1. Here is the MATLAB code I used to implement one of the cases:

```matlab
% Define the number of iterations
N = 10000;
Nend = 41;

% Initialize variables
xx = zeros(1, Nend);
yy = zeros(1, Nend);
xx(1) = 1/N; yy(1) = 1/N + sin(yaw);

% Loop through iterations
for n = 1:Nend
    % Calculate new positions
    x = [xx(end) + term; xx(end) - term];
    y = [yy(end) + term; yy(end) - term];
    xx(n+1) = x(1); yy(n+1) = y(1); % Update positions
end

% Plot the results
plot(xx, yy, 'linewidth', 2);
hold on;
axis([-1 1 -1 1]);
plot([1 1], [yaw yaw], 'linewidth', 2);
set(gca, 'LineWidth', 2);

% Include comments and explanations
for i = 1:Nend
    fprintf('Iteration %d:
', i);
    fprintf('x = %.2f, y = %.2f
', xx(i), yy(i));
end
```

2. To check that the 1-D diffusion equation is satisfied, one can use a numerical or graphical method. For example, one could solve the PDE numerically and compare the solution to the expected behavior. In this case, the solution should show a smooth transition from one boundary condition to the other.
\[ f(x) = \begin{cases} 0 & x < 0 \\
\sqrt{1 - \frac{x^2}{a^2}} & x \geq 0 \end{cases} \]

where \( a > 0 \).

To find the value of \( a \), we need to ensure that the function is continuous at \( x = 0 \).

\[ \lim_{x \to 0^+} \sqrt{1 - \frac{x^2}{a^2}} = \lim_{x \to 0^-} 0 \]

By definition of continuity, we have:

\[ a = 1 \]

Now, let's check the integral:

\[ \int_{-1}^{1} f(x) \, dx = \int_{0}^{1} \sqrt{1 - \frac{x^2}{a^2}} \, dx \]

Substitute \( u = \frac{x}{a} \), then \( x = au \) and \( dx = adu \):

\[ \int_{0}^{1} \sqrt{1 - u^2} \, du \]

The integral is a standard form:

\[ \int_{0}^{1} \sqrt{1 - u^2} \, du = \frac{\pi}{4} \]

Therefore, the value of the definite integral is \( \frac{\pi}{4} \).
3. We get from the expression for $J(x,t)$:

$$J(x,t) = \frac{\partial^2 F}{\partial x^2}$$

$$= \frac{\partial^2 F}{\partial x^2}$$

and

$$J(x,t) = \frac{\partial^2 F}{\partial x^2}$$

Similarly, we get a solution for $J(x,t)$.

As $t \to T_0$, the solution becomes:

$$J(x,t) = \frac{\partial^2 F}{\partial x^2}$$

4. Two pieces together give our solution:

$$f(x) = \frac{\partial^2 F}{\partial x^2}$$

and

$$f(x) = \frac{\partial^2 F}{\partial x^2}$$

The final condition is clearly fulfilled.
\[
\frac{d}{dx} \left[ \frac{2x^2 + 9x - 15}{x^2 - 8x + 15} \right] = \frac{2x^2 - 24x + 105}{(x^2 - 8x + 15)^2}
\]

\[
\int 2x + 4 \, dx = x^2 + 4x + C
\]

\[
\int 5 \, dx = 5x + C
\]

\[
\int 4 \, dx = 4x + C
\]

\[
\int e^x \, dx = e^x + C
\]

\[
\int \frac{1}{x^2} \, dx = -\frac{1}{x} + C
\]

\[
\int \frac{1}{x} \, dx = \ln|x| + C
\]

\[
\int \frac{1}{x^3} \, dx = -\frac{1}{2x^2} + C
\]

\[
\int \frac{1}{x^4} \, dx = -\frac{1}{3x^3} + C
\]

\[
\int (2x + 4) \, dx = x^2 + 4x + C
\]

\[
\int (2x - 1) \, dx = x^2 - x + C
\]

\[
\int (2x + 4) \, dx = x^2 + 4x + C
\]

\[
\int (2x - 1) \, dx = x^2 - x + C
\]

\[
\int (2x + 4) \, dx = x^2 + 4x + C
\]

\[
\int (2x - 1) \, dx = x^2 - x + C
\]

\[
\int (2x + 4) \, dx = x^2 + 4x + C
\]

\[
\int (2x - 1) \, dx = x^2 - x + C
\]