Simultaneous Equations Test

1 **3 bottles of oil and 1 bottle of milk have a total mass of 750 g. 4 bottles of oil and 1 bottle of milk have a total mass of 950 g. Work out the total mass of 2 bottles of oil and 2 bottles of milk.** (1)

A. 700 g

B. 800 g

C. 750 g

D. 850 g

E. 650 g

Let the mass of 1 bottle of oil be 'x' and of 1 bottle of milk be 'y'.

$3x + y = 750$ ... equation (1)

$4x + y = 950$ ... equation (2)

Subtracting equation (1) from (2)

$$\begin{array}{r} 4x + y = 950 \\ -\quad 3x + y = 750 \\ \hline x \;\; + 0 = 200 \end{array}$$

Using the value of $x = 200$ in equation (1) we get,

$3 \times 200 + y = 750$

$600 + y = 750$

$y = 750 - 600$

$y = 150$

Mass of 2 bottles of oil and 2 bottles of milk $= 2x + 2y$

$= 2 \times 200 + 2 \times 150$

$= 400 + 300$

$= 700$ g

Option A is correct.

2 **Micheal has 24 coins of 10p and 50p. The total value of the coins is £4. How many of each coin does he have?**

(1)

A. 10 and 14

B. 18 and 6

C. 20 and 4

D. 22 and 2

E. 16 and 6

Let the number of 10p coins be 'x' and 50p coins be 'y'
Total number of coins $= 24$
$x + y = 24$ equation... (1)

Total value of 10p coins $= 10x$
Total value of 50p coins $= 50y$
Total value of both 10p and 50p coins $= £4 = 4 \times 100$ p $= 400$ p
$10x + 50y = 400$ equation... (2)

Multiplying equation... (1) by 10,
$10 \times (x + y = 24)$
$10x + 10y = 240$ equation...(3)
Subtracting equation (2) from (3),

$$\begin{array}{r} 10x + 50y = 400 \\ -\ \underline{10x + 10y = 240} \\ 40y = 160 \\ y = 160 \div 40 \\ y = 4 \end{array}$$

Using the value of $y = 4$ in (1) we get,
$x + 4 = 24$
$x = 24 - 4$
$x = 20$

Number of 10p coins $= 20$ and Number of 50p coins $= 4$
Option C is correct.

3 **The rule to workout the next term in a sequence is: "Add the previous two terms together". The fourth term is 34 and the sixth term is 90. What are the first two terms of the sequence?** (1)

A. 10 and 12

B. 11 and 12

C. 12 and 14

D. 10 and 14

E. 8 and 12

Let the first term be 'x' and the second term be 'y'
Using the condition,
Third term $=x+y$
Fourth term $=$ Second term $+$ Third term $=y+(x+y)=x+2y$
$x+2y=34$ equation... (1)
Fifth term $=$ Third term $+$ Fourth term $=(x+y)+34$
Sixth term $=$ Fourth term $+$ Fifth term $=34+(x+y)+34$
$=68+x+y$
$68+x+y=90$
$x+y=90-68$
$x+y=22$ equation... (2)
Subtracting equation (2) from (1)

$$\begin{array}{r} x+2y=34 \\ -\ \underline{x+\ y=22} \\ y=12 \end{array}$$

Using the value of $y=12$ in equation (1) we get,
$x+2\times 12=34$
$x+24=34$
$x=34-24$
$x=10$

First two terms are 10 and 12
Option A is correct.

4 **Mary is thinking of two numbers. The sum of the two numbers is 136. The difference between the two numbers is 30. What are the two numbers?** (1)

A. 73 and 43

B. 73 and 53

C. 93 and 43

D. 83 and 53

E. 93 and 63

Let the two numbers be 'x' and 'y'.

$x + y = 136$ equation... (1)

$x - y = 30$ equation... (2)

Adding equations (1) and (2)

$$\begin{array}{rl} & x + y = 136 \\ + & x - y = 30 \\ \hline & 2x + 0 = 166 \\ & x = 166 \div 2 \\ & x = 83 \end{array}$$

Using the value of $x = 83$ in equation (1) we get,

$83 + y = 136$

$y = 136 - 83$

$y = 53$

The two numbers are 83 and 53.

Option D is correct.

