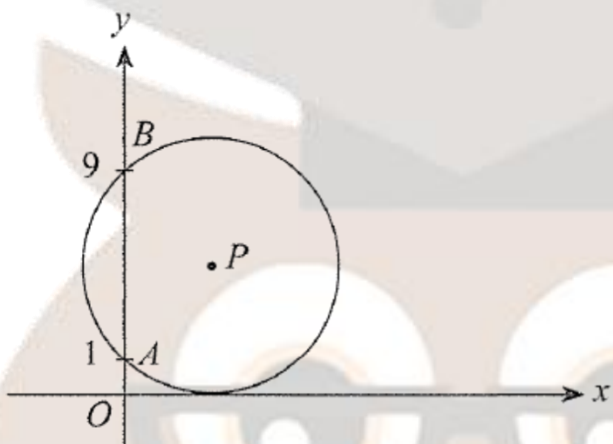
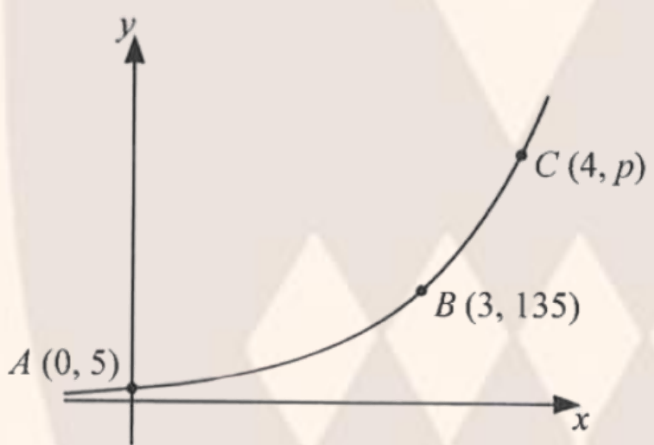
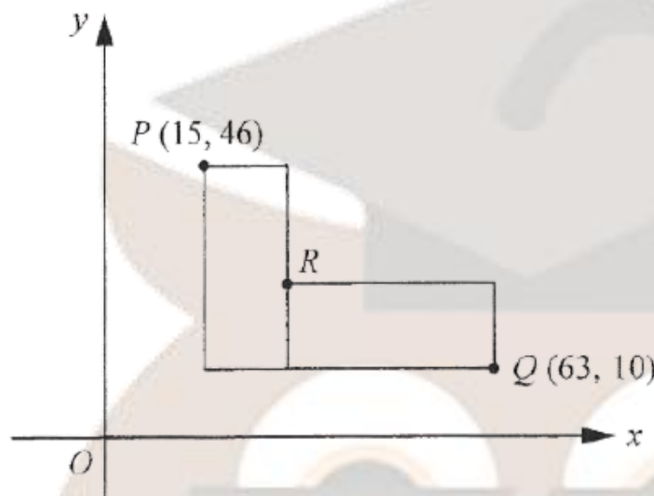


