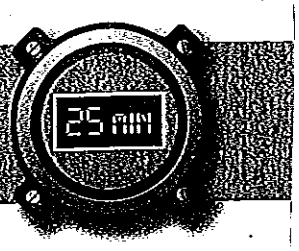
CALCULATOR ALLOWED | **Advanced level questions**

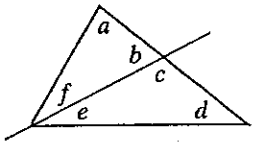


Mini Test 28: Angles

1 A polygon has each of its angles equal to 144°. What type of polygon is it?

A hexagon B octagon
C decagon D dodecagon

2 A straight line has divided a triangle into two parts. All of the angles are marked.



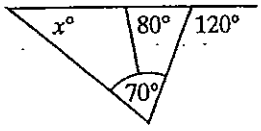
Which expression is **not** equal to 180°?

A $a+b+c+d$ B $a+d+e+f$
C $a+b+f$ D $e+c+d$

3 Four squares can meet and fill the space at a single point. Which of these **cannot** meet at a single point?

A 3 regular hexagons
B 1 regular hexagon, 1 equilateral triangle and two squares
C 2 regular octagons and 1 square
D 1 regular octagon, 2 equilateral triangles and 1 square

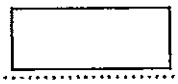
4 What is the value of x in this diagram?



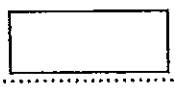
A 60 B 50
C 40 D 30

5 This clock shows that it is 8 o'clock.

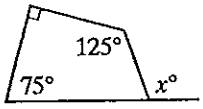
What is the size of the **smaller** angle between the two hands?

 °

6 A polygon has two angles of 150° and three other equal angles. What size is each of those three remaining angles?

 °

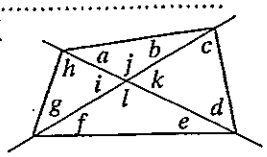
7 What is the value of x?



8 A polygon has two angles of 90° and each of its remaining angles is 120°. What type of polygon is it?

A pentagon B hexagon
C octagon D decagon

9 A quadrilateral is divided into four parts with two straight lines. All of the angles are marked.

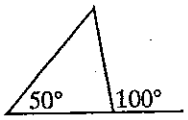


Which expression is equal to 360°?

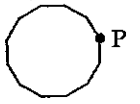
A $a+b+j$ B $d+e+f+g$
C $i+j+k+l$ D $h+g+c+d$

10 Which description applies to this triangle?

A acute-angled, isosceles
B acute-angled, scalene
C obtuse-angled, isosceles
D obtuse-angled, scalene

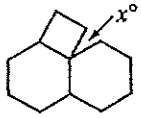


11 Which could **not** be placed beside the dodecagon to fill the space at P?



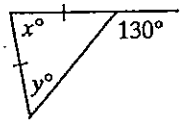
A a regular hexagon and a square
B 2 equilateral triangles and a square
C a dodecagon and an equilateral triangle
D 4 equilateral triangles

12 The diagram shows a square and two regular hexagons.



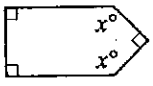
What is the value of x?

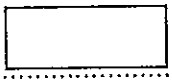
13 Which is correct?



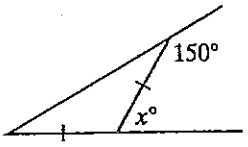
A $x = 25$ and $y = 25$
B $x = 50$ and $y = 80$
C $x = 50$ and $y = 50$
D $x = 80$ and $y = 50$

14 What is the value of x?

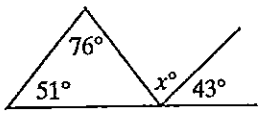


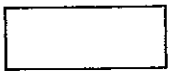


15 What is the value of x?



16 What is the value of x?



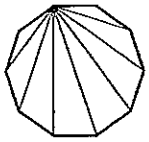


☞ Answers and explanations on pages 124–126

Mini Test 28: Angles Page 31

1 C **2** A **3** D **4** B **5** 120° **6** 80° **7** 110 **8** A **9** C
10 A **11** D **12** 30 **13** D **14** 135 **15** 60 **16** 84

1 [A polygon can be divided into triangles by drawing lines from one vertex to all the other vertices. The number of triangles is always 2 less than the number of sides. The angles of these triangles add to 180°.]



