Limits At Infinity

Evaluate each of the following limits.

1. $\lim\limits_{x\to\infty} \dfrac{(x-7)(x-2)}{5x^2+x-10}$

2. $\lim\limits_{t\to-\infty} \dfrac{7t^4+6t^3+8t}{5+8t^2-4t^3}$

3. $\lim\limits_{z\to\infty} \dfrac{z^5-7z^3+5}{2z^6+4z^2}$

4. Evaluate $\lim\limits_{y\to\infty} \dfrac{\sqrt{6+2y^2}}{9y-8}$ and $\lim\limits_{y\to-\infty} \dfrac{\sqrt{6+2y^2}}{9y-8}$.

Continuity

5. Determine where the following function is NOT continuous.

$$g(x) = \frac{x^2+7x+1}{1+\csc(2x)}$$

6. Use the Intermediate Value Theorem to show that somewhere in the interval [-3, 0] there is a root of $h(x) = 3x^2 + 2x - \mathbf{e}^{-x}$. Note that you aren't being asked to actually find the root, only show that one exists.

7. The population (in hundreds) of fish in a lake is given by,

$$P(t) = 2\sin\left(\tfrac{t}{2}\right)\cos(t) + 4$$

where *t* is in months. Sometime in the first 5 months the population of fish will fall below 250. Use the Intermediate Value theorem to find a time span of no more than ½ of a month where the population does fall below 250. Note that there are multiple answers to this question and any of them will be accepted.

Continued on Back $\Rightarrow$

Definition of the Derivative

For problems 8 – 11 use the definition of the derivative to compute the derivative of the given function.

8. $g(x) = 4 - 15x$

9. $V(t) = \dfrac{2-t}{4+3t}$

10. $f(x) = 4x^2 - 2x + 1$

11. $W(z) = \sqrt{1-4z}$

Interpretation of the Derivative

For problems 12 – 14 use the derivatives found in the previous part to answer each question.

12. Is $f(x) = 4x^2 - 2x + 1$ increasing, decreasing or not changing at $x = -2$?

13. Find the equation of the tangent line to $h(x) = 4 - 15x$ at $x = 9$

14. Does $V(t) = \dfrac{2-t}{4+3t}$ ever stop changing? If so when does it stop?

15. Below is the graph of the **derivative** of some function. Determine if the **function** is increasing, decreasing or not changing at the points : $x = -2$, $x = 1$ and $x = 4$?