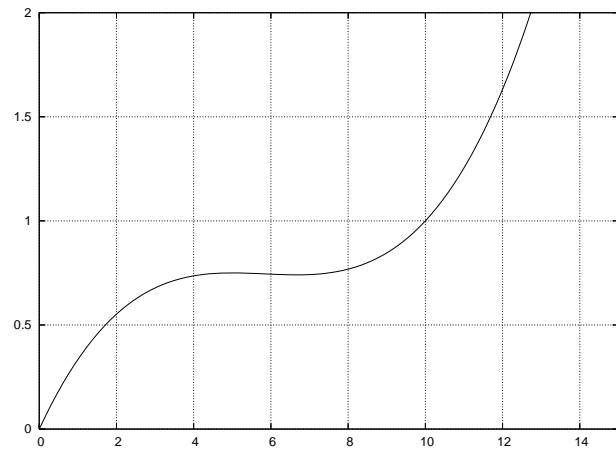


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1. Consider the family of functions given by  $f(x) = ax - e^{bx}$ , where  $a$  and  $b$  are constants. What conditions on  $a$  and  $b$  guarantee that there will be at least one local maximum or minimum? In this case, how many local maxima are there, and where are they located? (4 points)

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2. Suppose that the graph given to the right shows  $E(s)$ , the total effort required to rouse  $s$  students from bed on a Thursday morning at some point in the semester. (The units of  $E$  are “Herculean tasks,” Ht.) How is the average effort required per student represented on this graph? What number of students requires the minimum average effort per student? (3 points)



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3. Suppose that the cost of producing  $q$  items of some product is given by  $C(q) = 7 + 6q + 6q^2 + q^3$ , where  $C$  is in thousands of dollars and  $q$  is in hundreds of the items produced. If each item is sold for 69 thousand dollars (no, really), write an equation for the profit obtained by selling the items. What number of items maximizes profit? (3 points)