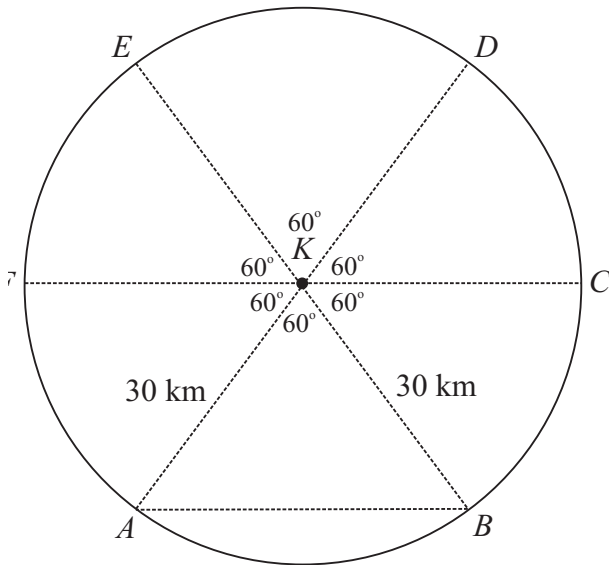


## LC 2013 (SET D): PAPER 2

### QUESTION 8 (75 MARKS)

#### Question 8 (a) (i)



#### MARKING SCHEME NOTES

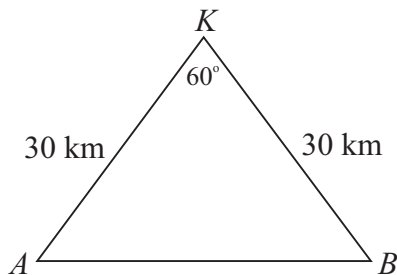
**Question 8 (a) (i) [Scale 5B (0, 3, 5)]**

**3:** • Six equal sectors identified or notes the angle at the centre is  $360^\circ$

**NOTE:** A correct answer without work shown, award full credit

$$|\angle BKA| = \frac{360^\circ}{6} = 60^\circ \quad [\text{The angle at the centre of the circle is } 360^\circ. \text{ The angle } BKA \text{ is one-sixth of this angle.}]$$

#### Question 8 (a) (ii)

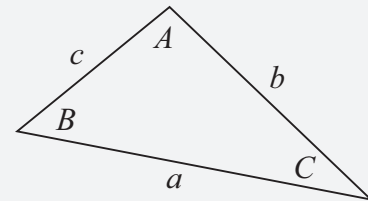


$$\text{Area of } \triangle KAB = \frac{1}{2}(30)(30)\sin 60^\circ = 389.7 \text{ km}^2$$

#### FORMULAE AND TABLES BOOK

#### Trigonometry of the triangle:

[page 16]



$$\text{Area: } \frac{1}{2}ab \sin C$$

$$\text{Cosine rule: } a^2 = b^2 + c^2 - 2bc \cos A$$

#### MARKING SCHEME NOTES

**Question 8 (a) (ii) [Scale 10C\* (0, 4, 7, 10)]**

**4:** • Writes a correct relevant formula

• One or two correct substitutions into formula

**7:** • Correct or consistent substitution into formula

• Incorrect answer from an incorrect calculator mode

\* Penalise one mark for incorrect or omitted units, provided full marks otherwise

**NOTE:** A correct answer without work shown, award full credit

**Question 8 (a) (iii)**

Each sector is one-sixth of the area of a circle.

$$\text{Area of sector } KAB = \frac{1}{6}\pi(30)^2 = 471.24 \text{ km}^2$$

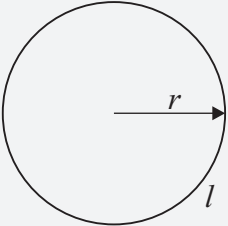
$$\frac{\text{Area of triangle } KAB}{\text{Area of sector } KAB} \times 100\% = \frac{389.7 \text{ km}^2}{471.24 \text{ km}^2} \times 100\% = 82.7\%$$

**Question 8 (a) (iv)**

$$|AB|^2 = 30^2 + 30^2 - 2(30)(30)\cos 60^\circ$$

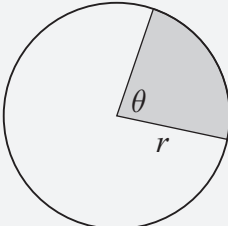
$$|AB| = \sqrt{30^2 + 30^2 - 2(30)(30)\cos 60^\circ} = 30 \text{ km}$$

