(1) Find the limit.

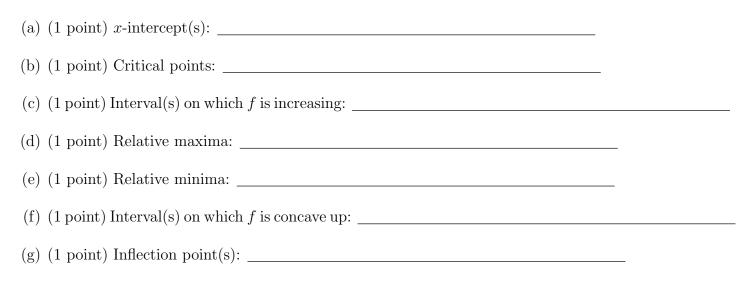
(a) (6 points) 
$$\lim_{x \to 0} \frac{e^{2x} - 1}{\sin x}$$

(b) (6 points) 
$$\lim_{x \to +\infty} \frac{x^2 + 8x + 7}{e^x + 2x - 50}$$

(c) (6 points) 
$$\lim_{x \to +\infty} x \sin \frac{\pi}{x}$$

(d) (6 points) 
$$\lim_{x \to 0} \left( \csc x - \frac{1}{x} \right)$$

(2) Let  $f(x) = 4x^3 - x^4$ . Answer the following questions.



(h) (3 points) Sketch the graph and label the coordinates of the intercepts, relative extrema, and inflection point(s).

(3) (5 points) Let  $f(x) = \frac{3x^2 - 2}{x}$ . Find the horizontal, vertical, and oblique asymptotes, if any.

(4)	Let $f(x) =$	$\frac{3-x}{2}$	Answer the following questions.
		$\overline{x-2}$ .	

- - (e) (1 point) Vertical asymptote:
  - (f) (1 point) Interval(s) on which f is decreasing:
  - (g) (1 point) Interval(s) on which f is concave up:
  - (h) (3 points) Sketch the graph and label the coordinates of the intercepts and asymptotes.

(5) (7 points) Find the **absolute** maximum and minimum values of  $f(x) = 4x^3 - 3x^4$ , if any, on  $(-\infty, +\infty)$ , and state where those values occur.

(6) (8 points) Find the **absolute** maximum and minimum values of  $f(x) = (x^2 + x)^{\frac{2}{3}}$  on the closed interval [-2, 3], and state where those values occur.

(7) Find the antiderivative.

(a) (6 points) 
$$\int \sqrt{x} + \frac{x^2 + 1}{x} dx$$

(b) (6 points) 
$$\int \sec x (\sec x + \tan x) dx$$

(c) (6 points) 
$$\int \frac{x}{(x^2+1)^4} dx$$

(8) (8 points) Verify that the hypotheses of the Mean-Value Theorem are satisfied for  $f(x) = x - \frac{1}{x}$  on the interval [3, 4], and find all values of c in (3, 4) that satisfy the conclusion of the theorem.

(9) (10 points) A closed cylindrical can is to hold 100 cm<sup>3</sup> of liquid. Find the height and radius that minimize the amount of material needed to manufacture the can.