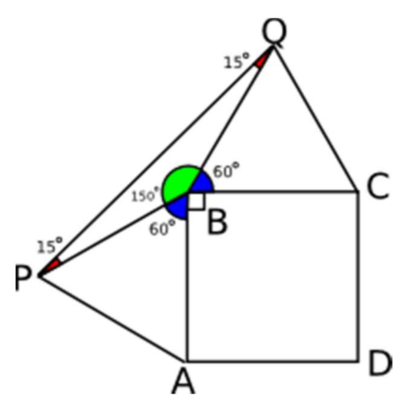
Stage 3 ⋆
Mixed Selection 2 – Solutions

1. **Robo-turn**
   The total angle turned through after each of the first 4 moves is $10°, 30°, 60°,$ and $100°$. So the robot does not face due East at the end of a move in its first complete revolution. The total angle it has turned through after each of the next 5 moves is $150°, 210°, 280°, 360°$, and $450°$, so at the end of the 9th move the robot does face East. As the robot moves 5m in each move, the distance it travels is 45m.

2. **Stellar angles**
   The four marked angles are the interior angles of a quadrilateral. Hence, $x = 360° - (105° + 115° + 125°) = 15°$.

3. **Two exterior triangles**
   Since ABQ and BCQ are equilateral, the angles ABP and CBQ are both 60°. So,
   $$\angle PBQ = 360° - 90° - 60° - 60° = 150°$$
   PBQ is isosceles, so the angles BPQ and PQB are equal. So,
   $$2 \times \angle PQB = 180° - 150° = 30°$$
   Therefore, $\angle PQB = 15°$.



4. As long as possible

The length of AD must be less than $15cm$, since $15cm$ would be its length if all four points lay in a straight line. However, by making angles ABC and BCD close to $180°$, AD can be made close to $15\ cm$ in length.

As the length of AD is a whole number of centimetres, its maximum value, therefore is 14cm.

5. Polygon cradle

As PQRST is a regular pentagon, each of its internal angles is $108°$. The internal angles of the quadrilateral PRST add up to $360°$ and so, by symmetry, $\angle\text{PRS} = \angle\text{RPT} = \frac{1}{2}(360° - 2 \times 108°) = 72°$. Each interior angle of a regular hexagon is $120°$, so $\angle\text{PRU} = 120°$.

Therefore, $\angle\text{SRU} = \angle\text{PRU} - \angle\text{PRS} = 120° - 72° = 48°$.