**FORMULAE AND TABLES BOOK**  
**Length and area: Circle [page 8]**



$l = 2\pi r$   
 $A = \pi r^2$

**Length and area: Arc/sector [page 9]**



$l = 2\pi r \left( \frac{\theta}{360^\circ} \right)$   
 $A = \pi r^2 \left( \frac{\theta}{360^\circ} \right)$

*when  $\theta$  is in degrees.*

**MARKING SCHEME NOTES**

**Question 8 (a) (iii) [Scale 10C (0, 4, 7, 10)]**

- 4: • Writes a correct formula for area of sector  
• Some correct substitution into a correct relevant formula
- 7: • Correct area of sector  
• Fraction written with one error, calculated

**MARKING SCHEME NOTES**

**Question 8 (a) (iv) [Scale 10C\* (0, 4, 7, 10)]**

- 4: • Formula for the cosine rule written  
• Some correct substitution
- 7: • A fully correct substitution, without complete and correct calculation  
• Substantially correct work in substitution and calculation  
\* Penalise one mark for incorrect or omitted units, provided full marks otherwise

**Question 8 (a) (v)**

The triangle *KAB* is an equilateral triangle as all angles are equal.

**MARKING SCHEME NOTES**

**Question 8 (a) (v) [Scale 5B (0, 3, 5)]**

- 3: • Work of merit such as reference to two sides equal

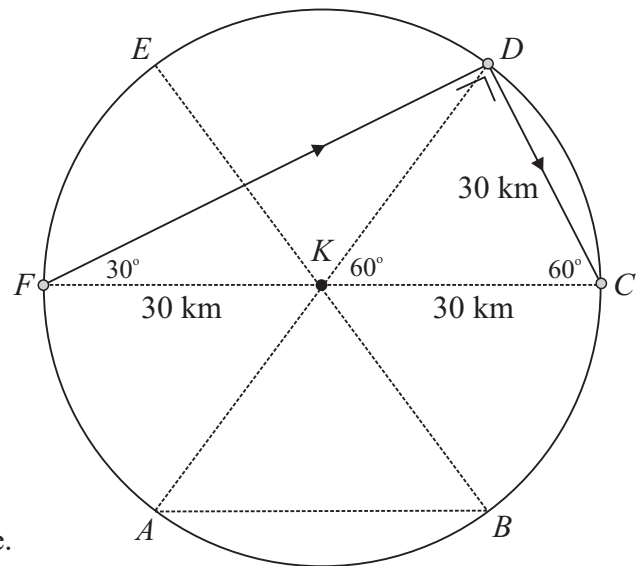
**Question 8 (b) (i)**

The perimeter is the length of the circumference of the circle.

$$l = 2\pi r = 2\pi(30) \approx 188 \text{ km}$$

**Question 8 (b) (ii)**

Diagram shown.



**Question 8 (b) (iii)**

$$|\angle FDC| = 90^\circ$$

THEOREM: The angle in a semicircle is a right-angle.

**MARKING SCHEME NOTES**

**Question 8 (b) (i) [Scale 5C\* (0, 3, 4, 5)]**

- 3: • Writes the correct formula.  
 4: • Correct substitution into formula without complete and correct calculation  
 • Incorrect substitution with correct calculation  
 • An answer of 189 km with work  
 \* Penalise one mark for incorrect or omitted roundoff, provided full marks otherwise.  
**NOTE:** A correct answer without work shown, award full credit

**Question 8 (b) (ii) [Scale 5B (0, 3, 5)]**

- 3: • One correct line drawn

**Question 8 (b) (iii) [Scale 5B (0, 3, 5)]**

- 3: • Relevant work such as  $|\angle FDC|$  indicated correctly

**Question 8 (b) (iv)**

Triangle  $FDC$  is a right-angled triangle.

$$\cos 30^\circ = \frac{\text{Adjacent}}{\text{Hypotenuse}} = \frac{|FD|}{|FC|}$$

$$\therefore |FD| = |FC| \cos 30^\circ = 60 \cos 30^\circ = 51.96 \text{ km}$$

$$\text{Total distance} = |FD| + |DC| = 51.96 + 30 = 81.96 \text{ km}$$

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}} = \frac{81.96 \text{ km}}{80 \text{ km/h}} = 1.0245 \text{ h} = 61.47 \text{ minutes}$$

