

# Mathematics

# 數學科

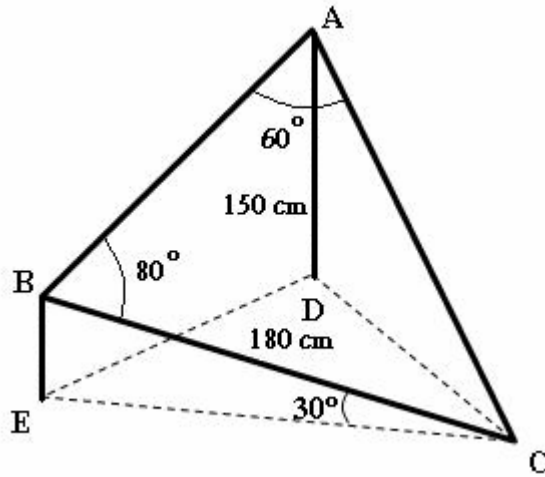
**3-D Trigonometry**

**3-D 三角學**



計數要小心，  
咪期望快一陣！

e.g.2 例子二



In the figure above,  $ABC$  is a solar energy electronic board hanging on the roof of a building, the vertex  $C$  is on the horizontal.  $D$  and  $E$  are on the ground, and are the projection of  $A$  and  $B$  respectively. The angle between  $BC$  and the horizontal is  $30^\circ$ . Given  $AD = 150\text{ cm}$ 、 $BC = 180\text{ cm}$ 、 $\angle CAB = 60^\circ$  and  $\angle ABC = 80^\circ$ .

- (a) Find  $BE$  and  $CE$ . (2 marks)  
 (b) Find  $AB$  and  $AC$ . Hence, find the area of the board  $ABC$ . (3 marks)  
 (c) Find  $\angle CDE$  and the shortest distance between  $C$  and  $DE$ . (6 marks)

圖中,  $ABC$  為一懸掛在一建築物上的三角形太陽能電子板, 其頂點  $C$  位於水平地面上。  $D$  及  $E$  為地面上的點, 且分別鉛垂於  $A$  及  $B$  之下。  $BC$  與水平傾斜  $30^\circ$ 。 已知  $AD = 150\text{ cm}$ 、 $BC = 180\text{ cm}$ 、 $\angle CAB = 60^\circ$  及  $\angle ABC = 80^\circ$ 。

- (a) 求  $BE$  及  $CE$ 。 (2分)  
 (b) 求  $AB$  及  $AC$ 。 由此, 求板  $ABC$  的面積 (3分)  
 (c) 求  $\angle CDE$  及由  $C$  到  $DE$  的最短距離。 (6分)

**Solutions 題解: (a)**

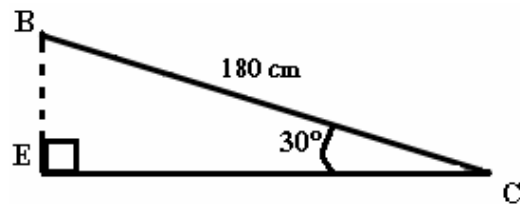
Consider 考慮  $\triangle BEC$ ,

$$BE = 180 \times \sin 30^\circ,$$

$$BE = 90\text{ cm}. \text{----- (1A)}$$

$$CE = 180 \times \cos 30^\circ,$$

$$CE = 90\sqrt{3}\text{ cm}. \text{----- (1A)}$$



**Remarks: (Steps by Steps 逐步破解)**

1. Convert \_\_\_\_\_

將 \_\_\_\_\_

2. Finding \_\_\_\_\_

找 \_\_\_\_\_

3. Definition of \_\_\_\_\_

\_\_\_\_\_ 的定義.

