Planner

# Angles and polygons

- Finding the sum of the exterior angles of a polygon
- Finding the sum of the interior angles of a polygon
- Finding the angle between a radius and tangent
- Proving statements in geometry

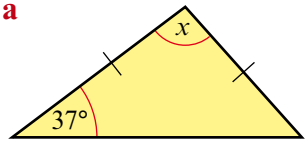
Keywords

You should know

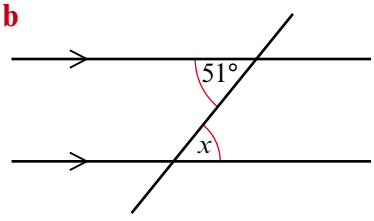
explanation 1a | explanation 1b | explanation 1c | explanation 1d | online

**1** In each diagram, find the size of $x$. Give reasons for your answers.

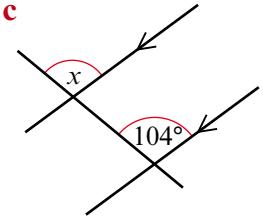
**a**



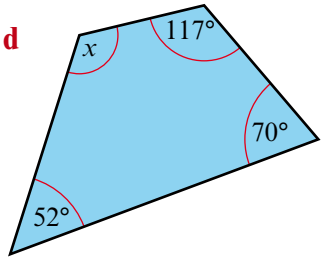

**b**



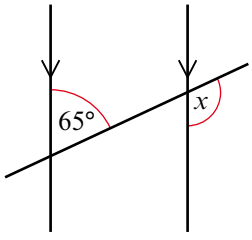

**c**



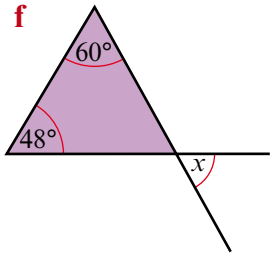

**d**




**e**

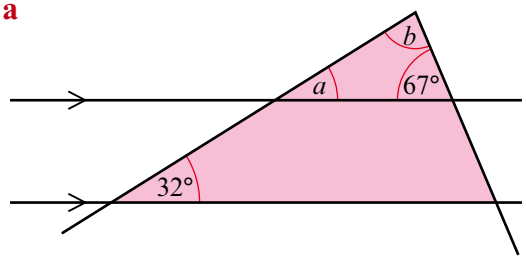



**f**

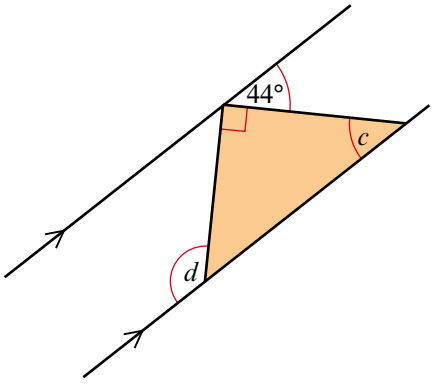



**2** Find the size of each angle marked by a letter.
Give reasons for your answers.

**a**

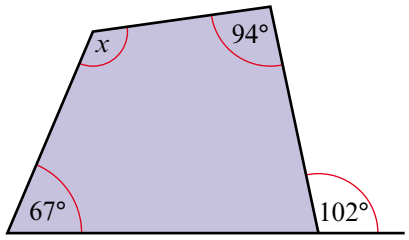



**b**

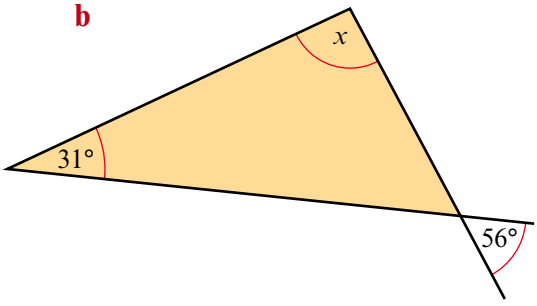


**3** In each diagram, find the size of $x$.

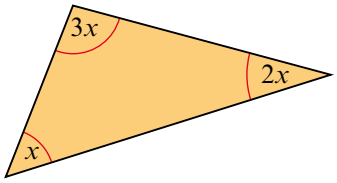
**a**



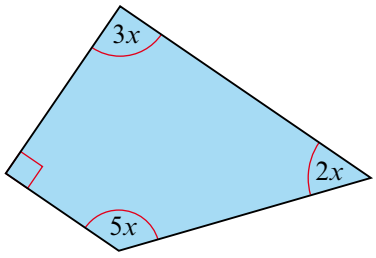

**b**




**c**

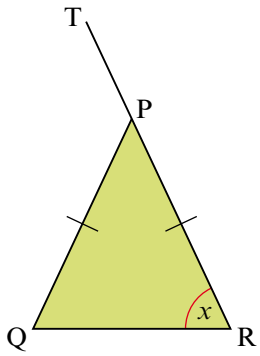



**d**

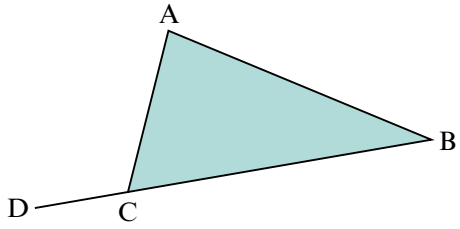



explanation 2

**4** Prove that angle TPQ = $2x$.



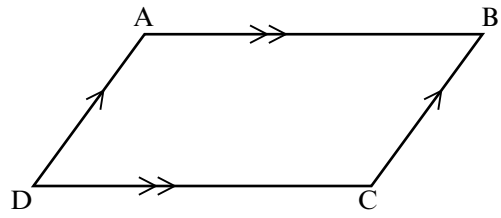

