PROBLEM-SOLVING WITH SIMULTANEOUS EQUATIONS

1 There are 450 students at Newton High School. If there are 50 more boys than girls, how many boys and girls are there at the school?

b g

$\begin{cases} b = 50 + g \\ b + g = 450 \end{cases}$ so $(50+g)+g = 450$

$\Leftrightarrow 2g = 400$ so $g = 200$

and $b = 250$

200 girls, 250 boys.

2 A contractor has 8 trucks. Some trucks carry a load of 10 tonnes and the other trucks carry a load of 5 tonnes. When all 8 trucks are filled, they contain a total load of 70 tonnes. How many of each size of truck does the contractor own?

t for ten f for 5

$\begin{cases} t + f = 8 \\ 10t + 5f = 70 \end{cases}$ $\begin{cases} t = 8 - f \\ 10(8-f) + 5f = 70 \end{cases}$

so $-5f = 70 - 80 = -10$ $\boxed{f = 2}$

and $t = 6$

6 trucks of 10 tonnes load

2 _____ 5 _____

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m s

4 John's mother is now 5 times as old as John. Three years ago, she was 9 times his age. What are their ages now?

$$\begin{cases} m = 5s \\ m-3 = 9(s-3) \end{cases}$$

so $5s - 3 = 9s - 27$

$\therefore 4s = 24 \quad s = 6$

and $m = 30$

Mum is 30 years old

Son is 6 years old.

a c

5 Tickets to a movie cost \$15 for adults and \$12 for children. If 1000 people paid to see a movie and the total money paid was \$13 800, how many adults and how many children were there?

$$\begin{cases} a + c = 1000 \\ 15a + 12c = 13{,}800 \end{cases}$$

so $15(1000 - c) + 12c = 13{,}800$

$-3c = 13800 - 15000 = -1200$

so $c = 400$ and $a = 600$

600 adults

400 children

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7 Let x be the numerator and y be the denominator of a fraction. The denominator is 5 more than the numerator. If 2 is subtracted from both the numerator and the denominator, the denominator is then twice the numerator. What is the fraction?

$$\begin{cases} y = 5 + x \\ (y-2) = 2(x-2) \end{cases}$$

so $5 + x - 2 = 2x - 4 \Rightarrow x = 7$

and $y = 5 + 7 = 12$

$$\frac{x}{y} = \frac{7}{12}$$

c a

9 The weekly wages of 5 carpenters and 3 apprentices total \$5480 while the wages of 3 carpenters and 5 apprentices total \$4440. Find the weekly wages of a carpenter and of an apprentice.

$$\begin{cases} 5c + 3a = 5480 & ① \\ 3c + 5a = 4440 & ② \end{cases}$$

$3 \times ① - 5 \times ② \Rightarrow 9a - 25a = 3 \times 5480 - 5 \times 4440$

$-16a = -5760$

$\boxed{a = 360}$

$5c = 5480 - 3 \times 360 = 4400$

so $\boxed{c = 880}$

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13 Maya runs a market stall at the weekends, selling paintings. It costs her \$90 per day for the site. It costs her on average \$4 per painting that she sells and she sells them for an average price of \$10. If she sells x articles each day, find:

(a) the cost function C and revenue function R
(b) her break-even point
(c) the profit she will make if she sells 40 paintings in a day.
(d) One weekend, the weather is fine on the Saturday and rainy on the Sunday. On Saturday Maya sells 30 paintings, but on Sunday she only sells 10 paintings. What profit (or loss) does she make for the weekend?

a) $C = x \times 4 + 90$ $\quad R = 10x$

b) $C = R$ when $10x = +4x + 90$

$\Leftrightarrow \quad 6x = 90 \quad x = 15$ articles

c) $P = R - C = 10x - (4x + 90) = 6x - 90$

$P = 6 \times 40 - 90 = 150$

d) $P_{day1} = 6 \times 30 - 90 = 180 - 90 = 90$

$P_{day2} = 6 \times 10 - 90 = -30$

Total 60 profit