

1) One of the roots of the quadratic function  $f(x) = x^2 - 4x + c$  is  $x = -3$ . What is the  $y$ -coordinate of its vertex?

2) The parabola  $y = ax^2 - 6x + c$  has only one real root. Find the value of the product  $ac$ .

3) Consider the following two parabolas:

(i)  $y = x^2 - 2x - 5$

(ii) a parabola with vertex  $(1, 6)$  that passes through  $(-2, -12)$

a) Find the roots of parabola (i).

b) Find the roots of parabola (ii).

c) Find the distance between the vertices of the two parabolas.

d) Find the slope of the line that passes between the points of intersection of the two parabolas.

4) Spunky Sam has a new adventure game coming out. In the first level, Spunky Sam will travel through the air in a parabolic path and will reach a maximum height of 300. The programmer wants the roots of Sam's parabolic path to be 25 and 325. Additionally, Sam will collide with a roof that is modeled as a linear function passing through points  $(290, 20)$  and  $(340, 70)$ . What conditions for  $x$  and  $y$  does the programmer need to put into the code so that the computer will alter Spunky Sam's path when he collides with the roof? Round your answer to the nearest thousandth.