4.

4. Since the fences enclose a rectangular plot without one side, two sides have length b and one side has length a:

$a + b + b = 1413 \implies a = 1413 - 2b$

the area:

$area = a \times b = (l - 2b) b = 1413 \, b - 2 \, b^2$

Note that the function is for parabola. Now find the vertex:

$vertex = (\frac{1413}{4} \text{ yd }, \frac{1\,996\,569}{8} \text{ yd}^2)$

Square the unit for vertex's vertical coordinate since it is a quadratic.