1. [9 points] Find all of the **critical numbers** of each function.
   (a) $f(x) = (x-1)(x-5)^3$
   (b) $f(x) = 10x^{4/5} - 5x^{9/5}$

2. [9 points] Evaluate each **limit at infinity**.
   (a) $\lim_{x\to\infty} \frac{3x^2 - 8x + 4}{6x^2 + 7x - 4}$
   (b) $\lim_{x\to-\infty} \frac{7x+1}{2x^2 - 3x - 7}$
   (c) $\lim_{x\to\infty} \frac{x^2+7}{2x+3}$

3. [10 points] Find the **absolute maximum and minimum** values of $f(x) = x\sqrt{12-x}$ on the interval $[3, 11]$.

4. [12 points] Sand is being poured onto a conical pile at a rate of 40 cubic feet per minute. The diameter of the pile is 4 times the height. How quickly (in feet per minute) is the radius of the pile increasing, when the radius is equal to 20 feet?

   (The volume of a cone with height h and radius r is $\frac{1}{3}\pi r^2 h$.)

5. [20 points] Consider the function
$$f(x) = \frac{x^2+4}{x^2+12}.$$
   The first two derivatives of this function are as follows. **You do not need to compute these.**
$$\begin{aligned} f'(x) &= \frac{16x}{(x^2+12)^2} \\ f''(x) &= -\frac{48(x^2-4)}{(12+x^2)^3} \end{aligned}$$
   (a) On which intervals is $f(x)$ **increasing** on which intervals is it **decreasing**?
   (b) Using your answer to part (a), determine any **local max(s) and/or local min(s)** of $f(x)$. Give **both the x and y coordinates.**
   (c) On which intervals is $f(x)$ **concave up** and on which intervals is it **concave down**?
   (d) Using your answer to part (c), determine any **point(s) of inflection** of $f(x)$. Give **both the x and the y coordinates.**
   (e) Determine any **horizontal asymptotes** of the function $f(x) = \frac{x^2+4}{x^2+12}$.
   (f) Draw a rough sketch of the graph $y = f(x)$, incorporating the information you found in parts (a) through (e).