Assignment 4

The due date for submitting this assignment has passed.

Due on 2021-02-17, 23:59 IST.

As per our records you have not submitted this assignment.

1) Inverse kinematics determines the *1 point*

- Rate of change of joint variable for a desired end effector velocity
- End effector velocity for a desired rate of change of joint variable
- Joint variables for a desired end effector position and orientation
- End effector position and orientation for a desired joint variable

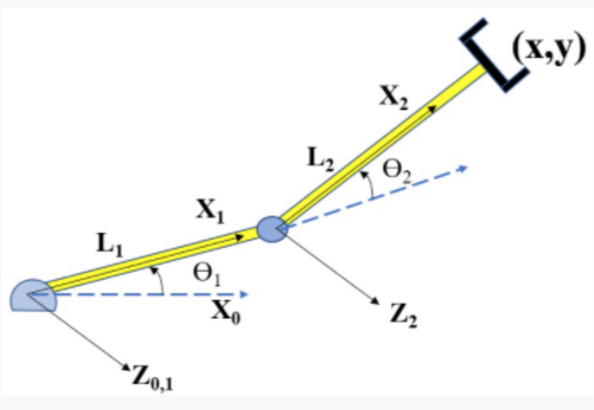
No, the answer is incorrect.
Score: 0
Accepted Answers:
Joint variables for a desired end effector position and orientation

2) Forward kinematics gives the relation between the *1 point*

- End effector position and orientation and joint variables
- End effector velocities and rate of change of joint variables
- Rate of change of joint variables and torques
- Propagation of force from the end effector to the various links of the robot

No, the answer is incorrect.
Score: 0
Accepted Answers:
End effector position and orientation and joint variables

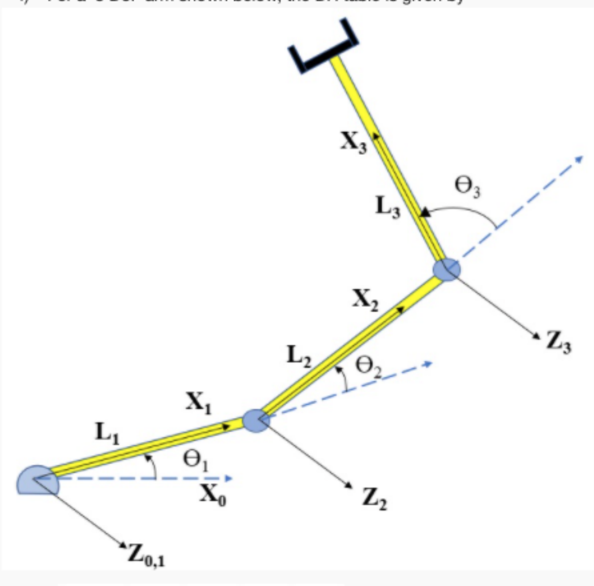
3) For a 2 DoF arm as shown below and for $\theta_1 = \theta_2 = 30^\circ$ and link length $l_1 = l_2 = 1$ unit, the end effector position is *1 point*



- (0.366,0.366)
- (1.366,1.366)
- (0.366,1.366)
- (1.366,0.366)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(1.366,1.366)

4) For a 3 DoF arm shown below, the DH table is given by *1 point*



	a	α	d	Θ
0-1	0	0	0	0
1-2	0	0	L_1	Θ_2
2-3	L_2	0	0	Θ_3

	a	α	d	Θ
0-1	0	0	0	0
1-2	L_1	0	0	Θ_2
2-3	0	0	L_2	Θ_3

	a	α	d	Θ
0-1	0	0	0	Θ_1
1-2	L_1	0	0	Θ_2
2-3	L_2	0	0	Θ_3

	a	α	d	Θ
0-1	0	0	0	0
1-2	0	0	L_1	Θ_2
2-3	0	0	L_2	Θ_3

No, the answer is incorrect.
Score: 0
Accepted Answers:

	a	α	d	Θ
0-1	0	0	0	Θ_1
1-2	L_1	0	0	Θ_2
2-3	L_2	0	0	Θ_3

5) For a 3 DOF arm shown in Q4, the first row of the homogeneous transformation matrix from link 0 to 1 is *1 point*

- $cos(\theta_1), -sin(\theta_1), 0$
- $cos(\theta_1), -sin(\theta_1), 0, 0$
- $cos(\theta_1), -sin(\theta_1), 0, L_1$
- $cos(\theta_1), sin(\theta_1), 0, 0$

