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Table 1: Sample Table

Review 2 (Lessons 4-6)

Instructions: Create a tex file containing the items below so that they appear in pdf format exactly as this project file (for example, in-line mode, display mode, numbering). Submit your tex file to `teprice@uakron.edu`. The name of your file should be of the form **yourlastnameR02.tex**. All calculations should be done using the CAS in SWP.

1. Tables such as the following are often used.. Note that the table is placed here in the SWP document but because it is floated it appears at the top of your pdf document.
2. Create a fragment called “lgtable” that will reproduce the table shell above. Use your fragment to create another table below.
3. We have already discussed math names such as `deg lg`. Using unit names (the `ft lb` button above) type in `acre A` (current) `N` (force) `GHz`

1 Matrices

Label this section `s:matrix` for future reference.

Exercise 1 *The CAS in SWP can be used to compute the determinant of a matrix. For example,*

$$\det \begin{bmatrix} 2 & -1 & 3 \\ 5 & -6 & 2 \\ 0 & 1 & -1 \end{bmatrix} = 18$$

We could also use

$$\left| \begin{bmatrix} 2 & -1 & 3 \\ 5 & -6 & 2 \\ 0 & 1 & -1 \end{bmatrix} \right| = 18$$

Exercise 2 *The eigenvalues of the matrix above can be computed by solving*

$$\det \begin{bmatrix} 2 - \lambda & -1 & 3 \\ 5 & -6 - \lambda & 2 \\ 0 & 1 & -1 - \lambda \end{bmatrix} = 0$$

Using the solve button to solve the above equation we obtain

$$2, -\frac{1}{2}\sqrt{13} - \frac{7}{2}, \frac{1}{2}\sqrt{13} - \frac{7}{2}$$

Example 3 Recall where it was shown that $f(x) = \frac{|x-2|}{x-2}$ is not continuous at $a = 2$. Is the discontinuity removable?

Solution 4 The problem requires that we determine the existence of $\lim_{x \rightarrow 2} f(x)$. Consider the two limits below.

$$\lim_{x \rightarrow 2^+} f(x) = \lim_{x \rightarrow 2^+} \frac{|x-2|}{x-2} = \lim_{x \rightarrow 2^+} \frac{x-2}{x-2} = \lim_{x \rightarrow 2^+} 1 = 1$$

while

$$\lim_{x \rightarrow 2^-} f(x) = \lim_{x \rightarrow 2^-} \frac{|x-2|}{x-2} = \lim_{x \rightarrow 2^-} \frac{-(x-2)}{x-2} = \lim_{x \rightarrow 2^-} (-1) = -1.$$

since the left and right limits above do not agree, $\lim_{x \rightarrow 2} f(x)$ does not exist suggesting that the discontinuity is not removable. Note: when you depress the enter key you will still be in a solution environment. To back out of the solution environment and return to the example environment depress the green, left arrow below left.

Example 5 Solve the differential equation

$$\frac{dy}{dx} = y + x$$

subject to the initial condition $y(0) = 1$ using the Solve ODE in the CAS in SWP

Solution 6 The exact solution is $y(x) = e^{x-C_4} - x - 1$. Further, since $y(0) = 1$ we have

$$e^{0-C_4} - 0 - 1 = 2$$

so that

$$e^{C_4} = \frac{1}{2}$$

It follows that

$$C_4 = \ln .5$$

Example 7 Simplify and Factor

$$\frac{a-b}{a^{1/3} - b^{1/3}}$$

Solution 8 Write

$$a - b = \left(a^{1/3}\right)^3 - \left(b^{1/3}\right)^3 = \left(a^{1/3} - b^{1/3}\right) \left(a^{2/3} + a^{1/3}b^{1/3} + b^{2/3}\right)$$

(I will check this last step using expand in the CAS: $(a^{1/3} - b^{1/3})(a^{2/3} + a^{1/3}b^{1/3} + b^{2/3}) = a - b$) Hence,

$$\begin{aligned} \frac{a - b}{a^{1/3} - b^{1/3}} &= \frac{(a^{1/3} - b^{1/3})(a^{2/3} + a^{1/3}b^{1/3} + b^{2/3})}{a^{1/3} - b^{1/3}} \\ &= a^{2/3} + a^{1/3}b^{1/3} + b^{2/3} \end{aligned}$$

Note that the CAS will not perform these calculations directly...at least, I couldn't figure out a way to do it.

Example 9 Using the expand command we obtain

1. $\cos(2a) = \cos^2 a - \sin^2 a$
2. $\tan(x + y) = (\cos x) \frac{\sin y}{\cos x \cos y - \sin x \sin y} + (\cos y) \frac{\sin x}{\cos x \cos y - \sin x \sin y}$
3. $(a + b)^3 = a^3 + b^3 + 3ab^2 + 3a^2b$

Example 10 Use the Power Series command in the Compute menu to obtain

$$(1 + x)^{1/4} = 1 + \frac{1}{4}x - \frac{3}{32}x^2 + \frac{7}{128}x^3 + O(x^4)$$

The $O(x^4)$ term means that x^4 can be factored from the remaining part of this expansion. To better understand this expand $(1 + x)^{1/4}$ using, say, 7 terms. We have

$$(1 + x)^{1/4} = 1 + \frac{1}{4}x - \frac{3}{32}x^2 + \frac{7}{128}x^3 - \frac{77}{2048}x^4 + \frac{231}{8192}x^5 - \frac{1463}{65536}x^6 + O(x^7)$$

Note that the additional terms all contain x^k where $k \geq 4$.

Example 11 Here we will reference section 1 using the cross referenc properties of latex. Now we will reference Table 1.

Example 12 We can compute partial derivatives directly as the following calculation demonstrates

$$\frac{\partial}{\partial y} (3x^2y + \cos y^2) = 3x^2 - 2y \sin y^2$$

This was done by making a copy of the expression on the left to the right of the equals sign, highlighting this copy, and finally depressing the control key with the evaluate button.