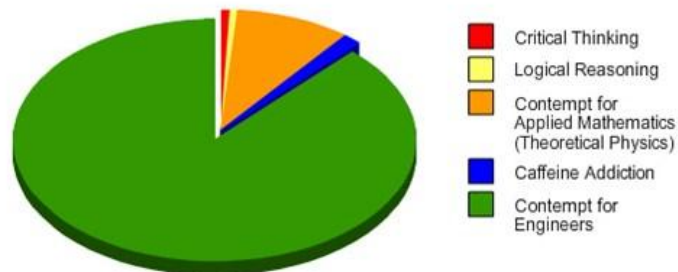


## Thing I got out of Undergrad Mathematics



## Level Two Calculus

There are three questions, worth a total of 24 marks.

Attempt ALL questions, showing all working.

Read questions carefully before attempting them.

Marks are available for partial answers.

The amount of time expected to be spent per question may not necessarily correlate “nicely” to the number of marks.

Diagrams may be used to support answers.

Candidates who do not provide diagrams for some questions may be disadvantaged.

Some marks are given for clarity and neatness of solutions or proofs.

**Time Allowed:** Three Hours

**Achieved:** 8 marks

**Merit:** 14 marks

**Excellence:** 20 marks

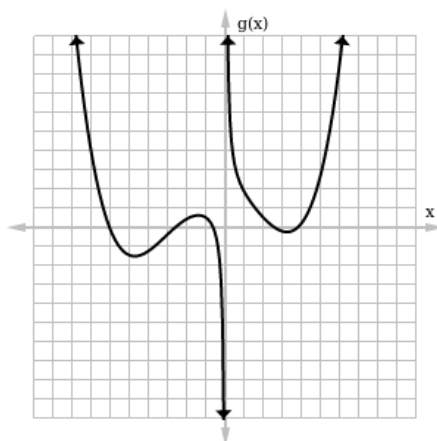
Question:	1	2	3	Total
Points:	8	8	8	24
Score:				

**Available Grades:** *Not Achieved* *Achieved* *Merit* *Excellence*

1. (a) Consider the function  $f$  of  $x$  defined by

$$f(x) = x^5 - 6x^4 + 13x^3 - 12x^2 + 4x.$$

- i. Calculate  $f'(2)$ . (2)
  - ii. Find all points of extrema of  $f$  and classify each one as a maximum, a minimum, or neither. (3)
- (b) Given the following graph of a function  $g$  of  $x$ , draw a graph of the functions' derivative  $g'$  and label any points of interest. (3)



2. (a) Find  $\int 3x^2 + \sqrt{x} \, dx$ . (2)
- (b) Find the total area under the graph of  $y = 6x^{-2} + 4x$  between  $x = 1$  and  $x = 4$ . (3)
- (c) Explain, without calculation, why (3)

$$\int_{2\pi}^0 \cos x \, dx + \int_{-\pi}^{\pi} \sin x \, dx = 0.$$

3. Suppose the velocity of a particle after  $t$  seconds is given by

$$v(t) = (3 + 2t^2)^2.$$

- (a) What is the acceleration of the particle at  $t = 3$  seconds? (2)
- (b) Given that the particle was located at the origin at  $t = 0$  write an expression for  $s(t)$ , the displacement of the particle after time  $t$ . (3)
- (c) In the interval  $0 \leq t \leq 60$ , when is the acceleration of the particle at a maximum? (3)