Interpolation

Reading Between the Lines

1

What is Interpolation ?

Given (x_0,y_0), (x_1,y_1), …… (x_n,y_n), find the value of 'y' at a value of 'x' that is not given.

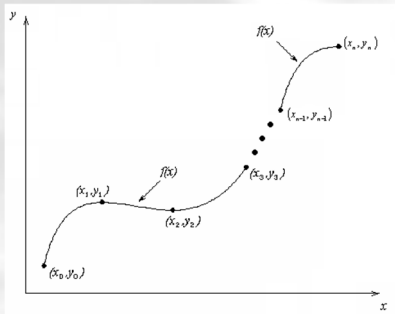


Figure Interpolation of discrete data.

2

2

APPLIED PROBLEMS

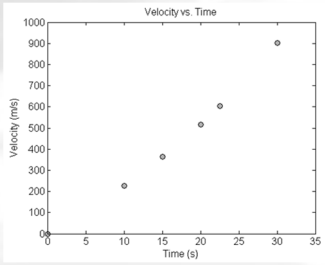
3

Fly Rocket Fly, Fly Rocket Fly

The upward velocity of a rocket is given as a function of time in table below. Find the velocity and acceleration at t=16 seconds.

Table Velocity as a function of time.

t, (s)	$v(t)$, (m/s)
0	0
10	227.04
15	362.78
20	517.35
22.5	602.97
30	901.67



Velocity vs. time data for the rocket example

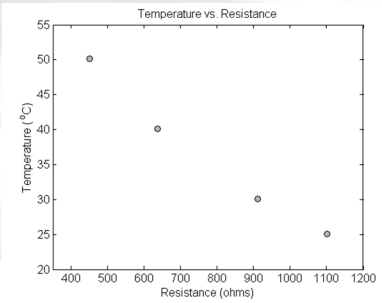
4

Thermistor Calibration

Thermistors are based on change in resistance of a material with temperature. A manufacturer of thermistors makes the following observations on a thermistor. Determine the calibration curve for thermistor.

$$\frac{1}{T} = a_0 + a_1[\ln R] + a_2[\ln R]^2 + a_3[\ln R]^3$$

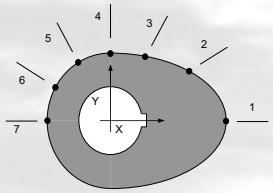
R (Ω)	T(°C)
1101.0	25.113
911.3	30.131
636.0	40.120
451.1	50.128



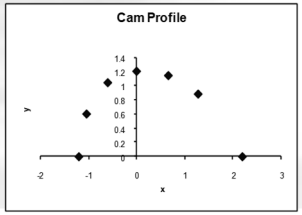
5

Following the Cam

A curve needs to be fit through the given points to fabricate the cam.



Point	x (in.)	y (in.)
1	2.20	0.00
2	1.28	0.88
3	0.66	1.14
4	0.00	1.20
5	–0.60	1.04
6	–1.04	0.60
7	–1.20	0.00

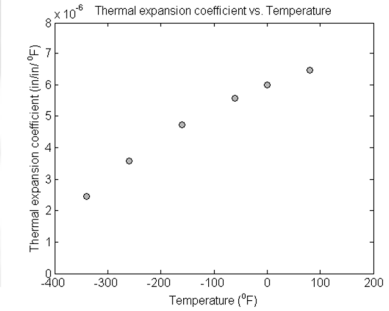


6

Thermal Expansion Coefficient Profile

A trunnion is cooled 80°F to – 108°F. Given below is the table of the coefficient of thermal expansion vs. temperature. Determine the coefficient of thermal expansion profile as a function of temperature.

Temperature (°F)	Thermal Expansion Coefficient (in/in/°F)
80	6.47×10^{-6}
0	6.00×10^{-6}
−60	5.58×10^{-6}
−160	4.72×10^{-6}
−260	3.58×10^{-6}
−340	2.45×10^{-6}



7

A polynomial of degree n has this many zeros

$n-2$ 0%

$n-2$ 0%

n 0%

$n+1$ 0%

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If a polynomial of degree n has more than n zeros, then the polynomial is

- oscillatory 0%
- zero everywhere 0%
- quadratic 0%
- not defined 0%

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10

Choose the data points

The following velocity vs time data is given. To find the velocity at $t = 14.9s$, the three time data points you would choose for second order polynomial interpolation are

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

- 0, 15, 18 0%
- 15, 18, 22 0%
- 0, 15, 22 0%
- 0, 18, 24 0%

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11

Given n data points of y vs x for conducting quadratic spline interpolation, the x-data needs to be

- equally spaced 0%
- in ascending or descending order 0%
- integers 0%
- positive 0%

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12

A quadratic spline is made of 4 quadratics. How many unknowns do we have to find.

