Simultaneous Equations Exam Practice

Q1. Solve the following pair of equations

$$4x - y = 9 \quad (1)$$
$$2x - y = -11 \quad (2)$$

$2x = 20$

$x = 10$ in (1):

$4(10) - y = 9$

$40 - y = 9$

$40 - 9 = y$

$31 = y$

Answer: $x = 10, y = 31$

(4 marks)

Q2. Solve the following pair of equations

$$2x + 3y = 5 \quad (1) \times 4$$
$$5x + 4y = 16 \quad (2) \times 3$$

$8x + 12y = 20$

$15x + 12y = 48$

$-7x = -28$

$x = 4$ in (1)

$2(4) + 3y = 5$

$8 + 3y = 5$

$3y = -3$

$y = -1$

Answer: $x = 4, y = -1$

(4 marks)

Q3. Solve the following pair of equations

$$2a = 13 - 3b \quad \Rightarrow \quad 2a + 3b = 13 \quad (1)$$

$$6b = a - 4 \quad \Rightarrow \quad a - 6b = 4 \quad (2)$$

- $(2) \times 2 \Rightarrow 2a - 12b = 8$

- $2a + 3b = 13$

$$\underline{-\quad 2a - 12b = 8}$$

$$15b = 5$$

$$b = \frac{1}{3} \quad \text{in } (2)$$

- $a - 6\left(\frac{1}{3}\right) = 4$

$$a = 6$$

Answer: $a = 6, b = \frac{1}{3}$

(4 marks)

Q4. Solve the following pair of equations:

$$2c - d = 5 \quad (1)$$

$$\frac{c}{4} + \frac{d}{3} = 2 \quad (2) \times 12 \Rightarrow 3c + 4d = 24$$

$$\Rightarrow \begin{cases} 2c - d = 5 & (\times 4) \\ 3c + 4d = 24 \end{cases}$$

$$\Rightarrow + \begin{cases} 8c - 4d = 20 \\ 3c + 4d = 24 \end{cases}$$

$$\underline{\qquad\qquad}$$

$$11c = 44$$

$$c = 4 \quad \text{in } (1)$$

- $2(4) - d = 5$

$$8 - d = 5$$

$$d = 3$$

Answer: $c = 4, d = 3$

(4 marks)

Q5. Solve the following pair of equations

$$0.8x + 0.2y = 5$$
$$0.2x + y = -1.6$$

$\Rightarrow 8x + 2y = 50$ (1)

$2x + 10y = -16$ (×4)

$8x + 2y = 50$

$-\quad 8x + 40y = -64$

$-38y = 114$

$y = -3$ in (1) : $8x + 2(-3) = 50$

$8x = 56$

$x = 7$

Answer: $x = 7, y = -3$

(4 marks)

Q6. Solve the following pair of equations

$$-120a - 150b + 1050 = 0$$
$$6b + 32a = 178$$

(2)

$\Rightarrow -120a - 150b = -1050$ (1) $\Rightarrow -12a - 15b = -105$

$32a + 6b = 178$ (2) $\Rightarrow 16a + 3b = 89$ (×5)

$\Rightarrow -12a - 15b = -105$

$+\quad 80a + 15b = 445$

$68a = 340$

$a = 5$ in (2)

$6b + 32(5) = 178$

$6b = 18$

$b = 3$

Answer: $a = 5, b = 3$

(3 marks)

Q7. Solve the following pair of equations

$$2x = 1 - 3y \quad \Rightarrow \quad 2x+3y=1 \qquad (\times 4)$$

$$\frac{8x - 5y}{11} = 5 \quad \Rightarrow \quad 8x-5y=55$$

$$\begin{array}{r} 8x+12y=4 \\ - \\ 8x-5y=55 \\ \hline 17y=-51 \end{array}$$

$y=-3$ in (1)

$2x+3(-3)=1$

$2x=10$

$x=5$

Answer: $x=5,\ y=-3$

(5 marks)

Q8. Given that k is a number such $k \neq 0$, solve the following pair of equations, giving your answer in terms of k:

$$2y - kx = 4 \quad (1)$$

$$y + 2kx = 7 \quad (2) \quad \times 2$$

$$\begin{array}{r} 2y-kx=4 \quad (3) \\ - \\ 2y+4kx=14 \quad (4) \\ \hline -5kx=-10 \end{array}$$

$\Rightarrow \quad x = \frac{2}{k}$ in (2)

$y = 7 - 2k\left(\frac{2}{k}\right)$

$y = 7-4$

$y=3$

Answer: $x=\frac{2}{k},\ y=3$

(5 marks)

Problem Questions:

Q9. The sum of Mary's parents is 84. The difference of their ages is 8.