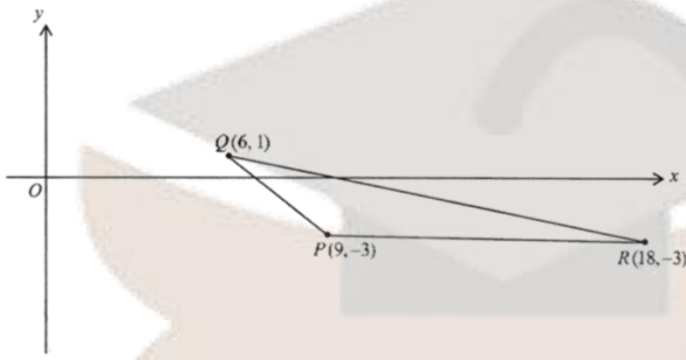
10 ESSENTIAL QUESTIONS TO MASTER

COORDINATE GEOMETRY

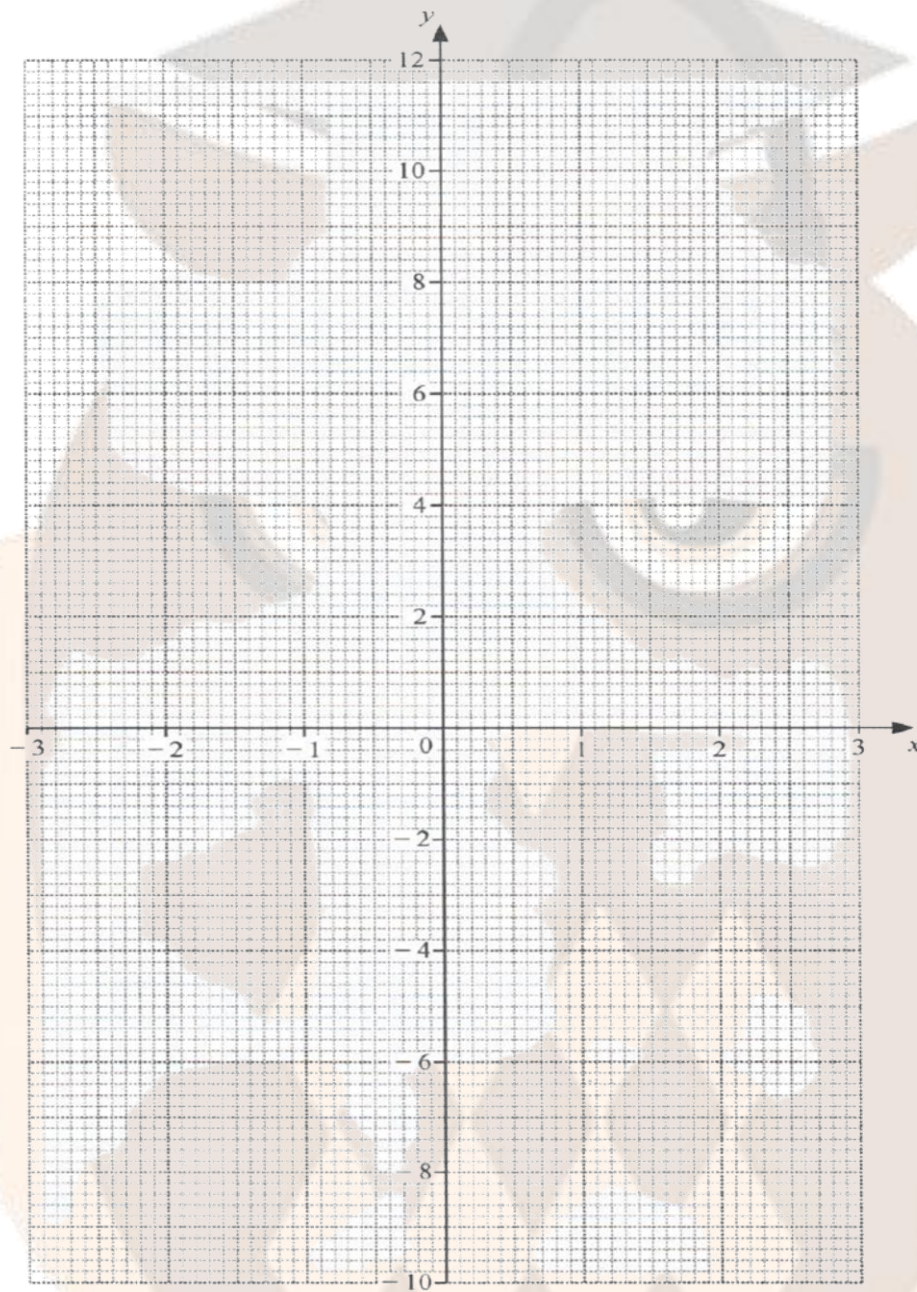
1	(a) Given that the gradient of the line joining the points $(t, 5)$ and $(3, t+9)$ is $\frac{2}{5}$, find the value of t. (b) Given that the line $y = 3x + 1$ passes through the point $(k-2, k+2)$, find the value of k.	
2	Write an equation for the following (a) The line passes through the points $(4, 5)$ and $(7, 11)$. (b) The line passes through the point $(1, 5)$ and is parallel to the x-axis. (c) The line passes through the point $(-2, -3)$ and is parallel to the line $x = 9$. (d) The line passes through the point $(0, 8)$ and has the same gradient as the line $2y - x + 3 = 0$.	
3	(a) Find the gradient of the straight line L_1 which has the equation $2y - 5x = 4$ (b) Another straight line L_2 has the equation $3y + 2x - 4 = 0$. It passes through the point $(3k, k + 2)$. Calculate the value of k.	
4	(a) Sketch the graph of $y = -(x - 3)^2 + 1$.  (b) State the coordinates of the turning point of the graph $y = -(x - 3)^2 + 1$. (c) Write down the equation of the line of symmetry.	
5	The line joining the points $P(-10, 2)$ and $Q(5, 5)$ cuts the x-axis at point N, and the y-axis at M. (a) Find the coordinates of M and of N. (b) Find the length of MN, giving your answer in the form of $\sqrt{a}$, where a is an integer.	
6	In the diagram, the x-axis is a tangent to a circle. Given that the circle cuts the y-axis at	

