

8 ESSENTIAL QUESTIONS TO MASTER

QUADRATIC FUNCTIONS & EQUATIONS

1	Solve the equation: $\frac{3x+1}{4} + \frac{x-2}{2} = \frac{7}{4}$	
2	Solve the following equations: (a) $(x-3)(x+4) = -4(x+4)$ (b) $(3x-4)(x-7) = -20$ (c) $6x^2 + 21x + 9 = 0$	
3	Solve the following equations: (a) $x^2 + 7x = 0$ (b) $(2x+1)^2 = \frac{100}{81}$	
4	One of the solutions of $x^2 + kx - 28 = 0$ is $x = 4$, find (a) The value of k (b) The other solution of the equation.	
5	Jean drove from her home to a park which was 100 km away. She left home at 1300 and reached home at 1815. She spent 2 hours at the park. Let x km/h be the average speed taken to drive from her home to the park. (a) Find the time taken, in terms of x , for Jean to reach the park. (b) When she was driving back home, there was a massive traffic jam. Her average speed was slowed down by 30 km/h. Find the time taken, in terms of x , for Jean to return home. (c) Using the information given above, form an equation in x and show that it reduces to $13x^2 - 1190x + 12\,000 = 0$. (d) Solve the equation and find her average speed, in km/h, from her home to the park.	
6	A group of x Secondary 3 students planned an excursion to Malacca. They intended to share the total cost of S7600. (a) Write down an expression, in terms of x , the amount each student had to pay. 5 days before the outing, 2 students fell ill and thus could not go on the excursion. (b) Write down an expression, in terms of x , the amount each student had to pay now. (c) If the cost per person was now \$10 more than what was originally expected, form an equation in x and show that it reduces to $x^2 - 2x - 1520 = 0$. (d) Solve the equation and find the original amount each student had to pay.	
7	An importer bought x glass bottles for \$805. (a) Write down an expression, in terms of x , for the cost of 1 glass bottle. (b) Upon inspection, he realized that 11 were cracked, and he sold the remaining bottles. Write down an expression, in terms of x , for the number of the remaining bottles. (c) He decided to sell each of the remaining bottles at a profit of \$2.50. As a result, he collected \$1125 for the remaining bottles. Use this information to write down an equation involving x and show that it simplifies to	

Primary Secondary Samir College

	$x^2 - 139x - 3542 = 0$ (d) Solve the equation and find the number of bottles he bought.																	
8	Answer of whole of this question on a sheet of graph paper. The variables x and y are connected by the equation $y = 2x^2 - 12x + 10$ Some corresponding values of x and y are given in the following table. <table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>y</td><td>10</td><td>p</td><td>-6</td><td>-8</td><td>-6</td><td>0</td><td>10</td></tr></table> (a) Find the value of p. (b) Using a scale of 2 cm to represent 1 unit on the horizontal x-axis and 1 cm to represent 1 unit on the vertical y-axis, draw the graph of $y = 2x^2 - 12x + 10$ for $0 \leq x \leq 6$ (c) From the graph, find the (i) equation of the line of symmetry (ii) values of x when y = -4 (iii) coordinates of the minimum point.	x	0	1	2	3	4	5	6	y	10	p	-6	-8	-6	0	10	
x	0	1	2	3	4	5	6											
y	10	p	-6	-8	-6	0	10											

Answer Key:

1	$\frac{3x+1}{4} + \frac{x-2}{2} = \frac{7}{4}$ $4 \times \left(\frac{3x+1}{4} + \frac{x-2}{2} \right) = 4 \cdot \frac{7}{4}$ $(3x+1) + 2(x-2) = 7$ $3x + 1 + 2x - 4 = 7$ $5x - 3 = 7$ $x = \frac{10}{5} = 2$	
2	(a) $x^2 + 4x - 3x - 12 = -4x - 16$ $x^2 + x - 12 = -4x - 16$ $x^2 + x - 12 + 4x + 16 = 0$ $x^2 + 5x + 4 = 0$ $(x+1)(x+4) = 0$ $x+1 = 0$ or $x+4 = 0$ $x = -1$ & $x = -4$ (b) $3x^2 - 21x - 4x + 28 = -20$ $3x^2 - 25x + 28 = -20$ $3x^2 - 25x + 48 = 0$ $(3x-16)(x-3) = 0$ $3x - 16 = 0 \Rightarrow 3x = 16 \Rightarrow x = \frac{16}{3}$ $x - 3 = 0 \Rightarrow x = 3$ $x = 3$ & $x = \frac{16}{3}$	

