

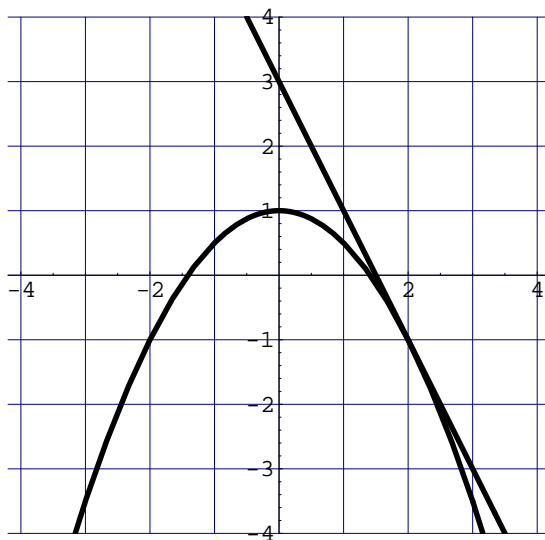
### MATH 251 (PHILLIPS): WRITTEN HOMEWORK 4

This homework sheet is due in class on Tuesday 28 January 2025 (week 3), in class. Write answers on a separate piece of 8.5 by 11 inch paper, well organized and well labelled, with each solution starting on the left margin of the page.

All the requirements in the sheet on general instructions for homework apply. In particular, show your work (unlike WeBWorK), give exact answers (not decimal approximations), and **use correct notation**. (See the course web pages on notation.) Some of the grade will be based on correctness of notation in the work shown.

Point values as indicated, total 50 points.

- (10 points.) Find the derivative of the function  $R(t) = 4at^3 - t^2 \cos(t) - \pi^2$ . ( $a$  is a *constant*.)
- (10 points.) The picture below shows the graph of a function  $y = f(x)$  and the tangent line to the graph at  $x = 2$ .



Let  $g$  be the function  $g(x) = \frac{f(x)}{x^2 + 7}$ . Find  $g'(2)$ .

- (10 points.) Let  $f$  and  $g$  be functions which are differentiable at  $-2$  and which satisfy

$$f(-2) = -5, \quad f'(-2) = -3, \quad g(-2) = 4, \quad \text{and} \quad g'(-2) = 2.$$

Let  $w(x) = x - f(x)g(x)$  for all  $x$ . Find  $w'(-2)$ .

- (20 points.) A right circular cylinder is inscribed in a sphere of radius  $r$ . Find the largest possible volume of such a cylinder.

Be sure to verify that your maximum or minimum really is what you claim it is.