3.3.1

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Question

Draw a triangle $\triangle ABC$ with

$$BC = 6\,\text{cm}, \quad AB = 5\,\text{cm}, \quad \text{and } \angle ABC = 60^\circ. \tag{1}$$

Theoretical Solution

Given three points
Let us solve the given equation theoretically and then verify the solution computationally
According to the question,
Take

$$\mathbf{B} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \quad \mathbf{C} = \begin{pmatrix} 6 \\ 0 \end{pmatrix} \quad \mathbf{A} = \begin{pmatrix} 5\cos 60 \\ 5\sin 60 \end{pmatrix} \tag{2}$$

$$\mathbf{A} = \begin{pmatrix} 2.5 \\ 2.5\sqrt{3} \end{pmatrix} \tag{3}$$

C Code

```c
#include <stdio.h>
#include <math.h>

int main() {
    // Given values
    double BC = 6.0;
    double AB = 5.0;
    double angle_ABC = 60.0; // in degrees

    // Convert degrees to radians
    double angle_rad = angle_ABC * M_PI / 180.0;

    // Apply cosine rule: AC^2 = AB^2 + BC^2 - 2*AB*BC*cos(angle)
    double AC = sqrt(AB*AB + BC*BC - 2*AB*BC*cos(angle_rad));

    // Print results
    printf("Given: BC = %.2f cm, AB = %.2f cm, Angle ABC = %.2f
        degrees\n", BC, AB, angle_ABC);
```

C Code - Resultant velocity

```
  printf("The length of AC = %.2f cm\n", AC);

    return 0;
}
```

Python Code

```
import matplotlib.pyplot as plt
import numpy as np

# Given values
BC = 6
AB = 5
angle_ABC = np.radians(60) # convert degrees to radians

# Use cosine rule to find AC
AC = np.sqrt(AB**2 + BC**2 - 2*AB*BC*np.cos(angle_ABC))

# Coordinates of points
B = np.array([0, 0])
C = np.array([BC, 0])
A = np.array([AB * np.cos(angle_ABC), AB * np.sin(angle_ABC)])
```

Python Code

```
# Plot triangle
x_coords = [A[0], B[0], C[0], A[0]]
y_coords = [A[1], B[1], C[1], A[1]]

plt.figure(figsize=(6,6))
plt.plot(x_coords, y_coords, 'b-o')

# Label points
plt.text(A[0], A[1]+0.2, 'A', fontsize=12, color='red')
plt.text(B[0]-0.3, B[1]-0.3, 'B', fontsize=12, color='red')
plt.text(C[0]+0.1, C[1]-0.3, 'C', fontsize=12, color='red')
# Add side labels
plt.text((A[0]+B[0])/2 -0.5, (A[1]+B[1])/2, f"AB={AB}", fontsize
    =10, color="green")
```

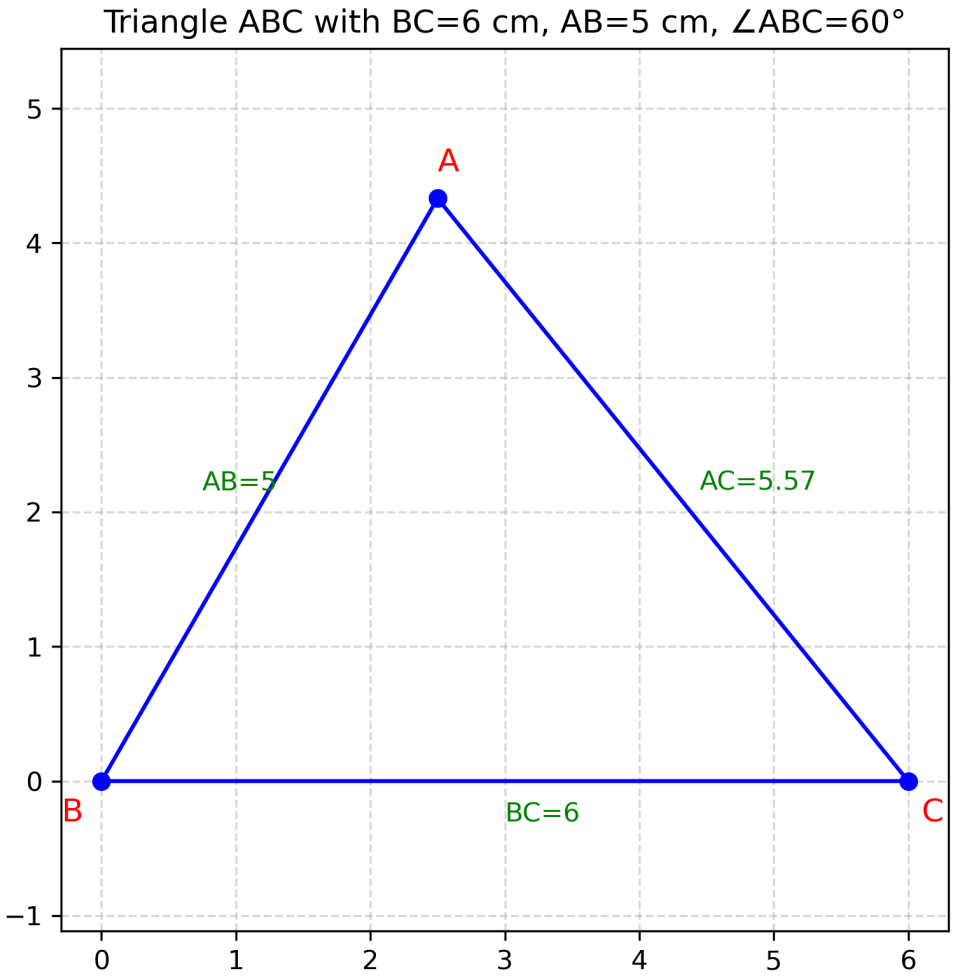
Python Code

```
plt.text((B[0]+C[0])/2, (B[1]+C[1])/2 -0.3, f"BC={BC}", fontsize
    =10, color="green")
plt.text((A[0]+C[0])/2 +0.2, (A[1]+C[1])/2, f"AC={AC:.2f}",
    fontsize=10, color="green")

# Formatting
plt.axis("equal")
plt.grid(True, linestyle="--", alpha=0.5)
plt.title("Triangle ABC with BC=6 cm, AB=5 cm, ABC=60")
# Save as image
plt.savefig("triangle_solution.png", dpi=300)
plt.show()

print("Triangle saved as 'triangle_solution.png'")
```

Plot


Triangle ABC with BC=6 cm, AB=5 cm, ∠ABC=60°
A
B
C
AB=5
AC=5.57
BC=6
5
4
3
2
1
0
−1
0
1
2
3
4
5
6