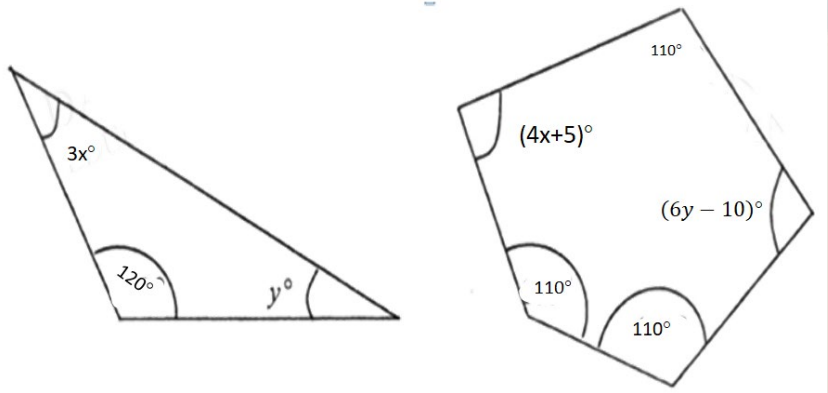


8 ESSENTIAL QUESTIONS TO MASTER

SIMULTANEOUS EQUATIONS

1	Solve the following simultaneous equations. $2x + y = 5$ $3x + y = 7$									
2	Solve the following simultaneous equations. $2x - y = 12$ $x - 2y = 9$									
3	Solve the following simultaneous equations. $\frac{1}{3}x - \frac{1}{4}y = 4$ $6x + 5y = -42$									
4	Tickets for a theme park are priced at \$50 for an adult and \$20 for a child. On a particular weekend, there are p adults and q children. The total amount of ticket sales for the weekend was \$44500. To commemorate an opening anniversary, a total of 700 discount coupons were given, on a first come first serve basis, to $\frac{3}{4}$ of adult visitors and $\frac{1}{3}$ of child visitors. (a) Form two simultaneous equations in terms of p and q. (b) Show that one of the equations can be simplified to $9p + 4q = 8400$. (c) Solve the simultaneous equations to find the value of p and of q. (d) Hence, find the total number of visitors on that particular weekend.									
5	The table shows the values of x and y for the equation of the line $5y - 4x = -15$. <table border="1"><tr><td>x</td><td>-3</td><td>1</td><td>4</td></tr><tr><td>y</td><td>n</td><td>-2.2</td><td>0.2</td></tr></table> (a) Find the value of n. (b) On a piece of graph paper, draw the graph of $5y - 4x = -15$ for $-3 \leq x \leq 4$. (c) Find the value of y when $x = 1$ (d) Draw the line $y = -1$ on the same graph. Hence, find the coordinates of the point where both lines meet.	x	-3	1	4	y	n	-2.2	0.2	
x	-3	1	4							
y	n	-2.2	0.2							
6	(a) (i) Solve the simultaneous equations ($2x + y = 8$) and ($5x - 4y = -5$). (ii) Name the method you used to solve (a)(i). (b) Explain why the simultaneous equations ($3a - b = 6$) and ($6a - 2b = 12$) have infinitely many solutions.									

