> **You must show COMPLETE CALCULUS WORK on ALL PROBLEMS to verify your answers. Please CIRCLE your final answers.**

1.) Given: $f(x) = x^3 - x^2 - x + 2$ answer the following questions.

a.) Find all critical numbers, if there are any.

b.) Find the intervals on which the function is increasing and/or decreasing.

c.) Find all local maxima and/or minima, if any. If there are none, state why.

d.) Find all points of inflection, if any. If there are no points of inflection, state why.

e.) Determine the intervals on which the function is concave up and/or concave down.

2. Find the number c in the function that satisfies the conclusion of the MVT on the given interval.

$$f(x) = x^2 - 5x - 2, \quad [0, 2]$$

3. Suppose the derivative of a function f is given as: $f'(x) = x^2 - 6x + 8$. On what interval(s) of x is f increasing and/or decreasing?

4. Given: $f(x) = 5 - 2\cos x + \dfrac{3}{x}$ (a) Find the general antiderivative.

(b) Check your answer by differentiation.

5. The acceleration of a particle that is moving in a straight line is given by $a(t) = 3\cos t - 2\sin t$.

(a) Find the velocity function, $v(t)$, and (b) the position function, $s(t)$ given that $v(0) = 4$ and $s(0) = 0$.

6. *Given:* $f''(x) = 4x - 2$ (*a*) *Find* f' *if* $f'(2) = 9$ *and* (*b*) *Find* f *if* $f(1) = \frac{14}{3}$

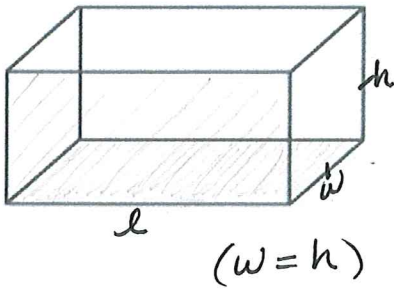Use L'Hopital's Rule (if necessary) to find:

7. $\lim\limits_{x \to 0} \dfrac{x^2}{1 - \cos x}$.

8. $\lim\limits_{x \to \infty} \dfrac{x^5 - 1}{x^6 - 1}$

9. A box in the shape of a rectangular prism has a surface area of 16,000 cm² where the width and the height are equal (see the picture below).

(a) Find the dimensions that would maximize the volume of the box.

(b) What is the maximum volume of the box?

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$(w = h)$

Hint: The left & right end faces are equal. The top, bottom, front & back faces are equal ∴ Surface Area $= 2w^2 + 4lw$