MONASH University

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ENGINEERING
ENG1060

MATRIX CALCULATIONS EXAMPLE

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GROUP OF EIGHT AUSTRALIA

SINE TAYLOR SERIES

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- Taylor series approximation of sine

$$\sin(x) = \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)!} x^{2n+1} = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \dots$$

- This is how calculators approximate sine
  - How many terms do calculators use? How many is sufficient?
  - Remember, more terms = more processing = more time

- Your boss asks you to calculate the first two terms in the sine Taylor series for values between [-π, π] and compare it with the values from a calculator/MATLAB

SOLVING THE PROBLEM IN MATLAB

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- Create a vector of x values: x = -pi : 0.01 : pi;

- Calculating the first two terms (i.e. n=0 and n=1)

```
n = 0;
sin_n0 = (-1)^n / factorial(2*n + 1) * x.^(2*n + 1);
n = 1;
sin_n1 = (-1)^n / factorial(2*n + 1) * x.^(2*n + 1);
```

- When dealing with vectors and matrices, don't forget element-by-element operations

SOLVING THE PROBLEM IN MATLAB

- Finally, adding the two terms to get the sine approximation

```
sin_approx = sin_n0 + sin_n1;
MATLAB_sin = sin(x);
```

- The x vector has 629 elements …

- What would the boss do if you showed this to him/her?
  - How else could we present the data?

THE SOLUTION: PLOTTING THE DATA