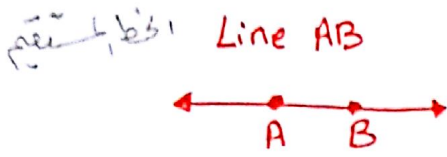


6.1

Angles

الزوايا



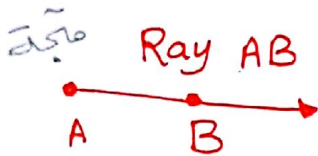
خطية Two distinct points A and B determine a line « Line AB »

نقطتين مختلفتين على خط



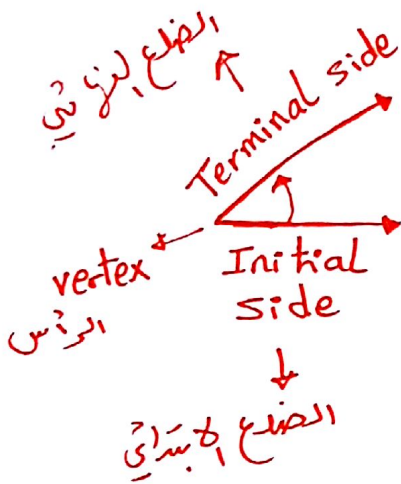
جزء portion of a line between A and B « Segment AB »

جزء من خط بين A, B



Portion of Line AB that starts at A and continues through B « Ray AB »

جزء من خط AB يبدأ من A ويمر بـ B



Angle consists of two rays with common endpoint.

الزاوية تتكوّن على تقاطع خطين لهاتين زاوية مشتركة.

Positive measure « angle » +ve

-ve Negative measure « angle »



دوران عقارب الساعة Counterclockwise rotation



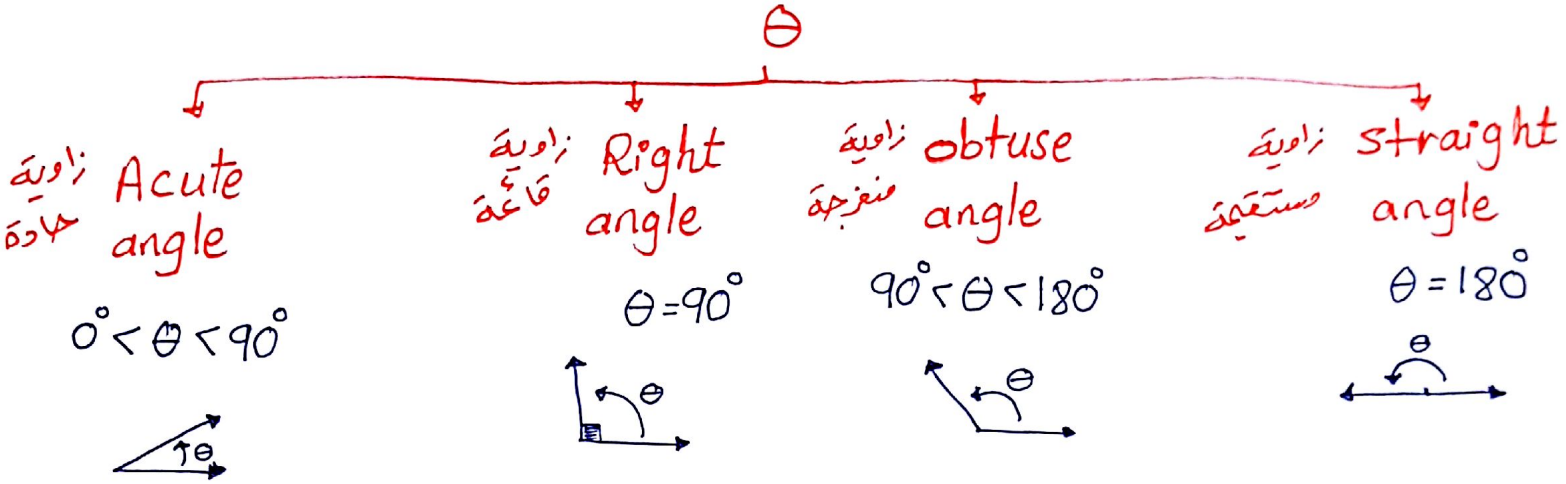
دوران مع عقارب الساعة clockwise rotation

clockwise rotation

Degree measure :-

unit for measuring angles \rightarrow degree

وحدة قياس الزاوية = الدرجة



مكملة Complements
 $\theta_1 + \theta_2 = 90^\circ$

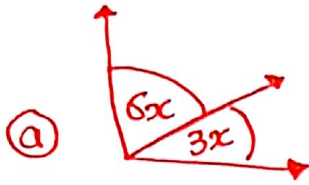
متممة Supplements
 $\theta_1 + \theta_2 = 180^\circ$

