

3. (35 points) Evaluate each of the limits indicated below.

$$(a) \lim_{x \rightarrow \infty} \frac{2x^6 - 6}{(11 - 2x^2)^3}$$

$$(b) \lim_{x \rightarrow 1} \frac{x^4 - 1}{x^2 - 1}$$

$$(c) \lim_{h \rightarrow 0} \frac{(2 + h)^3 - 8}{h}$$

$$(d) \lim_{x \rightarrow 1} \frac{x^2 - 4x + 3}{x^2 + x - 2}$$

$$(e) \lim_{x \rightarrow 2} \frac{\frac{1}{3x} - \frac{1}{6}}{\frac{1}{2x} - \frac{1}{4}}$$

$$(f) \lim_{x \rightarrow -\infty} \frac{\sqrt{36x^2 - 3x}}{9x - 11}$$

$$(g) \lim_{x \rightarrow 2} \frac{\sqrt{8x} - 4}{x - 2}$$

4. (12 points) Find the domain of the function

$$g(x) = \frac{\sqrt{(x + 10)(2x - 3)(3x - 17)}}{x^2 - 4}$$

Express your answer as a union of intervals. That is, use interval notation.

5. (12 points) Let $H(x) = (x^2 - 4)^2(2x + 3)^3$. Using the chain rule and the product rule,

$$H'(x) = 2(x^2 - 4) \cdot 2x(2x + 3)^3 + (x^2 - 4)^2 \cdot 3(2x + 3)^2 \cdot 2.$$

Three of the zeros of $H'(x)$ are $x = \pm 2$ and $x = -3/2$. Find the other two.

6. (25 points) Given two functions,

$$g(x) = 2x + 1$$

and

$$f(x) = \begin{cases} x^2 & \text{if } x \leq 2 \\ -2 & \text{if } x > 3 \end{cases}$$

Use 'dne' for 'does not exist.'

(a) Write the domain of f in interval notation.

(b) Compute $\lim_{x \rightarrow 3^+} f(x)$

(c) Compute $\lim_{x \rightarrow 3^-} f(x)$

(d) Complete the following table.

x	$g \circ f(x)$
-2	
-1	
0	
1	
2	
3	
π	

(e) Find the symbolic representation of $g \circ f(x)$

7. (25 points) Let $f(x) = \sqrt{4x - 3}$.

(a) Let h be a positive number. What is the slope of the line passing through the points $(3, f(3))$ and $(3 + h, f(3 + h))$. Your answer depends on h , of course. Suppose your answer is called $G(h)$.

(b) Compute $\lim_{h \rightarrow 0} G(h)$.

(c) Your answer to (b) is the slope of the line tangent to the graph of f at the point $(3, f(3))$. In other words, your answer is $f'(3)$. Write an equation for the tangent line.

8. (10 points) Evaluate the following limits.

(a)
$$\lim_{x \rightarrow \infty} \frac{(2 - x)(10 + 6x)}{(3 - 5x)(8 + 8x)}$$

(b)
$$\lim_{x \rightarrow -\infty} \frac{(2 - x)(10 + 6x)}{(3 - 5x)(8 + 8x)}$$