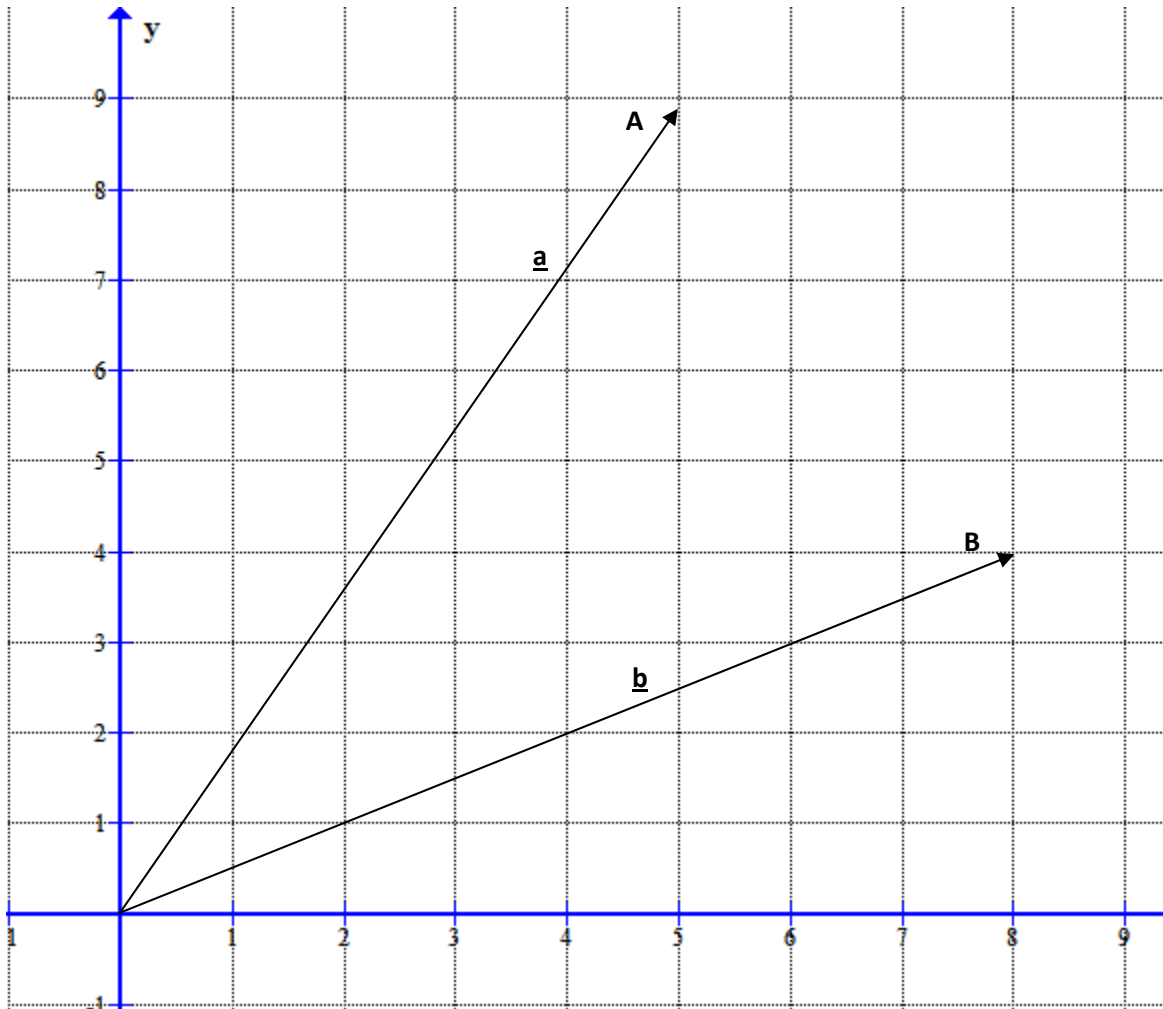


Mathematics/Vectors Part 1



(1) In the diagram above  $\overrightarrow{OA}$  and  $\overrightarrow{OB}$  are position vectors such that  $\overrightarrow{OA} = \mathbf{a}$  and  $\overrightarrow{OB} = \mathbf{b}$

