

## Some Problems about Quadratic Functions for Enrichment<sup>1</sup>

1. If  $f(x) = x^2 - 7x + k$  and  $f(k) = -9$ , find  $f(-1)$ .
2. An ellipse has its centre at the origin, its foci on the  $y$ -axis, and its major axis three times as long as its minor axis. Given that the ellipse passes through the point  $(-4, -2)$ , find its equation.
3. The parabola with equation  $y = ax^2 + bx + 1$  passes through the point  $(1, 2)$ . For what values of  $a$  does the parabola intersect the  $x$ -axis at two distinct points?
4. If  $(-2, 7)$  is the maximum point for the graph of the function  $y = -2x^2 - 4ax + k$ , find the value of  $k$ .
5. (a) The line with equation  $x + y = 3$  intersects the parabola whose equation is  $y = x^2 + 1$  at points  $A$  and  $B$ . Find the coordinates of  $A$  and  $B$ .  
(b) If  $C$  is the vertex of the given parabola, find the area of triangle  $ABC$ .
6. Find the equation of the locus of a point  $P$  which moves so that the length of the tangent from  $P$  to the circle with equation  $x^2 + y^2 + 6x - 9y = 2$  is always twice the distance from  $P$  to the line with equation  $2x + 3y = 18$ .

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<sup>1</sup>borrowed from some books of Canadian Mathematics Competition Problems produced by the University of Waterloo