- 4 0%
- 8 0%
- 12 0%
- 16 0%

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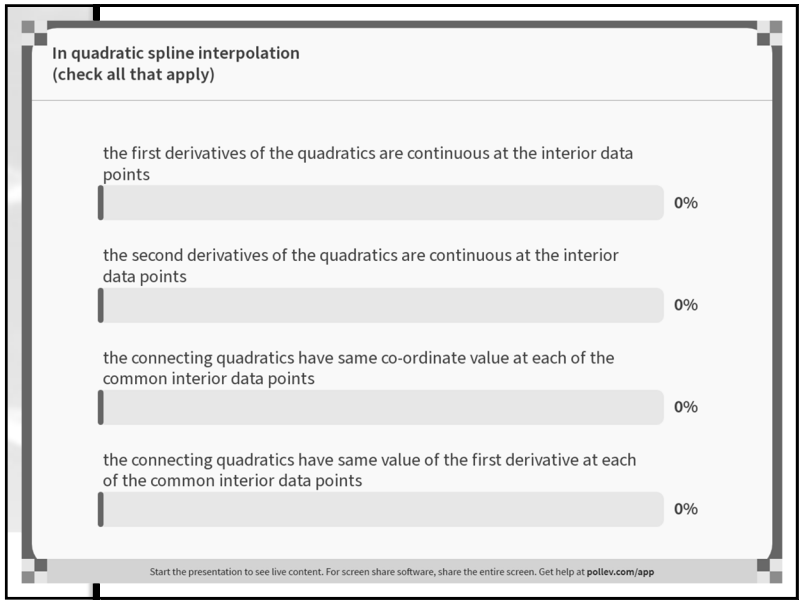
13


In quadratic spline interpolation
(check all that apply)
the first derivatives of the quadratics are continuous at the interior data points
0%
the second derivatives of the quadratics are continuous at the interior data points
0%
the connecting quadratics have same co-ordinate value at each of the common interior data points
0%
the connecting quadratics have same value of the first derivative at each of the common interior data points
0%
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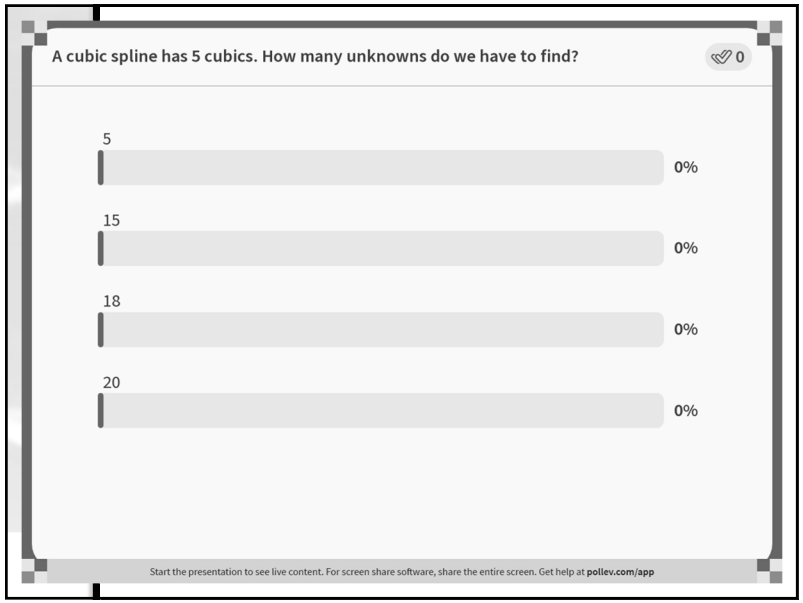
14


A cubic spline has 5 cubics. How many unknowns do we have to find?
0
5
0%
15
0%
18
0%
20
0%
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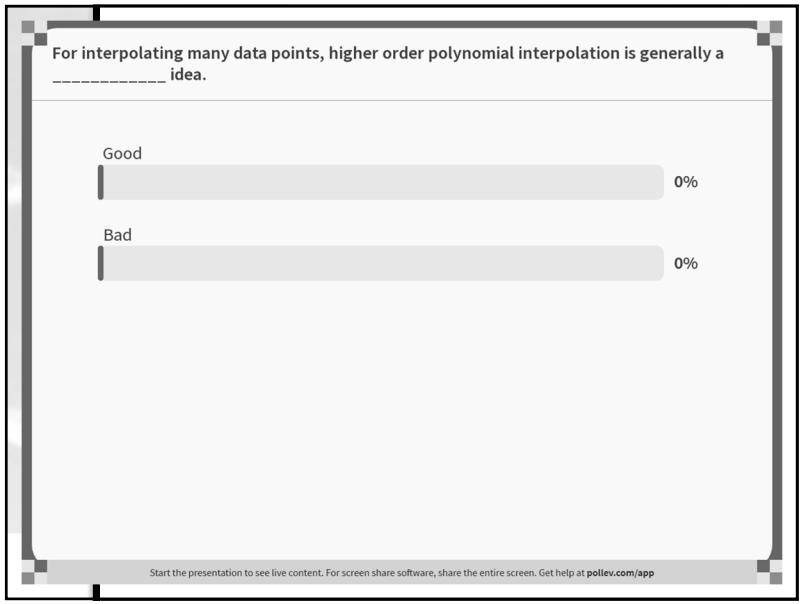
15


