Math 2413 **Homework Set 3** **10 Points**

Limits At Infinity

Evaluate each of the following limits.

1. $\lim\limits_{t \to \infty} \dfrac{10t^2 + 8t}{7 - 6t + 2t^3}$

2. $\lim\limits_{z \to \infty} \dfrac{(2+3z)(4z-1)}{4 - z^2}$

3. $\lim\limits_{p \to -\infty} \dfrac{9 + 5p^4}{5p^3 + 9p^2 - 1}$

4. Evaluate $\lim\limits_{y \to \infty} \dfrac{8 - 4y}{\sqrt{7y^2 - 1}}$ and $\lim\limits_{y \to -\infty} \dfrac{8 - 4y}{\sqrt{7y^2 - 1}}$.

Continuity

5. Determine where the following function is NOT continuous.

$$g(x) = \frac{x^2 - 4x + 4}{2x^2\mathbf{e}^{3-x} - x^2\mathbf{e}^{2x+9}}$$

6. Use the Intermediate Value Theorem to show that somewhere in the interval [-15, -7] there is a root of $f(x) = \ln(10 - x) - x\sin\left(\frac{x}{4}\right)$. Note that you aren't being asked to actually find the root, only show that one exists.

7. The function

$$A(t) = t\,\mathbf{e}^{\sin(2t)}$$

will the value of 8 somewhere in the interval [0, 5]. Use the Intermediate Value theorem to find a span of width of no more that ½ in which the function will have a value of 8. Note that there are multiple answers to this question and any of them will be accepted.

Definition of the Derivative

For problems 9 – 12 use the definition of the derivative to compute the derivative of the given function.

8. $g(x) = 2 - 5x$

9. $f(x) = 7 + 2x - 3x^2$

Continued on Back $\Rightarrow$

10. $Q(t) = \sqrt{4t+1}$

11. $f(x) = 4x - \dfrac{1}{x}$

Interpretation of the Derivative

For problems 13 – 15 use the derivatives found in the previous part to answer each question.

12. Is $g(x) = 2 - 5x$ increasing, decreasing or not changing at $x = -8$? What about at $x = 3$?

13. Find the equation of the tangent line to $f(x) = \sqrt{4x+1}$ at $x = 7$.

14. Does $f(x) = 7 + 2x - 3x^2$ ever stop changing? If so when does it stop?

15. Below is the graph of the **derivative** of some function. Use the graph to determine where the **function** is increasing, decreasing and not changing.