RELATIONSHIPS BETWEEN ANGLES

A COMPLEMENTARY AND SUPPLEMENTARY ANGLES

A.1 CALCULATING COMPLEMENTARY ANGLES

Ex 1: Calculate the complementary angle to 63°.

$$\text{Complementary angle} = \boxed{27}^\circ$$

Answer: The sum of complementary angles is 90°.

$$\begin{aligned} x^\circ + 63^\circ &= 90^\circ \\ x^\circ &= 90^\circ - 63^\circ \quad \text{(subtract } 63^\circ\text{)} \\ &= 27^\circ \end{aligned}$$

Ex 2: Calculate the complementary angle to 87°.

$$\text{Complementary angle} = \boxed{3}^\circ$$

Answer: The sum of complementary angles is 90°.

$$\begin{aligned} x^\circ + 87^\circ &= 90^\circ \\ x^\circ &= 90^\circ - 87^\circ \quad \text{(subtract } 87^\circ\text{)} \\ &= 3^\circ \end{aligned}$$

Ex 3: Calculate the complementary angle to 72°.

$$\text{Complementary angle} = \boxed{18}^\circ$$

Answer: The sum of complementary angles is 90°.

$$\begin{aligned} x^\circ + 72^\circ &= 90^\circ \\ x^\circ &= 90^\circ - 72^\circ \quad \text{(subtract } 72^\circ\text{)} \\ &= 18^\circ \end{aligned}$$

Ex 4: Calculate the complementary angle to 19°.

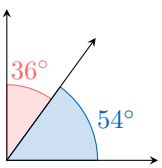
$$\text{Complementary angle} = \boxed{71}^\circ$$

Answer: The sum of complementary angles is 90°.

$$\begin{aligned} x^\circ + 19^\circ &= 90^\circ \\ x^\circ &= 90^\circ - 19^\circ \quad \text{(subtract } 19^\circ\text{)} \\ &= 71^\circ \end{aligned}$$

A.2 VERIFYING COMPLEMENTARY ANGLES

MCQ 5: Are the angles 36° and 54° complementary?



Choose one answer

☒ Yes

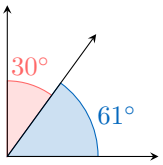
☐ No

Answer:

$$\begin{aligned} 36^\circ + 54^\circ &= 90^\circ \quad \text{(add the angles)} \\ &= 90^\circ \end{aligned}$$

Since $36^\circ + 54^\circ = 90^\circ$, the angles are complementary.

MCQ 6: Are the angles 30° and 61° complementary?



Choose one answer

☐ Yes

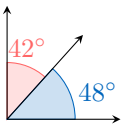
☒ No

Answer:

$$\begin{aligned} 30^\circ + 61^\circ &= 91^\circ \quad \text{(add the angles)} \\ &\neq 90^\circ \end{aligned}$$

Since $30^\circ + 61^\circ \neq 90^\circ$, the angles are not complementary.

MCQ 7: Are the angles 42° and 48° complementary?



Choose one answer

☒ Yes

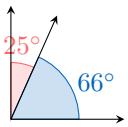
☐ No

Answer: The sum of complementary angles is 90°.

$$\begin{aligned} 42^\circ + 48^\circ &= 90^\circ \quad \text{(add the angles)} \\ &= 90^\circ \end{aligned}$$

Since $42^\circ + 48^\circ = 90^\circ$, the angles are complementary.

MCQ 8: Are the angles 25° and 66° complementary?



Choose one answer

☐ Yes

☒ No

Answer: The sum of complementary angles is 90°.

$$\begin{aligned} 25^\circ + 66^\circ &= 91^\circ \quad \text{(add the angles)} \\ &\neq 90^\circ \end{aligned}$$

Since $25^\circ + 66^\circ \neq 90^\circ$, the angles are not complementary.

A.3 CALCULATING SUPPLEMENTARY ANGLES

Ex 9: Calculate the supplementary angle to 115°.

$$\text{Supplementary angle} = \boxed{65}^\circ$$

Answer: The sum of supplementary angles is 180°.

$$\begin{aligned} x^\circ + 115^\circ &= 180^\circ \\ x^\circ &= 180^\circ - 115^\circ \quad \text{(subtract } 115^\circ\text{)} \\ &= 65^\circ \end{aligned}$$

Ex 10: Calculate the supplementary angle to 168°.

$$\text{Supplementary angle} = \boxed{12}^\circ$$

Answer: The sum of supplementary angles is 180°.

$$\begin{aligned} x^\circ + 168^\circ &= 180^\circ \\ x^\circ &= 180^\circ - 168^\circ \quad \text{(subtract } 168^\circ\text{)} \\ &= 12^\circ \end{aligned}$$

Ex 11: Calculate the supplementary angle to 132°.

$$\text{Supplementary angle} = \boxed{48}^\circ$$

Answer: The sum of supplementary angles is 180°.

$$\begin{aligned} x^\circ + 132^\circ &= 180^\circ \\ x^\circ &= 180^\circ - 132^\circ \quad \text{(subtract } 132^\circ\text{)} \\ &= 48^\circ \end{aligned}$$

Ex 12: Calculate the supplementary angle to 47°.

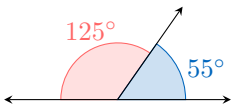
$$\text{Supplementary angle} = \boxed{133}^\circ$$

Answer: The sum of supplementary angles is 180°.

$$\begin{aligned} x^\circ + 47^\circ &= 180^\circ \\ x^\circ &= 180^\circ - 47^\circ \quad \text{(subtract } 47^\circ\text{)} \\ &= 133^\circ \end{aligned}$$

A.4 VERIFYING SUPPLEMENTARY ANGLES

MCQ 13: Are the angles 125° and 55° supplementary?



Choose one answer

☒ Yes

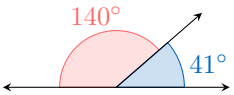
☐ No

Answer: The sum of supplementary angles is 180°.

$$\begin{aligned} 125^\circ + 55^\circ &= 180^\circ \quad \text{(add the angles)} \\ &= 180^\circ \end{aligned}$$

Since $125^\circ + 55^\circ = 180^\circ$, the angles are supplementary.

MCQ 14: Are the angles 140° and 41° supplementary?



Choose one answer

☐ Yes

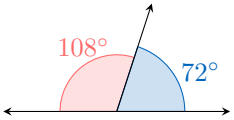
☒ No

Answer: The sum of supplementary angles is 180°.

$$\begin{aligned} 140^\circ + 41^\circ &= 181^\circ \quad \text{(add the angles)} \\ &\neq 180^\circ \end{aligned}$$

Since $140^\circ + 41^\circ \neq 180^\circ$, the angles are not supplementary.