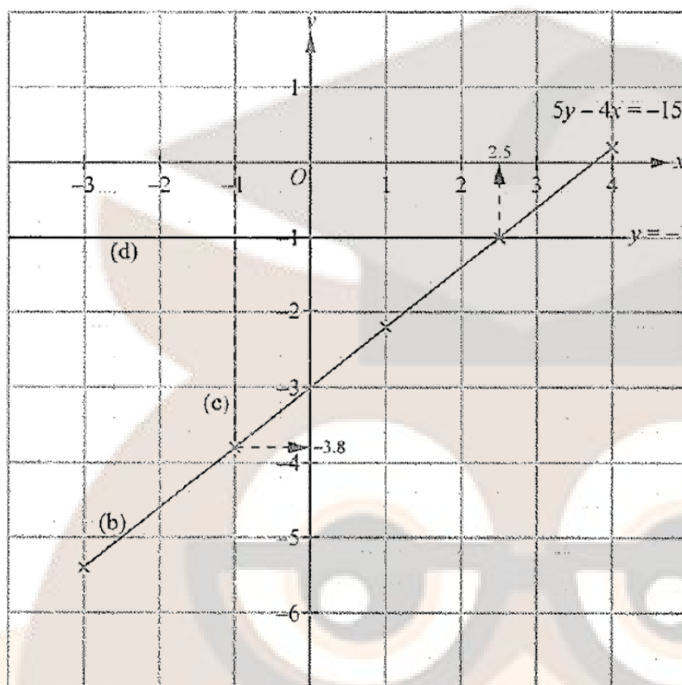
	(c) A pair of simultaneous equations is given by $4p + q = 15 \text{ and } \frac{p}{2} + \frac{q}{5} = \frac{8}{5}$ Ben claims that the solution to the simultaneous equations is $(p = 3.5, q = 1)$. Explain how he can check if his answer is correct. Hence, explain whether his answer is correct.	
7	(a) If $x = -2$ and $y = 4$ is the solution of the simultaneous equations $mx + ny = 8$ $nx - my = -16$ Find the value of m and n. (b) A train and a car start from the same location and travel in the same direction. After 4 hours, the train is 120 miles ahead of the car. If they travel in opposite directions, they are 680 miles apart after 4 hours. Let the speed of the train be x mph and the speed of the car be y mph. Assuming their speeds are constant, find the speed of the train and the car.	
8	 a) Using the information shown in the diagrams, write down two equations in x and y. b) Solve these equations to find the values of x and y.	

Answer Key:

1	$(2x + y) - (3x + y) = 5 - 7$ $2x + y - 3x - y = -2$ $-x = -2$ $x = 2$ $2(2) + y = 5$ $y = 1$	
2	$2x - 4y = 18$ $(2x - y) - (2x - 4y) = 12 - 18$	

	$2x - y - 2x + 4y = -6$ $3y = -6$ $y = -2$ $x - 2(-2) = 9$ $x = 9 - 4$ $x = 5$	
3	$12\left(\frac{1}{3}x - \frac{1}{4}y\right) = 12(4)$ $4x - 3y = 48$ $x = \frac{3}{4}y + 12$ $6\left(\frac{3}{4}y + 12\right) + 5y = -42$ $\frac{18}{4}y + 72 + 5y = -42$ $\frac{9}{2}y + 5y = -114$ $\frac{19}{2}y = -114$ $y = -114 \times \frac{2}{19}$ $y = -12$ $x = \frac{3}{4}(-12) + 12$ $x = -9 + 12$ $x = 3$	
4	(a) Equation 1 (Total Ticket Sales): $50p + 20q = 44500$ Equation 2 (Discount Coupons) The number of adults receiving coupons is $\frac{3}{4}p$ and the number of children receiving coupons is $\frac{1}{3}q$. The total number of coupons given out is 700: $\frac{3}{4}p + \frac{1}{3}q = 700$ (b)	

	$\frac{3}{4}p + \frac{1}{3}q = 700$ $12 \times \left(\frac{3}{4}p + \frac{1}{3}q \right) = 12 \times 700$ $\left(12 \times \frac{3}{4} \right)p + \left(12 \times \frac{1}{3} \right)q = 8400$ $9p + 4q = 8400$ (c) $50p + 20q = 44500$ (1) $9p + 4q = 8400$ (2) $-5 \times (9p + 4q) = -5 \times 8400$ $-45p - 20q = -42000$ $50p + 20q = 44500$ $45p - 20q = -42000$ $5p = 2500$ $p = \frac{2500}{5} = 500$ $9(500) + 4q = 8400$ $4q = 8400 - 4500$ $4q = 3900$ $q = \frac{3900}{4} = 975$ Therefore, $p = 500$ and $q = 975$. (d) <i>Total Visitors</i> = $p + q = 500 + 975 = 1475$	
5	(a) When $(x = -3, y = n)$, $5n - 4(-3) = -15$ $5n + 12 = -15$ $5n = -15 - 12$ $= -27$ $n = \frac{-27}{5}$ $= -5.4$ (b)	



(c) From the graph, when $(x = -1, y = -3.8)$

(d) From the graph, the coordinates of the point where both lines meet are $(2.5, -1)$

6 (a) (i) From the first equation, we can express (y) in terms of (x) :

$$y = 8 - 2x$$

Substitute this expression for (y) into the second equation:

$$5x - 4(8 - 2x) = -5$$

$$5x - 32 + 8x = -5$$

$$13x = 27$$

$$x = \frac{27}{13}$$

Now, substitute the value of (x) back into the expression for (y) :

$$y = 8 - 2\left(\frac{27}{13}\right) = 8 - \frac{54}{13} = \frac{104 - 54}{13} = \frac{50}{13}$$

So the solution is $(x = \frac{27}{13})$ and $(y = \frac{50}{13})$.