**Solutions 題解: (b)****Consider 考慮**  $\triangle ABC$ ,

$$\frac{180}{\sin 60^\circ} = \frac{AC}{\sin 80^\circ}.$$

$$AC = 180 \times \frac{\sin 80^\circ}{\sin 60^\circ} = 204.67.$$

$$\underline{AC = 205\text{cm}} \quad \text{----- (1A)}$$

$$\frac{AB}{\sin(180^\circ - 80^\circ - 60^\circ)} = \frac{180}{\sin 60^\circ}.$$

$$AB = 180 \times \frac{\sin 40^\circ}{\sin 60^\circ} = 133.60.$$

$$\underline{AB = 134\text{cm}} \quad \text{----- (1A)}$$

**(1)****Area of  $\triangle ABC$  面積  $\triangle ABC$** 

$$= \frac{1}{2}(AB)(AC)\sin \angle BAC$$

$$= \frac{1}{2}(133.60)(204.67)\sin 60^\circ$$

$$= 11840.26$$

$$\underline{= 11800\text{cm}^2} \quad \text{----- (1A)}$$

**Remarks: (Steps by Steps 逐步破解)****1. Convert**

將

**2. Finding**

找

**3. Apply**

應用

**4. Area of triangle:  $\frac{1}{2}ab \sin C$** 三角形面積:  $\frac{1}{2}ab \sin C$ **Thinking Corner 思考角****Part (c) Find  $\angle CDE$ .**

諗法: 考慮  $\triangle CDE$ , 要找

$\angle CDE$ , \_\_\_\_\_

再利用 \_\_\_\_\_

\_\_\_\_\_ 去求  $\angle CDE$ .

(III)

(I)

(II)

(VI)

Label the diagram (I) as shown above:

標示圖像 (I) 如上:

Consider 考慮  $\triangle ACD$  (II), which is a right-angled  $\triangle$  直角三角形.

$$AC^2 = AD^2 + CD^2 \text{ (Pythagoras's Theorem 畢氏定理).}$$

$$\underline{\underline{CD = 139cm}}$$

Consider trapezium 梯形 ABDE (III),

Adding a straight line BF so that  $\triangle ABF$  is a right-angled  $\triangle$  and  $DE=BF$ .

加直線 BF.  $\triangle ABF$  是直角三角形及  $DE=BF$ .

Consider 考慮  $\triangle ABF$  (III), which is a right-angled  $\triangle$  直角三角形.

$$AB^2 = AF^2 + BF^2 \text{ (Pythagoras's Theorem 畢氏定理).}$$

$$(133.60)^2 = (150 - 90)^2 + BF^2$$

$$BF = 119.37cm.$$

$$\underline{\underline{DE = 119cm.}}$$

Consider 考慮  $\triangle CDE$  (VI),

$$CE^2 = CD^2 + DE^2 - 2(CD)(DE)\cos(\angle CDE) \text{ (cosine formula 餘弦公式).}$$

$$\angle CDE = 73.68^\circ$$

$$\underline{\underline{\angle CDE = 73.7^\circ}}$$

The shortest distance between C and DE

C 和 DE 之間最短距離

$$= CG$$

$$= CD \sin \angle CDE$$

$$= 139.25 \sin(73.68^\circ)$$

$$= 133.64$$

$$\underline{\underline{= 134cm}}$$

Remarks: (Steps by Steps 逐步破解)

1. Write down \_\_\_\_\_

將\_\_\_\_\_

2. Convert \_\_\_\_\_

將\_\_\_\_\_

3. Finding \_\_\_\_\_

找\_\_\_\_\_

4. \_\_\_\_\_

\_\_\_\_\_ 定理

5. Finding \_\_\_\_\_

找\_\_\_\_\_

6. Apply \_\_\_\_\_

應用\_\_\_\_\_

7. The \_\_\_\_\_

點和直線之間的\_\_\_\_\_

8. Definition of \_\_\_\_\_

\_\_\_\_\_ 的定義.



這條 3D Trigo 長題目不是太深, '轉彎' 既地方唔係咁多, 一開波 part(a) 當然係用“\_\_\_\_\_”, “\_\_\_\_\_”, “\_\_\_\_\_”. part (b) 就考用 “\_\_\_\_\_” 計邊長和計“三角形面積”, 至難係 part (c) 問  $\angle CDE$  同“\_\_\_\_\_”. 細心 d 就會想到 part (b) 考左“\_\_\_\_\_”, part (c) 再考角度好自然會用 “\_\_\_\_\_” 啦! 大家請留意, 長題目每一部份考既技巧, 99% 唔會重複考. 還有, “\_\_\_\_\_”. 做完每一 part, 一定要將 answers 寫在圖上[如 part(c) 圖 I 所示], 提醒自己那些東西是已知和可以運用的, 這樣難題便迎刃而解了.