MCQ 15: Are the angles 108° and 72° supplementary?



Choose one answer

☒ Yes

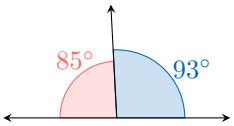
☐ No

Answer: The sum of supplementary angles is 180°.

$$\begin{aligned} 108^\circ + 72^\circ &= 180^\circ \quad \text{(add the angles)} \\ &= 180^\circ \end{aligned}$$

Since $108^\circ + 72^\circ = 180^\circ$, the angles are supplementary.

MCQ 16: Are the angles 85° and 93° supplementary?



Choose one answer

☐ Yes

☒ No

Answer: The sum of supplementary angles is 180°.

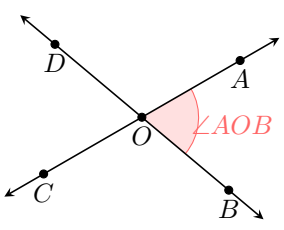
$$\begin{aligned} 85^\circ + 93^\circ &= 178^\circ \quad \text{(add the angles)} \\ &\neq 180^\circ \end{aligned}$$

Since $85^\circ + 93^\circ \neq 180^\circ$, the angles are not supplementary.

B OPPOSITE ANGLES AT A VERTEX

B.1 IDENTIFYING OPPOSITE ANGLES AT A VERTEX

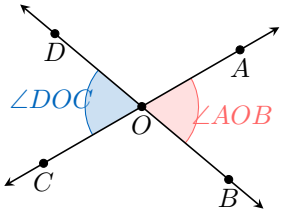
MCQ 17: Identify the angle opposite $\angle AOB$ at the vertex.



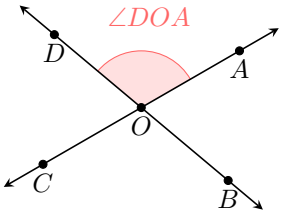
Choose one answer

- ☐ $\angle DOA$
- ☐ $\angle COB$
- ☒ $\angle DOC$
- ☐ $\angle AOD$

Answer: Opposite angles at a vertex are formed by two intersecting lines and are equal. The angle opposite $\angle AOB$ at the vertex is $\angle DOC$.



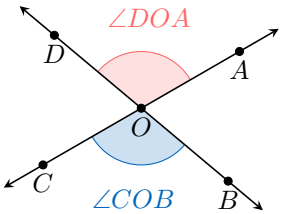
MCQ 18: Identify the angle opposite $\angle DOA$ at the vertex.



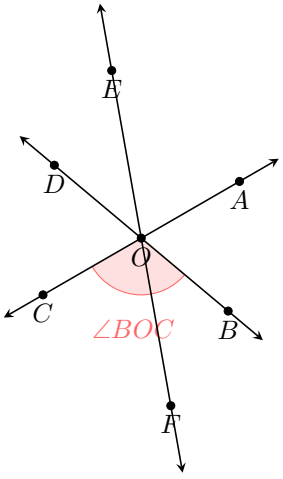
Choose one answer

- ☐ $\angle DOA$
- ☒ $\angle COB$
- ☐ $\angle DOC$
- ☐ $\angle AOD$

Answer: Opposite angles at a vertex are formed by two intersecting lines and are equal. The angle opposite $\angle DOA$ at the vertex is $\angle COB$.



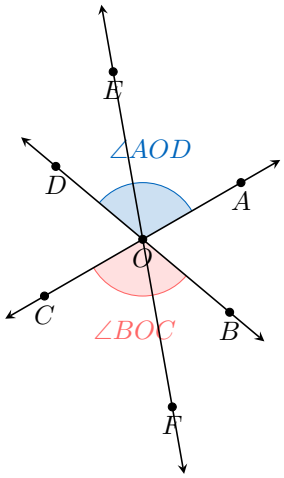
MCQ 19: Identify the angle opposite $\angle BOC$ at the vertex.



Choose one answer

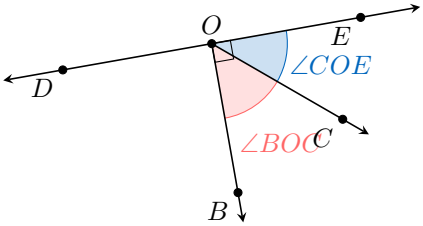
- ☐ $\angle DOC$
- ☐ $\angle DOE$
- ☐ $\angle EOA$
- ☒ $\angle AOD$

Answer: Opposite angles at a vertex are formed by two intersecting lines and are equal. The angle opposite $\angle BOC$ at the vertex is $\angle AOD$.



B.2 DETERMINING ANGLE RELATIONSHIPS

MCQ 20: Which relationship describes $\angle BOC$ and $\angle COE$?



Choose one answer

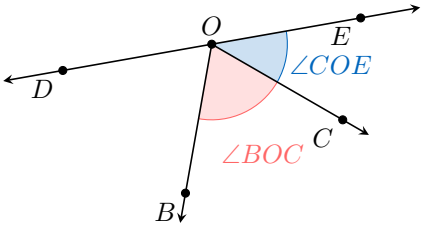
- ☐ Opposite angles at a vertex
- ☒ Complementary angles
- ☐ Supplementary angles
- ☐ None of the above

Answer: The angle $\angle BOE$ is a right angle ($\angle BOE = 90°$). Since $\angle BOC$ and $\angle COE$ share ray OC and form $\angle BOE$, their sum is:

$$\angle BOC + \angle COE = \angle BOE \quad \text{(angle addition)}$$
$$= 90°$$

Since $\angle BOC + \angle COE = 90°$, they are complementary angles.

MCQ 21: Which relationship describes $\angle BOC$ and $\angle COE$?

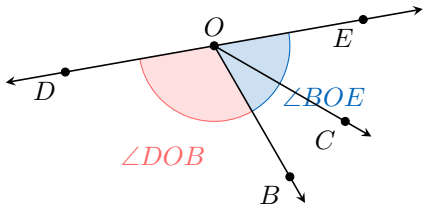


Choose one answer

- ☐ Opposite angles at a vertex
- ☐ Complementary angles
- ☐ Supplementary angles
- ☒ None of the above

Answer: The angles $\angle BOC$ and $\angle COE$ share ray OC but do not form a straight line, right angle, or opposite pair at the vertex. Their sum is not constrained to $90°$ or $180°$, and they are not opposite angles at a vertex.

