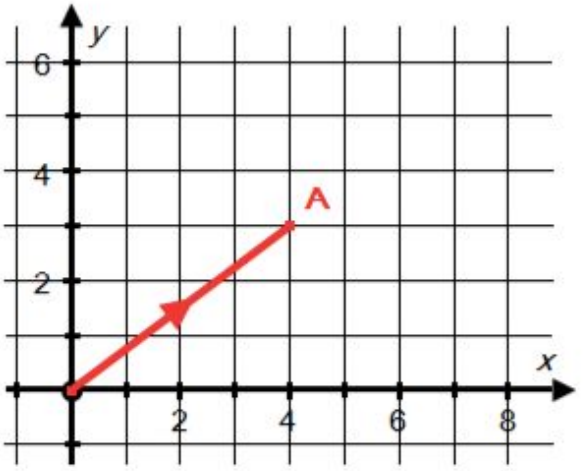
Math SL EXPLORATION LAB 4

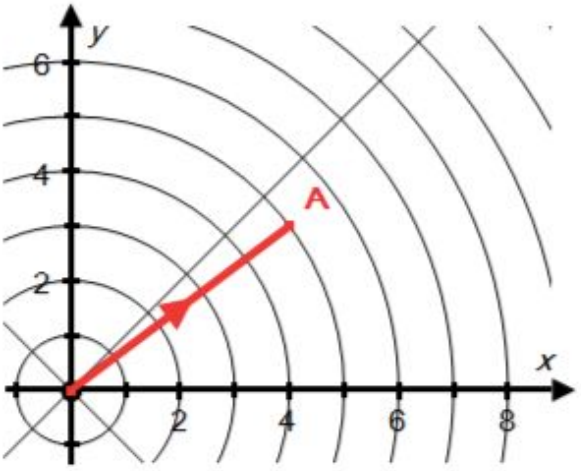
Concept LAB - "Movement Instructions" - Introduction to Vectors

Activity 1

A is a point. It could be an airport relative to a town centre (with the scale in kilometres), or a football on a football field relative to the centre point (with the scale in metres).

Use the diagrams to help you describe at least two different ways on how to find A from the origin.





Activity 2

The Cartesian coordinate system can describe movements (i.e. how to move from one point to another) very well. If a point P has coordinates $(2,4)$ then to move from the origin to P can be represented in the form $\begin{pmatrix}2\\4\end{pmatrix}$, where the top number signifies horizontal movement and the bottom number signifies vertical movement. The expression $\begin{pmatrix}2\\4\end{pmatrix}$ is an example of a *movement instruction*.

1. How should the movement from P back to the origin be represented using this form?
2. What is the distance travelled by moving from the origin to point P?
3. Make up the coordinates of four additional points. With the points you have created:
   (a) Write down the *movement instruction* needed to get from the origin to this point.
   (b) Write down the *movement instruction* needed to get from the point back to the origin.
   (c) Calculate the exact distance of the point from the origin.

Math SL EXPLORATION LAB 4

Activity 3

Suppose a point P has coordinates (3, 1) and a point Q has coordinates (−2, 4).

1. Write down the *movement instruction* needed to get from P to Q.
2. Describe the *movement instruction* needed to get from Q to P.
3. Calculate the exact distance between P and Q.
4. Make up the coordinates of three additional pairs of points. Answer the above questions (1-3) for each pair of points you created.

Activity 4

Suppose a point A has coordinates (2, 5), a point B has coordinates (−1, −2) and a point C has coordinates (4, −3).

1. Where would you end up if you applied the *movement instruction* for moving from A to B starting from point C? Name the point you end up point R.
2. Where would you end up if you applied the *movement instruction* for moving from B to C starting from point A? Name this point S.
3. Where would you end up if you applied the *movement instruction* for moving from C to A starting from point B? Name this point T.
4. Illustrate the locations of A, B, C, R, S and T on a diagram. Be as creative as you can with colours, arrows, etc to illustrate what has happened in terms of movements from the original three points A, B and C to get to the 'new' points R, S and T.
5. Define your own set of three initial points A, B and C and repeat the set of tasks above (1-4).

Activity 5

1. On a coordinate system, plot four points which are the vertices of a parallelogram.
2. Label the four points A, B, C and D.
3. Consider the various *movement instructions* you can create using the four points you have plotted. Which *movement instructions* are the same?
4. Using *movement instructions*, how could you determine if the figure you have created is a rhombus, a rectangle or a square?
5. Now plot three more points at random (not in a straight line) and determine the coordinates. How can you use *movement instructions* to help you decide where a fourth point is to be plotted if the four points must be the vertices of a parallelogram.

Activity 6

1. On a coordinate system, plot four points which are the vertices of a trapezium.
2. Label the four points A, B, C and D.
3. Consider the various *movement instructions* you can create using the four points you have plotted.
4. Are any of the *movement instructions* the same?
5. Are any of the *movement instructions* parallel?
6. Calculate the lengths of the *movement instructions* which are parallel, and determine how many times longer the longer one is compared to the shorter one.