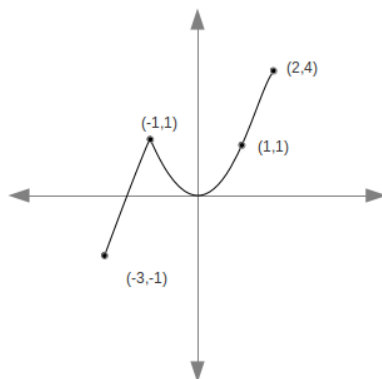


Justify your solutions and show your work.

1. The graph of  $f'$  on the interval  $[-3, 2]$  is shown in the figure.



- On what interval(s) is  $f$  increasing? Decreasing?
  - Find the critical points of  $f$ . Identify whether the critical points correspond to minima, maxima, or neither for  $f$ .
  - On what intervals is  $f$  concave up? Concave down?
  - Sketch the graph of  $f''$ .
  - Sketch a possible graph of  $f$ .
- Consider the curve defined by  $y^2 \sin x + \cos(xy) + y^2 = 2$ . Find the tangent to this curve at the point  $(0, 1)$ .
  - Find the average value of  $f(x) = x(x^2 - 7)^3$  over the interval  $[-1, 1]$ .
  - Find the point(s) on the graph of  $y = x^2 + 1$  that is/are closest to the point  $(0, 2)$ .
  - Suppose that a function  $f(x)$  is defined and has  $f'(x) < 0$  and  $f''(x) < 0$  for all  $x$ . Suppose also  $f(3) = 5$  and  $f'(3) = -2$ . (a) Find an integer  $n$  such that  $|f(2) - n| < 1$ . (b) Suppose  $f(r) = 0$  and find an integer  $k$  such that  $|r - k| < 2$ .