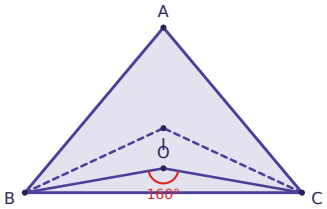
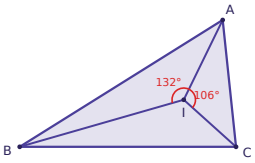
**Task card 1** Expert Angle Problems: Triangle Ce...

Acute triangle ABC has circumcenter O and incenter I. If ∠BOC = 160°, find ∠BIC.




**Task card 2** Expert Angle Problems: Triangle Ce...

Acute triangle ABC has incenter I and orthocenter H. If ∠AIB = 132° and ∠AIC = 106°, find ∠BHC.




**Task card 3** Expert Angle Problems: Triangle Ce...

The interior angles of a convex polygon form an arithmetic sequence. The smallest angle is 135° and the angles increase by 3° each time. How many sides does the polygon have?

**Task card 4** Expert Angle Problems: Triangle Ce...

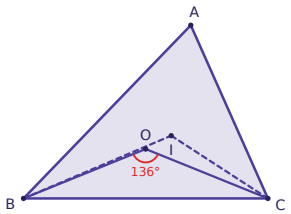
A regular star is drawn by joining every 4th vertex of a regular polygon. Each point of the star measures 20°. How many points does the star have?

**Task card 5** Expert Angle Problems: Triangle Ce...

The interior angles of a convex polygon form an arithmetic sequence. The smallest angle is 105° and the angles increase by 6° each time. Find the largest angle.

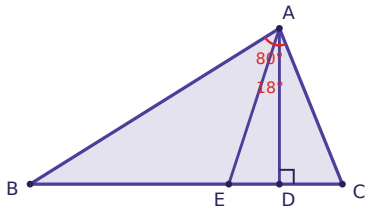
**Task card 6** Expert Angle Problems: Triangle Ce...

Acute triangle ABC has circumcenter O and incenter I. If ∠BOC = 136°, find ∠BIC.



**Task card 7** Expert Angle Problems: Triangle Ce...

In triangle ABC, AD is the altitude to BC and AE bisects ∠BAC (D and E lie on BC). If ∠DAE = 18°, ∠BAC = 80° and ∠ACB > ∠ABC, find ∠ACB.

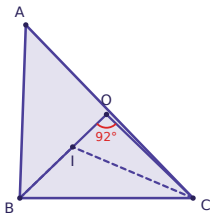



**Task card 8** Expert Angle Problems: Triangle Ce...

Inside acute angle XOY, points $P_1$, $P_3$, $P_5$, … lie on ray OX and points $P_2$, $P_4$, … lie on ray OY, each point farther from O than the one before it on the same ray, so that $OP_1 = P_1P_2 = \ldots = P_9P_{10}$. The last segment $P_9P_{10}$ is perpendicular to OX (the ray through $P_9$). Find $\angle OP_6P_7$.

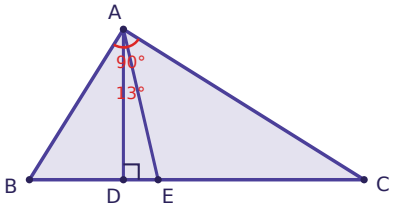
**Task card 9** Expert Angle Problems: Triangle Ce...

Acute triangle ABC has circumcenter O and incenter I. If ∠BOC = 92°, find ∠BIC.



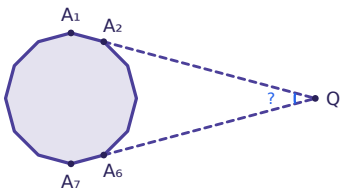

**Task card 10** Expert Angle Problems: Triangle Ce...

In triangle ABC, AD is the altitude to BC and AE bisects ∠BAC (D and E lie on BC). If ∠DAE = 13°, ∠BAC = 90° and ∠ABC > ∠ACB, find ∠ABC.




**Task card 11** Expert Angle Problems: Triangle Ce...

The sides $A_1A_2$ and $A_6A_7$ of a regular 12-sided polygon $A_1A_2\ldots A_{12}$ are extended beyond $A_2$ and $A_6$ until they meet at Q. Find $\angle A_2QA_6$.

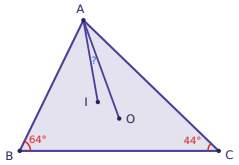



**Task card 12** Expert Angle Problems: Triangle Ce...

Inside acute angle XOY, points $P_1$, $P_3$, $P_5$, … lie on ray OX and points $P_2$, $P_4$, … lie on ray OY, each point farther from O than the one before it on the same ray, so that $OP_1 = P_1P_2 = \ldots = P_9P_{10}$. The last segment $P_9P_{10}$ is perpendicular to OX (the ray through $P_9$). Find $\angle OP_3P_4$.

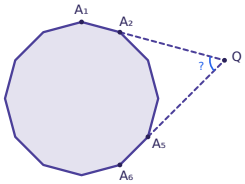
**Task card 13** Expert Angle Problems: Triangle Ce...

Acute triangle ABC has circumcenter O and incenter I. If ∠ABC = 64° and ∠ACB = 44°, find ∠OAI.




