Stage 3 ★★
Mixed Selection 1 - Solutions

1. **Don't be late**
   Let the time for which Mary drove at 70 mph be t hours. Then the total distance covered was 55 x 2 + 70 x t miles. Also, as her average speed over 2+t hours was 60 mph, so the total distance travelled was 60(2+t) miles.
   Therefore 110 + 70t = 120 + 60t, that is 10t = 10, that is t=1.
   So in total Mary's journey took 3 hours.

2. **Bike shop**
   Suppose the distance to and from the bike shop is x miles.
   Then the time taken on the journey there is $x/3$ hours, and the time taken on the journey back is $x/12$ hours.

   So altogether a distance of $2x$ miles is travelled in $x/3 + x/12 = 5x/12$ hours.

   So the average speed is $2x \div 5x/12 = 4.8$ miles per hour

3. **Decimal clock**
   Six hours, i.e. one quarter of a day will have elapsed. One quarter of the ten 'hour' day is two and a half 'hours', or 2 'hours' 50 'minutes'.

4. **Overtake**
   Tom travels for 10 minutes longer than Tim, a time of 1 hour and 50 minutes.

   Travelling at a speed of 60 mph (or 1 mile per minute), Tom travels a distance of 110 miles.

   Tim travelled the same distance in 1 hour 40 minutes, so his speed in mph was 110 ÷ 5/3 = 110 x 3/5 = 66 mph.

5. **Very long line**
   To convert from millimetres to metres, we need to divide by 1000, so $0.2\text{mm} = 0.0002\text{m}$. Then, as the area is length multiplied by width, the line needs to be $1\text{m}^2 \div 0.0002\text{m} = 5000\text{m}$ long.

   Therefore the line needs to be 5km long!

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