

# 7 MUST KNOW QUESTIONS TO CONQUER

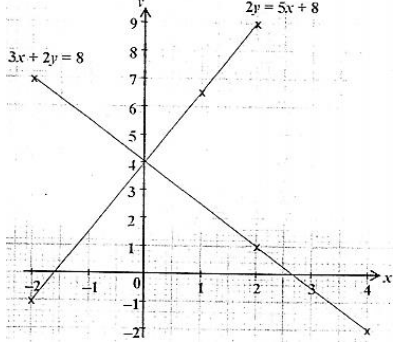
## Simultaneous Equation

1	Solve the following simultaneous equations. $2x = 9 - y$ $3x - 2y = 24$																								
2	Solve the simultaneous equations. $2x - 3y = 12$ $4x + 5y = -9$																								
3	Solve the following simultaneous equations. $\frac{x}{3} + \frac{y}{4} = \frac{1}{2}$ $-4y - 5x = 6$																								
4	Jennifer drove 4 hours at an average speed of $x$ km/h and then for 6 hours at an average speed of $y$ km/h. She drove a total distance of 816 km. (a) Write down an equation in terms of $x$ and $y$ , and show that it simplifies to $2x + 3y = 408$ (b) Kenny drove for 3 hours at an average speed of $x$ km/h and then for 5 hours at an average speed of $y$ km/h He drove a total distance of 654 km. Write down an equation, in terms of $x$ and $y$ , to represent this information. (c) Solve these two equations to find the value of $x$ and of $y$ .																								
5	A pair of simultaneous equations is given by $2y = 5x + 8 \text{ and } 3x + 2y = 8$ The table of values for both equations are shown below. <table style="margin-left: auto; margin-right: auto;"> <tr> <td colspan="4" style="text-align: center;"><math>2y = 5x + 8</math></td> <td colspan="4" style="text-align: center;"><math>3x + 2y = 8</math></td> </tr> <tr> <td style="border: 1px solid black;"><math>x</math></td> <td style="border: 1px solid black;">-2</td> <td style="border: 1px solid black;">1</td> <td style="border: 1px solid black;">2</td> <td style="border: 1px solid black;"><math>x</math></td> <td style="border: 1px solid black;">-2</td> <td style="border: 1px solid black;">2</td> <td style="border: 1px solid black;">4</td> </tr> <tr> <td style="border: 1px solid black;"><math>y</math></td> <td style="border: 1px solid black;">-1</td> <td style="border: 1px solid black;">6.5</td> <td style="border: 1px solid black;">9</td> <td style="border: 1px solid black;"><math>y</math></td> <td style="border: 1px solid black;"><math>a</math></td> <td style="border: 1px solid black;">1</td> <td style="border: 1px solid black;">-2</td> </tr> </table> (a) Find the value of $a$ . (b) Plot the graphs of $2y = 5x + 8$ and $3x + 2y = 8$ . (c) Hence, find the solution to the simultaneous equations $2y = 5x + 8$ and $3x + 2y = 8$ .	$2y = 5x + 8$				$3x + 2y = 8$				$x$	-2	1	2	$x$	-2	2	4	$y$	-1	6.5	9	$y$	$a$	1	-2
$2y = 5x + 8$				$3x + 2y = 8$																					
$x$	-2	1	2	$x$	-2	2	4																		
$y$	-1	6.5	9	$y$	$a$	1	-2																		
6	(a) (i) Solve the simultaneous equations $x + 3y = 5$ and $7x - 6y = -19$ . (ii) Name the method you use to solve (a)(i). (b) Explain why the simultaneous equations $2a + b = 4$ and $4a + 2b = 8$ have infinitely many solutions. (c) A pair of simultaneous equation is given by $3a - b = 12 \text{ and } \frac{a}{3} - \frac{b}{4} = 2$ Amy claims that the solution to the simultaneous equations is $a = 4.8, b = 2.4$ . Explain how she can check if her answer is correct. Hence, explain whether her answer is correct.																								

- |   |  |
|---|--|
| 7 | <p>(a) if <math>x = 1</math> and <math>y = 2</math> is the solution of the simultaneous equations</p> $ax - by = 1$ $ay + bx = 17$ <p>find the value of <math>a</math> and <math>b</math>.</p> <p>(b) Jason and Benson are walking at different speeds.<br/>If they walk in the same direction, Jason would be 3 km in front of Benson after 3 hours. If they walk in opposite directions, Jason would be 10 km away from Benson after 2 hours.<br/>Let Jason's speed be <math>x</math> km/h and Benson's speed be <math>y</math> km/h.<br/>Assuming that their speeds are constant, find the speed of Jason and Benson.</p> |
|---|--|