Example 1:- For an angle measuring 40° . Find

(a) Complement
 $\theta_1 + \theta_2 = 90^\circ$
 $40 + \theta_2 = 90^\circ$
 $\theta_2 = 90^\circ - 40^\circ$
 $\theta = 50^\circ$

(b) Supplement
 $\theta_1 + \theta_2 = 180^\circ$
 $40^\circ + \theta = 180^\circ$
 $\theta = 180^\circ - 40^\circ$
 $\theta = 140^\circ$

HW1 Find the measure of the following graph. (3)



$$\begin{aligned}\theta_1 + \theta_2 &= 90^\circ \\ 3x + 6x &= 90 \\ 9x &= 90 \\ x &= \frac{90}{9} = 10\end{aligned}$$



$$\begin{aligned}\theta_1 + \theta_2 &= 180^\circ \\ 6x + 4x &= 180 \\ 10x &= 180 \\ x &= \frac{180}{10} = 18\end{aligned}$$

↓ degree a° ↓ دقيقة minute a' ↓ ثانية second a''

$$1^\circ = 60' \quad , \quad 1' = 60'' \quad ,$$

$$1^\circ = 3600''$$

الدرجة بإحدى 60 دقيقة فيها ، الدقيقة بإحدى 60 ثانية فيها .
 -- 3600 ثانية .

Example 2:~ per form each calculation :-

(a) $51^\circ 29' + 32^\circ 46'$

$$\begin{array}{r} 51^\circ 29' \\ + 32^\circ 46' \\ \hline 83^\circ 75' \end{array}$$

$$75' = 60' + 15' = 1^\circ 15'$$

$$84^\circ 15'$$

أجمع الدرجات مع بعضها والدقائق مع بعضها

لاحظنا أن لدينا 75 دقيقة ، لأننا نكتبها 60 دقيقة ونسجل الباقي 15 دقيقة

(b) $90^\circ - 73^\circ 12'$

$$\begin{array}{r} 89^\circ 90^\circ 00' \\ - 73^\circ 12' \\ \hline 16^\circ 48' \end{array} \quad (-)$$

هنا ناقص نخرج على طول لأنه لا يمكن طرح لنا دقائق سالبة .
 لازم يكتب 90° بشكل آخر 89° 60'

الموضع القياسي ~ standard position

(4)

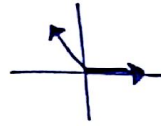
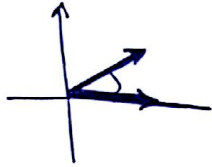
An angle is in standard position if:

- ① its vertex at the origin
- ② its initial side on +ve x-axis.

① رأسها يقع على نقطة الأصل.

② ضلعها الابتدائي على الجزء الموجب من محور x.

تكون الزاوية في الموضع القياسي



Exercises:

Find the Complement, Supplement.

① 60°

Complement

$$60^\circ + \theta = 90^\circ$$

$$\theta = 90^\circ - 60^\circ$$

$$\theta = 30^\circ$$

Supplement

$$60^\circ + \theta = 180^\circ$$

$$\theta = 180^\circ - 60^\circ$$

$$\theta = 120^\circ$$

$$\textcircled{5} \quad 39^\circ 50'$$

Complement

$$39^\circ 50' + \theta = 90^\circ$$

$$\theta = 90^\circ - 39^\circ 50'$$

$$\begin{array}{r} 89^\circ \quad 60' \\ 90^\circ \quad 00' \\ (-) \end{array}$$

$$\underline{39^\circ 50'}$$

$$50^\circ 10'$$

$$\therefore \theta = 50^\circ 10'$$

Supplement.

