MAT 1500 (Dr. Fuentes) Worksheet 4 - Sections 2.6 & 2.7

Section 2.6: Limits at Infinity; Horizontal Asymptotes

Problem 1. Find the limit or show it does not exist.

(a) $\lim_{x\to-\infty}\left(\sqrt{4x^2+3x}+2x\right)$ (b) $\lim_{x\to\infty}\dfrac{e^x+\cos(x)}{e^{2x}}$

HINT: Rationalize in (a). Use the Squeeze Theorem in (b).

Problem 2. Find the horizontal and vertical asymptotes of $f(x)=\dfrac{(2x^2-1)^3(x+1)}{x^4(3x-2)^3}$.

Problem 3. Find the limits as $x\to\infty$ and as $x\to-\infty$ of the function below. Use this information, together with the x and y intercepts of the graph, to give a rough sketch of the graph of the function.

$$f(x)=(3-x)(1+x)^2(1-x)^4$$

HINT: Consider the signs of each of the factors in the function as $x\to\infty$ or as $x\to-\infty$.

Section 2.7: Derivatives and Rates of Change

Problem 4. Let $f(x)=\dfrac{x+2}{x-3}$. Using the **limit definition** of the derivative, find $f'(2)$ and use it to find the equation of the tangent line to the curve of f at the point where $x=2$.

Problem 5. Let $H(t)$ be the daily cost (in dollars) to heat an office building when the outside temperature is t degrees Fahrenheit.

(a) What is the meaning of $H'(75)$? What are its units?

(b) Would you expect $H'(75)$ to be positive or negative? Explain.

Problem 6. Let $D(t)$ be the US national debt at time t. The table below gives the approximate values of this function by providing end of year estimates, in billions of dollars, from 2000 to 2016.

Interpret and estimate the value of $D'(2008)$.

t	$D(t)$
2000	5662.2
2004	7596.1
2008	10,699.8
2012	16,432.7
2016	19,976.8

Source: US Dept. of the Treasury