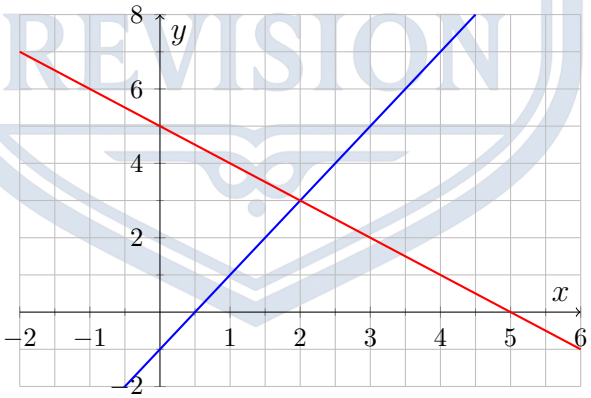
Topic: Solving Equations Algebraically and Graphically
IB Math AI SL

Answer all questions. Show all basic algebraic working where appropriate. Use the provided graphs to verify your solutions. Total: 56 marks.

1. **[Short Answer, Easy, 5 marks]**
   The graphs of two linear functions, $y = 2x - 1$ and $y = -x + 5$, are shown below.

   (a) By observing the graph, write down the coordinates of their point of intersection.

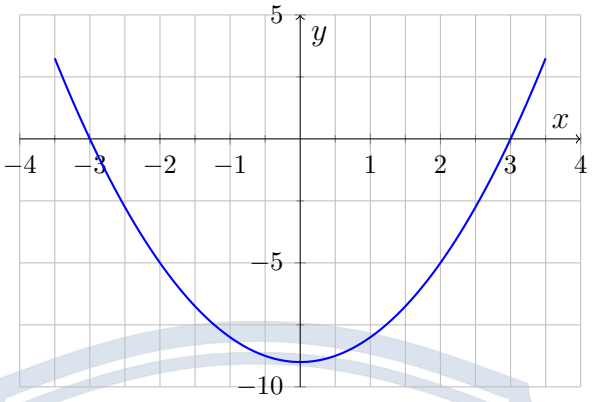
   (b) Solve the equation $2x - 1 = -x + 5$ using basic algebra to verify your graphical answer.



2. **[Short Answer, Easy, 5 marks]**
Consider the quadratic function $y = x^2 - 9$.

   (a) By observing the graph, write down the values of x where $x^2 - 9 = 0$.

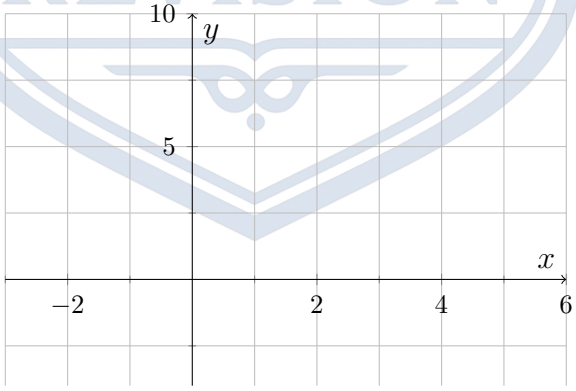
   (b) Solve the equation $x^2 - 9 = 0$ algebraically to verify your answer.



3. **[Short Answer, Easy, 6 marks]**
You are given the equation $x^2 - 2x = x + 4$.

   (a) Rearrange the equation into the form $x^2 + bx + c = 0$ and solve it algebraically by factorising.

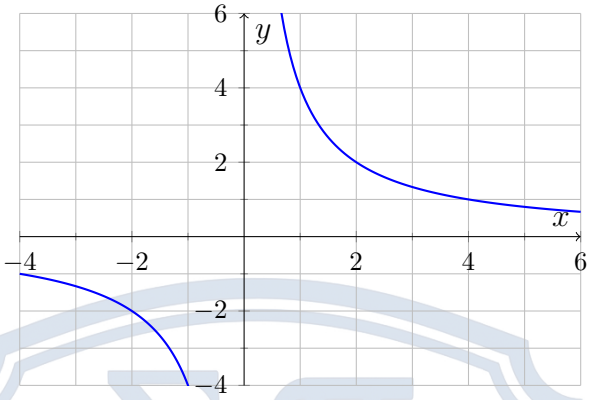
   (b) Sketch the graphs of $y = x^2 - 2x$ and $y = x + 4$ on the grid below to verify your solutions graphically.



4. **[Short Answer, Medium, 5 marks]**
The graph of the rational function $y = \frac{4}{x}$ is shown below.

   (a) Draw the horizontal line $y = 2$ on the same axes and state the x-coordinate of the intersection.

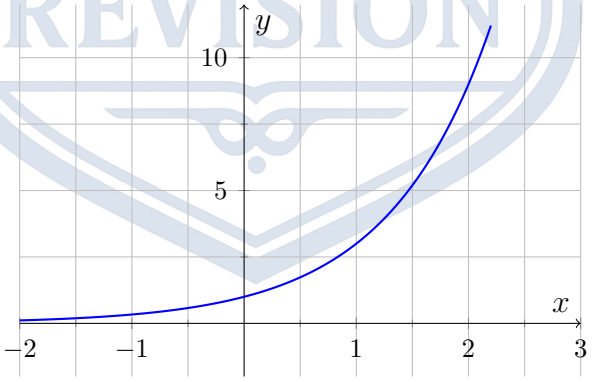
   (b) Solve the equation $\frac{4}{x} = 2$ algebraically to confirm your result.



