

1. (15 points) Sketch the graphs of the following functions. For each graph, label the axes, all x - and y -intercepts, and all vertical and horizontal asymptotes. Your graphs should be carefully and neatly drawn.

(a) $f(x) = x^{1/8}$

(b) $f(x) = -\cos(x)$ on $[0, 2\pi]$

(c) $f(x) = (x + 2)^{-1} + 3$

2. (20 points) Let $H(x) = \sqrt{2x - 3} + 4$.

(a) Find the domain of $H(x)$.

(b) Find the range of $H(x)$.

(c) Find functions $f(x)$ and $g(x)$ so that $H(x) = f(g(x))$. (That is, *decompose* $H(x)$.) Do not give a trivial decomposition.

(d) Let $s(x) = x^2 + 1$. Find $H(s(x))$.

3. (25 points) Evaluate the following limits. Give the most complete possible answer. (That is, if the limit is $+\infty$ or $-\infty$, say so.)

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

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

(c) $\lim_{x \rightarrow \infty} \frac{5 - x^5 + x^{14}}{x^2 - 2x^8 - 8x^{15}}$

(d) $\lim_{\theta \rightarrow 0} \frac{\cos \theta}{\theta + 1}$

(e) $\lim_{x \rightarrow 0} \frac{5x}{\tan(4x)}$

4. (15 points)

(a) Complete the following definition.

A function $f(x)$ is continuous at $x = c$ if

(b) Determine the value(s) of the constant k that will make the function continuous, if possible.

$$f(x) = \begin{cases} kx^2 & x \leq 2 \\ 5 + (k + 1)x & x > 2 \end{cases}$$

5. (15 points) Let $f(x) = \frac{1}{2x-1}$. Use the definition of the derivative to find $f'(x)$.
SHOW YOUR WORK.

6. (10 points) Let $f(x) = \frac{2}{(x+0.5)^3}$ and $f'(x) = \frac{-6}{(x+0.5)^4}$. Write the equation of the tangent line to the graph of $f(x)$ at $x = 0.5$.

Extra Credit (5 points)

Use the formal definition of the limit to prove:

$$\lim_{x \rightarrow 4} \sqrt{x} = 2$$