

**Instructions**

You should submit a carefully written report addressing the problems given below. You are encouraged to discuss ideas with others for this project. If you do work with others, you must still write your report independently.

Use the writing conventions given in *Some notes on writing in mathematics*. You should include enough detail so that a reader can follow your reasoning and reconstruct your work. You should not show every algebraic or arithmetic step. All graphs should be done carefully on graph paper or using appropriate technology.

The project is due in class on Monday November 17.

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Consider the function

$$U(r) = \frac{A}{r^4} - \frac{B}{r^2}$$

where  $A$  and  $B$  are parameters with  $A > 0$  and  $B > 0$ . Functions something like this are used in physics and chemistry as models of the *potential energy of interaction* between two molecules where  $r$  is the distance between the molecules. The relevant domain is thus  $(0, \infty)$ .

1. Use methods from this course to make a plot that shows all of the essential features on the graph of this function for  $r$  in  $(0, \infty)$ . Note that the scales for your axes will be in terms of the parameters  $A$  and  $B$ . You will probably find that the quantity  $\sqrt{A/B}$  is convenient to use as the unit for the  $r$ -axis.
2. Describe how the essential features of the graph change if  $B$  is held constant and  $A$  is changed.
3. Describe how the essential features of the graph change if  $A$  is held constant and  $B$  is changed.