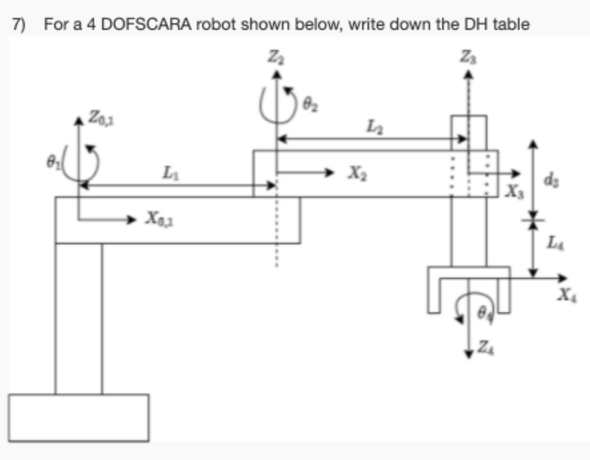
No, the answer is incorrect.
Score: 0
Accepted Answers:
$cos(\theta_1), -sin(\theta_1), 0, 0$

6) For a 3 DOF arm shown in Q4, compute the homogeneous transformation between the base (frame zero) and the end effector (frame 3). The last column is given by *0 points*

- $L_1cos(\theta_1) + L_2cos(\theta_1+\theta_2) + L_3cos(\theta_1+\theta_2+\theta_3)$
  $L_1sin(\theta_1) + L_2sin(\theta_1+\theta_2) + L_3sin(\theta_1+\theta_2+\theta_3)$
  0
  1
- $L_1cos(\theta_1) + L_2cos(\theta_1+\theta_2)$
  $L_1sin(\theta_1) + L_2sin(\theta_1+\theta_2)$
  0
  0
- $L_1cos(\theta_1) - L_2cos(\theta_1+\theta_2) - L_3cos(\theta_1+\theta_2+\theta_3)$
  $L_1sin(\theta_1) + L_2sin(\theta_1+\theta_2) + L_3sin(\theta_1+\theta_2+\theta_3)$
  0
  0
- $L_1cos(\theta_1) - L_2cos(\theta_1+\theta_2) - L_3cos(\theta_1+\theta_2+\theta_3)$
  $L_1sin(\theta_1) + L_2sin(\theta_1+\theta_2) + L_3sin(\theta_1+\theta_2+\theta_3)$
  0
  1

No, the answer is incorrect.
Score: 0
Accepted Answers:
$L_1cos(\theta_1) + L_2cos(\theta_1+\theta_2) + L_3cos(\theta_1+\theta_2+\theta_3)$
$L_1sin(\theta_1) + L_2sin(\theta_1+\theta_2) + L_3sin(\theta_1+\theta_2+\theta_3)$
0
1

7) For a 4 DOFSCARA robot shown below, write down the DH table *1 point*



	a	α	d	Θ
0-1	0	0	0	Θ_1
1-2	L_1	0	0	Θ_2
2-3	L_2	0	0	0
3-4	L_4	0	D_3	Θ_4

	a	α	d	Θ
0-1	0	0	0	Θ_1
1-2	L_1	0	0	Θ_2
2-3	L_2	0	D_3	0
3-4	L_4	0	0	Θ_4

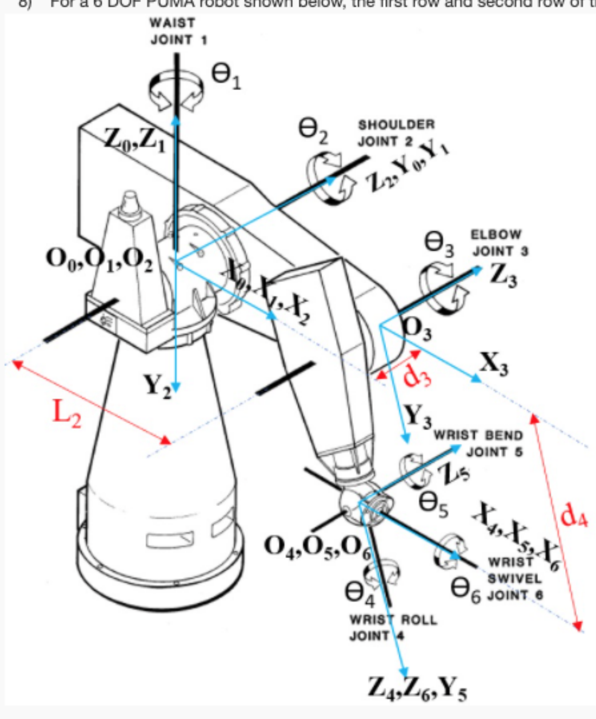
	a	α	d	Θ
0-1	0	0	0	Θ_1
1-2	L_1	0	0	Θ_2
2-3	L_2	0	D_3	0
3-4	0	0	L_4	Θ_4

