

4. (10 points) Differentiate the function $k(x) = \frac{\cos(x)}{e^x + x^2 + 24} + \frac{1}{\pi^2}$. (You need not do this directly from the definition.)

5. (10 points) Differentiate the function $h(x) = (x^3 - 7x)^{11}$. (You need not do this directly from the definition.)

6. (10 points) Find the exact value of the limit $\lim_{x \rightarrow -2} \frac{x + 2}{x^2 - 5x - 14}$, or explain why this limit does not exist.

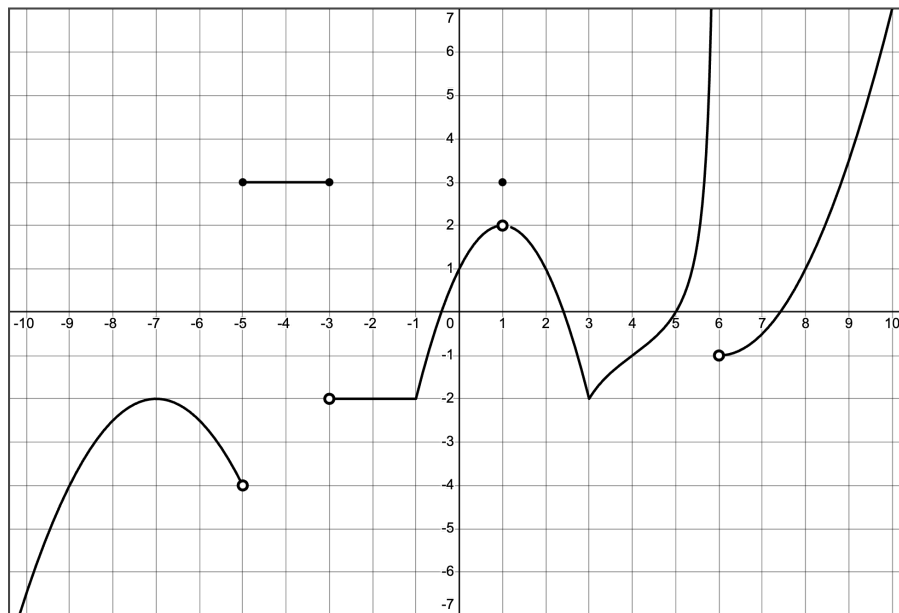
7. (20 points.) An open rectangular box (no top) is to have a base that is twice as long as it is wide. 24 square feet of material are available to make the box. Find the dimensions of the box which maximizes the volume.

Include units. Be sure to verify that your maximum or minimum really is what you claim it is, using methods we have seen so far (not the second derivative test).

8. (13 points) Use the methods of calculus to find the exact values of x at which the function $k(x) = x^3 - 6x^2 - 15x$ takes its absolute minimum and maximum on the interval $[-2, 2]$.

(No credit will be given for correct guesses without supporting work that is valid for general functions of the sort considered in this course.)

9. (5 points/part) For the function $y = L(x)$ graphed below, answer the following questions:



(a) Is L continuous at 3? Why or why not?

(b) Does $\lim_{x \rightarrow -5} L(x)$ exist? If so, what is it? If not, why not?

(Continued on back or on next page.)

10. (10 points.) This problem is about using correct notation. Accordingly, almost all the credit is for correctness of notation.

Consider the problem of finding the exact value of $\lim_{x \rightarrow -3} \frac{x^3 + x^2 - 6x}{x + 3}$. The method is to factor the numerator and cancel one of the factors. The factors of the numerator are $x + 3$, x , and $x - 2$. (You need not check these.)

Write out the calculation in full, in correct notation which exhibits correctly the steps of the calculation. In particular, put “=” and “lim” everywhere they belong, and nowhere else. Start by writing $\lim_{x \rightarrow -3} \frac{x^3 + x^2 - 6x}{x + 3}$. Show at least the following steps (not labelled):

- After factoring but before cancellation.
- After cancellation but before substituting $x = -3$.
- After substituting $x = -3$ but before possible simplification.
- The simplified final result, if the result in the previous step can be simplified.