

MATHEMATICAL MODELLING AND SIMULATION

PRACTICAL TEST – 3

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Q1. Identify the MATLAB statement that could be used to help determine the root of the function $x^3 - 1$ over the interval $x = 0$ to $x = 2$.

Ans. b. `fzero(@(x) x^3-1, [0, 2])`

Q2. The MATLAB function `roots` is used in the following statement: `p = roots(x)`

Ans. b. `x` is a vector containing the coefficients of a polynomial.

c. `p` is a vector containing the roots of a polynomial.

Q3.

Find the solution to the initial value problem

$$\mathbf{x}'(t) = \begin{bmatrix} 6 & 4 & 4 \\ -7 & -2 & -1 \\ 7 & 4 & 3 \end{bmatrix} \mathbf{x}(t), \quad \mathbf{x}(0) = \begin{bmatrix} 3 \\ -6 \\ 4 \end{bmatrix}.$$

CODE:

```
syms x1(t) x2(t) x3(t)
A = [6 4 4; -7 -2 -1; 7 4 3];

x = [x1; x2; x3];
odes = diff(x) == A*x
[x1Sol(t), x2Sol(t), x3Sol(t)] = dsolve(odes);

x1Sol(t) = simplify(x1Sol(t))
x2Sol(t) = simplify(x2Sol(t))
x3Sol(t) = simplify(x3Sol(t))
```

```
C = x(0) == [3;-6; 4];
[x1Sol(t),x2Sol(t),x3Sol(t)] = dsolve(odes,C)
```

OUTPUT:

```
odes(t) =
```

```
diff(x1(t), t) == 6*x1(t) + 4*x2(t) + 4*x3(t)
```

```
diff(x2(t), t) == - 7*x1(t) - 2*x2(t) - x3(t)
```

```
diff(x3(t), t) == 7*x1(t) + 4*x2(t) + 3*x3(t)
```

```
x1Sol(t) =
```

```
C1*exp(2*t) + C2*exp(6*t)
```

```
x2Sol(t) =
```

```
- 2*C1*exp(2*t) - C3*exp(-t) - C2*exp(6*t)
```

```
x3Sol(t) =
```

```
C1*exp(2*t) + C3*exp(-t) + C2*exp(6*t)
```

```
x1Sol(t) =
```

```
2*exp(2*t) + exp(6*t)
```

```
|
```

```
x2Sol(t) =
```

```
- exp(-t) - 4*exp(2*t) - exp(6*t)
```

```
x3Sol(t) =
```

```
exp(-t) + 2*exp(2*t) + exp(6*t)
```