	$A(0, 1)$ and $B(0, 9)$ respectively, find: (a) the coordinates of the center of the circle, P. (b) the equation of the line that passes through points A and P. 	
7	(a) The sketch shows the graph of $y = ka^x$, where $a > 0$. The graph passes through the points $A(0, 5)$, $B(3, 135)$ and $C(4, p)$. Find the value of p.  (b) The diagram shows two congruent rectangles. The sides are horizontal and vertical. Point P has coordinates $(15, 46)$ and Q has coordinates $(63, 10)$. Find the coordinates of R.	

																						
8	(a) Complete the table of values for $y = \frac{2}{x^2} + 3x - 1$. Values are given to one decimal place where appropriate. <table border="1" data-bbox="279 871 1339 945"><tr><td>x</td><td>-3</td><td>-2</td><td>-1</td><td>-0.5</td><td>0.5</td><td>1</td><td>1.5</td><td>2</td><td>3</td></tr><tr><td>y</td><td></td><td>-6.5</td><td>-2</td><td>5.5</td><td>8.5</td><td>4</td><td>4.4</td><td>5.5</td><td>8.2</td></tr></table> (b) On the grid opposite, draw the graph of $y = \frac{2}{x^2} + 3x - 1$ for $-3 \leq x \leq 3$. (c)(i) On the same grid, draw the graph of $2y - 5x = 7$ for $-3 \leq x \leq 3$. (ii) Write down the x-coordinates of the points where the line intersects the curve. (d) These values of x are solutions of the equation $x^3 + Ax^2 + B = 0$. Find the value of A and the value of B.	x	-3	-2	-1	-0.5	0.5	1	1.5	2	3	y		-6.5	-2	5.5	8.5	4	4.4	5.5	8.2	
x	-3	-2	-1	-0.5	0.5	1	1.5	2	3													
y		-6.5	-2	5.5	8.5	4	4.4	5.5	8.2													
9	In the diagram, the points P, Q and R have coordinates (9, -3), (6,1) and (18, -3) respectively. (a) Find the length of PQ. (b) Find the value of $\cos \angle QPR$, giving your answer as a fraction in its simplest form. (c) Find the area of triangle PQR (d) Find the equation of the line PQ. (e) The equation of a line passing through the point R is $4x + 21y = 9$. Find the coordinates of the point of the intersection of this line and the line PQ.																					

		
10	A is the point (2, 5) and B is the point (x, y) where x and y are both positive integers less than 10. The length of the line segment AB is $\sqrt{53}$ units. Find the coordinates of one of the possible positions for B.	

