MatLab Assignment 1:
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Exercise 1:

Vector 1: $R_1 = a_x + 2a_y + 3a_z$

$R_2 = 3a_x + 2a_y + a_z$

a) Dot product:

$\underline{R_1} \cdot \underline{R_2} = (1, 2, 3) \cdot (3, 2, 1)$

$= 3 + 4 + 3$

$= 10$

b) Projection of R_1 on R_2

i) Determine unit vector in the direction of R_2

$$a_{R_2} = \frac{R_2}{|R_2|} = \frac{3a_x + 2a_y + 1a_z}{\sqrt{3^2 + 2^2 + 1^2}} = \frac{R_2}{\sqrt{14}}$$

2) Inner product of unit vector R_2 (a_{R_2}) and R_1

$$R_{1\,R2} = (R_1 \cdot a_{R_2}) \cdot a_{R_2}$$

$$= \left(\frac{(1, 2, 3) \cdot (3, 2, 1)}{\sqrt{14}} \right) \left(\frac{(3, 2, 1)}{\sqrt{14}} \right)$$

$$= \frac{10}{\sqrt{14}} \left(\frac{3, 2, 1}{\sqrt{14}} \right)$$

$$= 2.142\,\underline{a}_x + 1.428\,\underline{a}_y + 0.714\,\underline{a}_z$$

c) Angle between R_1 and R_2

$$\cos\theta = \frac{\underline{R_1} \cdot R_2}{|R_1|\,|R_2|}$$

$$= \frac{(1, 2, 3) \cdot (3, 2, 1)}{\left(\sqrt{1^2 + 2^2 + 3^2}\right)\left(\sqrt{3^2 + 2^2 + 1^2}\right)}$$

$$\cos\theta = \frac{10}{\sqrt{14} \cdot \sqrt{14}}$$

$$\cos\theta = 0.714$$

$$\theta = 44.415^\circ$$

MatLab Code:

```
%Excercise 1
R1 = [1 2 3];
R2 = [3 2 1];

%A) Dot Product
dotr1r2 = dot(R1,R2);
disp('Dot Product between R1 and R2: ');
disp(dotr1r2);

% B) Projection of R1 on R2
%Unit vector in direction of R2
ar2 = (R2)/(norm(R2));
%Inner product of unit vector R2 and R1
R1r2 = dot(R1,ar2)*ar2;
disp('Projection of R1 on R2 is: ');
disp(R1r2);

% C) Angle between R1 and R2
angler1r2 = acos((dotr1r2)/((norm(R1)*norm(R2))));
%Converting to degrees
angler1r2 = (angler1r2*180)/pi;
disp('Angle between R1 and R2 is: ');
disp(angler1r2);
```

OUTPUT:

```
>> assignment1
Dot Product between R1 and R2:
    10

Projection of R1 on R2 is:
    2.1429    1.4286    0.7143

Angle between R1 and R2 is:
   44.4153
```