(i) Given that her father is older than her mother, write an equation for the sum of their ages and an equation for the difference of their ages.

let x = father's age, y = mother's age

$x + y = 84$

$x - y = 8$

Answer: _____

(2 marks)

(ii) Solve the equations in part (a) to find the age of each of Mary's parents.

$x + y = 84$

$x - y = 8$

$2y = 76$

$y = 38 \quad x = 46$

Answer: $x = 46,\ y = 38$

(2 marks)

Q10. 6 years ago, Tony was five times older than Simon. Now, Tony is three times older than Simon. Work out the age of Tony and Simon.

let x = Simon's age now

y = Tony's age now

- $y - 6 = 5(x - 6)$
- $y = 3x$

$\Rightarrow y - 6 = 5x - 30$

$y - 3x = 0$

$\Rightarrow y - 5x = -24 \quad (1)$

$y - 3x = 0 \quad (2)$

$-2x = -24$

$x = 12$, in (2)

$y = 36$

Answer: Simon is 12, Tony is 36

(3 marks)

Q11. In a sweet shop, Bill spends £3.69 on 4 chocolate bars and 3 lollipops. Ben spends £3.96 on 6 chocolate bars and 2 lollipops.

(i) Find the cost of a chocolate bar and the cost of a lollipop.

$4x + 3y = 369$ (1) $\times 2$

$6x + 2y = 396$ (2) $\times 3$

$8x + 6y = 738$

$-\ 18x + 6y = 1188$

$-10x = -450$

$x = 45$, in (1) $\Rightarrow y = 63$

Answer: choc 45p, lollipop 63p

(4 marks)

(ii) Harry has £5. Can he afford 8 lollipops? You must show your working.

$8 \times 63 = 504p$

He has only 500p, so he cannot afford it

Answer: no

(2 marks)

Q12. Three bananas and two oranges cost 95p. Fifty bananas and thirty oranges cost £15.10. Find the cost of eight bananas and 4 oranges

$3x + 2y = 95$ (1) $(\times 3)$

$50x + 30y = 1510 \Rightarrow 5x + 3y = 151$ (2) $\times 2$

$\Rightarrow 9x + 6y = 285$

$10x + 6y = 302$

$-x = -17$

$x = 17$, $y = 22$

8 bananas: 126, 4 oranges: 88

(bananas)	(oranges)
126p	88p

Answer:

(6 marks)

Q13. A taxi charges a price for each mile, which depends on whether the journey is being made at peak time or off peak time.
Rana travels 50 miles during peak time and then 30 miles during off peak time, and this costs her £155 in total. Amit travels 80 miles during peak time and 40 miles during off peak time, which costs £230 in total.
One morning, during off-peak time, Saul wish to take a taxi to Denton which is 36 miles away, to visit some friends. Late that evening, he wishes to come home using the same taxi cab, again at off-peak time.
How much would Saul spend in total?

. let m = cost per mile, peak
n = cost per mile, off peak

. $50m + 30n = 155$ (1) $\times 4$
$80m + 40n = 230$ (2) $\times 3$

$\Rightarrow$ $200m + 120n = 620$
$-$ $240m + 120n = 690$
$-40m = -70$
$m = \frac{7}{4}$, (£1.75)

in (1): $n = \frac{9}{4}$ (£2.25)

$\Rightarrow$ Saul's journey costs $(36 \times 2) \times 2.25$
$= £162$

Answer: £162

(6 marks)

Q14. To join a company, candidates must complete a series of question papers.
To ensure fairness, they take the same number of papers each.
When Charles and Debby both have one paper left to do, their mean scores are identical. Charles scores 81% on his last paper and his mean score is now 72% . Debby scores 55% on her last paper and her mean score is now 70% .
Determine the number of papers which were completed by each of the candidates.

let n = the no. of papers they take
let x = their score after $n-1$ papers

$$\frac{x+81}{n} = 72 \Rightarrow x + 81 = 72n$$

$$\frac{x+55}{n} = 70 \Rightarrow x + 55 = 70n$$

$$26 = 2n$$

$\Rightarrow n = 13$ papers

Answer: 13 papers each

(5 marks)