1. Find all rational roots (if any) of the polynomial $2x^3 + x^2 + 5x - 3$.

2. Show that $\sqrt[3]{38}$ is not a rational number.

3. (a) Use the Euclidean Algorithm to find the greatest common divisor $c$ of 117 and 45.
   
   (b) Express $c$ as $117a + 45b$, with $a$ and $b$ integers.

4. (a) Write an addition table for $\mathbb{Z}_{11}$.

   (b) Find all elements in $\mathbb{Z}_{55}$ which have a multiplicative inverse.

5. Using straight edge, compass and possibly triangle, construct the angle of $15^\circ$.

6. Using straight edge, compass and possibly triangle, construct $\sqrt{6}$.

7. Express in standard form $a + bi$: (a) $(2+3i)(3-i)$ and $\frac{2-3i}{2+i}$.

   Using complex numbers method, express $\sin(9x)$ in terms of $\sin x$ and $\cos x$.

8. Find all complex solutions of the equation $z^6 = i$.

9. Write down the equation $x^2 - 2y^2 + 2x + 4y + 10 = 0$ is standard from. Identify the curve.

10. The equation $4x^2 + 2\sqrt{3}xy + 2y^2 + 10\sqrt{3}x + 10y = 5$ represents an ellipse. Write down the equation in standard form. What are the semi-axes of this ellipse?

11. History problems (multiple choice)