1. Let L denote the normal line to the curve $y = x^2$ at the point $(9.11, 9.11^2)$. Find the x-coordinate of the point of the intersection of L and the x-axis. Give your answer correct to the nearest integer.

2. Let P denote the point on the ellipse $x^2 + \frac{y^2}{81} = 1$ with coordinates given by $(\cos t, 9 \sin t)$ where t is measured in radians and $0 < t < \frac{\pi}{2}$. Let Q denote the reflection of P using the y-axis as a mirror. If the two tangent lines to the ellipse at P and Q respectively are perpendicular to each other, find the value of t. Give your answer correct to two decimal places.

3. Let a denote a constant with $a > 1$. If

$$\int_0^{\pi} \frac{\sin\theta}{\sqrt{1 - 2a\cos\theta + a^2}} d\theta = 0.2018,$$

find the value of a. Give your answer correct to two decimal places.

4. Let a denote a positive constant. If the area of the region bounded by the loop of the curve $y^2 = x^2(a - x)$ is equal to 99, find the value of a. Give your answer correct to two decimal places.