Equations and Formulae

Stage 3 ★★
Mixed Selection 1

1. **Seven Dwarfs**
   The Seven Dwarfs were born on the same day, in seven consecutive years. The ages of the youngest three add up to 42 years. What do the ages of the oldest three add up to?

2. **Alien currency**
   The currency used on the planet Zog consists of bank notes of a fixed size differing only in colour. Three green notes and eight blue notes are worth 46 zogs; eight green notes and three blue notes are worth 31 zogs. How many zogs are two green notes and three blue notes worth?

3. **Symbol**
   We define $a \oplus b = ab + a + b$. Given that $3 \oplus 5 = 2 \oplus x$, what is the value of x?

4. **To run or not to run?**
   An athlete covers three consecutive miles by walking the first mile, running the second mile and cycling the third. He runs twice as fast as he walks, and he cycles one and a half times as fast as he runs. He takes ten minutes longer than he would do if he cycled the three miles. How long does he take by walking, running and cycling?

5. **Fractions of fractions**
   Two thirds of five sixths of a number X is the same as three quarters of four fifths of a number Y.

   What is the value of $\frac{X}{Y}$ as a fraction in its lowest terms?

6. **Packing boxes**
   Harry, Christine and Betty are packing 36 boxes of chocolates. Harry and Christine would take 2 hours to pack the boxes; Harry and Betty would take 3 hours; Christine and Betty would take 4 hours. How many boxes does Christine pack in one hour?

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