MECH 307 Numerical Methods for Mechanical Engineering
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Homework #1

FORMAT of the file to be submitted:

1. All the m-files should be named as pr1.m, pr2.m and so.
2. The results (figure, table, or individual result such as x = 2.653, …, and any comment) should be placed in a WORD file named as yourlastname_HW_01.doc
3. All the m-files should be inserted at the end of the WORD file using COURIER 9 font.
4. The WORD file and all the m-files should ZIPPED together, and the file should be named as yourlastname_HW_04.zip or (yourlastname_HW_04.rar).
5. Place the file to the following folder:
   F:\COURSES\UGRADS\MECH\MECH307\HOMEWORK\…

Problem 1.

a) Plot the given function on the domain $0 \le x \le 3$

$$y = \frac{\left(2x^3 + 4x^2 - 7x - 40\right)\cos(20x+2)(1+e^{-x})}{\sqrt{x+1}\left(1+x+x^2\right)}$$

b) In that domain, find:

y_{max} = _____ at x = _____, with an accuracy of +/-0.0001 in x.

c) Similar to part b, find:

y_{min} = _____ at x = _____, with an accuracy of +/-0.0001 in x.

Problem 2. Find the following limit using an array of x values where the elements are converging to 4^- (= 3.9, 3.99, 3.999, and so on). An accuracy of +/-0.0001 in y is enough.

$$y = \lim_{x \to 4^-} \frac{\sqrt{4-x}\,\sin(4-x)}{(16-4x)^{3/2}}$$

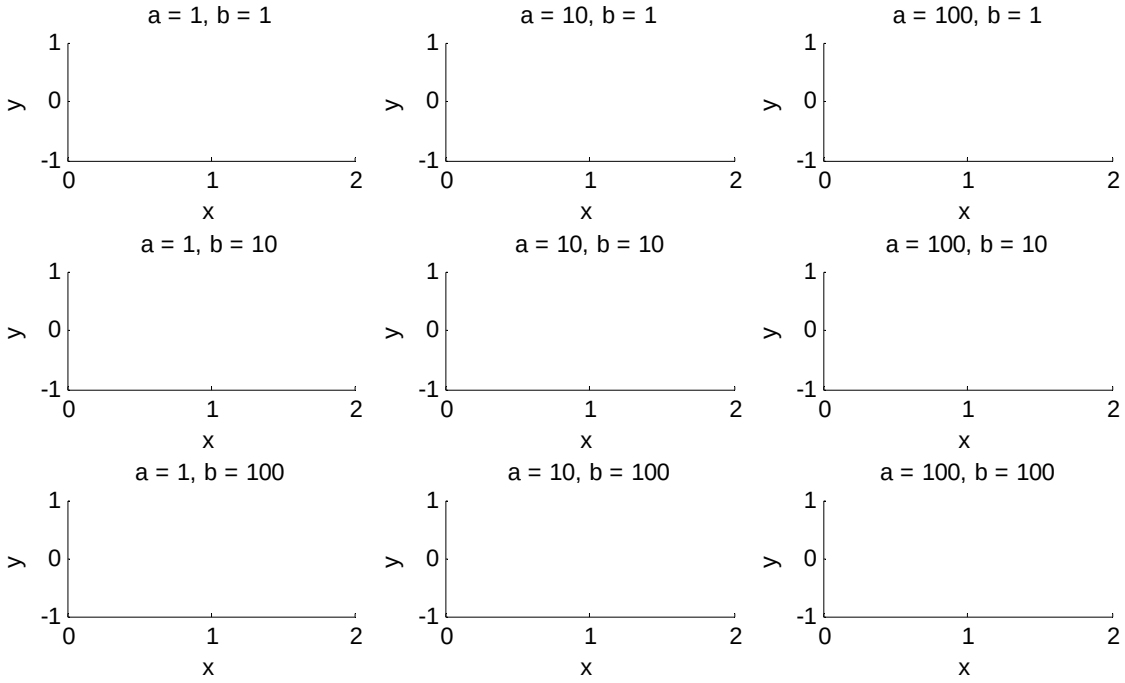
Problem 3 Plot ***s(N)*** versus ***N*** for $s(N) = \sum_{i=2,4,6,\ldots}^{N} \frac{1}{i^3 + i^2}$ for ***N*** = 10, 20, 30, … , 100.

Be careful when you use the index ***i*** of the summation: only the even values, ***i*** = 2, 4, 6, … .

Problem 4 Find the maximum ***N*** value such that:

$$\sum_{i=1,2,\ldots}^{N} \frac{i^2 + 4i + 1}{i+1} < 25{,}000$$

Problem 5 Plot $y(x) = \sin\left(\frac{a}{10}x\right)\cos\left(\frac{b}{10}x\right)$ for the following ***a*** and ***b*** values:



Note: 1) Select Δx small enough so that the curves are smooth.
2) All graphs should have $0 \le x \le 2$ and $-1 \le y \le 1$.

Problem 6 Calculate the following:

$$A = BC = \begin{bmatrix} 111 & 121 & 131 & 141 & \dots & 201 \\ 122 & 132 & 142 & 152 & \dots & 212 \\ 133 & 143 & 153 & 163 & \dots & 223 \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 210 & 220 & 230 & 240 & \dots & 300 \end{bmatrix} \begin{Bmatrix} 50 \\ 48 \\ 46 \\ \vdots \\ 32 \end{Bmatrix}$$

Problem 7 Consider the following function within a domain of x = [0,4].

$$f(x) = \sin(bx)\left(bx^2 - 2x + 10\right)$$

Plot f_{max} versus b and f_{min} versus b, where the parameter b varies between 0 and 2.

Problem 8 Which point on $y(x) = 0.15\ \cos(4x)(x-2)^2 - 2$ (for a domain of $-4 \le x \le 4$) is closest to the point P(0, –4) ? Draw the curve, given point, and the answer point on the curve with the shortest link.

Problem 9 A rectangle has corners at points (2,2), (7,2), (7,4) and (2,4). Ask the user to enter the x- and y-coordinate of any point. If the point is OUTSIDE OR ON the rectangle, then re-ask to enter another point's coordinates. If the point is INSIDE the rectangle, then draw (1) the rectangle, and (2) circle which is tangent to the rectangle and centered at the user's point.