MCQ 22: Which relationship describes $\angle DOB$ and $\angle BOE$?



Choose one answer

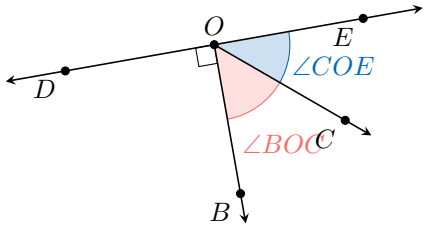
- ☐ Opposite angles at a vertex
- ☐ Complementary angles
- ☒ Supplementary angles
- ☐ None of the above

Answer: The angles $\angle DOB$ and $\angle BOE$ share ray OB and form a straight line along $\overleftrightarrow{ED}$, making their sum:

$$\begin{aligned} \angle DOB + \angle BOE &= 180° \quad \text{(straight angle)} \\ &= 180° \end{aligned}$$

Since $\angle DOB + \angle BOE = 180°$, they are supplementary angles.

MCQ 23: Which relationship describes $\angle BOC$ and $\angle COE$?



Choose one answer

- ☐ Opposite angles at a vertex
- ☒ Complementary angles
- ☐ Supplementary angles
- ☐ None of the above

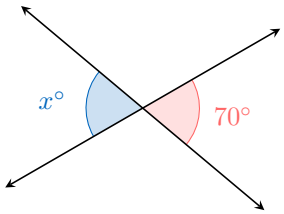
Answer: The angle $\angle DOB$ is a right angle ($\angle DOB = 90°$). The angles $\angle BOC$, $\angle COE$, and $\angle DOB$ form a straight line along $\overleftrightarrow{DE}$, so:

$$\begin{aligned} \angle BOC + \angle COE + \angle DOB &= 180° \quad \text{(straight angle)} \\ \angle BOC + \angle COE + 90° &= 180° \\ \angle BOC + \angle COE &= 180° - 90° \quad \text{(subtract } 90°\text{)} \\ &= 90° \end{aligned}$$

Since $\angle BOC + \angle COE = 90°$, they are complementary angles.

B.3 CALCULATING UNKNOWN ANGLES

Ex 24: Find the measure of the unknown angle $x°$.

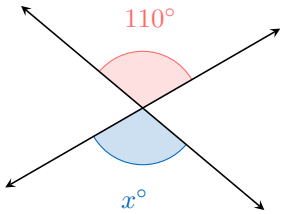


$x° = \boxed{70}°$

Answer: Opposite angles formed by two crossing lines are equal. The purple angle ($x°$) is opposite the red angle ($70°$).

$$x° = 70° \quad \text{(opposite angles are equal)}$$

Ex 25: Find the measure of the unknown angle $x°$.

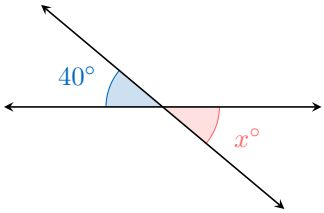


$x° = \boxed{110}°$

Answer: Opposite angles formed by two crossing lines are equal. The purple angle ($x°$) is opposite the red angle ($110°$).

$$x° = 110° \quad \text{(opposite angles are equal)}$$

Ex 26: Find the measure of the unknown angle $x°$.

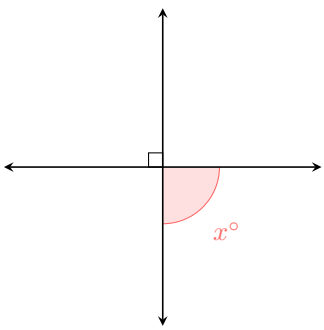


$x° = \boxed{40}°$

Answer: Opposite angles formed by two crossing lines are equal. The red angle ($x°$) is opposite the purple angle ($40°$).

$$x° = 40° \quad \text{(opposite angles are equal)}$$

Ex 27: Find the measure of the unknown angle $x°$.

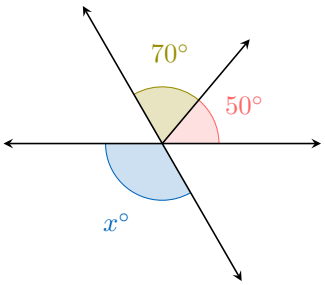


$x° = \boxed{90}°$

Answer: Opposite angles formed by two crossing lines are equal. The red angle ($x°$) is opposite a right angle ($90°$).

$$x° = 90° \quad \text{(opposite angles are equal)}$$

Ex 28: Find the measure of the unknown angle $x°$.

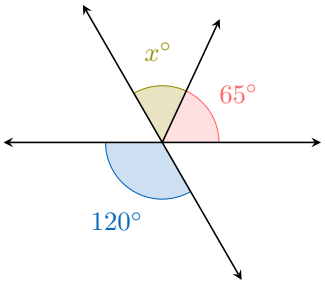


$x° = \boxed{120}°$

Answer: Opposite angles formed by two crossing lines are equal. The green angle ($50°$) and blue angle ($70°$) are next to each other, forming a larger angle. This larger angle is opposite the purple angle ($x°$).

$$\begin{aligned} x° &= 50° + 70° \quad \text{(add the green and blue angles)} \\ &= 120° \quad \text{(opposite angles are equal)} \end{aligned}$$

Ex 29: Find the measure of the unknown angle $x°$.

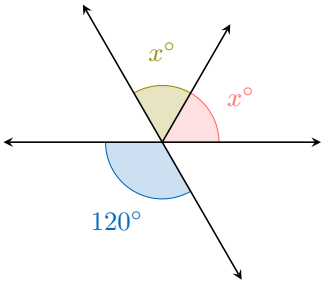


$x° = \boxed{55}°$

Answer: Opposite angles formed by two crossing lines are equal. The green angle ($65°$) and blue angle ($x°$) are next to each other, forming a larger angle. This larger angle is opposite the purple angle ($120°$).

$$\begin{aligned} 65° + x° &= 120° \quad \text{(opposite angles are equal)} \\ x° &= 120° - 65° \quad \text{(subtract } 65°\text{)} \\ &= 55° \end{aligned}$$

Ex 30: Find the measure of the unknown angle $x°$.



