Assignment 3.

(1) $x^2 = \frac{B}{A}$

$x = \sqrt{\frac{B}{A}}$

So the correct code is

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sqrt ([1 4;1 4]/[1 2;1 2])
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Answer = C

(2) When I ran this code in MATLAB the output I received was "error"

Answer = B

(3) Answer = A $\Rightarrow$ plot3 (x, y, t)

This function will produce a 3d plot that shows both functions 'f' and 'g' and also showing t on the z-axis.

(4) t is our independent variable. x and y are dependent variables

We need Lagrange polynomials at $t = 0.5$ so
$\Rightarrow$

$$L_1(0.5) = \frac{(0.5-t_2)(0.5-t_3)(0.5-t_4)}{(t_1-t_2)(t_1-t_3)(t_1-t_4)} =$$

(4)

$$\frac{(0.5-0.2)(0.5-0.4)(0.5-0.6)}{(0-0.2)(0-0.4)(0-0.6)} = 0.0625$$

calculations for the other Lagrange polynomials give

$L_2(0.5) = -0.3125,$

$L_3(0.5) = 0.9375$

$L_4(0.5) = 0.3125$

$\Rightarrow$ for the x value we get

$\Rightarrow x(0.5) =$

$x_1 L_1(0.5) + x_2 L_2(0.5) + x_3 L_3(0.5) + x_4 L_4(0.5)$

$= 1 \times 0.0625 + 1.2 \times -0.3125 + 1.3 \times 0.9375$
$+ 1.25 \times 0.3125$

$= 1.3$

and for y $\Rightarrow$
$y(0.5) \Rightarrow$

$y_1 L_1(0.5) + y_2 L_2(0.5) + y_3 L_3(0.5) + y_4 L_4(0.5)$

$= 2 \times 0.0625 + 2.1 \times -0.3125 + 2.3 \times 0.9375 + 2.6$
$\times 0.3125$

$= 2.44$

Answer = B $(1.3, 2.44)$

(S) We're looking for a 2nd order polynomial

$$v(t) = a_0 + a_1 t + a_2 t^2$$

when $t = 17$

three closest points to $t = 17$ that also bracket it

$t_0 = 15 \quad v(t_0) = 36$
$t_1 = 20 \quad v(t_1) = 57$
$t_2 = 22 \quad v(t_2) = 10$

Such that

$$v(15) = 36 = a_0 + a_1(15) + a_2(15)^2$$

$$v(20) = 57 = a_0 + a_1(20) + a_2(20)^2$$

$$v(22) = 10 = a_0 + a_1(22) + a_2(22)^2$$

in matrix form =>

$$\begin{bmatrix} 1 & 15 & 225 \\ 1 & 20 & 400 \\ 1 & 22 & 484 \end{bmatrix} \begin{bmatrix} a_0 \\ a_1 \\ a_2 \end{bmatrix} = \begin{bmatrix} 36 \\ 57 \\ 10 \end{bmatrix}$$

solve the 3 equations =>

$$a_0 + 15a_1 + 225a_2 = 36$$

$$z = \frac{4}{25} - \frac{a_0}{225} - \frac{a_1}{15}$$

(5) Substitute into other two equations $\Rightarrow$

$$a_0 + 20a_2 + 40c\left(\frac{4}{25} - \frac{1}{225}a_1 - \frac{1}{15}a_2\right) = 57$$

$\Rightarrow$ eventually we get to

$$a_0 = -1214.143$$
$$a_1 = 142.7$$
$$a_2 = -3.957$$

Thus

$$v(t) = -1214.143 + 142.7(t) - 3.9571(t)^2, \quad 15 \geq t \geq 22$$

$$a(t) = \frac{d}{dt}(-1214.143) + \frac{d}{dt}(142.7(t)) + \frac{d}{dt}(-3.957(t)^2)$$

$$= 142.7 - 7.9143(t), \quad 15 \leq t \leq 22$$

$$a(17) = 142.7 - 7.9143(17)$$

$$= 8.187 \text{ m/s}^{-2}$$

(6) Lagrange form $\Rightarrow$

x	-1	1	2
$f(x)$	9	5	12

using the formula for $P_2(x) \Rightarrow$ we get

$$\frac{(x-1)(x-2)}{(-1-1)(-1-2)}(9) + \frac{(x-(-1))(x-2)}{(1-(-1))(1-2)}(5) + \frac{(x-(-1))(x-1)}{(2-(-1))(2-1)}(12)$$

$$\Rightarrow \frac{(x-1)(x-2)}{6}(9) + \frac{(x+1)(x-2)}{-2}(5) + \frac{(x+1)(x-1)}{3}$$

6

$$\Rightarrow \frac{9(x^2-3x+2)}{6} + \frac{5(x^2-x-2)}{-2} + \frac{12(x^2-1)}{3}$$

$$\Rightarrow \frac{9x^2-27x+18}{6} + \frac{5x^2-5x-10}{-2} + \frac{12x^2-12}{3}$$

multiply by variable to make common denominator

$$2(9x^2-27x+18) + -6(5x^2-5x-10) + 4(12x^2-12)$$

$$18x^2 - 54x + 36 - 30x^2 + 30x + 60 + 48x^2 - 48$$

$$36x^2 - 24x + 48$$

divide by 12

$$\Rightarrow 3x^2 - 2x + 4$$

Newton's polynomial

x	y
-1	9
1	5
2	12

$$\frac{5-9}{1-(-1)} = \frac{-4}{2} = -2$$

$$\frac{12-5}{2-1} = \frac{7}{1} = 7$$

$$\frac{7-(-2)}{2-(-1)} = \frac{9}{3} = 3$$

$$f(x) = b_0 + b_1(x-x_0) + b_2(x-x_0)(x-x_1)$$
$$= 9 - 2(x+1) + 3(x+1)(x-1)$$

$$= 9 - 2x - 2 + 3x^2 - 3$$
$$= 3x^2 - 2x + 4$$

Answer = D

7

$x_{-1} = x_0 - h_1$ $\Rightarrow$ $x_0 - h$

$x_0 = x_0$ $\quad$ x_0

$x_1 = x_0 + h_2$ $\quad$ $x_0 + h$

$$f_2'(x_0) = \frac{f(x_1) - f(x_{-1})}{(x_0+h) - (x_0-h)}$$

$$= \frac{f(x_1) - f(x_{-1})}{2h}$$

Answer = D

(10)

$$\int_0^2 \cosh(x)\,dx$$

$$\frac{\Delta x}{3}\left(f(x_0) + 4f(x_1) + 2f(x_2) + 4f(x_3) + 2f(x_4)\right)\ldots$$

$$\Delta x = \frac{b-a}{n}$$

$a = 0$ $\quad b = 2$ $\quad n = 4$

$\Delta x = \frac{1}{2}$

$f(x_0) = 1$

$4f(x_1) = 4\cosh \frac{1}{2} = 4.515$

$2f(x_2) = 2\cosh 1 = 3.086$

$4f(x_3) = 4\cosh \frac{3}{2} = 9.41$

$f(x_4) = \cosh 2 = 3.76$

$\frac{1}{6}(1 + 4.515 + 3.086 + 9.41 + 3.76) = 3.628$

Answer = B

3.63