**5** Prove that angle DCA = angle CAB + angle ABC.




**Note**
Your answer proves that, in general: The exterior angle of a triangle equals the sum of the two interior opposite angles.

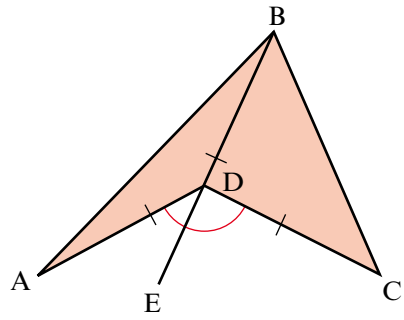
**6** Prove that angle ADC = angle ABC.

Hint: Copy the diagram and draw in the diagonal BD.




**7** Prove that red angle ADC = 2 × angle ABC.

Hint: Copy the diagram and label angle ABD as $x$ and angle DBC as $y$.




explanation 3a explanation 3b

**8** This question is about regular hexagons.

**a** Work out the angles at the centre of a regular hexagon.

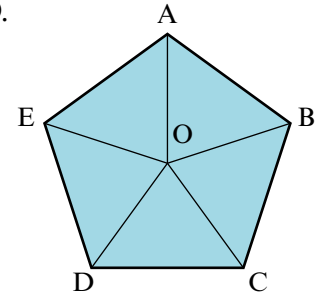
**b** Use your answer to part **a** to draw a regular hexagon.

**9** This question is about regular nonagons.

**a** Work out the angles at the centre of a regular nonagon.

**b** Use your answer to part **a** to draw a regular nonagon.

**10** The diagram shows a regular pentagon, with centre O.




**a** Work out the size of angle AOB.

**b** Work out the size of angle OAB.

**c** Work out the size of angle EAB.

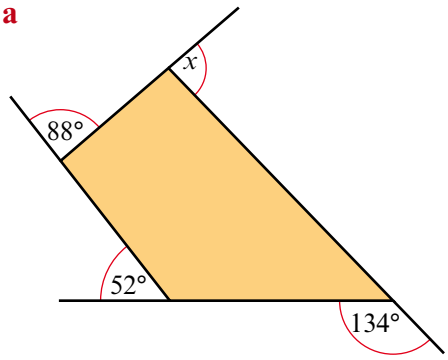
**d** EAB is an interior angle of the polygon.
Work out the sum of all the interior angles in the pentagon.

**11** Work out the sum of all the interior angles in a regular octagon.
Use a similar method to that in question **10**.