5. **[Short Answer, Medium, 5 marks]**
The exponential function $y = 3^x$ is graphed below.

   (a) Draw the line $y = 9$ on the grid and find the point of intersection.

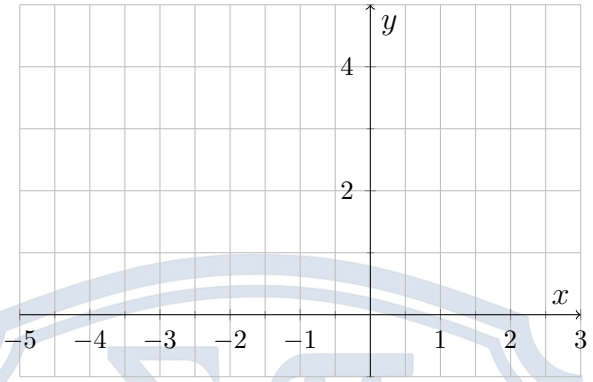
   (b) Solve the exponential equation $3^x = 9$ algebraically using common bases.



6. **[Short Answer, Medium, 6 marks]**
Consider the absolute value equation $|x+1|=2$.

   (a) Solve the equation algebraically by considering both the positive and negative cases.

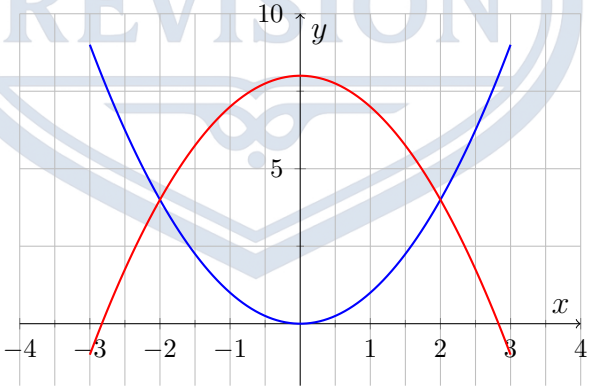
   (b) Sketch $y=|x+1|$ and $y=2$ on the grid below to show the two intersection points.



7. **[Short Answer, Medium, 6 marks]**
The graphs of $y=x^2$ and $y=-x^2+8$ are drawn below.

   (a) Write down the coordinates of the two points where the parabolas intersect.

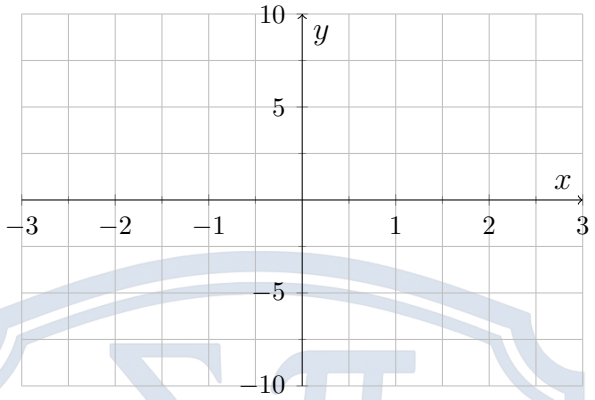
   (b) Solve the equation $x^2=-x^2+8$ algebraically to verify the x-coordinates.



8. **[Short Answer, Hard, 6 marks]**
You need to solve the cubic equation $x^3 = 4x$.

(a) Rearrange the equation to equal zero and solve it algebraically by fully factorising.

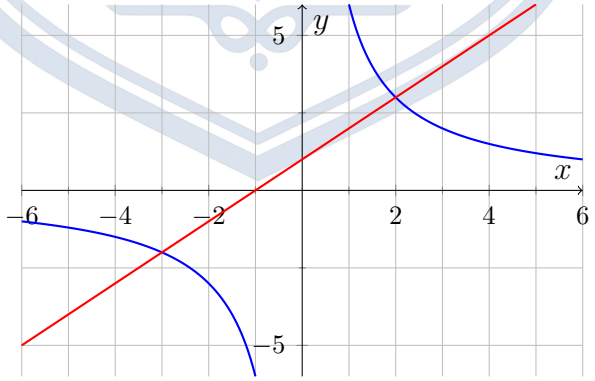
(b) Sketch $y = x^3$ and $y = 4x$ on the grid below to visually confirm the number of solutions.



9. **[Short Answer, Hard, 6 marks]**
The graphs of the rational function $y = \frac{6}{x}$ and the linear function $y = x + 1$ are shown.

(a) From the graph, write down the x-coordinates of the points of intersection.

(b) Multiply the equation $\frac{6}{x} = x + 1$ by x to form a quadratic equation, and solve it algebraically.



10. **[Short Answer, Hard, 6 marks]**
The graphs of the exponential function $y = 2^x$ and the linear function $y = 3 - x$ are shown below.

(a) Explain briefly why the equation $2^x = 3 - x$ is difficult to solve using basic algebraic methods alone.

(b) Use the provided graph to find the exact solution to $2^x = 3 - x$.