# MathTools HW1

```
%% 2024-9-13
%Question 1
```

## Tetsing

```
%a)Get projection of V onto U
u = [0;1];
v = [2;3];
question1a = projection(u,v);
disp('Returned vector for 1a:');
```

```
Returned vector for 1a:
```

```
disp(question1a);
```

```
     0
     3
```

```
%b)Get component V that is orthogonal to U
question1b = ortho(u,v);
disp('Returned vector for 1b:');
```

```
Returned vector for 1b:
```

```
disp(question1b);
```

```
     2
     0
```

```
%c)Returns distance
question1c = distance(u,v);
disp('Returned distance:');
```

```
Returned distance:
```

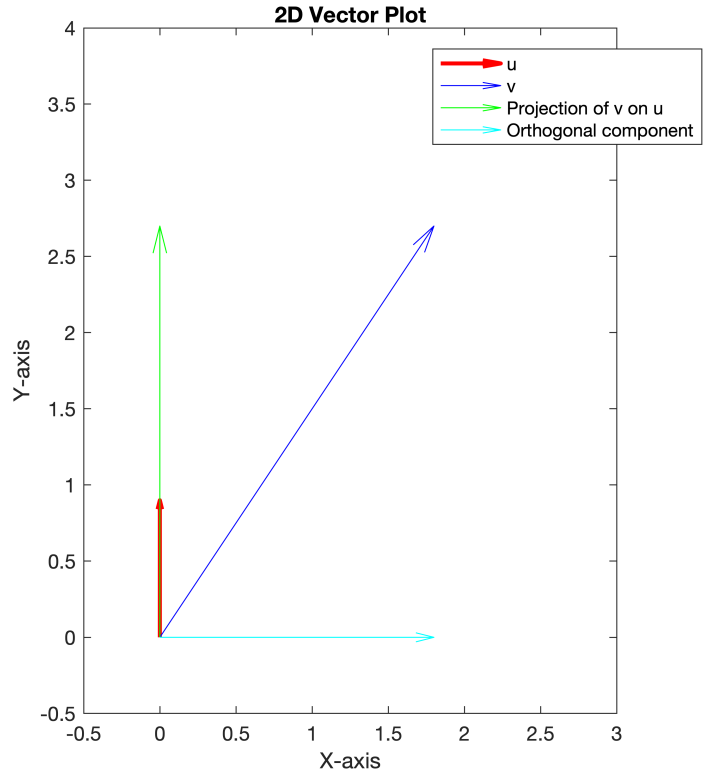
```
disp(question1c);
```

```
     2
```

## Plotting

```
% figure;
% quiver(0, 0, u(1), u(2), 'r'); hold on; % Vector u
% quiver(0, 0, v(1), v(2), 'b');          % Vector v
% question1a = projection(u,v)
% quiver(0, 0, question1a(1), question1a(2), 'g');    % Projection of v onto u
% question1b = ortho(u,v)
% quiver(question1a(1), question1a(2), question1b(1), question1b(2), 'k');  % Orthogona
% axis equal;
% grid on;
% legend('u', 'v', 'Projection of v on u', 'Orthogonal component');
```

```
figure;
quiver(0, 0, u(1), u(2), 'r','LineWidth',2); hold on;% Vector u
quiver(0, 0, v(1), v(2), 'b'); hold on;% Vector v
quiver(0, 0, question1a(1), question1a(2), 'g'); hold on;% Projection
quiver(0, 0, question1b(1), question1b(2), 'c'); hold on;% Orthogonal
axis equal;
xlabel('X-axis'); ylabel('Y-axis');
title('2D Vector Plot');
xlim([-0.5, max(v(1)) + 1]); ylim([-0.5, max(v(2)) + 1]);
legend('u', 'v', 'Projection of v on u', 'Orthogonal component', Location='best');
hold off;
```




```
function question1a = projection(u,v)
question1a = (sum(v.*u)/sum(u.*u))*u;
end

function question1b = ortho(u,v)
question1a = projection(u,v);
question1b = v-question1a;
end

function question1c = distance(u,v)
question1b = ortho(u,v);
question1c = sqrt(sum(question1b .^ 2));
end
```