$$39^\circ 50' + \theta = 180^\circ$$

$$\theta = 180^\circ - 39^\circ 50'$$

$$\begin{array}{r} 179^\circ \quad 60' \\ 180^\circ \quad 00' \\ (-) \end{array}$$

$$\underline{39^\circ 50'}$$

$$140^\circ 10'$$

$$\therefore \theta = 140^\circ 10'$$

$$\textcircled{6} \quad 50^\circ 40' 50''$$

Complement

$$50^\circ 40' 50'' + \theta = 90^\circ$$

$$\theta = 90^\circ - 50^\circ 40' 50''$$

$$\begin{array}{r} 89^\circ \quad 59' \quad 60'' \\ 90^\circ \quad 00' \quad 00'' \\ (-) \end{array}$$

$$\underline{50^\circ 40' 50''}$$

$$39^\circ 19' 10''$$

$$\therefore \theta = 39^\circ 19' 10''$$

Supplement

$$50^\circ 40' 50'' + \theta = 180^\circ$$

$$\theta = 180^\circ - 50^\circ 40' 50''$$

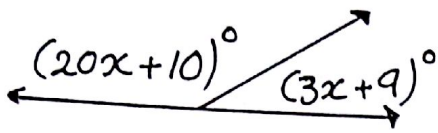
$$\begin{array}{r} 179^\circ \quad 59' \quad 60'' \\ 180^\circ \quad 00' \quad 00'' \\ (-) \end{array}$$

$$\underline{50^\circ 40' 50''}$$

$$129^\circ 19' 10''$$

$$\theta = 129^\circ 19' 10''$$

⑦



$$\theta_1 + \theta_2 = 180^\circ$$

$$20x + 10 + 3x + 9 = 180^\circ$$

$$23x + 19 = 180$$

$$23x = 180 - 19$$

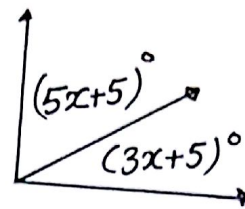
$$23x = 161$$

$$x = \frac{161}{23} = 7$$

$$\theta_1 = 3x + 9 = 3(7) + 9 = 30^\circ$$

$$\theta_2 = 20x + 10 = 20(7) + 10 = 150^\circ$$

⑧



$$\theta_1 + \theta_2 = 90^\circ$$

$$5x + 5 + 3x + 5 = 90$$

$$8x + 10 = 90$$

$$8x = 90 - 10$$

$$8x = 80$$

$$x = \frac{80}{8} = 10$$

$$\theta_1 = 5x + 5 = 5(10) + 5 = 55^\circ$$

$$\theta_2 = 3x + 5 = 3(10) + 5 = 35^\circ$$

⑥

Find:

⑩ Supplementary angles with measures θ_1 $6x - 4$ and θ_2 $8x - 12$ degree

$$\theta_1 + \theta_2 = 180^\circ \Rightarrow 6x - 4 + 8x - 12 = 180$$

$$14x - 16 = 180$$

$$14x = 196 \Rightarrow x = \frac{196}{14} = 14$$

$$\therefore \theta_1 = 6x - 4 = 6(14) - 4 = 80^\circ, \theta_2 = 8x - 12 = 8(14) - 12 = 100^\circ$$

⑪ Complementary angle with measures θ_1 $3x - 5$ and θ_2 $6x - 40$ degree

$$\theta_1 + \theta_2 = 90^\circ \Rightarrow 3x - 5 + 6x - 40 = 90$$

$$9x - 45 = 90$$

$$9x = 135 \Rightarrow x = 15$$

$$\theta_1 = 3x - 5 = 3(15) - 5 = 40^\circ, \theta_2 = 6x - 40 = 6(15) - 40 = 50^\circ$$

Perform each calculation :-

(7)

(20)

$$47^{\circ} 23' - 73^{\circ} 48'$$

$$\begin{array}{r} 47^{\circ} 23' \\ 73^{\circ} 48' \\ \hline -26^{\circ} -25' \end{array} \quad (-)$$

→ البتة

(23)

$$55^{\circ} 30' + 12^{\circ} 44' - 8^{\circ} 15'$$

$$\begin{array}{r} 55^{\circ} 30' \\ 12^{\circ} 44' \\ \hline 67^{\circ} 74' \\ 8^{\circ} 15' \\ \hline 59^{\circ} 59' \end{array} \quad \begin{array}{l} (+) \\ (-) \end{array}$$

(24)

$$90^{\circ} - 36^{\circ} 18' 47''$$

$$\begin{array}{r} 89^{\circ} \quad 59' \quad 60'' \\ 90^{\circ} \quad 00' \quad 00'' \\ \hline 36^{\circ} \quad 18' \quad 47'' \end{array} \quad (-)$$

$$\begin{array}{r} 36^{\circ} \quad 18' \quad 47'' \\ \hline 53^{\circ} \quad 41' \quad 13'' \end{array}$$