MAT 137Y: Calculus with proofs
Assignment 3 - Comments and common errors

Q1

- g must have domain $\mathbb{R}$.
- At $x = 2$, g has a vertical tangent line, not a vertical asymptote. Notice that $\lim_{x\to 2} g'(x) = \infty$ but g is continuous. Rewatch Video 3.9. It is exactly about this distinction.
- $g'(0) = 0$, but this does not mean g has a local maximum or minimum at $x = 0$. It only means g has a horizontal tangent line at 0.

Q2

- Read the text inside the box, with the label "**Important**", before Q2. We could not make this any more clear. Why did so many of you ignore this?
- Some of you are confused about how to prove that g is differentiable at a. By definition, this means that the limit
$$\lim_{x\to a} \frac{g(x) - g(a)}{x - a}$$
exists. If you prove that this limit equals a certain real number (and therefore exists), you have proven that g is differentiable at a. You are done. You do not need to do something else. If you attempt to prove that g is differentiable at a *in addition to this*, it means you do not understand what you are doing.
- If in your proof you write $\lim_{x\to a} f(x) = f(a)$, you are using that f is continuous at a. You need to state this explicitly and justify why you know that f is continuous at a.

Q3

- Read the text inside the box, with the label "**Important**", before Q2. We could not make this any more clear. Why did so many of you ignore this?
- The point of this question is to keep track of the things we have proven so far, to acknowledge every time we use some previous result, and not to use unproven results. If you ignored this, you should get 0 points in the question. Specifically:
  - When you divide by something, notice that it is not zero.
  - When you use the power rule for positive-integer exponents, explicitly say so.
  - You may not use the power rule for negative-integer exponents without proving it first. Otherwise, you are either bluffing and you know it, or you do not know what you are doing.

Q4

This is not an error, but a comment.

This question is purely computational. If you cannot do the computations correctly, your answer is wrong. Please do not submit regrade requests with comments like “I understand the concept but I made a careless mistake” or “I only made a little mistake but my derivation after that is right” or “My computational error is small so I should get X marks”.