Stage 4 ★
Mixed Selection 2 – Solutions

1. In the hundreds

If $\frac{1}{2}n$ is a three-digit whole number, then n is an even number between 200 and 1998 inclusive.

Since we also want $2n$ to be a three-digit whole number, n must be an even number between 200 and 499 inclusive.

There are 150 such numbers.

2. Weighing the baby

Let m be my weight, b be the baby's weight and n be the nurse's weight.

We have:

$m + b = 78$

$b + n = 69$

$m + n = 137$

Adding all three equations together we get

$(m + b) + (b + n) + (m + n) = 78 + 69 + 137 \Rightarrow 2(b + m + n) = 284$

$\Rightarrow b + m + n = 142$. So the combined weight is 142kg.

3. Near 10

We require that $-1 < \sqrt{n} - 10 < 1 \Rightarrow 9 < \sqrt{n} < 11 \Rightarrow 81 < n < 121$.

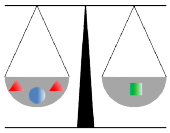
Hence the possible integer values for n are the 39 values

$n = 82,\ 83,\ \ldots,\ 119,\ 120$.

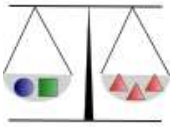
These problems are adapted from UKMT Mathematical Challenge problems (ukmt.org.uk).

4. Weighing scales

Say a cone weighs x, a sphere weighs y and a cube weighs z.
Then $(1)\ \ 2x + y = z$ since two cones and a sphere together weigh the same as a cube.



Also, $(2)\ \ y + z = 3x$ since a sphere and a cube together weigh the as three cones.



Taking y from each side of (1) (or taking a sphere from each side of the first scales) gives $(3)\ \ 2x = z - y$
Then to find out how much one cone weighs, we take equation (3) from equation (2) to give
$3x - 2x = (y + z) - (z - y)$
$\Rightarrow x = y + z - z + y$
$\Rightarrow x = 2y$
So a cone weighs the same as two spheres.

5. I love musical stars

Consider the third column:
$2♫ + ♥ = 13$ $\quad (1)$
and the second row:
$♫ + 2♥ = 11$ $\quad (2)$
$2 \times (2) - (1)$ yields:
$3♥ = 9$
So $♥ = 3$.

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