Questions on tangent lines to $y = x^2$

1. At which point does the line tangent to $y = x^2$ at $x = a$ meet the $x$-axis?

2. A tangent line to $y = x^2$ passes through the point $(4,7)$. Find all possible points of tangency.

3. Two lines tangent to $y = x^2$ meet on the $y$-axis and form a $60^\circ$ angle. Find the point of their intersection. How many answers are possible?

4. Consider the parabola $y = x^2$ and let $(2,-1)$ be the position of an observer. Find the angle subtended by the parabola at $(2,-1)$.