Stage 3 ★
Mixed Selection 1 – Solutions

1. Right-angled request

Four right-angled triangles can be drawn in each of the squares, plus four formed from two adjacent sides of the rectangle - that makes 12.

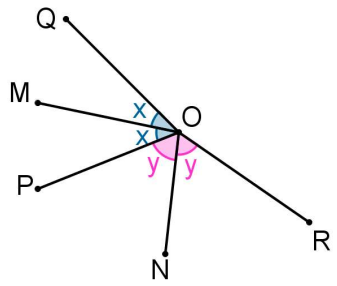
Then there are two right-angled triangles formed by joining the points UQS and PTR.

This makes a total of 14 triangles.

2. Angular reflection

As OQ is the reflection of OP in OM,
$\angle QOM = \angle POM$.
Similarly, $\angle RON = \angle PON$.
Hence, reflex $\angle QOR \quad 2 \times \angle MON = 260°$.

Therefore, $\angle QOR = 360° - 260° = 100°$.



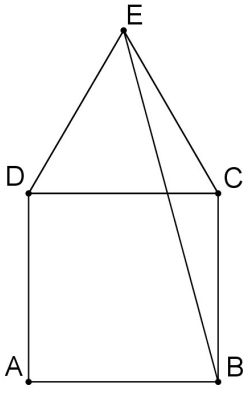
3. Homely angles

Since $ABCD$ is a square, $\angle BCD = 90°$, and since CDE is an equilateral triangle, $\angle DCE = 60°$.

Thus $\angle BCE = \angle BCD + \angle DCE = 90° + 60° = 150°$.

Because CDE is an equilateral triangle, $EC = DC$ and also, because $ABCD$ is a square, $DC = CB$.
Hence, $EC = CB$ and ECB is an isosceles triangle.

So $\angle CEB = \angle CBE = \frac{1}{2}(180 - 150)° = 15°$, and hence $\angle BED = \angle CED - \angle CEB = 60° - 15° = 45°$.



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

4. Isosceles Meld

Triangle PQR is isosceles. Therefore, $\angle PQR = \angle PRQ = 72°$.
Triangle PSR is also isosceles. Therefore, $\angle RPS = \angle RSP = 36°$.

Therefore, $x = (180 - 36 - 36)° = 108°$.

5. Central distance

Each centre is $2.5\ \text{cm}$ from the nearer end. So the distance between them is $\big(9 - (2 \times 2.5)\big)\text{cm} = 4\text{cm}$.