MATH2017 Homework 2 Feedback

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Question 1

1. Note that the complement of a 'not open' set is *not always open*. For example, both the rationals $\mathbb{Q}$ and the irrationals $\mathbb{R}\backslash\mathbb{Q}$ are not open subsets of $\mathbb{R}$ (they are also both not closed).

2. for the first set, careful if you use the argument $\delta/2 \notin \mathbb{Z}$! You need to first make sure δ is not an even natural number.

3. Note the difference between $\in$ and $\subset$ - and make sure you use the correct one!

4. Boundedness/unboundedness do not relate to a set being open/closed.

5. To show a set $X \subset \mathbb{R}$ is not open you need to show that 'there is $x \in X$ such that for all $\delta > 0$, we have that $(x - \delta, x + \delta)$ is not a subset of X'. Showing just one such δ exists is not enough.

   Question 2

6. Some students opted to show $f'(x) > 0$ for all x, hence f is strictly increasing hence injective.

7. You used bad justification. To show $f'(x) > 0$, try setting $y = x^3$ and completing the square.

8. Note that having two polynomials (one in x, one in y) be equal (for some value of x and y) does *not* mean that you can make all the powers equal (i.e. $x^n = y^n$ for all n).

   Question 3

9. For the third expression, you forgot to mention it's by the product rule.

10. For the third expression, you missed a '$-$' sign, which messed up your answer. Keep in mind to calculate $g'(-x)$ you should use the chain rule. (Note: about 70 percent of your colleagues made the same error!)

    Question 4

11. You need to separately check (from first principles, for eg) that f is differentiable at the point 0 (note this is not an interval, so most theorems won't work).

12. For the first part, note it is not enough to show that $f(x) \geqslant 0$ - you need to point out that $f(0) = 0$ to show that this is indeed the *minimum*, rather than just a lower bound for the values of $f(x)$.

13. For the first part, some people tried using the Extreme Value Theorem. Keep in mind it only applies to closed intervals! Continuity in general does not imply a min/max value is attained - eg, $f(x) = x^3$ is continuous on $\mathbb{R}$, but has neither a min nor a max!

    Question 5

14. Make sure you give the values as exact numbers (eg, π instead of 3.14).

15. Make sure you simplify your expressions. For example, you know that $\tan^{-1}(1) = \pi/4$.

16. Make some note that the function is decreasing hence you sample the endpoints. Or otherwise justify using the bounds you do.