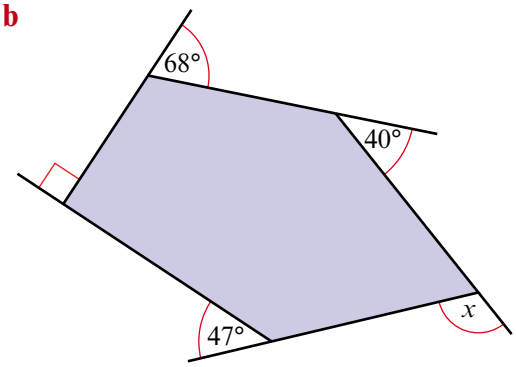
explanation 4a | explanation 4b

**12** In each diagram, find the size of $x$.

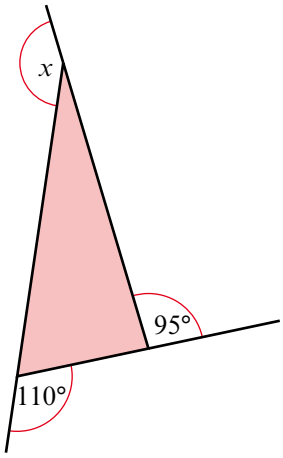
**a**



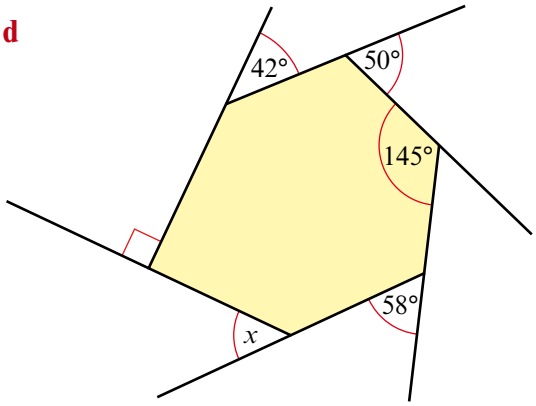

**b**



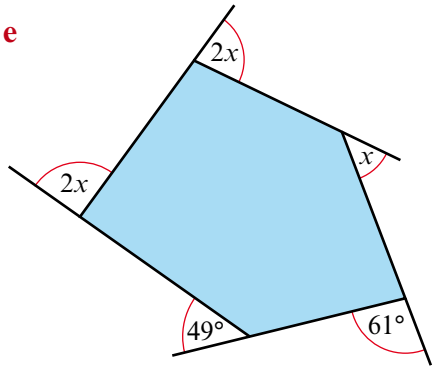

**c**



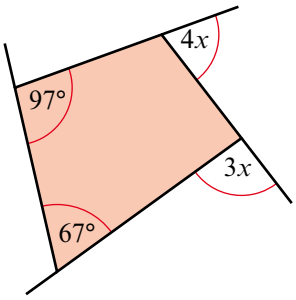

**d**




**e**




**f**




**13** The exterior angles of a pentagon are $2x$, $2x$, $3x$, $4x$ and $4x$.

**a** Find the value of $x$.

**b** What is the size of each of the pentagon's exterior angles?

**14** The exterior angles of a hexagon are $x$, $2x$, $3x$, $3x$, $4x$ and $5x$.
What is the size of each of the hexagon's exterior angles?

explanation 5a | explanation 5b

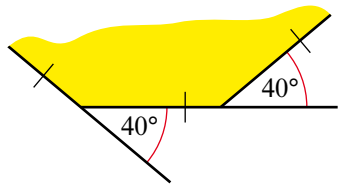
**15** Below are the numbers of sides of regular polygons.
What is the size of an exterior angle in each regular polygon?

**a** 5 sides **b** 8 sides **c** 10 sides

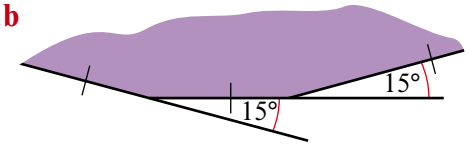
**d** 15 sides **e** 16 sides **f** 30 sides

**16** Each diagram shows part of a regular polygon.
How many sides does each regular polygon have?

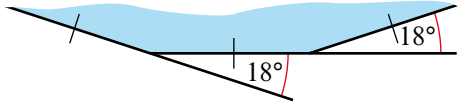
**a**



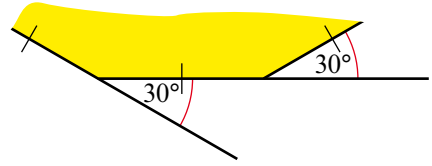

**b**




**c**




**d**




**17** Each exterior angle of a regular polygon is 20°.
How many sides does the regular polygon have?

explanation 6a | explanation 6b | online

**18** Below are the numbers of sides of regular polygons.
What is the sum of the interior angles in each regular polygon?