$x° = \boxed{60}°$

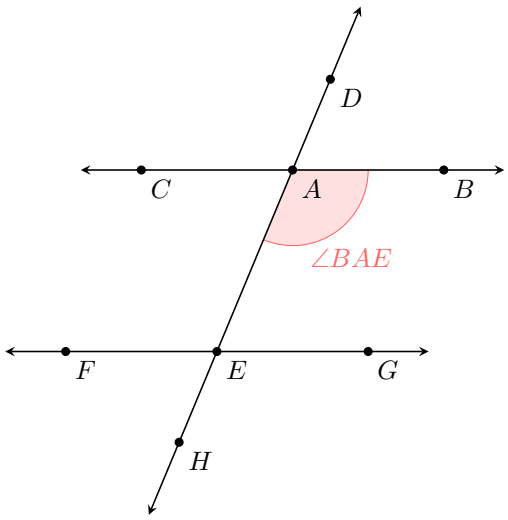
Answer: Opposite angles formed by two crossing lines are equal. The green angle ($x°$) and blue angle ($x°$) are next to each other, forming a larger angle. This larger angle is opposite the purple angle ($120°$).

$$\begin{aligned} x° + x° &= 120° \quad \text{(opposite angles are equal)} \\ 2x° &= 120° \quad \text{(combine like terms)} \\ x° &= 120° \div 2 \quad \text{(divide by 2)} \\ &= 60° \end{aligned}$$

C CORRESPONDING, ALTERNATE, AND CO-INTERIOR ANGLES

C.1 IDENTIFYING ANGLES

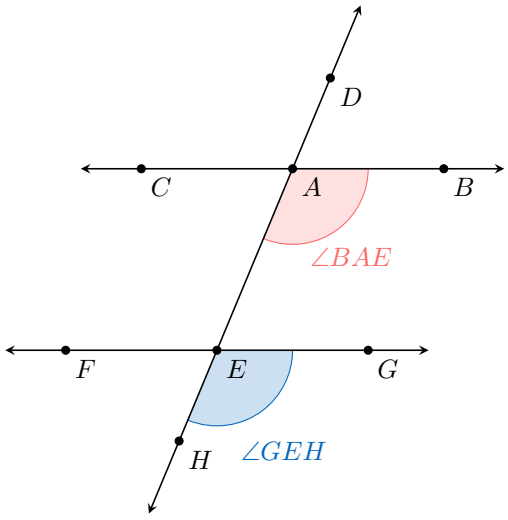
MCQ 31: Identify the corresponding angle to $\angle BAE$.



Choose one answer

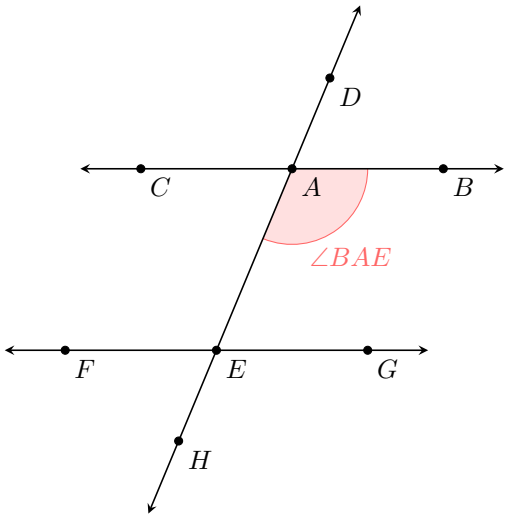
- ☐ $\angle CAD$
- ☐ $\angle FEA$
- ☐ $\angle AEG$
- ☒ $\angle GEH$

Answer: Corresponding angles are in the same position on parallel lines cut by a transversal and are equal. The red angle ($\angle BAE$) corresponds to the purple angle ($\angle GEH$).



$\angle BAE = \angle GEH$ (corresponding angles are equal)

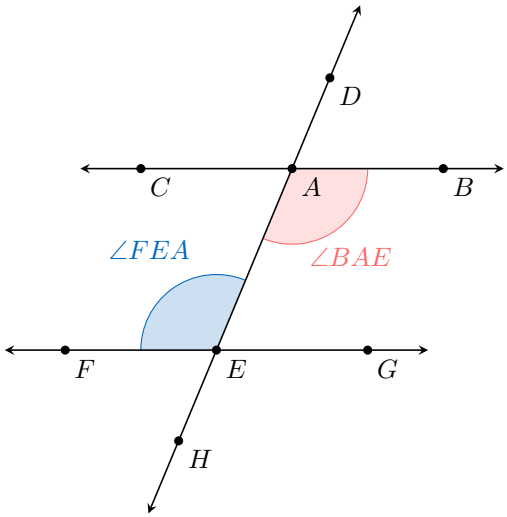
MCQ 32: Identify the alternate angle to $\angle BAE$.



Choose one answer

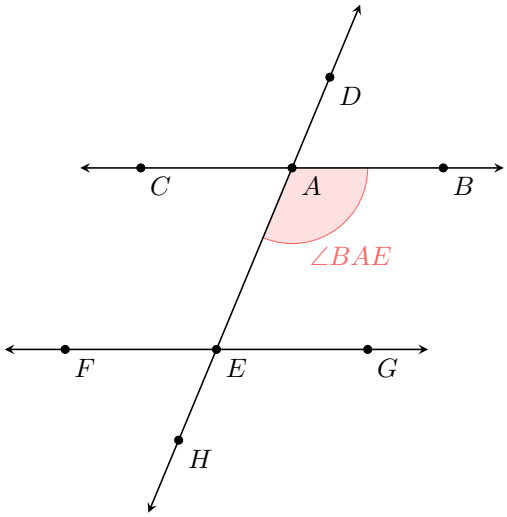
- ☐ $\angle CAD$
- ☒ $\angle FEA$
- ☐ $\angle AEG$
- ☐ $\angle GEH$

Answer: Alternate angles are on opposite sides of the transversal between parallel lines and are equal. The red angle ($\angle BAE$) has the purple angle ($\angle FEA$) as its alternate angle.



$\angle BAE = \angle FEA$ (alternate angles are equal)

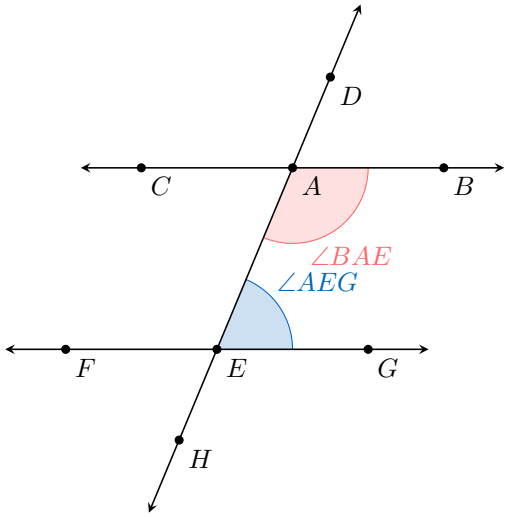
MCQ 33: Identify the co-interior angle to $\angle BAE$.



