

**Problem statement** For any constant  $c$ , define the function  $f_c$  with the formula  $f_c(x) = x^3 + 2x^2 + cx$ .

a) Graph  $y = f_c(x)$  for these values of the parameter  $c$ :  $c = -1, 0, 1, 2, 3, 4$ . What are the similarities and differences among the graphs, and how do the graphs change as the parameter increases?

b) For what values of the parameter  $c$  will  $f_c$  have one local maximum and one local minimum? Use calculus. As  $c$  increases, what happens to the distance between the local maximum and the local minimum?

c) For what values of the parameter  $c$  will  $f_c$  have no local maximum or local minimum? Use calculus.

d) Are there any values of the parameter  $c$  for which  $f_c$  will have exactly one horizontal tangent line?