BC 2

$\frac{dx}{dt} = x'(t) = 14\cos\left(t^2\right)\sin\left(e^t\right)$ and $\frac{dy}{dt} = y'(t) = 1 + 2sin\left(t^2\right)$ for $0 \le t \le 1.5$

(a) The tangent line is vertical when $\frac{dx}{dt} = 0$ and $\frac{dy}{dt} \ne 0$. This occurs at $\boxed{t = 1.145 \text{ and } t = 1.253.}$

(b) Let position of the particle be $\left(x(t), y(t)\right)$. Then

$x(1) = x(0) + x'(t)dt = -2 + 11.315 = 9.315$ and

$y(1) = y(0) + \int_0^1 y'(t)dt = 3 + 1.621 = 4.621.$

At $t = 1$, $\left.\frac{dy}{dx}\right|_{t=1} = \left.\frac{dy/dt}{dx/dt}\right|_{t=1} = \frac{2.6829}{3.1072} = 0.863$

An equation for the tangent line is $\boxed{y - 4.621 = 0.863(x - 9.315)}$

(c) The speed at $t = 1$ is $\sqrt{\left(x'(1)\right)^2 + \left(y'(1)\right)^2} = \sqrt{3.1072^2 + 2.6829^2} = \boxed{4.105}$

(d) The acceleration vector is $\left\langle x''(1), y''(1) \right\rangle$ = $\boxed{\left\langle -28.425, 2.161 \right\rangle}$