Choose one answer

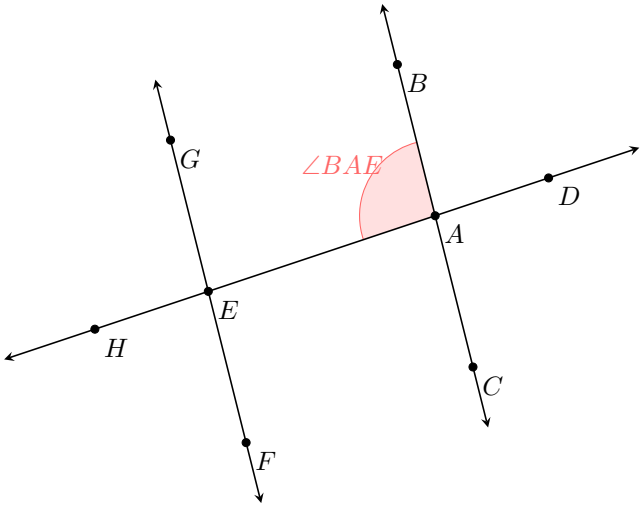
- ☐ $\angle CAD$
- ☐ $\angle FEA$
- ☒ $\angle AEG$
- ☐ $\angle GEH$

Answer: Co-interior angles are on the same side of the transversal between parallel lines and sum to 180°. The red angle ($\angle BAE$) has the purple angle ($\angle AEG$) as its co-interior angle.



$\angle BAE + \angle AEG = 180°$ (co-interior angles sum to 180°)

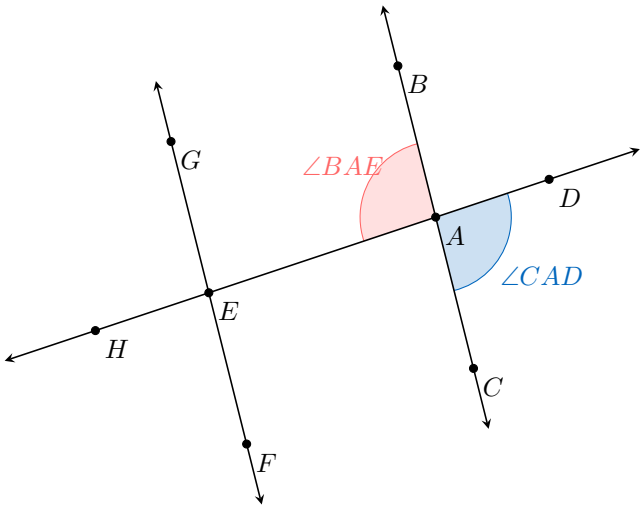
MCQ 34: Identify the opposite angle to $\angle BAE$.



Choose one answer

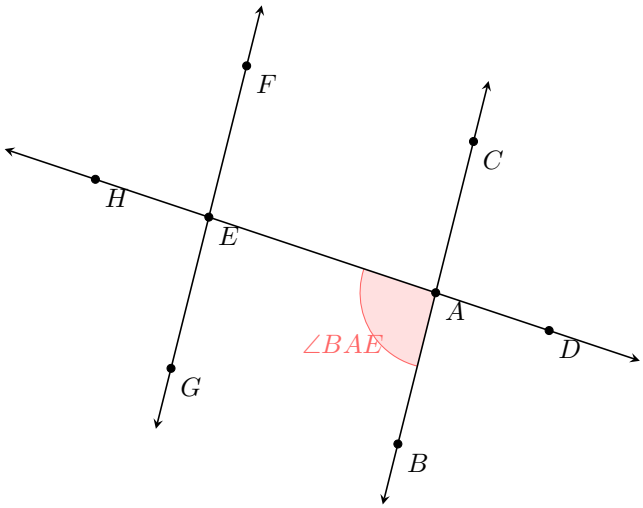
- ☒ $\angle CAD$
- ☐ $\angle FEA$
- ☐ $\angle AEG$
- ☐ $\angle GEH$

Answer: Opposite angles at a vertex are formed by two intersecting lines and are equal. The red angle ($\angle BAE$) is opposite the purple angle ($\angle CAD$) at point A.



$\angle BAE = \angle CAD$ (opposite angles are equal)

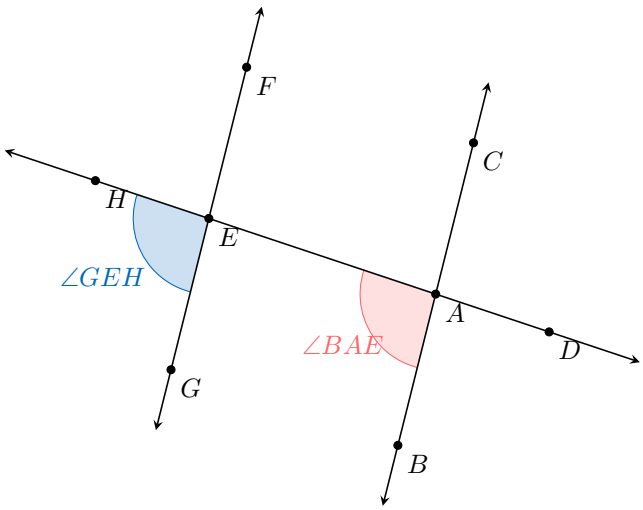
MCQ 35: Identify the corresponding angle to $\angle BAE$.



Choose one answer

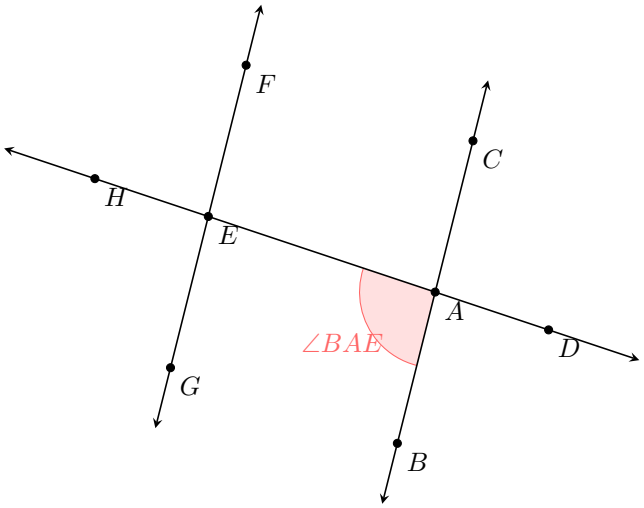
- ☐ $\angle CAD$
- ☐ $\angle FEA$
- ☐ $\angle AEG$
- ☒ $\angle GEH$

Answer: Corresponding angles are in the same position on parallel lines cut by a transversal and are equal. The red angle ($\angle BAE$) corresponds to the purple angle ($\angle GEH$).