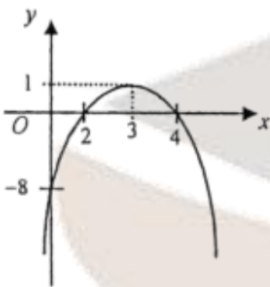
For Question 8:

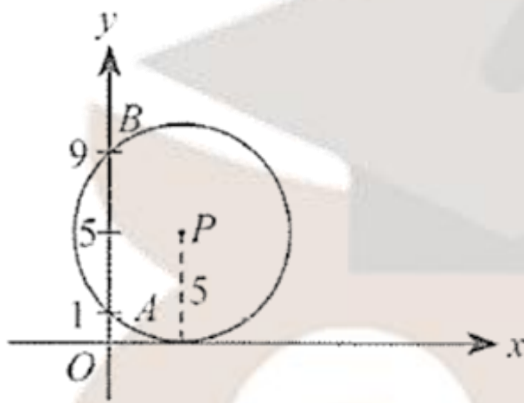


Answer Key:

1	(a) The slope m between two points (x_1, y_1) and (x_2, y_2) is calculated as: $m = \frac{y_2 - y_1}{x_2 - x_1}$ Applying the Formula In our case: $(x_1, y_1) = (t, 5)$ $(x_2, y_2) = (3, t+9)$ $m = \frac{2}{5}$ Plugging these values into the slope formula: $\frac{2}{5} = \frac{(t + 9) - 5}{3 - t}$ Solving for t 1. Simplify the equation: $\frac{2}{5} = \frac{t + 4}{3 - t}$ 2. Cross-multiply: $2(3 - t) = 5(t + 4)$ 3. Expand: $6 - 2t = 5t + 20$ 4. Rearrange and solve for t: $-14 = 7t$ $t = -2$ (b) Since the line $y = 3x + 1$ passes through the point $(k - 2, k + 2)$, we can substitute $x = k - 2$ and $y = k + 2$ into the equation of the line: $k + 2 = 3(k - 2) + 1$ Now we solve for k: $k + 2 = 3k - 6 + 1$ $k + 2 = 3k - 5$ Subtract k from both sides: $2 = 2k - 5$ Add 5 to both sides: $7 = 2k$ Divide by 2:	
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	$k = \frac{7}{2}$	
2	(a) First, we calculate the slope (gradient) of the line: $m = \frac{11 - 5}{7 - 4} = \frac{6}{3} = 2$ So, the equation of the line is $y = 2x + c$, where c is the y-intercept. To find c, we can substitute one of the given points into the equation. Let's use the point $(4, 5)$: $5 = 2(4) + c$ $5 = 8 + c$ $c = 5 - 8$ $c = -3$ Therefore, the equation of the line is: $y = 2x - 3$ (b) Equation of line: $y = 5$ (c) Equation of line: $x = -2$ (d) $2y - x + 3 = 0$ $2y = x - 3$ $y = \frac{1}{2}x - 1\frac{1}{2}$ Gradient of line $= \frac{1}{2}$ Equation of line: $y = \frac{1}{2}x + 8$	
3	(a) $y = \frac{5}{2}x + 2$ Comparing this with the standard form $y = mx + c$, we can see that the gradient $m = \frac{5}{2}$. (b) Solve for k: $3(k+2) + 2(3k) = 4$ Distribute: $3k + 6 + 6k = 4$ Combine like terms: $9k + 6 = 4$ Subtract 6 from both sides: $9k = -2$ Divide by 9: $k = -\frac{2}{9}$	

