# Math SL PROBLEM SET 2

Section A (Short Answer Qs)

1. **(F2.8 - R)** **(CI)** Given the polynomial $f(x) = x^3 + 2x^2 - 5x - 6$,

   a. Given that $(x + 1)$ is a factor of $f(x)$, find the other two factors and express $f(x)$ as the product of three linear factors (i.e. write $f(x)$ in fully factored form).
   b. Hence, solve the inequality $f(x) > 0$ (i.e. on what interval is $f(x) > 0$).
   c. Let $g(x) = x^4 + 2x^3 - 5x^2 - 6x$. Using what you know about $f(x)$ find all roots of $g(x)$.

2. **(T3.4 - R)** **(CI)** Given the following graph:
   (Cirrito 10.3, p337)

   a. Determine a sinusoidal equation to model the graph above using the sine function and then write another equation to model the graph, but using the cosine function.

   b. What will the y-value be when $x = 400°$?
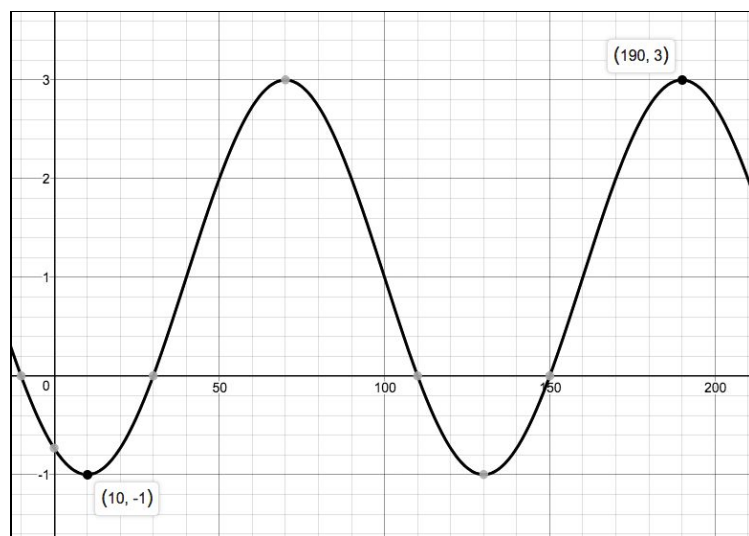
3. **(F2.4 - R)** **(CI)** Given the quadratic equation $f(x) = 2(x + 1)^2 - 8$; **(Cirrito 2.4.2, p44)**

   a. Find the inverse of $f(x)$ (that is, find $f^{-1}(x)$).
   b. Rewrite $f(x)$ in standard form.
   c. Hence, determine the discriminant of $f(x)$. Explain what this number means about $f(x)$.
   d. Solve the equation $f(x) = 0$.
   e. On what interval is the function $f(x)$ increasing?

4. **(F2.5 - R)** **(CI)** Given the function $y = \frac{1}{x-2} + 5$; **(Cirrito 5.3.5, p144)**

   a. Write the asymptotes of this equation.
   b. Determine the intercepts of this function.
   c. State the end-behavior of this function.
   d. Rewrite this equation in the form $y = \frac{Ax+B}{Cx+D}$.

5. **(T3.4 - R) (CI)** Steve rides a Ferris Wheel at the local carnival. He keeps track of his height at different times. His data is given below. **(Cirrito 10.5, p361)**

Time *in seconds)*	0	9	18	27	36
Height *(in Meters)*	2	11	20	11	2

    a. Based on this data what is radius of the Ferris Wheel?
    b. How long does it take for the Wheel to complete one whole revolution?
    c. Hence determine a sinusoidal equation that models this situation.
    d. Sketch your graph, include at least two full periods and label the key points.

6. **(T3.6 - R) (CA)** Daniel insists on painting a huge triangle on the playground. He stands on one edge of the playground and looks at a heading of $N60°E$ and tells Aryan to stand 7.5 meters away. Then Daniel looks $S40°E$ and tells Eman to stand 10 meters away. **(Cirrito 9.5, p290)**

    a. Determine all of the sides and angles of the Daniel-Aryan-Eman triangle.
    b. Hence determine the area of the triangle.

Daniel bought exactly (and only) enough paint to cover his triangle. Sherif decides that instead of Daniel's triangle, they should just make a nice, clean equilateral triangle instead.

    c. Given that Daniel had exactly enough paint to cover his triangle, how long should the sides of Sherif's triangle be to use the same amount of paint?

7. **(F2.4, F2.5 - R) (CA)** Myel put together a business model, and her projected revenue for this playground is given by $R(d) = -0.08d^2 + 31d - 100$, $\{0 \le d \le 365\}$ where d is in days ($d = 1$ is January 1st etc…) and R is in LE. **(Cirrito 2.4.2, p44 & Cirrito 5.3.5, p144)**

    a. What is the expected revenue on April 1st? (Day 90)
    b. On what day does the model predict Revenue will be at its highest?
    c. How much money should they earn on that day?
    d. Myel also projected the cost of this enterprise. Based on her research and calculation the cost can be modelled by $C(d) = \frac{1800(d+20)}{d+70}$ where d is in days and R is in LE
    e. What are the break-even points for this model (that is, when are the profits equal to zero)
    f. Based on this model what is the maximum amount the cost *could* be?
    g. Taking Revenue and Cost into account, on what day is the playground most ***profitable?***
    h. How much profit did they earn on that day?