



Angles, Polygons and Geometrical Proof

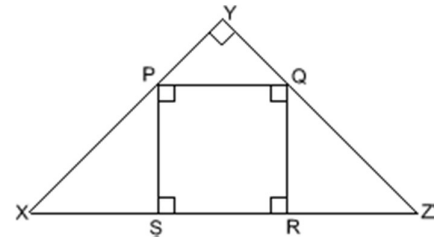
Stage 3 ★★

Mixed Selection 1

1. Square in a triangle

The diagram shows a right-angled isosceles triangle XYZ which circumscribes a square $PQRS$.

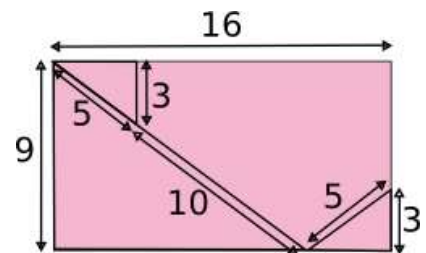
What is the ratio of the area of square $PQRS$ to the area of the triangle XYZ ?



2. Rectangle dissection

The 16 by 9 rectangle is cut as shown.

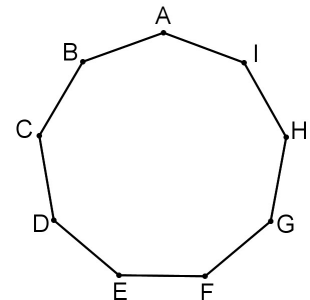
If the pieces are rearranged to form a square, what is the perimeter of the square?



3. Nonagon angle

$ABCDEFGHI$ is a regular nine-sided polygon (called a 'nonagon' or 'enneagon').

What is the size of the angle FAE ?



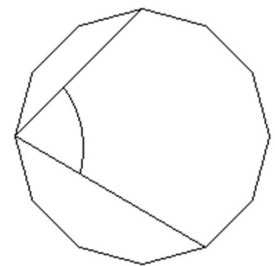
4. Handy angles

How big is the angle between the hour hand and the minute hand of a clock at twenty to five?

5. Dodecagon angles

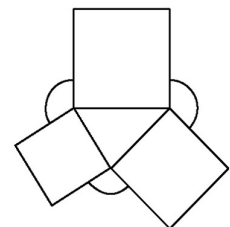
The diagram shows a regular dodecagon (a polygon with twelve equal sides and equal angles).

What is the size of the marked angle?



6. Outside the boxes

The diagram shows three squares drawn on the sides of a triangle. What is the sum of the three marked angles?



These problems are adapted from UKMT Mathematical Challenge problems (ukmt.org.uk)



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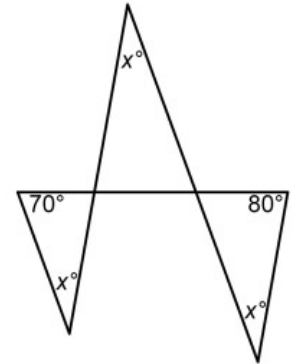
Mixed Selection 2

1. Right angled octagon

A quadrilateral can have four right angles. What is the largest number of right angles an octagon (8 sides) can have?

2. Fangs

What is the value of x in this diagram?



3. Integral polygons

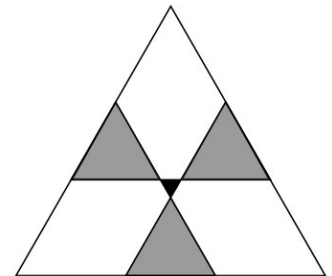
Each interior angle of a particular polygon is an obtuse angle which is a whole number of degrees.

What is the greatest number of sides the polygon could have?

4. Radioactive triangle

The diagram shows a large equilateral triangle divided by three straight lines into seven regions. The three grey regions are equilateral triangles with sides of length 5cm and the central black region is an equilateral triangle with sides of length 2cm.

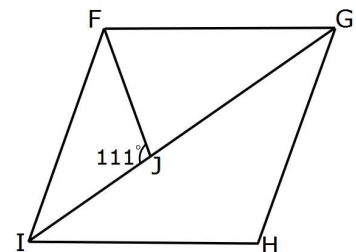
What is the side length of the original large triangle?



5. Rhombus diagonal

The diagram on the right shows a rhombus $FGHI$ and an isosceles triangle FGJ in which $GF = GJ$, and $\angle FJI = 111^\circ$.

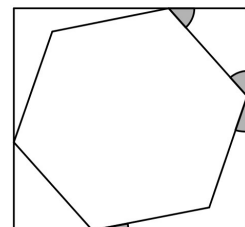
What is the size of the angle JFI ?



6. Inscribed hexagon

The diagram shows a regular hexagon inside a rectangle.

What is the sum of the four marked angles?



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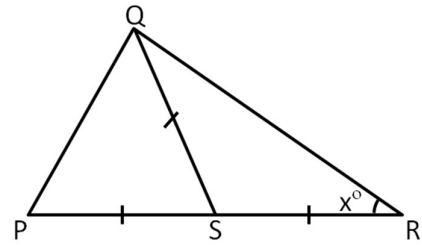
Stage 3 ★★

Mixed Selection 3

1. Triangle split

In the diagram the length SP , SQ and SR are equal and the angle SRQ is x° .

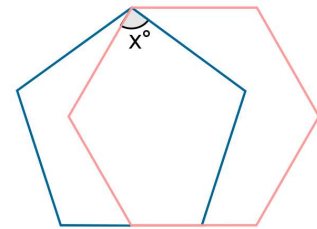
What is the size (in degrees) of the angle PQR ?



2. Hexapentagon

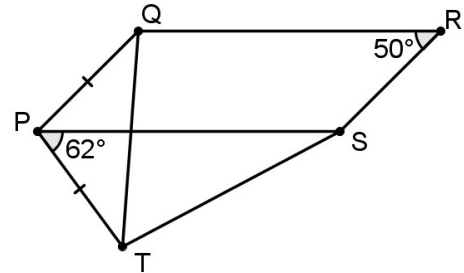
The diagram shows a regular pentagon and regular hexagon which overlap.

What is the value of x ?



3. Extended parallelogram

In the diagram, $PQRS$ is a parallelogram; $\angle QRS = 50^\circ$; $\angle SPT = 62^\circ$ and $PQ = PT$. What is the size of $\angle TQR$?



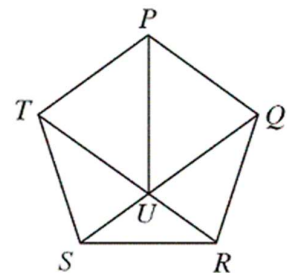
4. Six minutes past eight

What is the obtuse angle between the hands of a clock at 6 minutes past 8 o'clock?

5. U in a pentagon

The diagram shows a regular pentagon $PQRST$. The lines QS and RT meet at U .

What is the size of the angle PUR ?



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