{new} - D_{old} = (x_p - 1/2)^2 + (y_{p+1} + 1)^2 - r^2 - [(x_p - 1/2)^2 + (y_p + 1)^2 - r^2]$$
$$= 2(y_p + 1) + 1$$
$$\therefore D_{new} = D_{old} + 2(y_p + 1) + 1$$

2) D_{new} after proceeding with NW $(x_p - 1, y_p + 1)$:

$$D_{new} = (x_{p-1} - 1/2)^2 + (y_{p+1} + 1)^2 - r^2$$
$$D_{old} = (x_p - 1/2)^2 + (y_p + 1)^2 - r^2$$
$$D_{new} - D_{old} = (x_{p-1} - 1/2)^2 + (y_{p+1} + 1)^2 - r^2 - [(x_p - 1/2)^2 + (y_p + 1)^2 - r^2]$$
$$= 2(y_p + 1) - 2(x_p + 1) + 1$$
$$\therefore D_{new} = D_{old} + 2(y_p + 1) - 2(x_p + 1) + 1$$

We can derive D_{start} by plugging in the initial coordinates (r, 0).

$$D_{start} = F(r - 1/2, 1)$$
$$= (r - 1/2)^2 + 1 - r^2$$
$$= 5/4 - r$$
$$\cong 1 - r \qquad \text{(r is an integer)}$$

Lastly, we can derive coordinates in 8 symmetric regions by considering eight symmetric points at: (x,y), (-x,y), (x,-y), (-x,-y), (y,x), (-y,x), (y,-x), (-y,-x) on a circle.

(b)

OpenGL uses right-handed coordinate system, where positive x-axis is to viewer's right, positive y-axis is up. Origin $(0, 0)$ is located at the bottom-left corner of the window. Therefore, if any of the x and y is less than 0, the coordinate won't be shown in the window.