**MATH1040 Summer Assignment 7**

This is the final assignment. All questions should be submitted by 2pm on Thursday 24 January. Assignments can be submitted at your tutorial or to the MATH1040 assignment box (3rd floor, Priestley Building). **Make sure that your name, student number and assignment number are on each sheet of your answers.** Write your answers on a separate sheet of paper. You do not need a cover sheet nor do you need to include this question sheet. Solutions will be placed on the course website. **This assignment is worth double marks.**

1. Answer each of the following questions, showing all working:

   (1) Find $y'$ where $y = -4 + 2x$

   (2) Find $y'$ where $y = 6x^2 + 2 + 4x$

   (3) Find $y'$ where $y = -4x + \frac{8}{x^5}$

   (4) Find $y'$ where $y = 3\sin x$

   (5) Find $y'$ where $y = -2e^x$

   (6) Find $y'$ where $y = -5\cos x + \frac{1}{x^3}$

   (7) Let $f(x) = x^3 + 3x^2$.
   Q1 Find $f'(x)$.
   Q2 Solve $f'(x) = 0$.
   Q3 Find $f''(x)$.
   Q4 Find $f'(-6)$.

   (8) Find $\frac{dy}{dx}$, if $y = \left(-10x^{-1} - 4\right)^6$.

   (9) If $y = \frac{2 + 5x}{-10x + 3}$, find $y'$.

   (10) Let $y = \left(-2z - 3z^3\right)\left(4z^3 + 5z\right)$. Find $y'$ using the product rule.

2. Find and classify all critical points of $f(x) = x^3 - 3x + 1$.

3. Egbert breeds echidnas for export to the European Union. He spends \$200 on establishing his business. Food and other expenses cost \$16 per echidna produced. If he sets a price per echidna of $y(x) = 70 - x$, then he will sell $x$ echidnas $(0 \leq x \leq 70)$.

   (a) What are the fixed and variable costs associated with this operation?

   (b) Write an expression for $c(x)$, the total costs associated with producing $x$ echidnas.

   (c) Write an expression for $r(x)$, the total operating revenue if he sells $x$ echidnas.

   (d) Write an expression for $p(x)$, the total profit or loss he makes from selling $x$ echidnas.

   (e) Find the level(s) of production at which he exactly breaks even.

   (f) What level of production results in a maximum profit? What is the maximum profit he can make?

   (g) If the fixed costs were doubled, what impact would you expect this to have on the optimal level of echidna production? (Note: this does not say *profit*, it instead says *optimal level of production.*)