# MA104 - Differential Calculus
# Lesson 31: Introduction to Vectors and Vector Operations

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**Instructions for all groups:** You will be assigned 3 of the 9 topics below to investigate and present to the class. These topics are all covered in the Lesson 31 reading, in Section 12.2 of Stewart. For each topic, start by understanding the answers to the questions given. Then, come up with examples (drawings, computations, etc.) that illustrate your topics and main points. Choose a member (or members) to present your topics (along with appropriate examples for discussion) to the rest of the class at the front board.

1. Describe the two notations for a vector: the angled brackets and the **i**, **j**, **k** notation. What is the difference? How are the two related to one another? How is this related to parametric equations?

2. How do we draw a vector geometrically? Draw some with 2 coordinates (i.e. in $\mathbb{R}^2$) and some with 3 coordinates (i.e. in $\mathbb{R}^3$). Does it matter where we place the vector? What is the difference between a point $(x_0, y_0, z_0)$ and a vector $\langle x_0, y_0, z_0 \rangle$?

3. How do we represent a vector between two points $A$ and $B$? (In $\mathbb{R}^2$ and in $\mathbb{R}^3$)

4. How are two vectors **a** and **b** added together? (Algebraically and geometrically.)

5. How are two vectors **a** and **b** subtracted? (Algebraically and geometrically.)

6. What happens to a vector geometrically and algebraically when we multiply it by a contstant (i.e. a scalar)? (In other words, how are $c\mathbf{a}$ and **a** related?) What happens to **a** if the scalar $c$ is equal to -1?

7. How do you compute the magnitude of a vector? (2D and 3D) What is the notation for this? What does this represent geometrically?

8. What is a unit vector? How do you find a unit vector that goes in the direction of a given vector **a**?

9. How are vectors used to describe different forces acting on an object? Specifically, a) how do we find the horizontal and vertical components of a force vector and b) what is a resultant force? (See Example 7 and Problem 26.)