For interpolating many data points, higher order polynomial interpolation is generally a _____ idea.
Good
0%
Bad
0%
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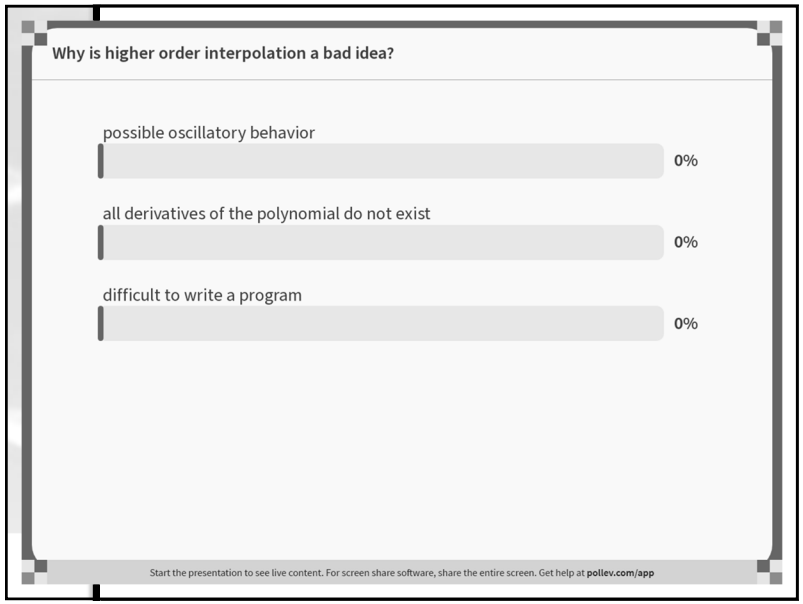
16


Why is higher order interpolation a bad idea?
possible oscillatory behavior
0%
all derivatives of the polynomial do not exist
0%
difficult to write a program
0%
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17

Slope of the spline function

Continuous 0%

Discontinuous 0%

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18

Length of the path

$\sqrt{(6-4)^2+(22-42)^2}+\sqrt{(7-6)^2+(15-22)^2}$ 0%

$\int_4^7 \sqrt{1+(x^2-20x+106)^2}dx$ 0%

$\int_4^7 \sqrt{1+(2x-20)^2}dx$ 0%

$\int_4^7 (x^2-20x+106)dx$ 0%

SEE MORE

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To find the length of the curve $y=3\sin(2x)+5\ln(7x)$ from $x=2$ to $x=5$, you would do the following

Integrate y with respect to x from $x=2$ to $x=5$ 0%

Integrate $\frac{dy}{dx}$ with respect to x from $x=2$ to $x=5$ 0%

Integrate $1+\left(\frac{dy}{dx}\right)^2$ with respect to x from $x=2$ to $x=5$ 0%

Integrate $\sqrt{1+\left(\frac{dy}{dx}\right)^2}$ with respect to x from $x=2$ to $x=5$ 0%

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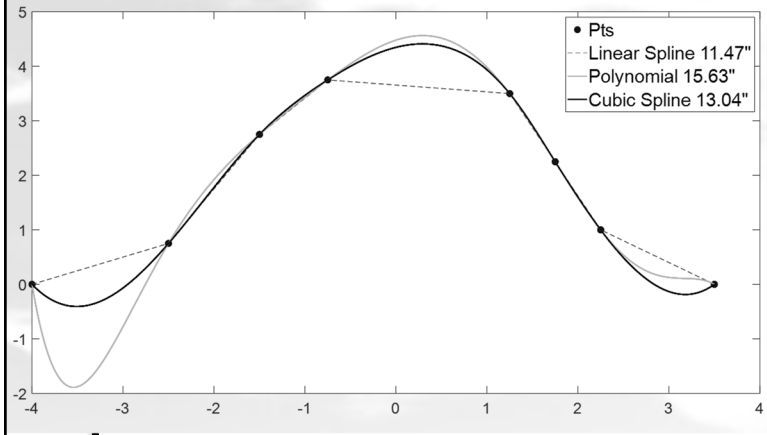
Length of interpolants



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