

**UNIT 8: SEXAGESIMAL SYSTEM.****Sexagesimal System:**

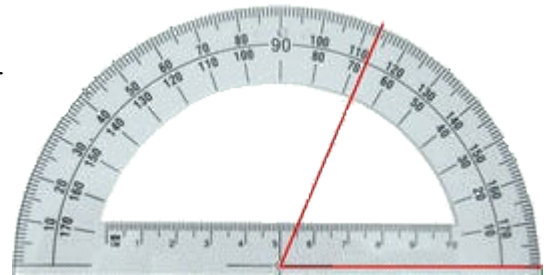
There are some magnitudes as angles and time in which the decimal system is not the only that is used. Sexagesimal system is more frequently used; on this system every unit is divided into 60 equal parts to get the subunit.

For the angles the unit is the **degree**.

The subunits of the degree are the **minute** and the **second**.

One minute  $1' = \frac{1}{60}$  of a degree, that is  $1^\circ = 60'$ .

One second  $1'' = \frac{1}{60}$  of a minute, that is  $1' = 60''$ .



Protractor

Using this system an angle “A” can be expressed for example  $A = 34^\circ 35' 40''$  and we need to operate angles and expressed in this form.

For time the unit as you know is the **hour** and is divided into **minutes** and **seconds** with the same relationship they have on the angles.

A period of time is expressed as 3h 5min 3s for example.

We need to be able to operate in this system using these two angles.



1. Convert into minutes:

- a)  $7^\circ$
- b)  $0,3^\circ$
- c)  $5^\circ 45'$
- d)  $21^\circ 43'$

2. Convert into seconds:

- a) 2 min
- b) 37 min
- c) 7 h
- d) 2 h 12 min
- e) 1 h 23 min 34 s

3. Convert into hours:

- a) 345 min
- b) 6 h 30 min
- c) 1080 s

4. Convert into degrees, minutes and seconds:

- a) 3840"
- b) 290'
- c) 145' 36"
- d) 4510"

### Operations in the sexagesimal system:

#### **Addition:**

We need to add separately degrees or hours, minutes and seconds and then convert the seconds into minutes and the minutes into degrees/hours if we get more than 60.

**Example:** Add  $15^\circ 43' 30'' + 25^\circ 50' 34''$

$$\begin{array}{r}
 15^\circ 43' 30'' \\
 + 25^\circ 50' 34'' \\
 \hline
 40^\circ 93' 64'' \\
 + \quad 1' \\
 \hline
 40^\circ 94' 4'' \\
 + 1^\circ \\
 \hline
 41^\circ 34' 4''
 \end{array}$$

*Your turn* 

1. Add:

- a)  $35^\circ 45' 21'' + 66^\circ 51' 44''$

b)  $29 \text{ h } 45 \text{ min } 7 \text{ s} + 5 \text{ h } 24 \text{ min } 43 \text{ s}$

c)  $33^\circ 15' 49'' + 79^\circ 38' 50''$

**Subtraction:**

We need to subtract separately degrees/hours, minutes and seconds, if we do not have enough seconds or minutes we convert one degree/hour into minutes or a minute into seconds.

**Example:** Subtract  $3 \text{ h } 15 \text{ min } 24 \text{ s} - 1 \text{ h } 36 \text{ min } 40 \text{ s}$

$$\begin{array}{r}
 3 \text{ h } 15 \text{ min } 24 \text{ s} \longrightarrow 3 \text{ h } 14 \text{ min } 84 \text{ s} \longrightarrow 2 \text{ h } 74 \text{ min } 84 \text{ s} \\
 - 1 \text{ h } 36 \text{ min } 40 \text{ s} \quad (1 \text{ min} = 60 \text{ s}) \quad - 1 \text{ h } 36 \text{ min } 40 \text{ s} \quad (1 \text{ h} = 60 \text{ min}) \quad - 1 \text{ h } 36 \text{ min } 40 \text{ s} \\
 \hline
 \phantom{3 \text{ h } 15 \text{ min } 24 \text{ s}} \phantom{3 \text{ h } 14 \text{ min } 84 \text{ s}} \phantom{2 \text{ h } 74 \text{ min } 84 \text{ s}} 1 \text{ h } 38 \text{ min } 44 \text{ s}
 \end{array}$$

*Your turn* 

1. Subtract:

a)  $45^\circ 6' 30'' - 34^\circ 34' 55''$

b)  $25 \text{ h } 34 \text{ min } 56 \text{ s} - 20 \text{ h } 43 \text{ min } 40 \text{ s}$

c)  $50^\circ 34' - 25^\circ 15' 20''$

**Multiplication by a whole number:**

We multiply separately degrees/hours, minutes and seconds and then we convert the seconds into minutes and the minutes into degrees/hours when we get more than 60 subunits.

**Example:** Multiply  $(13^\circ 23' 26'') \cdot 4$ :

$$\begin{array}{r}
 13^\circ 23' 26'' \\
 \cdot 4 \\
 \hline
 52^\circ 92' 104'' \\
 \quad 1' \\
 \hline
 52^\circ 93' 44'' \\
 \quad 1^\circ \\
 \hline
 53^\circ 33' 44''
 \end{array}$$

**Division by a whole number:**

We divide the degrees/hours, and the remainder is converted into minutes that must be added to the previous quantity that we had, divide the minutes and we repeat the same that we have before. The remainder is in seconds.

**Example:**  $(14 \text{ h } 25 \text{ min } 45 \text{ s}) : 4$

$$\begin{array}{r}
 14 \text{ h } 25 \text{ min } 45 \text{ s} \quad | \quad 4 \\
 \hline
 2 \text{ h} \quad 3 \text{ h } 36 \text{ min } 26 \text{ s} \quad \longleftarrow \text{Quotient} \\
 \quad 145 \text{ min} \\
 \quad \quad 1 \text{ min} \\
 \quad \quad \quad 105 \text{ s} \\
 \quad \quad \quad \quad 1 \text{ s} \quad \longleftarrow \text{Remainder}
 \end{array}$$



1. Given the angle:  $A = 42^\circ 13' 30''$ , calculate: a)  $5 \cdot A$    b)  $3 \cdot A$    c)  $\frac{A}{3}$

2. We want to divide the full turn into seven equal sectors. Which is the angle of each sector?