**Task card 14** Expert Angle Problems: Triangle Ce...

The sides $A_1A_2$ and $A_5A_6$ of a regular 12-sided polygon $A_1A_2\ldots A_{12}$ are extended beyond $A_2$ and $A_5$ until they meet at Q. Find $\angle A_2QA_5$.

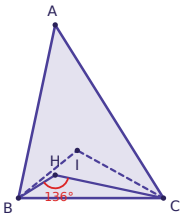



**Task card 15** Expert Angle Problems: Triangle Ce...

Inside acute angle XOY, points $P_1$, $P_3$, $P_5$, … lie on ray OX and points $P_2$, $P_4$, … lie on ray OY, each point farther from O than the one before it on the same ray, so that $OP_1 = P_1P_2 = \ldots = P_4P_5$. The last segment $P_4P_5$ is perpendicular to OY (the ray through $P_4$). Find $\angle OP_3P_4$.

**Task card 16** Expert Angle Problems: Triangle Ce...

Acute triangle ABC has orthocenter H and incenter I. If ∠BHC = 136°, find ∠BIC.




**Task card 17** Expert Angle Problems: Triangle Ce...

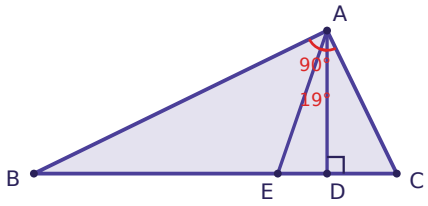
A regular star is drawn by joining every 3rd vertex of a regular polygon. Each point of the star measures 45°. How many points does the star have?

**Task card 18** Expert Angle Problems: Triangle Ce...

Inside acute angle XOY, points $P_1$, $P_3$, $P_5$, … lie on ray OX and points $P_2$, $P_4$, … lie on ray OY, each point farther from O than the one before it on the same ray, so that $OP_1 = P_1P_2 = \ldots = P_4P_5$. The last segment $P_4P_5$ is perpendicular to OY (the ray through $P_4$). Find $\angle OP_1P_2$.

**Task card 19** Expert Angle Problems: Triangle Ce...

In triangle ABC, AD is the altitude to BC and AE bisects ∠BAC (D and E lie on BC). If ∠DAE = 19°, ∠BAC = 90° and ∠ACB > ∠ABC, find ∠ACB.

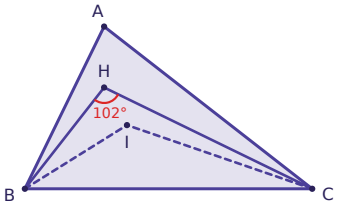



**Task card 20** Expert Angle Problems: Triangle Ce...

Inside acute angle XOY, points $P_1$, $P_3$, $P_5$, … lie on ray OX and points $P_2$, $P_4$, … lie on ray OY, each point farther from O than the one before it on the same ray, so that $OP_1 = P_1P_2 = \ldots = P_5P_6$. The last segment $P_5P_6$ is perpendicular to OX (the ray through $P_5$). Find $\angle OP_1P_2$.

**Task card 21** Expert Angle Problems: Triangle Ce...

Acute triangle ABC has orthocenter H and incenter I. If ∠BHC = 102°, find ∠BIC.

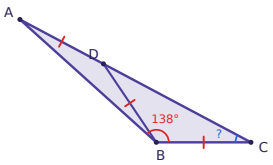



**Task card 22** Expert Angle Problems: Triangle Ce...

A regular star is drawn by joining every 3rd vertex of a regular polygon. Each point of the star measures 72°. How many points does the star have?

**Task card 23** Expert Angle Problems: Triangle Ce...

In triangle ABC, point D lies on side AC so that AD = DB = BC. If ∠ABC = 138°, find ∠ACB.




**Task card 24** Expert Angle Problems: Triangle Ce...

Inside acute angle XOY, points $P_1$, $P_3$, $P_5$, … lie on ray OX and points $P_2$, $P_4$, … lie on ray OY, each point farther from O than the one before it on the same ray, so that $OP_1 = P_1P_2 = \ldots = P_8P_9$. The last segment $P_8P_9$ is perpendicular to OY (the ray through $P_8$). Find $\angle OP_2P_3$.

# Expert Angle Problems: Triangle Centers, Circles & Polygons Task Cards

Recording sheet · Grade 10 · Solve each problem. Give angles in degrees. Equal tick marks show equal segments. Figures are not drawn to scale.

Scan to check your answers

Name: _____ Date: _____

| | | | |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 |

# Expert Angle Problems: Triangle Centers, Circles & Polygons Task Cards: Answer Key

Grade 10 · Hard

The answers online

| | | |
|---|---|---|
| **1.** 130° | **2.** 116° | **3.** 15 |
| **4.** 9 | **5.** 135° | **6.** 124° |
| **7.** 68° | **8.** 117° | **9.** 113° |
| **10.** 58° | **11.** 30° | **12.** 144° |
| **13.** 10° | **14.** 60° | **15.** 108° |
| **16.** 112° | **17.** 8 | **18.** 144° |
| **19.** 64° | **20.** 150° | **21.** 129° |
| **22.** 10 | **23.** 28° | **24.** 150° |