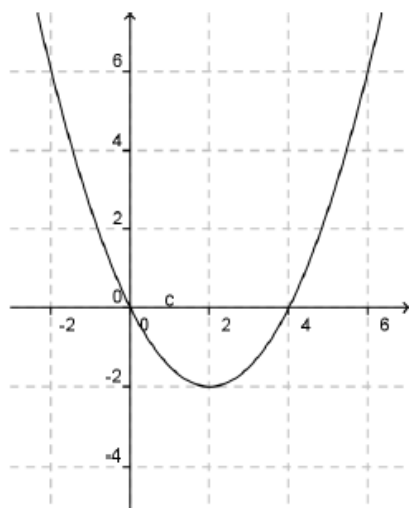


The derivative of a graph of a function is the \_\_\_\_\_ of the \_\_\_\_\_ line at any given point and it is represented by the following symbols: \_\_\_\_\_ or \_\_\_\_\_.

### Problem 1

Given the function  $f$  graphed below, answer the following questions about the function and its derivative.



Upon what interval(s) is  $f$  increasing? \_\_\_\_\_

Upon what interval(s) is  $f$  decreasing? \_\_\_\_\_

Does  $f$  have any local extrema? If so, where and is it a maximum or minimum?

Draw tangent lines to  $f$  at each integral value of  $x$  over the interval  $[-2, 6]$ .

Estimate  $f'(-1)$ ,  $f'(2)$ , and  $f'(4)$ .

Write an equation for the tangent line to  $f$  at  $x = 4$ .

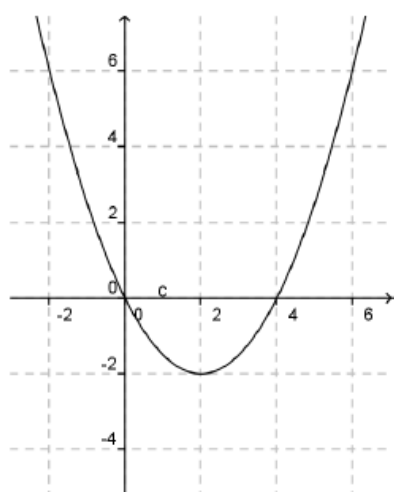
Looking at your tangent lines, determine the intervals where  $f' > 0$ ,  $f' < 0$ , and  $f' = 0$ .

Compare these intervals to your answers to the above questions. What conclusions can be made?

Sketch a graph of  $f'$  on the same axes above by using your information from the previous questions.

## Problem 2

Given the function  $f'$  (the derivative of  $f$ ) graphed below, answer the following questions about the function  $f$  and its derivative.



Upon what interval(s) is  $f' > 0$ ? \_\_\_\_\_

Upon what interval(s) is  $f' < 0$ ? \_\_\_\_\_

At what values does  $f' = 0$ ? \_\_\_\_\_

What does this information imply about the function  $f$ ?

Estimate  $f'(-1)$ ,  $f'(2)$ , and  $f'(4)$ .

Upon what interval(s) is  $f'$  increasing? \_\_\_\_\_

Upon what interval(s) is  $f'$  decreasing? \_\_\_\_\_

At what value(s) does  $f'$  have local extrema? \_\_\_\_\_

Draw tangent lines to  $f'$  at each integral value of  $x$  over the interval  $[-2, 6]$ .

Use your tangent lines to estimate the following values:  $f''(0)$ ,  $f''(2)$ , and  $f''(3)$ .

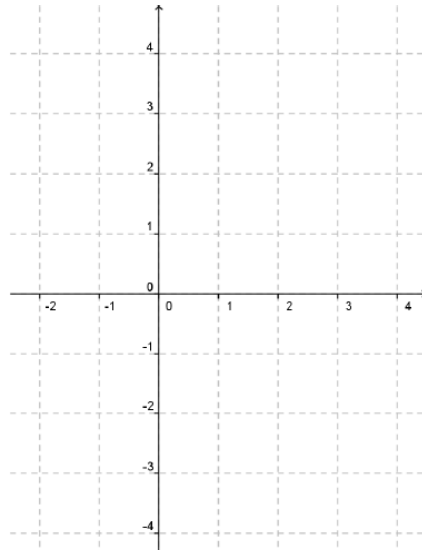
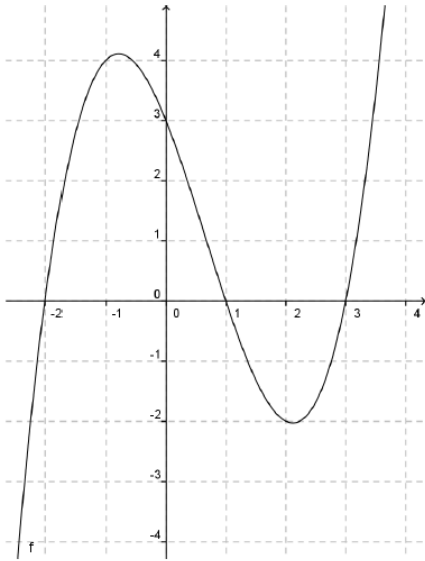
Looking at your tangent lines, determine the intervals where  $f'' > 0$ ,  $f'' < 0$ , and  $f'' = 0$ .

Compare these intervals to your answers to the above questions. What conclusions can be made?

How do these characteristics relate to the concavity of the function  $f$ ?

### Problem 3

Using the function  $f'$  graphed below, sketch the graphs of  $f$  and  $f''$ . Explain all of the characteristics that determine what each graph looks like (concavity, increasing/decreasing, local extrema, inflection points, etc.) Use one set of axes for all three or separate your graphs if you wish.



### Problem 4

In the following graph, the functions are related by derivatives. Determine which function is  $f$ ,  $f'$ , and  $f''$ . Explain your reasoning.