**Answer Key**

1	Solution: $2x + y = 9$ $4x + 2y = 18 \dots (1)$ $3x - 2y = 24 \dots (2)$ $(1) + (2),$ $7x = 42$ $x = 6$ $y = -3$
2	Solution: $y = -3, x = 1.5$ $(2x - 3y = 12 \dots (1)$ $(1) \times 2:$ $4x - 6y = 24 \dots (2)$ $4x + 5y = -9 \dots (3)$ $(2) - (3):$ $4x - 6y - (4x + 5y) = 24 - (-9) \dots \text{M1 (substitution or elimination)}$ $4x - 6y - 4x - 5y = 33$ $-11y = 33$ $y = -3$ $x = 1.5$
3	Solution: $y = -54, x = 42$ $\frac{x}{3} + \frac{y}{4} = \frac{1}{2} \dots (1)$ $-4y - 5x = 6 \dots (2)$ <p>From (1),</p> $4x + 3y = 6$ $x = \frac{6-3y}{4} \dots (3)$ <p>Sub (3) into (2)</p> $-4y - 5\left(\frac{6-3y}{4}\right) = 6$ $-16y - 30 + 15y = 24$ $\therefore y = -54 \dots (4)$ <p>Sub (4) into (1)</p> $\frac{x}{3} + \frac{(-54)}{4} = \frac{1}{2}$ $\frac{x}{3} = \frac{56}{4}$ $\therefore x = 42$
4	Solutions: $(a) 4x + 6y = 816$ $2x + 3y = 408$ $(b) 3x + 5y = 654$ $(c) 2x + 3y = 408 \dots (1)$ $3x + 5y = 654 \dots (2)$ $(1) \times 3 \Rightarrow 6x + 9y = 1224 \dots (3)$ $(2) \times 2 \Rightarrow 6x + 10y = 1308 \dots (4)$ $(4) - (3) \Rightarrow (6x + 10y) - (6x + 9y) = 1308 - 1224$ $y = 84$

	<p>Substitute <math>y = 84</math> into (1)</p> $2x + 3(84) = 408$ $2x = 408 - 252$ $= 156$ $x = \frac{156}{2}$ $= 78$ <p>Ans: (b) <math>3x + 5y = 654</math> (c) <math>y = 84, x = 78</math></p>	
5	<p>Solutions:</p> <p>(a) <math>a = 7</math>                  When <math>x = -2</math>,  <math>3(-2) + 2y = 8</math>  <math>-6 + 2y = 8</math>  <math>2y = 8 + 6</math>  <math>2y = 14</math>  <math>y = 7</math>  <math>\therefore a = 7</math></p> <p>(b) </p> <p>(c) <math>x = 0, y = 4</math></p> <p>Ans: (a) 7 (c) <math>x = 0, y = 4</math></p>	
6	<p>Solutions:</p> <p>(a)(i) <math>y = 2, x = -1</math>  <math>x + 3y = 5</math> --- (1)  <math>7x - 6y = -19</math> ---- (2)                  By Elimination:  <math>7x + 21y - (7x - 6y) = 35 - (-19)</math>  <math>7x + 21y - 7x + 6y = 35 + 19</math>  <math>27y = 54</math>  <math>y = 2</math>                  Sub <math>y = 2</math> into (1):  <math>x + 3(2) = 5</math>  <math>x + 6 = 5</math>  <math>x = -1</math></p> <p>(ii) Elimination or substitution (based on answer in (a)(i))</p> <p>(b) This is because when the equation <math>2a + b = 4</math> is multiplied by 2, <math>2(2a + b) = 2(4)</math> <math>4a + 2b = 8</math>                  The result is the second equation, i.e., they are equivalent.</p> <p>(c) She can check if her answer is correct by <u>substituting the values of <math>x</math> and <math>y</math> into both equations.</u>                  Her answer is correct if the values <u>satisfy both equations.</u>  <math>3(4.8) - 2.4 = 14.4 - 2.4 = 12</math>  <math>\therefore a = 4.8, b = 2.4</math> satisfies the equation <math>3a - b = 12</math>.  <math>\frac{4.8}{3} - \frac{2.4}{4} = 1.6 - 0.6 = 1</math>  <math>\therefore a = 4.8, b = 2.4</math> does not satisfy the equation <math>\frac{a}{3} - \frac{b}{4} = 2</math>.                  Her answer is <u>not correct</u> as <math>a = 4.8, b = 2.4</math> does not satisfy <math>\frac{a}{3} - \frac{b}{4} = 2</math>.</p>	

7 Solutions:

(a)  $a = 7, b = 3$

 Substitute  $x = 1$  and  $y = 2$  into each equation.

$$a(1) - b(2) = 1$$

$$a - 2b = 1 \text{ ---- (1)}$$

$$a(2) + b(1) = 17$$

$$2a + b = 17 \text{ --- (2)}$$

From (1):

$$a = 1 + 2b \text{ --- (3)}$$

Sub (3) into (2):

$$2(1 + 2b) + b = 17$$

$$2 + 4b + b = 17$$

$$5b = 15$$

$$b = 3$$

 Sub  $b = 3$  into (3):

$$a = 1 + 2(3) = 7$$

$$a = 7, b = 3$$

(b)  $3x - 3y = 3 \text{ ---- (1)}$

$$2x + 2y = 10 \text{ ---- (2)}$$

$$(1) \times 2: 6x - 6y = 6 \text{ ---- (3)}$$

$$(2) \times 3: 6x + 6y = 30 \text{ ---- (4)}$$

$$(3) - (4): -6y - 6y = 6 - 30$$

$$-12y = -24$$

$$y = 2$$

 Sub  $y = 2$  into (1)

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

$$3x - 6 = 3$$

$$3x = 9$$

$$x = 3$$

Jason's speed = 3 km/h

Benson's speed = 2 km/h

 Ans: (a)  $a = 7, b = 3$  (b) Jason's speed = 3 km/h; Benson's speed = 2 km/h