

# Problem Solution

EE24BTECH11012  
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# Question

If  $(a, b)$  is the mid-point of the line segment joining the points A  $(10, -6)$  and B  $(k, 4)$  and  $a - 2b = 18$ , find the value of  $a$ ,  $b$  and the distance AB .

# Solution Outline

Find mid-point  $M = \frac{A+B}{2}$

Substitute in the relation between  $a$  and  $b$  .

Solve for  $k$  and find the distance using distance formula.

# Variables Used

Variable name	Description	Formula
A	$(10, -6)$ .	$M = \frac{A+B}{2}$
B	$(k, 4)$	
M	The midpoint of line-segment AB	

Table: Variables Used

# Solution

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

$$\mathbf{M} = \frac{\mathbf{A} + \mathbf{B}}{2} \quad (1)$$

$$\begin{pmatrix} a \\ b \end{pmatrix} = \frac{\begin{pmatrix} 10 \\ -6 \end{pmatrix} + \begin{pmatrix} k \\ 4 \end{pmatrix}}{2} \quad (2)$$

$$\Rightarrow \boxed{b = -1} \quad (3)$$

$$a = 18 + 2b \quad (4)$$

$$\Rightarrow \boxed{a = 16} \quad (5)$$

$$k = 2a - 10 \quad (6)$$

$$\Rightarrow \boxed{k = 22} \quad (7)$$

$$(8)$$

$$\|\mathbf{B} - \mathbf{A}\| = \sqrt{(\mathbf{B} - \mathbf{A})^T (\mathbf{B} - \mathbf{A})} \quad (9)$$

$$= \sqrt{(12 \quad 10) \begin{pmatrix} 12 \\ 10 \end{pmatrix}} \quad (10)$$

$$\boxed{\|\mathbf{AB}\| = 2\sqrt{61}} \quad (11)$$

$$(12)$$

# Plot

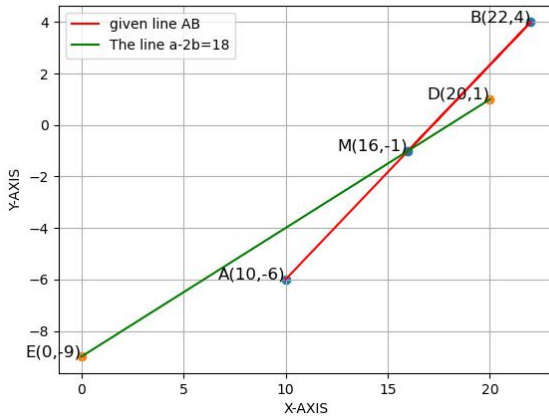


Figure:

# Functions defined

```
#include <stdio.h>
#include <math.h>
float mp(float a, float b )
{
    return (a+b)*0.5 ;
}

float norm(float a, float b, float c, float d )
{
    return sqrt(pow(a-c,2) + pow(b-d,2)) ;
}
```



```
int main(void)
{
    FILE *ptr;
    ptr=fopen("main.txt", "w");
    float mp(float, float) ; //function prototype
    float norm(float, float, float, float) ;
    float midp1, midp2, dist ;
    midp1 = (float) mp(10,22);
    midp2 = (float) mp(-6,4);
    dist = (float) norm(10,-6,22,4);
        fprintf(ptr, "%f\n", midp1 );
    fprintf(ptr, "%f\n", midp2 );
    fprintf(ptr, "%f", dist );
        fclose(ptr) ;
    return 0;
}
```

# Python Code

```
from ctypes import*
import matplotlib.pyplot as plt
import numpy as np
rel = CDLL('./func.so')
a = 10
b = -6
c = 22
d = 4
mp = rel.mp
mp.restype = c_float
norm = rel.norm
norm.restype = c_float
filename = 'main.txt'
with open(filename, 'r') as file:
    data = file.readlines()
    print (data)
```

# Python Code

```
dist = norm(c_float(a), c_float(b), c_float(c), c_float(d))  
print(dist)
```

```
x = [10, 22, mp(c_float(a), c_float(c)) ]  
y = [-6, 4, mp(c_float(b), c_float(d)) ]  
label = ['A(10,-6)', 'B(22,4)', 'M(16,-1)']  
plt.scatter(x,y)  
plt.text(x[0], y[0], label[0], fontsize=12, ha='right')  
plt.text(x[1], y[1], label[1], fontsize=12, ha='right')  
plt.text(x[2], y[2], label[2], fontsize=12, ha='right')  
w = [20, 0]  
z = [1, -9]  
labell = ['D(20,1)', 'E(0,-9)']  
plt.scatter(w,z)  
plt.text(w[0], z[0], labell[0], fontsize=12, ha='right')  
plt.text(w[1], z[1], labell[1], fontsize=12, ha='right')
```

```
plt.plot (x,y,color='red', linestyle='—', label='given-line-AB')  
plt.plot (w,z,color='green', linestyle='—', label='The-line-a—2b=18')  
plt.xlabel('X—AXIS')  
plt.ylabel('Y—AXIS')  
plt.grid()  
plt.legend()  
plt.show()
```