**Q2.**

The red shape denotes the original rigid body, and the blue shape denotes the transformed rigid body. The rigid body is transformed as follows:

**A.**

A graph showing different colored shapes

Description automatically generated

**B.**

A graph showing a different colored triangle

Description automatically generated with medium confidence

**C.**

A graph of a hexagon

Description automatically generated

**D.**

A graph showing different colored triangles

Description automatically generated

**E.**

A graph showing a different colored triangle

Description automatically generated with medium confidence

**Appendices:**

**A.1. Code for Q2**

% MEC

% Q2

clear;

A = [1, 0, 4;

0, 1, 0;

0, 0, 1];

B = [0.866, 0.5, 0;

-0.5, 0.866, 0;

0, 0, 1];

rigid\_body = [-1 0 1 0 -1;

1 1 0 -1 -1;

1 1 1 1 1];

% A

rigid\_body\_a = A \* B \* rigid\_body;

% B

rigid\_body\_b = B \* A \* rigid\_body;

% C

rigid\_body\_c = B \* rigid\_body;

% D

rigid\_body\_d = A \* B \* rigid\_body;

% E

rigid\_body\_e = B \* A \* rigid\_body;

% Plots

plot\_rigid\_body(rigid\_body, rigid\_body\_a, 'A fixed, B current');

plot\_rigid\_body(rigid\_body, rigid\_body\_b, 'A fixed, B fixed');

plot\_rigid\_body(rigid\_body, rigid\_body\_c, 'B fixed');

plot\_rigid\_body(rigid\_body, rigid\_body\_d, 'B fixed, A fixed');

plot\_rigid\_body(rigid\_body, rigid\_body\_e, 'B fixed, A current');

% Function to plot the rigid body

function plot\_rigid\_body(original\_vertices, vertices, title\_text)

figure;

fill(vertices(1, :), vertices(2, :), 'b', 'FaceAlpha', 0.3, 'EdgeColor', 'k');

hold on;

fill(original\_vertices(1, :), original\_vertices(2, :), 'r', 'FaceAlpha', 0.3, 'EdgeColor', 'k');

title('SE2 Transformation');

xlabel('X');

ylabel('Y');

title(title\_text);

grid on;

axis equal;

end