5 **Newton and Lebintiz's ages add to 51. In twelve years time, Newton will be one and a half times as old as Lebintiz. How old is Newton now?**

(1)

33

Let the Newton's age be 'x' and Lebintiz's age be 'y'.

$x + y = 51$ equation... (1)

After 12 years, Newton's age $= x + 12$

Lebintiz's age $= y + 12$

Using the condition,

$$x + 12 = 1\frac{1}{2} \times (y + 12)$$

$$x + 12 = \frac{3}{2} \times (y + 12)$$

$2 \times (x + 12) = 3 \times (y + 12)$

$2x + 24 = 3y + 36$

$2x - 3y = 12$ equation... (2)

Multiplying equation (1) by 2,

$2 \times (x + y = 51)$

$2x + 2y = 102$ equation... (3)

Subtracting equation (2) from (3),

$$\begin{array}{r} 2x + 2y = 102 \\ -\ \underline{2x - 3y = 12} \\ 5y = 90 \\ y = 90 \div 5 \\ y = 18 \end{array}$$

Using the value of $y = 18$ in equation (1) we get,

$x + 18 = 51$

$x = 51 - 18$

$x = 33$

Present age of Newton is 33 years.

6 **On a farm there are only cows and people. If there are 20 heads and 70 legs, how many cows are there?**

(1)

15

Let the number of people be 'x' and number of cows be 'y'
Using the condition,
$x + y = 20$ equation... (1)
Cows have 4 legs, humans have 2 legs.
Number of legs of people $= 2x$
Number of legs of cows $= 4x$
$2x + 4y = 70$ equation... (2)
Multiplying equation (1) by 2,
$2 \times (x + y = 20)$
$2x + 2y = 40$ equation... (3)
Subtracting equation (3) from (2),

$$\begin{array}{rr} & 2x + 4y = 70 \\ - & 2x + 2y = 40 \\ \hline & 2y = 30 \\ & y = 30 \div 2 \\ & y = 15 \end{array}$$

There are 15 cows.

7 **Daisy, Gilbert and Charles are cats. Daisy and Gilbert weigh 10 kg together. Gilbert and Charles weigh 12 kg together. Charles and Daisy weigh 14 kg together.**

(4)

[A]	[B]	[C]	[D]	[E]	[F]
8 kg	18 kg	2 kg	4 kg	16 kg	6 kg

a) How much does Daisy, Gilbert and Charles weigh altogether?

18 kg

Let Daisy's weight be 'x', Gilbert's weight be 'y' and Charles weight be 'z'.

$x + y = 10$ equation... (1)

$y + z = 12$ equation... (2)

$x + z = 14$ equation... (3)

Adding equations (1), (2) and (3)

$x + y + y + z + x + z = 10 + 12 + 14$

$2x + 2y + 2z = 36$

Dividing by 2

$x + y + z = 18$ equation... (4)

Daisy, Gilbert and Charles together weigh 18 kg.

Option B is correct.

b) How much does Gilbert weigh?

4 kg

$x + y + z = 18$ from equation (4)
$y = 18 - (x + z)$
Using equation (3), $x + z = 14$
$y = 18 - 14$
$y = 4$
Gilbert weigh 4 kg.
Option D is correct.

c) How much does Daisy weigh?

6 kg

$x + y = 10$ from equation (1)
Using the value of $y = 4$ in equation (1)
$x + 4 = 10$
$x = 10 - 4$
$x = 6$
Daisy weigh 6 kg.
Option F is correct.

d) How much does Charles weigh?

8 kg

$y + z = 12$ from equation (2)
Using the value of $y = 4$ in equation (1)
$4 + z = 12$
$z = 12 - 4$
$z = 8$
Charles weigh 8 kg.
Option A is correct.

8 **3 apples and 4 pears cost 120p. 4 apples and 3 pears cost 125p. What is the cost of a pear?** (1)

15p

Let the cost of one apple be 'x' and the cost of one pear be 'y'.