Consider the options:

A hexagon has 6 angles.
Sum of angles $= (6 - 2) \times 180°$
$= 4 \times 180°$
$= 720°$
But $6 \times 144° = 864°$
So the polygon is not a hexagon.

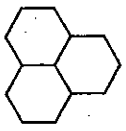
An octagon has 8 angles.
Sum of angles $= (8 - 2) \times 180°$
$= 6 \times 180°$
$= 1080°$
But $8 \times 144° = 1152°$
So the polygon is not an octagon.

A decagon has 10 angles.
Sum of angles $= (10 - 2) \times 180°$
$= 8 \times 180°$
$= 1440°$
Now $10 \times 144° = 1440°$
So the polygon is a decagon.

2 Angles in a straight line add to 180°.
So $b + c = 180°$

So $a + b + c + d$ must add to more than 180°.
The expression that is not equal to 180° is $a + b + c + d$.

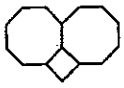
3 Angles at a point add to 360°.
Consider the options.
A hexagon has 6 angles.
Sum of angles $= (6 - 2) \times 180°$
$= 4 \times 180°$
$= 720°$
Each angle of a regular hexagon $= 720° \div 6$
$= 120°$
Now $3 \times 120° = 360°$
So 3 regular hexagons can meet and fill the space at a point.



Each angle of a regular hexagon is 120°.
Each angle of an equilateral triangle is 60°.
Each angle of a square is 90°.
Now $120° + 60° + 2 \times 90° = 360°$
So a regular hexagon, an equilateral triangle and 2 squares can meet and fill the space at a point.

An octagon has 8 angles.
Sum of angles $= (8 - 2) \times 180°$
$= 6 \times 180°$
$= 1080°$
Each angle of a regular octagon $= 1080° \div 8$
$= 135°$
Now $2 \times 135° + 90° = 360°$

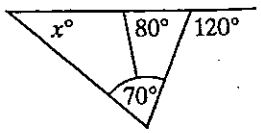
So 2 regular octagons and a square can meet and fill the space at a point.



$135° + 2 \times 60° + 90° = 345°$

So a regular octagon, 2 equilateral triangles and a square will not meet and fill the space at a point.

4 The exterior angle of a triangle is equal to the sum of the interior opposite angles.
So $120° = 70° + x°$
$x = 120 - 70$
$= 50$

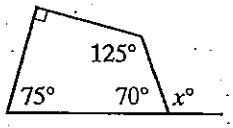


5 A complete revolution is 360°. So in one hour, the minute hand of a clock turns through 360°. The face of the clock is divided into 12 sections.
So the angle in each section $= 360° \div 12$
$= 30°$

At 8 o'clock there are 4 sections between the two hands.
Angle $= 4 \times 30°$
$= 120°$

6 The polygon has 5 angles so it is a pentagon.
Sum of angles $= (5 - 2) \times 180°$
$= 3 \times 180°$
$= 540°$
Now 2 angles measure 150°.
Sum of remaining angles $= 540° - 2 \times 150°$
$= 540° - 300°$
$= 240°$
Each angle $= 240° \div 3$
$= 80°$

7 The angles of a quadrilateral add to 360°.
Sum of given angles $= 75° + 90° + 125°$
$= 290°$
Remaining angle $= 360° - 290°$
$= 70°$
Angles in a straight line add to 180°.
So $x + 70 = 180$
$x = 110$



8 Consider the options.
A pentagon has 5 angles.
Sum of angles $= (5 - 2) \times 180°$
$= 3 \times 180°$
$= 540°$
Now $2 \times 90° + 3 \times 120° = 180° + 360°$
$= 540°$
The polygon is a pentagon.

