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MATLAB assignment for the course: Multivariable calculus and vector
calculus, 2024

Please provide your solutions and answers as m-files and move them into a
folder. The name of the folder must be the same as your name. Then upload
a zipped version of it on the course page on MyMoodle. Please submit your
folder no later than **24 October 2024**.

Good luck!

1. Plot the curve represented by

$$\begin{cases} x = 4 + t^3 \\ y = 1 + 5t^2 \end{cases}$$

for $0 \le t \le 5$. Hint: Open the matlab editor by writing edit in the
command window. Give the solution in this text file, i.e. give the code
that you shall submit:
% Task1
clear
$t = 0 : 0.01 : 5$;
$x = 4 + t.\hat{\,}3$;
$y = 1 + 5 * t.\hat{\,}2$;
plot(x, y)
Save the file as Task1.m and press F5 to run the commands, or type
"Task1" in the command window followed by enter.

2. Plot a circle of radius 3.

3. Plot the curve $r = 1 - \sin(4\theta)$ in polar coordinates.

4. A curve in three dimensions is plotted with the command plot3. Create a
curve given by:

$$\begin{cases} x = \sin(2t) \\ y = \cos(2t) \\ z = \sin(3t) \end{cases}$$

5. Create a helix with radius 2, which makes one revolution in the xy-plane
and moves one unit in z-direction in the same time.

6. Define the following matrices and vectors:

$$A = \begin{pmatrix} 1 & 0 & 3 \\ 0 & 4 & 5 \\ 1 & 2 & -1 \end{pmatrix}, \quad B = \begin{pmatrix} 1 & 3 & 1 \\ 2 & 2 & 2 \\ 3 & 1 & 3 \end{pmatrix}, \quad a = \begin{pmatrix} 2 \\ 3 \\ 0 \end{pmatrix}, \quad b = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}.$$

Do the following calculations:

$A * B$, $A * a$, $B * b^T$, $a * A$, $b^T * B$, $a^T * b$, $a * b^T$, $a. * b$, $A. * B$

Some of them do not work: which, why?
(Write your answer like comment in your m-file. Thanks.)

7. There are two commands for plotting surfaces in three dimensions, **surf** which gives a color surface and **mesh** which gives a color mesh. Below is an example for the plane $x + y + z = 0$. Comments in the code are written after a % sign.

figure(1)	% create or activate a figure with number 1
clf	% clear the figure
hold on	% the following plots will be superposed in the same figure
grid on	% visible grid lines
$x = -2 : 0.1 : 2$;	% plotting intervall in x-direction
$y = -2 : 0.1 : 2$;	% plotting intervall in y-direction
$[X, Y] = \text{meshgrid}(x, y)$;	% create a mesh of (x, y)-coordinate points in the xy-plane
$Z = -X - Y$;	% define a z-value for each (x, y)-coordinate
surf(X, Y, Z)	% plots a surface
view$(35, 35)$	% choose the viewing angle
	% can be changed with the rotation arrow in the figure
hold off	% inactivate the figure

Plot two planes that are parallel in the same figure.

8. Matlab has a command **sphere** to create the coordinates of a sphere. Use this command to create a unit sphere, enlarge its radius to 6 and move its centre to $(-2, 1, 3)$. Find the parametric representation of the surface of a unit sphere, with the variables θ and ϕ (longitude and colatitude). Plot a sphere without using the command **sphere**.

9. Show surfaces and level curves of
$(1) z = 2x^2 + 2y^2$
$(2) z = \sin x + \cos 5y$
$(3) z = \frac{1}{x^2 + y^2}$
$(4) z = \sqrt{6 - x^2 - y^2}$
Hint: Use the commands **surf** and **contour**.

10. Calculate the integral
$$\int_0^1 \frac{1}{(1 + x)^2} dx.$$