MATH 110 Problem Set 3.3

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Tuesday, March 10, 2026

The following problems based on Section 3.3 of the textbook will help you study. *You do not need to hand in solutions to these problems.*

1. (Based on 3.3.9–14) For each of the following functions f, find the intervals on which f is increasing or decreasing, find the local maximum and minimum values of f, find the intervals on which the function is concave up or down, and find the inflection points. You do not need to graph the functions!

   (a) $f(x) = 4x^3 + 3x^2 - 6x + 1$ (b) $f(x) = \dfrac{x^2}{x^2+3}$ (c) $f(x) = \cos^2 x - 2\sin x$, $0 \le x \le 2\pi$

2. (Based on 3.3.33–44) For each of the following functions, find the intervals on which the function is increasing or decreasing, find the local maximum and minimum values, find the intervals on which the function is concave up or down, find the inflection points, and then use the above information to sketch a graph of the function.

   (a) $h(x) = x^5 - 2x^3 + x$ (b) $B(x) = 3x^{2/3} - x$ (c) $G(x) = x - 4\sqrt{x}$ (d) $f(t) = t + \cos t$, $-2\pi \le t \le 2\pi$

3. (Based on 3.3.18) Find the critical numbers of $f(x) = x^4(x-1)^3$. What does the Second Derivative Test tell you about the behaviour of f at the critical numbers? What does the First Derivative Test tell you?

4. (Based on 3.3.45) Suppose the derivative of a function f is $f'(x) = (x+1)^2(x-3)^5(x-6)^4$. On what interval(s) is f increasing?

5. (Based on 3.3.60) Show that the curve $y = (1+x)/(1+x^2)$ has three points of inflection and they all lie on a straight line.

You may find the following additional exercises from Section 3.3 helpful.

3.3 C-level: 1–44, 53;
B-level: 45–46, 54–57, 59–62, 67–68, 72–73;
A-level: 58, 63–66, 69–71, 74–77