MATH 11 Problem Set 3.1

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The following problems based on Section 3.1 of the textbook will help you study. *You do not need to hand in solutions to these problems.*

1. (Based on 3.1.29–42) Find the critical numbers of the following functions.

   (a) $f(x) = x^3 + x^2 + x$ (b) $g(t) = |3t - 4|$ (c) $h(p) = \dfrac{p-1}{p^2+4}$ (d) $g(x) = \sqrt{1-x^2}$

2. (Based on 3.1.45–56) Find the absolute maximum and absolute minimum values of the following functions on the given interval.

   (a) $x^3 - 6x^2 + 9x + 2$, $[-1,4]$ (b) $(x^2-1)^3$, $[-1,2]$ (c) $\dfrac{x^2-4}{x^2+4}$, $[-4,4]$ (d) $\sqrt[3]{t}(8-t)$, $[0,8]$

3. (Based on 3.1.59–62) Find the absolute maximum and minimum values of the following functions on the given intervals.

   (a) $f(x) = x^4 - 3x^3 + 3x^2 - x$, $0 \le x \le 2$ (b) $f(x) = x - 2\cos x$, $-2 \le x \le 0$

4. (Based on 3.1.64) An object with weight W is dragged at constant velocity along a horizontal plane by a force acting along a rope attached to the object. If the rope makes an angle θ with the plane, then the magnitude of the force is

   $$F = \frac{\mu W}{\mu \sin\theta + \cos\theta}$$

   where μ is a positive constant called the *coefficient of friction* and where $0 \le \theta \le \pi/2$. Show that F is minimized when $\tan\theta = \mu$.

You may find the following additional exercises from Section 3.1 helpful.

3.1 C-level: 1–42,45–56; B-level: 57–65, 67–68; A-level: 43–44, 69–70, 72