1.8.23

EE24BTECH11012 - Bhavanisankar G S

QUESTION:
If $\brak{a, b}$ is the mid-point of the line segment joining the points A $\brak{10, -6}$ and B $\brak{k, 4}$ and $a - 2b = 18$, find the value of a, b and the distance AB .
SOLUTION:

Variable name	Description	Formula
A	10,-6.	$\mathbf{M} = \frac{\mathbf{A+B}}{2}$
B	k,4	A, B, k = ?
M	The midpoint of the line-segment AB with coordinates a, b	$\|\|AB\|\|$ = ?

TABLE 0: Variables Used

We know that if **M** is the mid-point of **AB**, then

$$\mathbf{M} = \frac{\mathbf{A} + \mathbf{B}}{2} \tag{0.1}$$

$$\begin{pmatrix} a \\ b \end{pmatrix} = \frac{\begin{pmatrix} 10 \\ -6 \end{pmatrix} + \begin{pmatrix} k \\ 4 \end{pmatrix}}{2} \tag{0.2}$$

$$\implies \boxed{b = -1} \tag{0.3}$$

$$a = 18 + 2b \tag{0.4}$$

$$\implies \boxed{a = 16} \tag{0.5}$$

$$k = 2a - 10 \tag{0.6}$$

$$\implies \boxed{k = 22} \tag{0.7}$$

$$\|\mathbf{B} - \mathbf{A}\| = \sqrt{\left(B - A\right)^T \left(B - A\right)} \tag{0.8}$$

$$= \sqrt{\begin{pmatrix} 12 & 10 \end{pmatrix} \begin{pmatrix} 12 \\ 10 \end{pmatrix}} \tag{0.9}$$

$$\boxed{\|\mathbf{AB}\| = 2\sqrt{61}} \tag{0.10}$$

$$\tag{0.11}$$

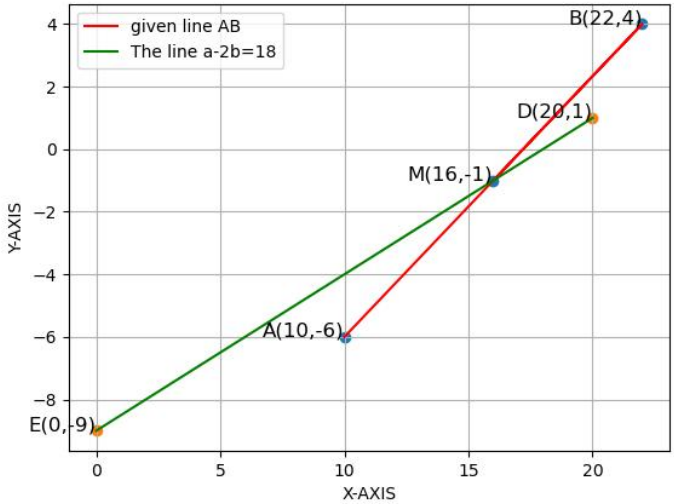

Fig. 0.1: A plot of the given question.