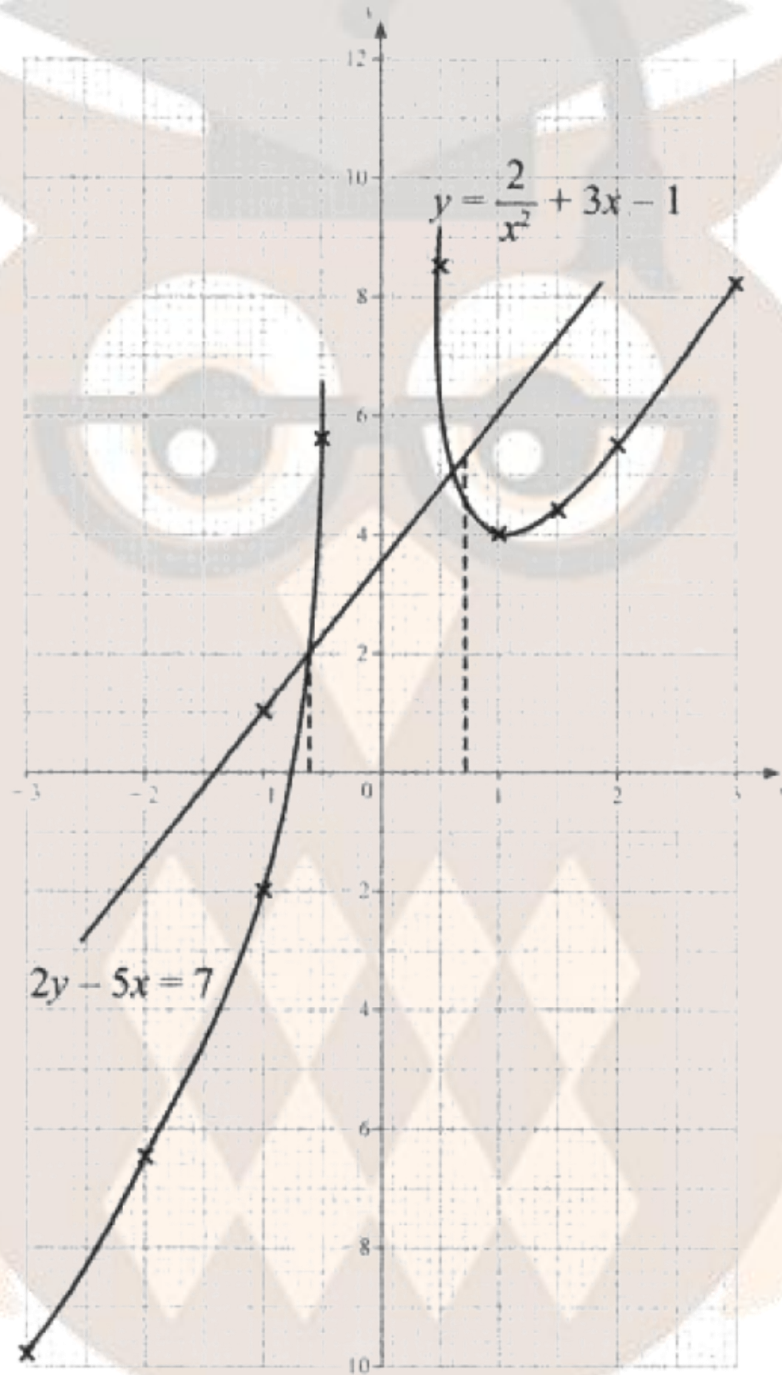
4	(a)  (b) From the sketch graph, the maximum point is (3, 1). (c) : $x = 3$	
5	(a) $\text{Gradient} = \frac{5 - 2}{5 - (-10)}$ $= \frac{1}{5}$ Substitute $x=5$, $y=5$ and $m = \frac{1}{5}$ into $y = mx + c$, $5 = \frac{1}{5}(5) + c$ $c = 4$ Therefore, Equation of PQ: $y = \frac{1}{5}x + 4$ At N, substitute $y=0$ into $y = \frac{1}{5}x + 4$, $0 = \frac{1}{5}x + 4$ $x = -20$ Therefore N(-20, 0). At M, substitute $x=0$ into $y = \frac{1}{5}x + 4$, $y = \frac{1}{5}(0) + 4$ $y = 4$ Therefore M(0, 4). (b) $MN = \sqrt{(-20 - 0)^2 + (0 - 4)^2}$	

	$= \sqrt{416}$ units	
6	 (a) y-coordinate of $P = \frac{9+1}{2} = 5$ The radius of the circle is 5 units. Let the coordinates of P be $(x, 5)$. Since $AP = 5$, $\sqrt{(x - 0)^2 + (5 - 1)^2} = 5$ $\sqrt{x^2 + 16} = 5$ $x^2 + 16 = 25$ $x^2 = 9$ $x = 3$ or -3 (rej.) Coordinates of P is $(3, 5)$. b) Gradient of $AP = \frac{5-1}{3-0} = \frac{4}{3}$ y-int. of line $AP = 1$ Therefore, Equation of AP: $y = \frac{4}{3}x + 1$	
7	(a) Sub A $(0, 5)$: $5 = ka^0$ Therefore, $k = 5$ Sub B $(3, 135)$: $135 = 5a^3$ $a^3 = 27$ Therefore, $a = 3$ Sub C $(4, p)$: $p = 5(3)^4$ $p = 405$	

