EDUCATION
MADE SIMPLE

Geometry

Degrees, minutes and seconds

1° = 60' and 1' = 60", just like hours and minutes! With two rules, carrying (60' → 1°) and borrowing (1° → 60'), you can add and subtract any angle.

In this video we see the column method and solve 3 exercises on the angles of a triangle step by step, all the way to seconds.

The method

$$1^\circ = 60' \qquad 1' = 60''$$

$$\text{carry}: \ 60' \to 1^\circ$$

$$\text{borrow}: \ 1^\circ \to 60'$$

Worked examples

Exercise 1

Two angles of a triangle are 68° 41' and 35° 19'. How big is the third angle?

Data: $\hat{A} = 68^\circ\,41' \ \cdot \ \hat{B} = 35^\circ\,19'$

1. **Column addition: degrees with degrees, minutes with minutes**

$$\begin{array}{rr} 68^\circ & 41' \\ +\,35^\circ & 19' \\ \hline 103^\circ & 60' \end{array}$$

$$103^\circ\,60' = 104^\circ$$

> 💡 60' = 1°: the minutes become one extra degree!

Result: $\hat{A} + \hat{B} = 104^\circ$

2. **The third angle: 180° minus the sum**

$$\hat{C} = 180° - 104° = 76°$$

Result: $\hat{C} = 76°$

✓ Check

$$68° 41' + 35° 19' + 76° = 180° \checkmark$$

Exercise 2

In an isosceles triangle each base angle is 35° 52'. How big is the vertex angle?

Data: $AC = BC \cdot \hat{A} = \hat{B} = 35° 52'$

1. **The two base angles: 35° 52' × 2**

$$\begin{array}{rr} 35° & 52' \\ \times\ 2 & \\ \hline 70° & 104' \end{array}$$

$$70° 104' = 71° 44'$$

> 💡 104' = 60' + 44', that is 1° 44'

Result: $\hat{A} + \hat{B} = 71° 44'$

2. **To subtract we write 180° as 179° 60'**

$$\begin{array}{rr} 179° & 60' \\ -\ 71° & 44' \\ \hline 108° & 16' \end{array}$$

$$\hat{C} = 108° 16'$$

Result: $\hat{C} = 108° 16'$

✓ **Check**

$$35^\circ\,52' + 35^\circ\,52' + 108^\circ\,16'$$

$$= 178^\circ\,120' = 180^\circ \checkmark$$

Exercise 3

In a triangle angle A is 102° 44' 39" and angle B is 25° 16' 41". How big is angle C?

Data: $\hat{A} = 102^\circ\,44'\,39''$ · $\hat{B} = 25^\circ\,16'\,41''$

1. **Column addition of degrees, minutes and seconds**

$$\begin{array}{rrr} 102^\circ & 44' & 39'' \\ +\,25^\circ & 16' & 41'' \\ \hline 127^\circ & 60' & 80'' \end{array}$$

$$127^\circ\,60'\,80'' = 128^\circ\,1'\,20''$$

> 💡 80" = 1' 20", then 61' = 1° 1'

Result: $\hat{A} + \hat{B} = 128^\circ\,1'\,20''$

2. **We write 180° as 179° 59' 60"**

$$\begin{array}{rrr} 179^\circ & 59' & 60'' \\ -\,128^\circ & 1' & 20'' \\ \hline 51^\circ & 58' & 40'' \end{array}$$

$$\hat{C} = 51^\circ\,58'\,40''$$

Result: $\hat{C} = 51^\circ\,58'\,40''$

✓ **Check**

$$128^\circ\,1'\,20'' + 51^\circ\,58'\,40''$$

$$= 179^\circ\,59'\,60'' = 180^\circ \checkmark$$

. .

© Education Made Simple