$3x + 4y = 120$ equation ... (1)

$4x + 3y = 125$ equation ... (2)

Multiplying equation (1) by 3, $3 \times (3x + 4y = 120)$

$9x + 12y = 360$ equation ...(3)

Multiplying equation (2) by 4, $4 \times (4x + 3y = 125)$

$16x + 12y = 500$ equation ...(4)

Subtracting equation (3) from (4),

$$\begin{array}{rl} & 16x + 12y = 500 \\ - & 9x + 12y = 360 \\ \hline & 7x + 0 = 140 \end{array}$$

$x = 140 \div 7$

$x = 20$

Using the value of $x = 20$ in equation (1)

$3 \times 20 + 4y = 120$

$60 + 4y = 120$

$4y = 120 - 60$

$4y = 60$

$y = 60 \div 4$

$y = 15$

Cost of one pear is 15p.

9 **Jason likes to eat lots of fruits. He finds that three kiwis and two watermelons cost £2.20 and that one watermelon and three mangoes cost £3.20. How much would it cost if he bought one kiwi, one watermelon and one mango?** (2)

£1.8

Let the cost of one Kiwi be 'x', cost of one watermelon be 'y' and the cost of one mango be 'z'

$3x + 2y = 2.2$ equation... (1)

$y + 3z = 3.2$ equation... (2)

Adding equations (1) and (2)

$3x + 2y + y + 3z = 2.2 + 3.2$

$3x + 3y + 3z = 5.4$

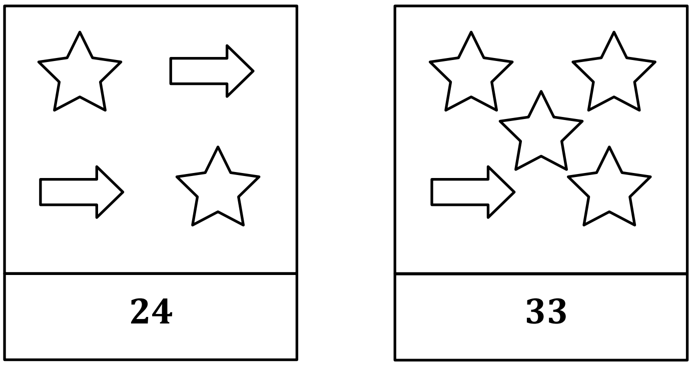
Dividing by 3

$$\frac{3x + 3y + 3z}{3} = \frac{5.4}{3}$$

$x + y + z = 1.8$

Cost of one kiwi, one watermelon and one mango is £1.8

10 **On the cards below, each star ☆ has the same value and each arrow ⇨ has the same value (but a different value to each star). The number on each card is the total value of the symbols on that card. Find the value of one star ☆.** (2)



7

....

Let the value of one star be 'x' and the value of one arrow be 'y'

Using the cards given,

$2x + 2y = 24$ equation... (1)

$4x + y = 33$ equation... (2)

Multiplying equation (2) by 2, $2 \times (4x + y = 33)$

$8x + 2y = 66$ equation...(3)

Subtracting equation (2) from (3),

$$\begin{array}{rl} & 8x + 2y = 66 \\ - & 2x + 2y = 24 \\ \hline & 6x + 0 = 42 \\ & x = 42 \div 6 \\ & x = 7 \end{array}$$

The value of one star is 7.

CHALLENGING QUESTION

Question:

♫ ♫ 𝄞 𝄞 = £20

𝄞 𝄞 ♭ ♭ = £14

♭ ♭ ♫ ♫ = £18

Using the totals given, can you calculate the price of each of the three shapes?

♫ + ♫ + 𝄞 + 𝄞 = 20

2♫ + 2𝄞 = 20

Dividing by 2, ♫ + 𝄞 = 10 equation... (1)

𝄞 + 𝄞 + ♭ + ♭ = 14

2𝄞 + 2♭ = 14

Dividing by 2, 𝄞 + ♭ = 7 equation... (2)

♭ + ♭ + ♫ + ♫ = 18

2♭ + 2♫ = 18

Dividing by 2, ♭ + ♫ = 9 equation... (3)

♫ = 9 − ♭ equation... (4)

Using value of ♫ = 9 − ♭ in equation (1)

9 − ♭ + 𝄞 = 10

𝄞 = 1 + ♭ equation (5)

Using value of 𝄞 = 1 + ♭ in equation (2)

1 + ♭ + ♭ = 7

2♭ = 6

♭ = 3

Using value of ♭ = 3 in equation (4)

♫ = 9 − 3

♫ = 6

Using value of ♭ = 3 in equation (5)

𝄞 = 1 + 3

𝄞 = 4