	a	α	d	Θ
0-1	0	0	0	Θ_1
1-2	L_1	0	0	Θ_2
2-3	L_2	0	D_3	0
3-4	0	180	L_4	Θ_4

No, the answer is incorrect.
Score: 0
Accepted Answers:

	a	α	d	Θ
0-1	0	0	0	Θ_1
1-2	L_1	0	0	Θ_2
2-3	L_2	0	D_3	0
3-4	0	180	L_4	Θ_4

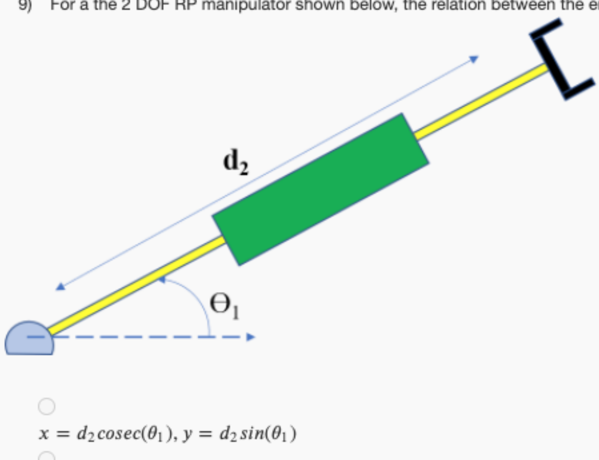
8) For a 6 DOF PUMA robot shown below, the first row and second row of the DH table is *1 point*



- $0, 0, 0, \theta_1; 0, 180, 0, \theta_2$
- $0, 0, 0, \theta_1; L_2, -90, 0, \theta_2$
- $0, 0, 0, \theta_1; 0, 0, 0, \theta_2$
- $0, 0, 0, \theta_1; 0, -90, 0, \theta_2$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$0, 0, 0, \theta_1; 0, -90, 0, \theta_2$

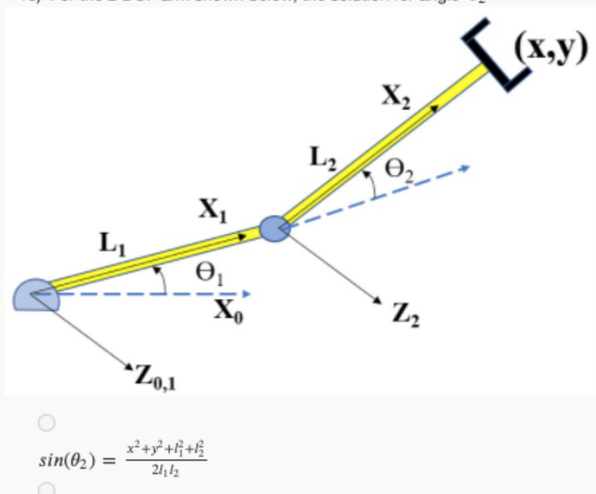
9) For a the 2 DOF RP manipulator shown below, the relation between the end effector position (x,y) and joint variables are *1 point*



- $x = d_2cosec(\theta_1), y = d_2sin(\theta_1)$
- $x = d_2cos(\theta_1), y = 0.5d_2sin(\theta_1)$
- $x = 0.5d_2cos(\theta_1), y = 0.5d_2sin(\theta_1)$
- $x = d_2cos(\theta_1), y = d_2sin(\theta_1)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$x = d_2cos(\theta_1), y = d_2sin(\theta_1)$

10) For the 2 DOF arm shown below, the solution for angle θ_2 *1 point*



- $sin(\theta_2) = \frac{x^2+y^2+l_1^2+l_2^2}{2l_1l_2}$
- $cos(\theta_2) = \frac{x^2+y^2+l_1^2+l_2^2}{2l_1l_2}$
- $sin(\theta_2) = \frac{x^2+y^2-l_1^2-l_2^2}{2l_1l_2}$
- $cos(\theta_2) = \frac{x^2+y^2-l_1^2-l_2^2}{2l_1l_2}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$cos(\theta_2) = \frac{x^2+y^2-l_1^2-l_2^2}{2l_1l_2}$