MA140: Engineering Calculus

Week 6: Exercises (and answers)

This is a collection of exercises from this week's MA140 lectures. You don't have to submit solutions for these, but you should work through them. Some may be similar to questions on the final exam.

1 Week 06, Lecture 1

2 Week 06, Lecture 1

3 Week 06, Lecture 3

Week 06, Lecture 1

Exer 6.1.1 (Based on 2019/20 Exam, Q3(a))

Let $f(x) = x^3 - 3x^2$.

1. Find all asymptotes of the graph $f(x)$. ANS There are none.
2. Determine the interval(s) on which $f(x)$ is increasing and decreasing.

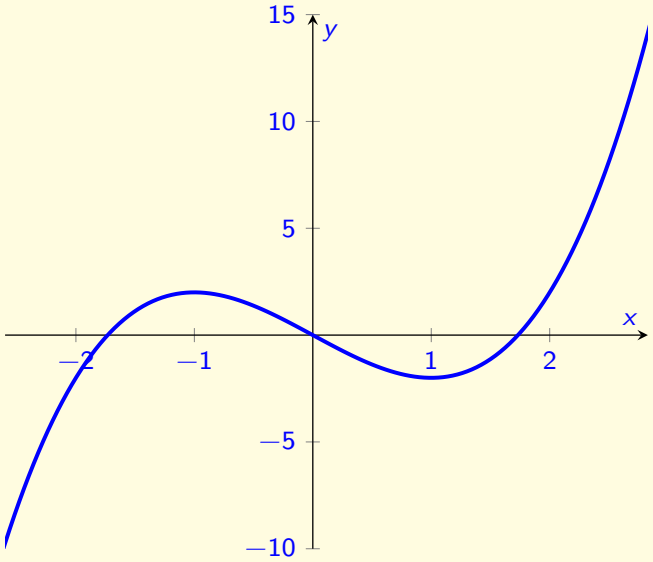
   Answer: $f(x)$ is increasing on $(-\infty, 0)$ and $(2, \infty)$. It is decreasing on $(0, 2)$.

3. Determine the interval(s) on which $f(x)$ is concave up (convex) and concave down (or concave).

   Answer: f is concave down on $(-\infty, 1)$ and concave up on $(1, \infty)$.

4. Find all point(s) of inflection for the graph of $f(x)$.
   ANS There is one inflection point: at $x = 1$.
5. Give a rough sketch the graph of $f(x)$ (your axes need not necessarily have the same scale).

Answer:



Exer 6.2.1 (Example 4.6.9 from the textbook)

Sketch the graph of $f(x) = \dfrac{x^2}{1-x^2}$. ANS Answer in the textbook

Exer 6.3.1

Use L'Hôpital's Rule to evaluate the following:

1. $\lim_{x \to 1} \dfrac{(x-1)^2}{\ln(x)}$. ANS 0
2. $\lim_{x \to \infty} \dfrac{(x-1)^2}{\ln(x)}$. ANS ∞

Exer 6.3.2

Use L'Hôpital's Rule to evaluate $\lim_{x \to 0^+} x \ln(x)$. (*Hint:* write $\ln(x)$ as $\frac{f(x)}{g(x)}$ where both $f(x)$ and $g(x)$ tend to either $-\infty$ or ∞ as $x \to 0$.) ANS 0