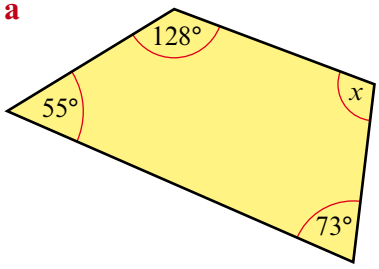
**a** 5 sides **b** 8 sides **c** 12 sides

**19** Below are the numbers of sides of regular polygons.
What is the size of an interior angle in each regular polygon?

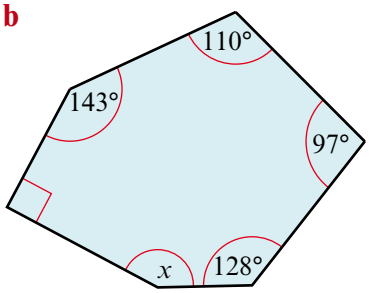
**a** 6 sides **b** 9 sides **c** 20 sides

**20** In each of the following questions, find the size of the angle marked $x$.

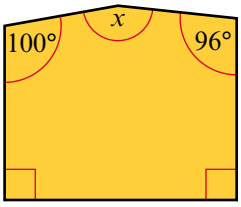
**a**



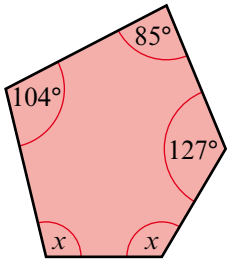

**b**



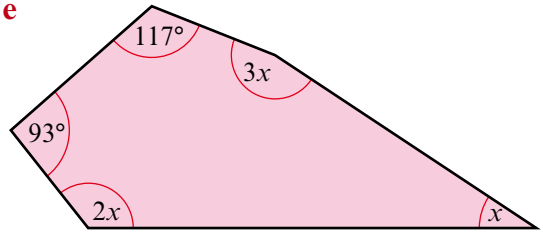

**c**




**d**




**e**

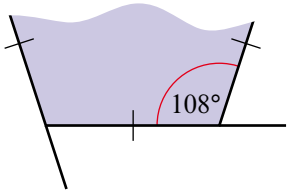



**21** Eloise says: 'The sum of the interior angles of a decagon is double the sum of the interior angles in a pentagon.'

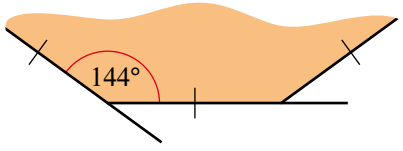
Is Eloise correct? Give an explanation for your answer.

**22** Each diagram shows part of a regular polygon.
In each case, work out the number of sides of the regular polygon.

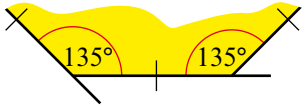
**a**



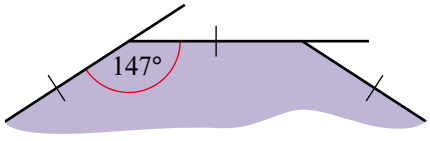

**b**




**c**



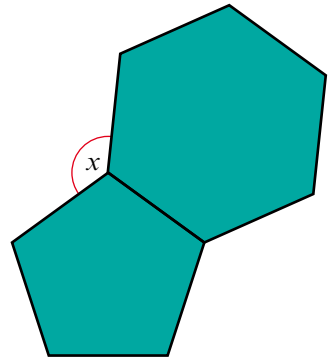

**d**




**23** Sahil says: 'I have drawn an accurate regular polygon. All the interior angles add up to 1000°.'

Could Sahil have drawn this regular polygon? Explain your answer.