	(c) $2x^2 + 7x + 3 = 0$ $2x^2 + 6x + x + 3 = 0$ $2x(x + 3) + 1(x + 3) = 0$ $(2x + 1)(x + 3) = 0$ $2x + 1 = 0 \Rightarrow 2x = -1 \Rightarrow x = -\frac{1}{2}$ $x + 3 = 0 \Rightarrow x = -3$ $x = -\frac{1}{2}$ & $x = -3$	
3	(a) $x(x + 7) = 0$ $x = 0$ $x + 7 = 0$ (b) 1. Take the square root of both sides: $\sqrt{(2x + 1)^2} = \pm \sqrt{\frac{100}{81}}$ $2x + 1 = \pm \frac{10}{9}$ 2. Solve for the two possible cases: Case 1: $2x + 1 = \frac{10}{9}$ $2x = \frac{10}{9} - 1$ $2x = \frac{10}{9} - \frac{9}{9}$ $2x = \frac{1}{9}$ $x = \frac{1}{18}$ Case 2: $2x + 1 = -\frac{10}{9}$ $2x = -\frac{10}{9} - 1$ $2x = -\frac{10}{9} - \frac{9}{9}$ $2x = -\frac{19}{9}$ $x = -\frac{19}{18}$ $x = \frac{1}{18} \quad \text{or} \quad x = -\frac{19}{18}$	
4	$(4)^2 + k(4) - 28 = 0$ $16 + 4k - 28 = 0$	

	$4k - 12 = 0$ $4k = 12$ $k = 3$ $x^2 + 3x - 28 = 0$ $(x - 4)(x + 7) = 0$ Therefore $x = 4$. The other solution is $x = -7$	
5	(a) Time = $\frac{\text{Distance}}{\text{Speed}}$ $= \frac{100}{x}$ hours (T_1) (b) Time = $\frac{100}{x-30}$ hours (T_2) (c) $5\frac{1}{4} - 2$ $t_2 + t_1 = 3\frac{1}{4}$ $\frac{100}{x-30} + \frac{100}{x} = \frac{13}{4}$ $\frac{100x + 100(x-30)}{x(x-30)} = \frac{13}{4}$ $\frac{200x - 3000}{x^2 - 30x} = \frac{13}{4}$ $4(200x - 3000) = 13(x^2 - 30x)$ $800x - 12000 = 13x^2 - 390x$ $-13x^2 + 1190x - 12000 = 0$ $13x^2 - 1190x + 12000 = 0 \text{ (shown)}$ (d) $13x^2 - 1190x + 12000 = 0$ $(x - 80)(13x - 150) = 0$ $x - 80 = 0$ or $13x - 150 = 0$ $x = 80$ or $x = 11\frac{7}{13}$ Reject as ($x > 30$) Average speed (home to park) = 80 km/h	
6	(a) $\frac{7600}{x}$ (b) $\frac{7600}{x-2}$ (c) $\frac{7600}{x-2} - \frac{7600}{x} = 10$ $\frac{7600x - 7600(x-2)}{x(x-2)} = 10$	

	$\frac{15200}{x^2 - 2x} = 10$ $15200 = 10(x^2 - 2x)$ $1520 = x^2 - 2x$ $x^2 - 2x - 1520 = 0 \quad (\text{shown})$ $(d) (x - 40)(x + 38) = 0$ $x - 40 = 0 \quad \text{or} \quad x + 38 = 0$ $x = 40 \quad \text{or} \quad x = -38 \quad (\text{reject as } (x > 0))$ $\text{Original amount} = \frac{7600}{40} = 190$	
7	(a) $\frac{805}{x}$ (b) $x - 11$ (c) $\frac{805}{x} + 2.50$ $(x - 11) \left(\frac{805}{x} + 2.50 \right) = 1125$ $805 + 2.5x - \frac{8855}{x} - 27.5 = 1125$ $2.5x - \frac{8855}{x} - 347.5 = 0$ $2.5x^2 - 8855 - 347.5x = 0$ $5x^2 - 695x - 17710 = 0$ $x^2 - 139x - 3542 = 0 (\text{shown})$ (d) $(x + 22)(x - 161) = 0$ $x + 22 = 0 \text{ or } x - 161 = 0$ $x = -22 \text{ or } x = 161$ (Reject $(x = -22)$ as $(x > 0)$) The importer bought 161 glass bottles.	
8	(a) Find the value of p: We need to find the value of y when $x = 1$. Substitute $x = 1$ into the equation $y = 2x^2 - 12x + 10$: $y = 2(1)^2 - 12(1) + 10 = 2 - 12 + 10 = 0$ Therefore, $p = 0$. (b) Draw the graph of $y = 2x^2 - 12x + 10$ for $0 \leq x \leq 6$: $(0,10), (1,0), (2,-6), (3,-8), (4,-6), (5,0), (6,10)$ Using a scale of 2 cm to represent 1 unit on the horizontal x-axis and 1 cm to represent 1 unit on the vertical y-axis, plot these points on a graph paper and draw a smooth curve through them. (c) From the graph, find: (i) Equation of the line of symmetry:	

	The line of symmetry is the vertical line that passes through the minimum point of the parabola. From the graph (or by completing the square), we can see that the minimum point occurs at $x=3$. Therefore, the equation of the line of symmetry is $x=3$. (ii) Values of x when $y = -4$. Draw a horizontal line at $y = -4$ on the graph. Find the x coordinates of the points where this line intersects the parabola. From the graph, the values of x are approximately $x \approx 2.3$ and $x \approx 3.7$. (iii) Coordinates of the minimum point: The minimum point is the vertex of the parabola. From the graph, the coordinates of the minimum point are $(3, -8)$	
--	--	--