(a) Write  $\overrightarrow{OA}$  and  $\overrightarrow{OB}$  in the form  $\begin{pmatrix} x \\ y \end{pmatrix}$

(b) A point P, not shown is such that  $\overrightarrow{OP} = \frac{1}{2}\mathbf{b} + \mathbf{a}$

(c) Write  $\overrightarrow{OP}$  in the form  $\begin{pmatrix} x \\ y \end{pmatrix}$

(d) What is the angle that  $\overrightarrow{OP}$  makes with the positive x axis

(e) Determine  $|\overrightarrow{OP}|$

(2) Given that  $\overrightarrow{AB} = \begin{pmatrix} 5 \\ 4 \end{pmatrix}$  and  $\overrightarrow{CD} = \begin{pmatrix} 6 \\ x \end{pmatrix}$

(a) For what values of  $x$  is  $|\overline{AB}| = |\overline{CD}|$

(b) For what value of  $x$  is  $\overline{AB}$  is parallel to  $\overline{CD}$

(4) ABC is a triangle. The coordinates of the points A, B and C are (2, 2), (6, 2) and (4, 6) respectively.

(a) Write in the form  $\begin{pmatrix} x \\ y \end{pmatrix}$  the position vectors of A, B and C

(b) Write in the form  $\begin{pmatrix} x \\ y \end{pmatrix}$ , the vectors, (i)  $\overline{AB}$  (ii)  $\overline{AC}$  (iii) Show that triangle ABC is Isosceles

(3)  $\overline{OA}$  and  $\overline{OB}$  are two position vectors relative to the origin O. Given the points A (3,1) and B(-1,-2)

(a) Write  $\overline{OA}$  and  $\overline{OB}$  as column vectors

(b) Express  $\overline{AB}$  as a column vector

(c) Calculate the length of  $\overline{AB}$

(4) (i) Given that  $\overline{AB} = \begin{pmatrix} 4 \\ -2 \end{pmatrix}$  and  $\overline{CB} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$  determine the magnitude of the vector  $\overline{AC}$

(5)  $\overline{X}$ ,  $\overline{Y}$  and  $\overline{R}$  are vectors such that  $\overline{X} = \begin{pmatrix} 1 \\ a \end{pmatrix}$ ,  $\overline{Y} = \begin{pmatrix} b \\ -2 \end{pmatrix}$  and  $\overline{R} = \begin{pmatrix} 2 \\ 8 \end{pmatrix}$

(a) Calculate  $3\overline{X} + 2\overline{Y}$

(b) If  $3\overline{X} + 2\overline{Y} = \overline{R}$ , calculate the values of **a** and **b**

(6)  $\overline{AB} = \begin{pmatrix} -3 \\ 4 \end{pmatrix}$  and  $\overline{EF} = \begin{pmatrix} 5 \\ e \end{pmatrix}$

(a) Calculate the length of  $|\overline{AB}|$

(b) If  $|\overline{EF}| = 3|\overline{AB}|$  show that  $e = 10\sqrt{2}$

(7) Given  $p = \begin{pmatrix} 8 \\ 1 \end{pmatrix}$  and  $q = \begin{pmatrix} 7 \\ x \end{pmatrix}$

(a) Calculate the value of  $x$  for which  $p = q$

(b) Calculate the values of  $x$  for which  $p$  and  $q$  have equal magnitudes

(8)  $\overline{PR} = \begin{pmatrix} b \\ -2b \end{pmatrix}$  and  $\overline{PS} = \begin{pmatrix} 3b \\ b+1 \end{pmatrix}$

(a) Express  $\overline{RP}$  and  $\overline{RS}$  in their simplest form (b) Find the value(s) of  $b$  if  $|\overline{PR}| = \sqrt{20}$