$\angle BAE = \angle GEH$ (corresponding angles are equal)

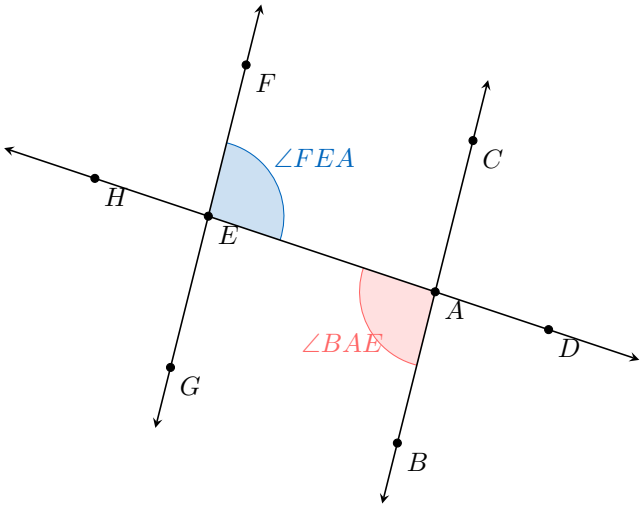
MCQ 36: Identify the alternate angle to $\angle BAE$.



Choose one answer

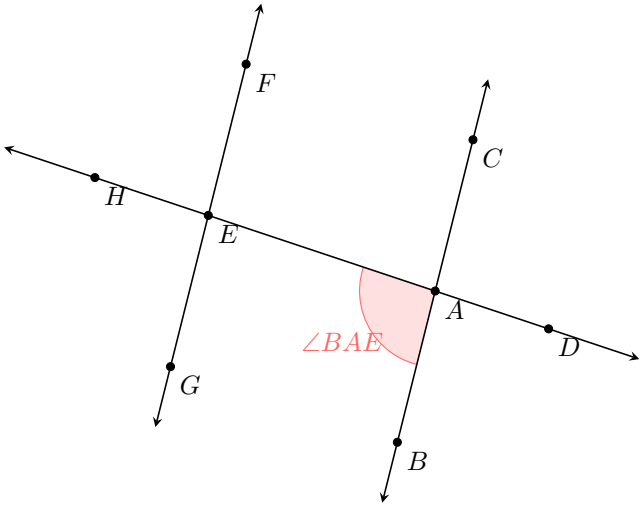
- ☐ $\angle CAD$
- ☒ $\angle FEA$
- ☐ $\angle AEG$
- ☐ $\angle GEH$

Answer: Alternate angles are on opposite sides of the transversal between parallel lines and are equal. The red angle ($\angle BAE$) has the purple angle ($\angle FEA$) as its alternate angle.



$\angle BAE = \angle FEA$ (alternate angles are equal)

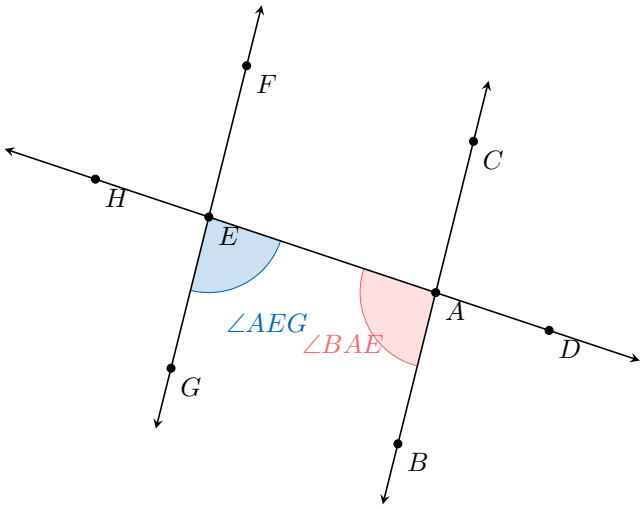
MCQ 37: Identify the co-interior angle to $\angle BAE$.



Choose one answer

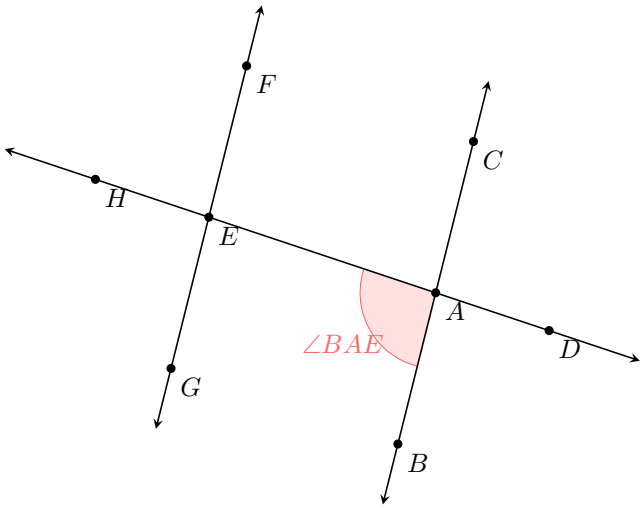
- ☐ $\angle CAD$
- ☐ $\angle FEA$
- ☒ $\angle AEG$
- ☐ $\angle GEH$

Answer: Co-interior angles are on the same side of the transversal between parallel lines and sum to 180°. The red angle ($\angle BAE$) has the purple angle ($\angle AEG$) as its co-interior angle.



$\angle BAE + \angle AEG = 180°$ (co-interior angles sum to 180°)

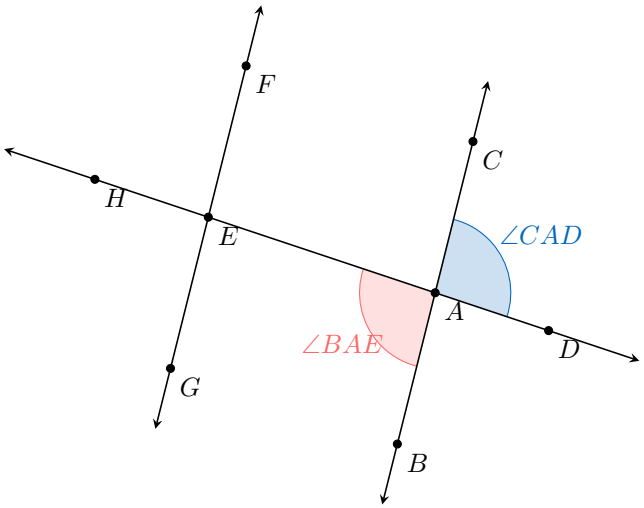
MCQ 38: Identify the opposite angle to $\angle BAE$.