(b) Length + Breadth = $63 - 15$ $= 48$ units Length = $46 - 10$ $= 36$ units Breadth = $48 - 36$ $= 12$ units x-coordinate of R = $15 + 12$ $= 27$ y-coordinate of R = $10 + 12$ $= 22$ Coordinates of R = (27, 22) Must-Know Concept: Since the rectangles are congruent, they have the same length and breadth.	
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8 (a) When $x = -3$, $y = -9.8$ (1 decimal place)

(b) (c) (i)



	(c) (ii) From the graph, $x = -0.65$ or 0.7 (c) (iii) sub $y = \frac{2}{x^2} + 3x - 1$ into $2y - 5x = 7$, $\frac{4}{x^2} + 6x - 2 - 5x = 7$ $4 + 6x^3 - 2x^2 - 5x^3 - 7x^2 = 0$ $x^3 - 9x^2 + 4 = 0$ Hence, $A = -9$, $B = 4$ Must-Know Concept: Points of intersections are graphical representations of the solutions to the simultaneous equations.	
9	(a) $PQ = \sqrt{(9-6)^2 + (-3-1)^2}$ $= \sqrt{3^2 + (-4)^2}$ $= 5$ units (b) $\cos \angle QPR = -\frac{3}{5}$ (c) Area of Triangle PQR $= \frac{1}{2} \times 9 \times 4 \text{ units}^2 = 18 \text{ units}^2$ (d) Gradient of PQ: $\frac{1 - (-3)}{6 - 9} = -\frac{4}{3}$ Equation of PQ: $y - 1 = -\frac{4}{3}(x - 6)$ $y - 1 = -\frac{4}{3}x + 8$ $y = -\frac{4}{3}x + 9$ or $4x + 3y = 27$ (e) The system of equations is: $4x + 3y = 27$ (1) $4x + 21y = 9$ (2)	

	Subtract equation (1) from equation (2): $(2) - (1):$ $18y = -18$ $y = -1$ Substitute $y = -1$ into equation (1): $4x + 3(-1) = 27$ $4x - 3 = 27$ $4x = 30$ $x = \frac{30}{4} = \frac{15}{2} = 7\frac{1}{2}$ Therefore, the point of intersection is $(7\frac{1}{2}, -1)$.	
10	We use the distance formula to find the distance between points A(2, 5) and B(x, y): $d = \sqrt{(x - 2)^2 + (y - 5)^2}$ We are given that $d = \sqrt{53}$, so $\sqrt{(x - 2)^2 + (y - 5)^2} = \sqrt{53}$ Square both sides: $(x - 2)^2 + (y - 5)^2 = 53$ We need to find positive integer values for x and y that are less than 10 and satisfy this equation. We can test different integer values for x and y: If $x = 3$, $(3 - 2)^2 = 1$, so $(y - 5)^2 = 52$. This doesn't give an integer solution for y. If $x = 4$, $(4 - 2)^2 = 4$, so $(y - 5)^2 = 49$, which means $y - 5 = \pm 7$. Then $y = 12$ or $y = -2$. Neither of these satisfy our condition. If $x = 5$, $(5 - 2)^2 = 9$, so $(y - 5)^2 = 44$. This doesn't give an integer solution for y. If $x = 6$, $(6 - 2)^2 = 16$, so $(y - 5)^2 = 37$. This doesn't give an integer solution for y. If $x = 7$, $(7 - 2)^2 = 25$, so $(y - 5)^2 = 28$. This doesn't give an integer solution for y. If $x = 8$, $(8 - 2)^2 = 36$, so $(y - 5)^2 = 17$. This doesn't give an integer solution for y. If $x = 9$, $(9 - 2)^2 = 49$, so $(y - 5)^2 = 4$, which means $y - 5 = \pm 2$. Then $y = 7$ or $y = 3$. Since x and y must be less than 10, (9, 7) and (9, 3) are valid solutions. Therefore, one possible position for B is (9, 7).	