Write in complete sentences!!! Explain what you are doing and convince me that you understand what you are doing and why.

I.1.6(a) By mimicking the derivation in Exercise I.1.5, show that the plane curve \( \vec{\alpha}(t) = (x(t), y(t)) \) has curvature
\[
k(t) = \frac{|x'(t)y''(t) - x''(t)y'(t)|}{(x'(t)^2 + y'(t)^2)^{3/2}}
\]
at \( \vec{\alpha}(t) \).

I.1.6(b) As a special case, show that the graph of \( y = f(x) \) has curvature
\[
k(x) = \frac{f''(x)}{(1 + f'(x)^2)^{3/2}}
\]
at \( (x, f(x)) \).

I.1.7(a) Let \( \vec{\alpha}(t) = (a \cos t, b \sin t) \) for \( 0 \leq y \leq 2\pi \). Since \( x^2/a^2 + y^2/b^2 = 1 \), the image of \( \vec{\alpha} \) is an ellipse. Compute its curvature \( k(t) \) by the formula of Exercise I.1.6(a) at \( t = 0 \) and \( t = \pi/2 \).

I.1.7(b) Sketch the ellipse \( x^2/4 + y^2 = 1 \) and its osculating circles at the points \((2,0)\) and \((0,1)\). Find the equations of the osculating circles.

I.1.9. Let \( \vec{\alpha}(t) \) be a smooth curve in \( E^3 \), where \( t \) is an arbitrary parameter. Let \( v(t) = ds/dt \) be the speed at parameter value \( t \). Then
\[
\vec{\alpha}(t) = \frac{d\vec{\alpha}}{ds} \frac{ds}{dt} = v \vec{T} \quad \text{and} \quad \vec{T}'(t) = \frac{d\vec{T}}{ds} \frac{ds}{dt} = kv \vec{N}.
\]
Prove that
\[
k = \frac{||\vec{\alpha}' \times \vec{\alpha}''||}{||\vec{\alpha}'||^3}
\]
where the primes indicate derivatives with respect to \( t \).

I.1.10. Compute the curvature of the helix \( \vec{\beta}(t) = (a \cos t, a \sin t, bt) \) (of Example 3) by means of the formula derived in Exercise I.1.9.

I.1.11(c) Compute the curvature \( k(t) \) for \( \vec{\alpha}(t) = (\cos t, \sin t, e^t) \).