Choose one answer

- ☒ $\angle CAD$
- ☐ $\angle FEA$
- ☐ $\angle AEG$
- ☐ $\angle GEH$

Answer: Opposite angles at a vertex are formed by two intersecting lines and are equal. The red angle ($\angle BAE$) is opposite the purple angle ($\angle CAD$) at point A.

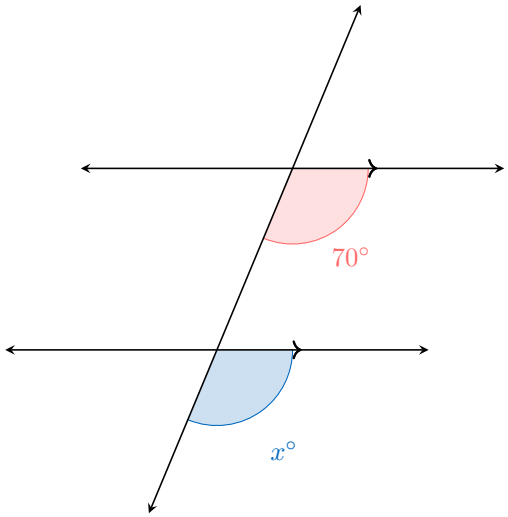


$\angle BAE = \angle CAD$ (opposite angles are equal)

D PROPERTIES OF PARALLEL LINES

D.1 CALCULATING UNKNOWN ANGLES: LEVEL 1

Ex 39: Find the measure of the unknown angle $x°$.

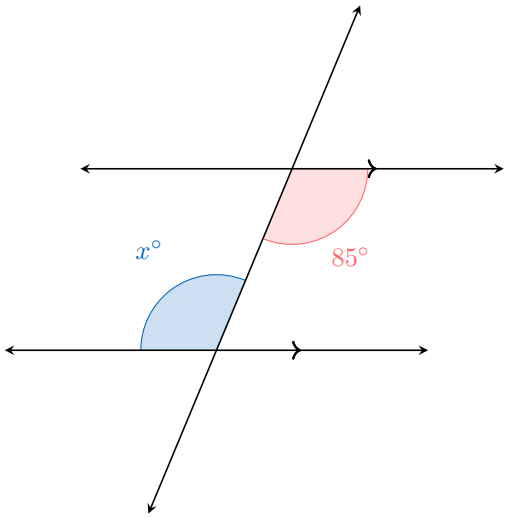


$x° = \boxed{70}°$

Answer: Corresponding angles are in the same position on parallel lines cut by a transversal and are equal. The purple angle ($x°$) corresponds to the red angle (70°).

$x° = 70°$ (corresponding angles are equal)

Ex 40: Find the measure of the unknown angle $x°$.

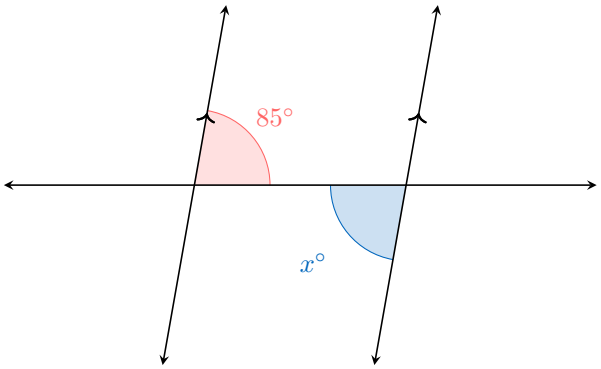


$x° = \boxed{85}°$

Answer: Alternate angles are on opposite sides of the transversal between parallel lines and are equal. The purple angle ($x°$) is alternate to the red angle (85°).

$$x° = 85° \quad \text{(alternate angles are equal)}$$

Ex 41: Find the measure of the unknown angle $x°$.

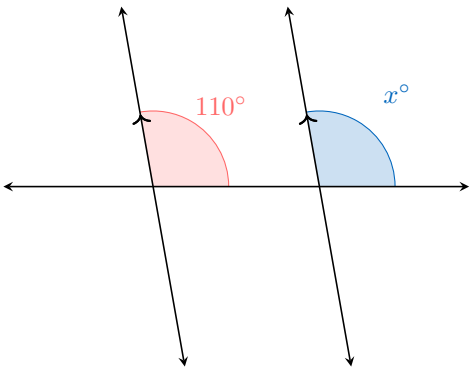


$x° = \boxed{85}°$

Answer: Alternate angles are on opposite sides of the transversal between parallel lines and are equal. The purple angle ($x°$) is alternate to the red angle (85°).

$$x° = 85° \quad \text{(alternate angles are equal)}$$

Ex 42: Find the measure of the unknown angle $x°$.



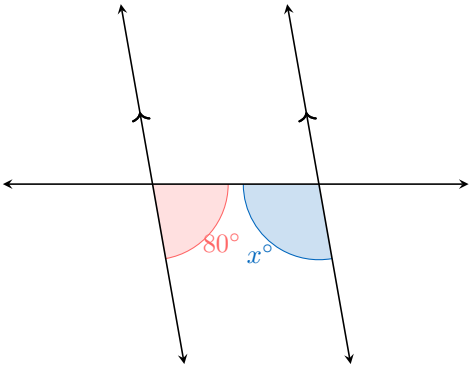
$x° = \boxed{110}°$

Answer: Corresponding angles are in the same position on parallel lines cut by a transversal and are equal. The purple angle ($x°$) corresponds to the red angle (110°).

$$x° = 110° \quad \text{(corresponding angles are equal)}$$

D.2 CALCULATING UNKNOWN ANGLES: LEVEL 2

Ex 43: Find the measure of the unknown angle $x°$.