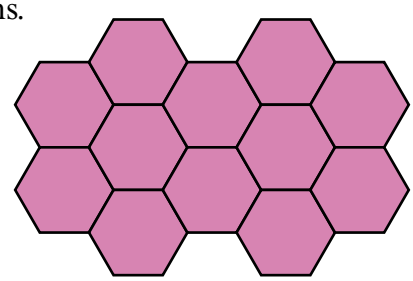
**24** The diagram shows a regular hexagon and a regular pentagon.
Work out the size of the angle marked $x$.




**25** The diagram shows a tessellation using hexagons.

**a** Explain why regular hexagons tessellate but regular octagons do not.

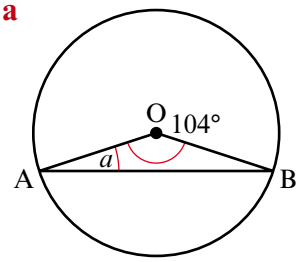
**b** Which other regular polygons will tessellate? Give an explanation for your answers.



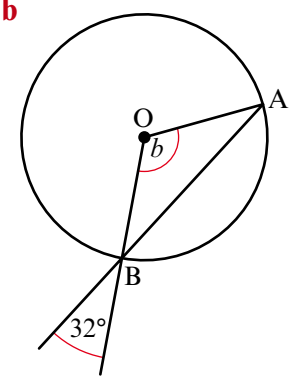
explanation 7a | explanation 7b | explanation 7c

**26** Find the sizes of the angles $a$ to $f$. Give reasons for your answers.

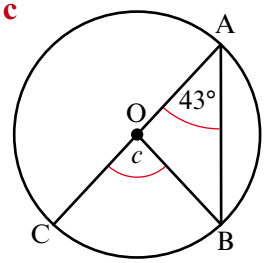
**a**



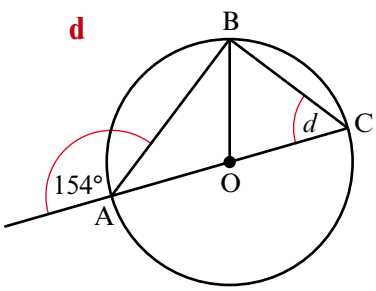

**b**



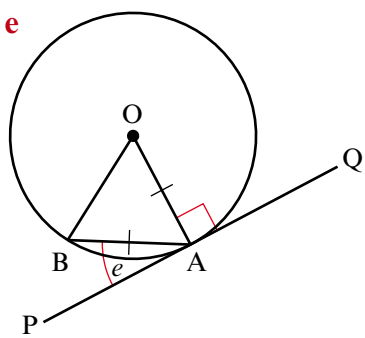

**c**



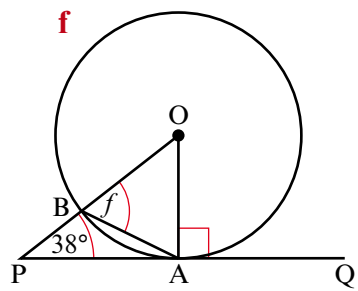

**d**




**e**



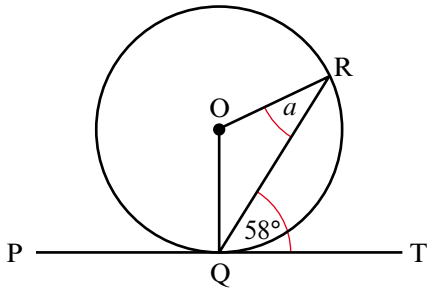

**f**



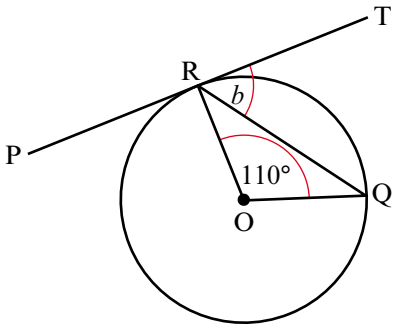
**27** In each diagram, PT is a tangent to the circle.

Find the sizes of the angles $a$, $b$, $c$, $d$ and $e$. Give reasons for your answers.

