Harder Writing Equations Practice #3

The solutions for some of these require the ability to solve quadratics and simultaneous equations, which are Year 11 skills.

*There is **no** point using "guess and check" or working backwards using only numerical techniques. Marks are not awarded for the answers, only correct techniques.*

Write equations and solve using algebraic methods. The solution is given for the first three, to help focus on the method, not just the answer.

1. What two numbers add to give 35 but taking away one from twice the other gives 10? (answer = 15 and 20)

2. A rectangle is 10 cm longer than it is wide. If the area is 336 cm^2, what are the side lengths? (answer = 14 cm by 24 cm)

3. Three brothers have ages that add up to 32. The oldest is twice the age of the youngest, who is four years younger than the middle one. How old is the oldest? (Answer = 14 years old)

4. Matilda trains on a park with two alternative training tracks. Two short and three long laps add to 4 km, whereas three short and two long add to 3.5 km. How long are the laps?

5. A cuboid has a square base and a height that is four times the length of the base edges. If its volume is 62.5 cm^3, give its dimensions.

6. The square of a number is 75 less than the square of three more than that number. What is the number?

Answers: Harder Writing Equations Practice #3

The equations we are looking for are shown in bold. Other forms are acceptable, and obviously the letters chosen for the unknown(s) do not matter.

1. Call them x and y. We are told that $\boldsymbol{x + y = 35}$ and that $\boldsymbol{2x - y = 10}$

   Adding the equations $x + y + 2x - y = 35 + 10$ $\quad 3x = 45$

   $x = 15$ $\quad x + y = 35$ $\quad$ **The numbers are 15 and 20**.

2. Call the shorter one x. The longer one is therefore $x + 10$

   Area = b × h $\quad$ $\boldsymbol{336 = x(x + 10)}$ $\quad x^2 + 10x = 336$

   $x^2 + 10x - 336 = 0$ $\quad (x - 14)(x + 24) = 0$ $\quad x = 14$ or $^-24$

   Ignore the negative length as senseless $\quad$ **The rectangle is 14 cm by 24 cm**

3. Call the older one x years old. The younger is $\frac{1}{2}x$ and the middle is $\frac{1}{2}x + 4$ years old

   $\boldsymbol{\frac{1}{2}x + (\frac{1}{2}x + 4) + x = 32}$ $\quad 2x + 4 = 32$ $\quad 2x = 28$ $\quad x = 28 \div 2$

   The oldest is 14 years old

   (If x is the youngest, we get $x + (x + 4) + 2x = 32$ which avoids fractional unknowns)

4. If a is the short distance and b the long: $\quad$ ① $\boldsymbol{2a + 3b = 4}$ and ② $\boldsymbol{3a + 2b = 3.5}$

   Adding ① and ② together gives $5a + 5b = 7.5$, so $a + b = 1.5$ and $2a + 2b = 3$

   If $2a + 2b = 3$ and $2a + 3b = 4$, then $b = 1$ (by looking at the difference)

   If b= 1, then $a = 0.5$ $\quad$ **The laps are 0.5 and 1 km long**

5. Volume = b × d × h $\quad$ $\boldsymbol{62.5 = x \times x \times 4x}$ $\quad \boldsymbol{4x^3 = 62.5}$

   $x^3 = 62.5 \div 4$ $\quad x = \sqrt[3]{15.625} = 2.5$ $\quad$ **The cuboid is 2.5 × 2.5 × 10 cm**

6. $(x + 3)^2 - x^2 = 75$ $\quad x^2 + 6x + 9 - x^2 = 75$

   $6x + 9 = 75$ $\quad 6x = 75 - 9$

   $x = 66 \div 6$ $\quad$ **The number is 11**