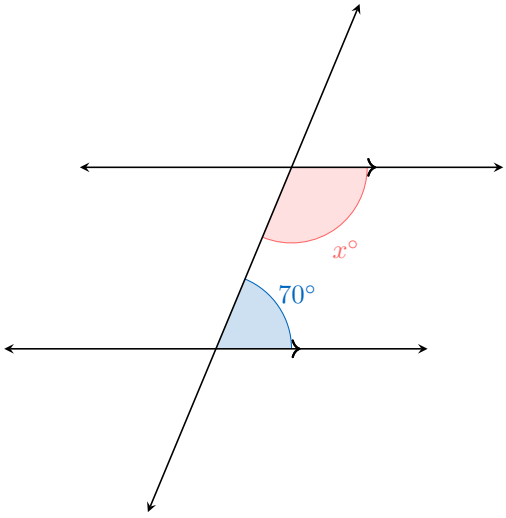


$x° = \boxed{100}°$

Answer: Co-interior angles are on the same side of the transversal between parallel lines and sum to 180°. The purple angle ($x°$) is co-interior to the red angle (80°).

$$\begin{aligned} x° + 80° &= 180° \quad \text{(co-interior angles sum to 180°)} \\ x° &= 180° - 80° \quad \text{(subtract 80°)} \\ &= 100° \end{aligned}$$

Ex 44: Find the measure of the unknown angle $x°$.

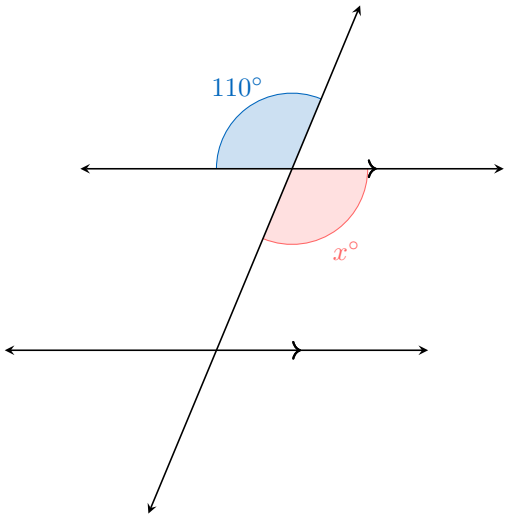


$x° = \boxed{110}°$

Answer: Co-interior angles are on the same side of the transversal between parallel lines and sum to 180°. The red angle ($x°$) is co-interior to the purple angle (70°).

$$\begin{aligned} x° + 70° &= 180° \quad \text{(co-interior angles sum to 180°)} \\ x° &= 180° - 70° \quad \text{(subtract 70°)} \\ &= 110° \end{aligned}$$

Ex 45: Find the measure of the unknown angle $x°$.

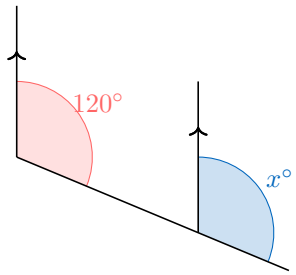


$x° = \boxed{110}°$

Answer: Opposite angles at a vertex are formed by two intersecting lines and are equal. The red angle ($x°$) is opposite the purple angle (110°) at point A.

$$x° = 110° \quad \text{(opposite angles are equal)}$$

Ex 46: Find the measure of the unknown angle $x°$.

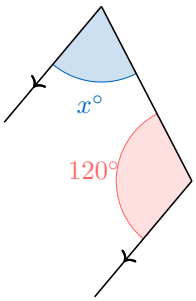


$x° = \boxed{120}°$

Answer: Corresponding angles are in the same position on parallel lines cut by a transversal and are equal. The purple angle ($x°$) corresponds to the red angle (120°).

$$x° = 120° \quad \text{(corresponding angles are equal)}$$

Ex 47: Find the measure of the unknown angle $x°$.

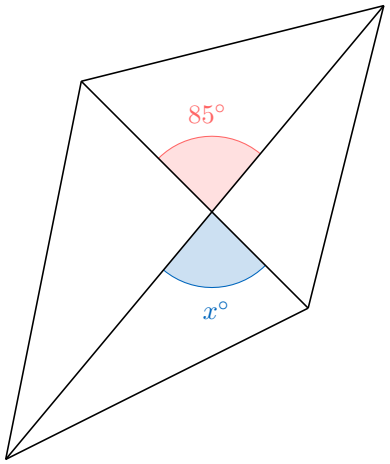


$x° = \boxed{60}°$

Answer: Co-interior angles are on the same side of the transversal between parallel lines and sum to 180°. The purple angle ($x°$) is co-interior to the red angle (120°).

$$\begin{aligned} x° + 120° &= 180° \quad \text{(co-interior angles sum to 180°)} \\ x° &= 180° - 120° \quad \text{(subtract 120°)} \\ &= 60° \end{aligned}$$

Ex 48: Find the measure of the unknown angle $x°$.

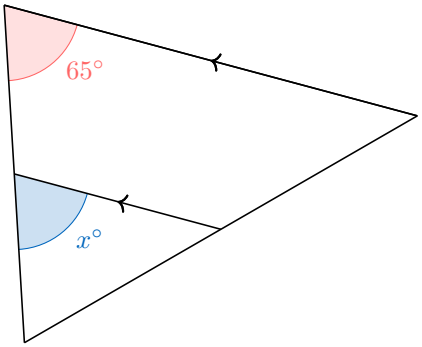


$x° = \boxed{85}°$

Answer: Opposite angles at a vertex are formed by two intersecting lines and are equal. The purple angle ($x°$) is opposite the red angle (85°) at the intersection point.

$$x° = 85° \quad \text{(opposite angles are equal)}$$

Ex 49: Find the measure of the unknown angle $x°$.

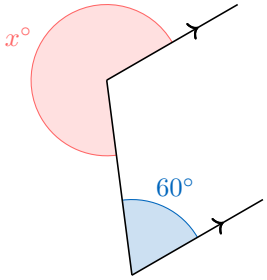


$x° = \boxed{65}°$

Answer: Corresponding angles are in the same position on parallel lines cut by a transversal and are equal. The purple angle ($x°$) corresponds to the red angle (65°).

$$x° = 65° \quad \text{(corresponding angles are equal)}$$

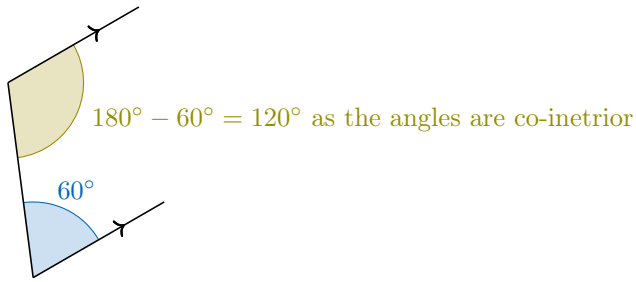
Ex 50: Find the measure of the unknown angle $x°$.



$x° = \boxed{240}°$

Answer:

1. Step 1 :



2. Step 2 : as the sum of angles in a point is equal to $360°$.