Math 331 – Worksheet 3 – Problems Ch.3

Name:	ID:	Time start:	Time end:

Problems section 3.9

1. [prob2] For the function $y = \frac{x^2-2}{x+4}$, calculate the value of y for the following values of x: $-3, -2, -1, 0, 1, 2, 3$.

Ans: 7.0000,1.0000,-0.3333,-0.5000,-0.2000,0.3333,1.0000 ☐ correct ☐ not correct

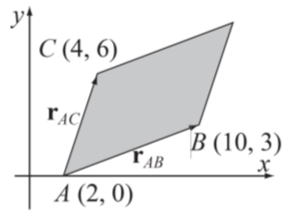
2. [prob8] The length $|\boldsymbol{u}|$ (magnitude) of a vector $\boldsymbol{u} = x\boldsymbol{i} + y\boldsymbol{j} + z\boldsymbol{k}$ is given by $|\boldsymbol{u}| = \sqrt{x^2 + y^2 + z^2}$. Given the vector $\boldsymbol{u} = 23.5\boldsymbol{i} - 17\boldsymbol{j} + 6\boldsymbol{k}$, determine its length by using element-by element operations and the commands: `sum` and `sqrt`.

Ans: 29.6184 ☐ correct ☐ not correct

3. [prob14] Define x and y as the vectors x: 1,3,5,7,9 and y: 2,5,8,11,14. Then calculate: $z = x(x^2 - y) - (x - y)^2$.

Ans: -2,8,76,250,578 ☐ correct ☐ not correct

4. [prob16] The area of the parallelogram shown can be calculated by $|\mathbf{r}_{AB} \times \mathbf{r}_{AC}|$. Use the following steps in a script file to calculate the area: Define the position of points A, B, and C as vectors $A = [2,0], B = [10,3]$ and $C = [4,6]$. Determine the vectors $\mathbf{r}_{AB}$ and $\mathbf{r}_{AC}$ from the points. Determine the area by using MATLAB's built-in functions `cross`, `sum`, and `sqrt`.



Ans: 42 ☐ correct ☐ not correct

5. [prob18] The dot product can be used for determining the angle between two vectors: $\theta = \cos^{-1}\left(\frac{\boldsymbol{r}_1 \cdot \boldsymbol{r}_2}{|\boldsymbol{r}_1||\boldsymbol{r}_2|}\right)$. Find the angle (in degrees) between $\boldsymbol{r}_1 = 3\boldsymbol{i} - 2\boldsymbol{j} + \boldsymbol{k}$ and $\boldsymbol{r}_2 = \boldsymbol{i} + 2\boldsymbol{j} - 4\boldsymbol{k}$.

Ans: 106.9541° ☐ correct ☐ not correct

6. [prob22] Show that $\lim_{x\to 1} \frac{x^2-1}{x-1} = 2$. Do this by first creating a vector x that has the elements: $5, 3, 2, 1.5, 1.1, 1.001,$ and 1.00001. Then, create a new vector y in which each element is determined from the elements of x by $\frac{x^2-1}{x-1}$. Compare the elements of y with the value 2 (use format long to display the numbers).

Ans: 6.000000000000000, 4.000000000000000, 3.000000000000000, 2.500000000000000, 2.100000000000000, 2.000999999999918, 2.000010000000827 ☐ correct ☐ not correct

7. [prob32] Solve the following system:

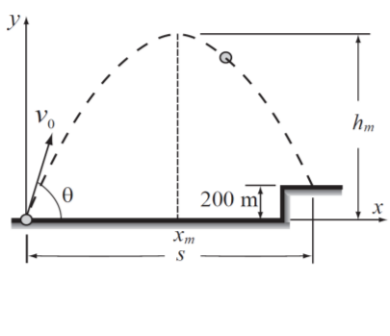
$$\begin{aligned}
3u + 1.5v + w + 0.5x + 4y &= -11.75\\
-2u + v + 4w - 3.5x + 2y &= 19\\
6u - 3v + 2w + 2.5x + y &= -23\\
u + 4v - 3w + 0.5x - 2y &= -1.5\\
3u + 2v - w + 1.5x - 3y &= -3.5
\end{aligned}$$

Ans: $u = -4, v = 2.5, w = 4, x = 1, y = -2$ ☐ correct ☐ not correct

8. [prob26] The path of a projectile fired with an initial speed v_0 at an angle θ is described by the equation

$$y = x\,tan\theta - \frac{g}{2v_0^2\cos^2\theta}x^2$$

where $g = 9.81\ m/s^2$. Consider the case where $\theta = 75°$ and $v_0 = 110\ m/s$. Write a MATLAB script that does the following: calculates the distance s travelled by the projectile, creates a vector x with 100 elements such that the first element is 0 and the last is s, calculates the value of y for each value of x, finds the maximum height h_m that the projectile reaches (use MATLAB built-in function `max`) and the distance x_{hm} where the maximum height is reached. When the script is executed only the values of h_m and x_{hm} are displayed.



Ans: $h_m = 575.3948m, x_{hm} = 309.6821m$ ☐ correct ☐ not correct