(ii) Substitution method

(b) The second equation is simply a multiple of the first equation. If we multiply the first equation by 2, we get:

$$2(3a - b) = 2(6)$$

$$6a - 2b = 12$$

Since the second equation is just a multiple of the first equation, the two equations

	represent the same line. Therefore, there are infinitely many solutions because any point on that line satisfies both equations. (c) For the first equation: $4p + q = 4(3.5) + 1 = 14 + 1 = 15$ The first equation is satisfied. For the second equation: $\frac{p}{2} + \frac{q}{5} = \frac{3.5}{2} + \frac{1}{5} = \frac{7}{4} + \frac{1}{5} = \frac{35 + 4}{20} = \frac{39}{20} = \frac{39}{20}$ But $(\frac{8}{5} = \frac{32}{20})$, so the second equation is not satisfied since $(\frac{39}{20} \neq \frac{32}{20})$. Therefore, Ben's answer is incorrect because it does not satisfy both equations.	
7	$mx + ny = 8$ $nx - my = -16$ Substitute $x = -2$ and $y = 4$ into the equations: $-2m + 4n = 8$ $-2n - 4m = -16$ Divide the first equation by 2 and the second equation by -2: $-m + 2n = 4$ $n + 2m = 8$ From the first equation, we can express m in terms of n: $m = 2n - 4$ Substitute this expression for m into the second equation: $n + 2(2n - 4) = 8$ $n + 4n - 8 = 8$ $5n = 16$ $n = \frac{16}{5}$ Now, substitute the value of n back into the expression for m: $m = 2\left(\frac{16}{5}\right) - 4$ $m = \frac{32}{5} - \frac{20}{5}$ $m = \frac{12}{5}$ (b) When the train and car travel in the same direction, the distance covered by the train is	

	4x and the distance covered by the car is 4y. The train is 120 miles ahead of the car, so: $4x - 4y = 120$ When they travel in opposite directions, the distance covered by the train is 4x and the distance covered by the car is 4y. The total distance between them is 680 miles, so: $4x + 4y = 680$ Divide both equations by 4: $x - y = 30$ $x + y = 170$ Add the two equations to eliminate y: $2x = 200$ $x = 100$ Now, substitute the value of x into the second equation to find y: $100 + y = 170$ $y = 70$ Therefore, the speed of the train is 100 mph and the speed of the car is 70 mph.	
8	a) Writing the equations: Diagram 1 (Triangle) : The sum of the angles in a triangle is always 180°. Therefore, we have the equation: $3x + y + 120 = 180$ Simplifying, we get: $3x + y = 60 \quad (1)$ Diagram 2 (Pentagon): The sum of the angles in a pentagon is $(5 - 2) \times 180^\circ = 3 \times 180^\circ = 540^\circ$. Therefore, we have the equation: $110 + 110 + 110 + (4x + 5) + (6y - 10) = 540$ Simplifying, we get: $330 + 4x + 5 + 6y - 10 = 540$ $4x + 6y + 325 = 540$ $4x + 6y = 215 \quad (2)$ b) Solving the system of equations: We have the following system of equations: $3x + y = 60 \quad (1)$ $4x + 6y = 215 \quad (2)$ We can solve this system using substitution or elimination. Let's use elimination. Multiply equation (1) by -6 : $-18x - 6y = -360 \quad (3)$ Now add equation (2) and equation (3): \$\$	

	$4x + 6y = 215$ $-18y - 6y = -360$ $-14x = -145$ So, $x = \frac{145}{14}$ Therefore, the solution is : $x = \frac{145}{14} \approx 10.36$ $y = \frac{405}{14} \approx 28.93$	
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