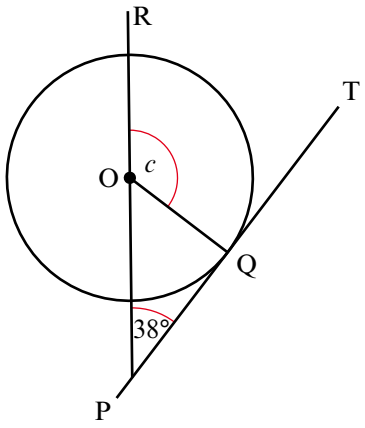
**a**



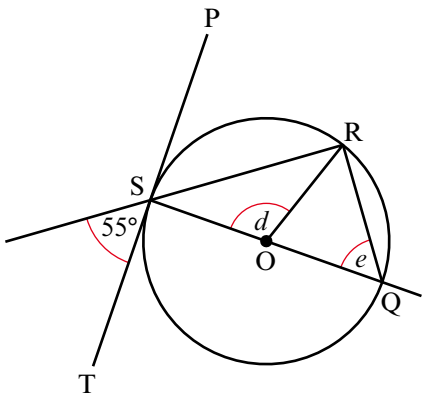

**b**




**c**



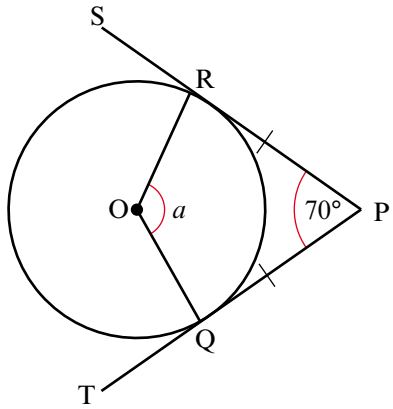

**d**



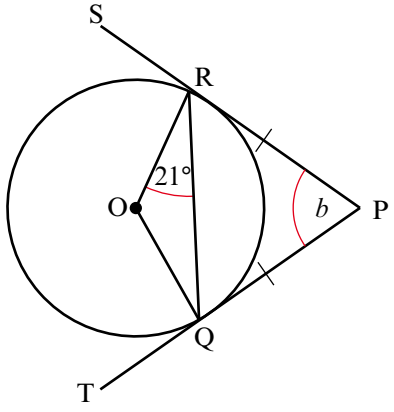

**28** In these diagrams, PS and PT are both tangents to the circle.

Find the sizes of the angles marked $a$ and $b$. Give reasons for your answers.

**a**



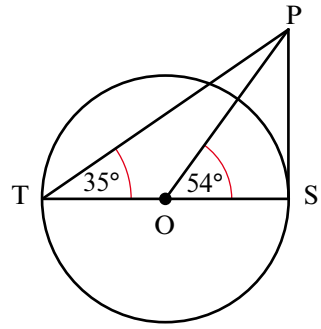

**b**



**29** PS is a tangent to the circle.

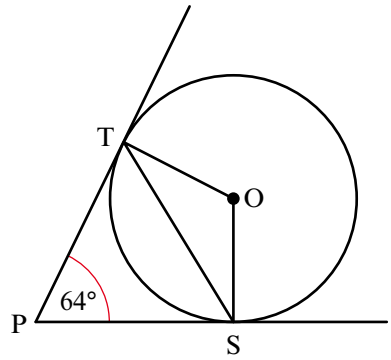
**a** Work out angle OPS.

**b** Work out angle OPT.




**30** PS and PT are tangents to the circle centre O.

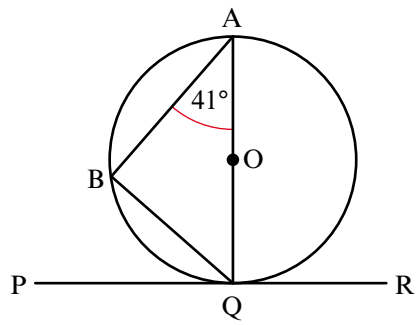
Work out the size of angle STO.




**31** AQ is the diameter of a circle, centre O.

PQR is a tangent to the circle at Q.

Work out the size of angle PQB.




**32** PQR is a tangent at Q to the circle, centre O.

Work out the size of angle OTQ.