

## Transformations (Intermediate UKMT)

These questions must be attempted **without a calculator**

Topics covered in the questions below may not necessarily be from the topic of the title.

1. 567 is multiplied by 3489. What is the units digit of the answer?

A 1                      B 3                      C 5                      D 7                      E 9

2. How many of the numbers

$3\sqrt{11}$      $4\sqrt{7}$      $5\sqrt{5}$      $6\sqrt{3}$      $7\sqrt{2}$  are greater than 10?

A 1                      B 2                      C 3                      D 4                      E 5

3. A sheet of A4 size paper (297mm × 210mm) is folded once and then laid flat on the table.

Which of these shapes could not be made?



4. Which of the following statements is false?

A an octagon has twenty diagonals

B a hexagon has nine diagonals

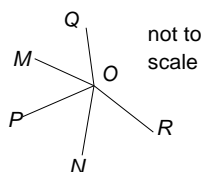
C a hexagon has four more diagonals than a pentagon

D a pentagon has the same number of diagonals as it has sides

E a quadrilateral has twice as many diagonals as it has sides

5. In the diagram,  $\angle MON = 130^\circ$ .

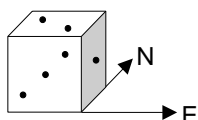
The reflection of  $OP$  in  $OM$  is  $OQ$  and the reflection of  $OP$  in  $ON$  is  $OR$ . What is the size of  $\angle QOR$ ?



A  $100^\circ$                       B  $120^\circ$                       C  $140^\circ$                       D  $150^\circ$                       E  $160^\circ$

6. The diagram shows an ordinary die in which the scores on opposite faces always total 7. It is placed on a horizontal table with the '1' face facing East. The die is moved four times, rotating it each time through  $90^\circ$  about an edge. The faces in contact with the table are first 1, then 2, then 3, then 5.

In which direction is the '1' face facing after this sequence of moves?



A West                      B East                      C North                      D South                      E Up

7. A square card printed with the letter N is held horizontally, as shown in the diagram, where the arrow indicates the direction of North. The card is turned over by rotating it through  $180^\circ$  about an axis running from East to West, and then turned over by rotating it through  $180^\circ$  about an axis running from North-East to South-West.



How does the diagram on the card now look to a person facing North?

- A B C D E

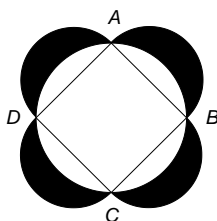
8. Beatrix has a 24-hour digital clock on a glass table-top next to her desk. When she looked at the clock at 13:08, she noticed that the reflected display also read 13:08, as shown.



How many times in a 24-hour period do the display and its reflection give the same time?

- A 12      B 36      C 48      D 72      E 96

9. The square  $ABCD$  is inscribed in a circle of radius 1. Semicircles are drawn with diameters  $AB$ ,  $BC$ ,  $CD$ ,  $DA$  as shown, and the parts of these semicircles which lie *outside* the original circle are shaded.

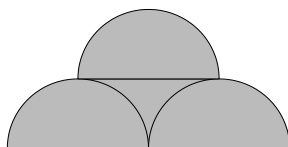


What is the total area of these four shaded regions?

- A  $3\pi + 2$       B 2      C  $\pi$       D 1      E  $\frac{\pi}{2}$

10. The diagram shows three semicircles, each of radius one.

What is the size of the total shaded area?



- A  $\pi + 2$       B 5      C  $\frac{3}{2}\pi + 1$       D 4      E  $2\pi - 1$