**FORMULAE AND TABLES BOOK**

**Speed:**

$$\text{Velocity} = \frac{\text{Distance}}{\text{Time}}$$

$$v = \frac{s}{t}$$

**MARKING SCHEME NOTES**

**Question 8 (b) (iv) [Scale 10C\* (0, 4, 7, 10)]**

- 4: • Calculates or gives one correct distance  
 7: • Calculates the total distance  
 • Sets up correct fraction to calculate time without complete and correct calculation  
 • Sets up incorrect fraction to calculate time with correct calculation  
 \* Penalise one mark for incorrect or omitted units, provided full marks otherwise

**Question 8 (c) (i)**

Consider the right-angled triangle  $KEX$ .

$$\sin 60^\circ = \frac{\text{Opposite}}{\text{Hypotenuse}} = \frac{|KX|}{|EK|}$$

$$\therefore |KX| = |EK| \sin 60^\circ = 30 \sin 60^\circ = 25.98 \text{ km}$$

**Question 8 (c) (ii)**

Call  $P$ , the point of intersection of the paths of the helicopter and lifeboat.

Consider the right-angled triangle  $FKP$ .

$$\tan 30^\circ = \frac{\text{Adjacent}}{\text{Opposite}} = \frac{|PK|}{|FK|}$$

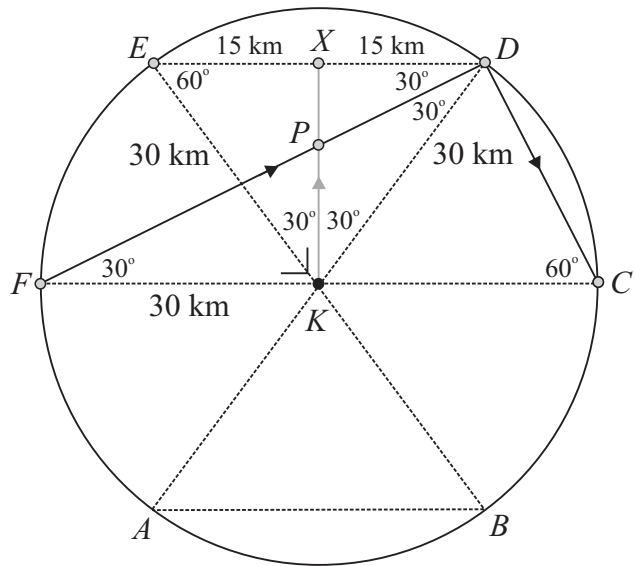
$$\therefore |PK| = |FK| \tan 30^\circ = 30 \tan 30^\circ = 17.32 \text{ km}$$

$$|PX| = |KX| - |PK| = 25.98 - 17.32 = 8.66 \text{ km}$$

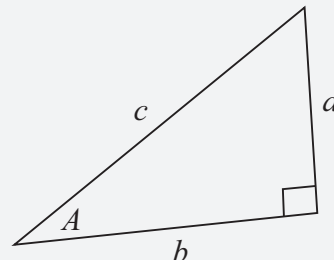
OR consider triangle  $DPX$ .

$$\tan 30^\circ = \frac{\text{Adjacent}}{\text{Opposite}} = \frac{|PX|}{|DX|}$$

$$\therefore |PX| = |DX| \tan 30^\circ = 15 \tan 30^\circ = 8.66 \text{ km}$$



**FORMULAE AND TABLES BOOK**  
**Trigonometry: Right-angled triangle** [page 16]



$$\sin A = \frac{a}{c}, \cos A = \frac{b}{c}, \tan A = \frac{a}{b}$$

**Question 8 (c) (i) [Scale 5C\* (0, 3, 4, 5)]**

- 3:**
- Draws a line from  $K$  to  $X$  or notes additional relevant work on the diagram
  - Correct trigonometric ratio set up
  - Correct application of theorem of Pythagoras written
- 4:**
- A fully correct substitution, without complete and correct calculation
  - One error in substitution with fully correct calculation
  - \* Penalise one mark for incorrect or omitted units, provided full marks otherwise

**Question 8 (c) (ii) [Scale 5C\* (0, 3, 4, 5)]**

- 3:**
- Indicates the required point on the diagram
  - Correct trigonometric ratio set up or similar work of merit.
- 4:**
- A fully correct substitution, without complete and correct calculation
  - One error in substitution with fully correct calculation
  - \* Penalise one mark for incorrect or omitted units, provided full marks otherwise