9 Consider the options.

$a + b + j = 180°$ (angle sum of a triangle)

So $a + b + j \neq 360°$

$a + b + c + d + e + f + g + h = 360°$ (angle sum of a quadrilateral)

So $d + e + f + g \neq 360°$

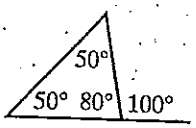
$i + j + k + l = 360°$ (angles at a point)

$h + g + i + c + d + k = 360°$ (angles in 2 triangles)

So $h + g + c + d \neq 360°$

Of the options the only expression that must equal 360° is $i + j + k + l$.

10 [Find the remaining angles of the triangle.]



The triangle has 2 equal angles so it is isosceles.

All of the angles are acute.

The triangle is acute-angled and isosceles.

11 A dodecagon has 12 angles.

Sum of angles $= (12 - 2) \times 180°$
$= 10 \times 180°$
$= 1800°$

Each angle of a regular dodecagon
$= 1800° \div 12$
$= 150°$

Angles at a point add to 360°.

Remaining angles $= 360° - 150°$
$= 210°$

Now consider the options.

A hexagon has 6 angles.

Sum of angles $= (6 - 2) \times 180°$
$= 4 \times 180°$
$= 720°$

Each angle of a regular hexagon $= 720° \div 6$
$= 120°$

Each angle of a square is 90°.

Now $120° + 90° = 210°$

So a regular hexagon and a square will fill the space at P.

Each angle of an equilateral triangle is 60°.

$2 \times 60° + 90° = 210°$

So 2 equilateral triangles and a square will fill the space at P.

$150° + 60° = 210°$

So a regular dodecagon and an equilateral triangle will fill the space at P.

$4 \times 60° = 240°$

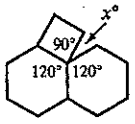
So 4 equilateral triangles could not be placed beside the dodecagon and fill the space at P.

12 A hexagon has 6 angles.

Sum of angles $= (6 - 2) \times 180°$
$= 4 \times 180°$
$= 720°$

Each angle of a regular hexagon $= 720° \div 6$
$= 120°$

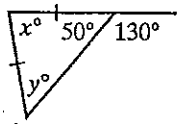
Each angle of a square $= 90°$.



Now angles at a point add to 360°.

$2 \times 120 + 90 + x = 360$
$330 + x = 360$
$x = 360 - 330$
$x = 30$

13 Angles in a straight line add to 180° so the third angle of the triangle must be 50°.



Now the triangle is isosceles. So $y = 50$.

The angles of a triangle add to 180°.

So $x + 2 \times 50 = 180$
$x + 100 = 180$
$x = 80$

$x = 80$ and $y = 50$

14 The polygon has 5 sides so it is a pentagon.

Sum of angles $= (5 - 2) \times 180°$
$= 3 \times 180°$
$= 540°$

Now 3 angles are right angles.

Sum of remaining angles $= 540° - 3 \times 90°$
$= 540° - 270°$
$= 270°$

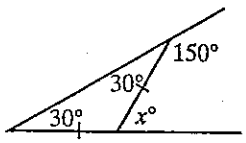
So 2 equal angles add to 270°.

$x = 270 \div 2$
$= 135$

15 Angles in a straight line add to 180°.

So the angle at the top of the triangle is 30°.

But the triangle is isosceles, so another angle is also 30°.

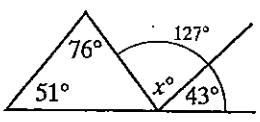


Now, the exterior angle of a triangle is equal to the sum of the interior opposite angles.

So $x = 30 + 30$
$x = 60$

16 The exterior angle of a triangle is equal to the sum of the interior opposite angles.

The exterior angle $= 76° + 51°$
$= 127°$



So $x + 43 = 127$
$x = 127 - 43$
$x = 84$