

**Multiple-Choice Test – Lagrange Method of Interpolation**  
**Autar Kaw**

1. A unique polynomial of degree \_\_\_\_\_ passes through  $n+1$  data points.
- (A)  $n+1$
  - (B)  $n$
  - (C)  $n$  or less
  - (D)  $n+1$  or less

2. Given the two points  $[a, f(a)], [b, f(b)]$ , the linear Lagrange polynomial  $f_1(x)$  that passes through these two points is given by

(A)  $f_1(x) = \frac{x-b}{a-b}f(a) + \frac{x-a}{a-b}f(b)$

(B)  $f_1(x) = \frac{x}{b-a}f(a) + \frac{x}{b-a}f(b)$

(C)  $f_1(x) = f(a) + \frac{f(b)-f(a)}{b-a}(b-a)$

(D)  $f_1(x) = \frac{x-b}{a-b}f(a) + \frac{x-a}{b-a}f(b)$

3. The Lagrange polynomial that passes through the 3 data points is given by

$x$	15	18	22
$y$	24	37	25

$$f_2(x) = L_0(x)(24) + L_1(x)(37) + L_2(x)(25)$$

The value of  $L_1(x)$  at  $x = 16$  is most nearly

- (A)  $-0.071430$
- (B)  $0.50000$
- (C)  $0.57143$
- (D)  $4.3333$



4. The following data of the velocity of a body is given as a function of time.

Time ( $s$ )	10	15	18	22	24
Velocity ( $m/s$ )	22	24	37	25	123

A quadratic Lagrange interpolant is found using three data points,  $t = 15, 18$  and  $22$ . From this information, at what of the times given in seconds is the velocity of the body  $26 \text{ m/s}$  during the time interval of  $t = 15$  to  $t = 22$  seconds.

- (A) 20.173  
 (B) 21.858  
 (C) 21.667  
 (D) 22.020
5. The path that a robot is following on a  $x, y$  plane is found by interpolating four data points as

$x$	2	4.5	5.5	7
$y$	7.5	7.5	6	5

$$y(x) = 0.15238x^3 - 2.2571x^2 + 9.6048x - 3.9000$$

The length of the path from  $x = 2$  to  $x = 7$  is

- (A)  $\sqrt{(7.5 - 7.5)^2 + (4.5 - 2)^2} + \sqrt{(6 - 7.5)^2 + (5.5 - 4.5)^2} + \sqrt{(5 - 6)^2 + (7 - 5.5)^2}$   
 (B)  $\int_2^7 \sqrt{1 + (0.15238x^3 - 2.2571x^2 + 9.6048x - 3.9000)^2} dx$   
 (C)  $\int_2^7 \sqrt{1 + (0.45714x^2 - 4.5142x + 9.6048)^2} dx$



$$(D) \int_2^7 (0.15238x^3 - 2.2571x^2 + 9.6048x - 3.9000)dx$$

6. The following data of the velocity of a body is given as a function of time.

Time (s)	0	15	18	22	24
Velocity (m/s)	22	24	37	25	123

If you were going to use quadratic interpolation to find the value of the velocity at  $t = 14.9$  seconds, what three data points of time would you choose for interpolation?

- (A) 0, 15, 18
- (B) 15, 18, 22
- (C) 0, 15, 22
- (D) 0, 18, 24

