2003 BC2

2a. At point C $\frac{dy}{dx}$ is positive.

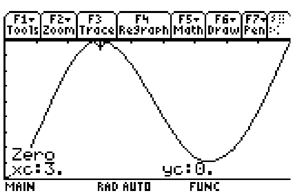
Since $\frac{dy}{dx} = \frac{dy/dt}{dx/dt}$

both dy/dt and dx/dt must have the same sign. dy/dt is negative since the vertical change is in the negative direction. dx/dt is negative since the particle is moving to the left.

2b. dy/dx is undefined at b.

Since $\frac{dy}{dx} = \frac{dy/dt}{dx/dt}$

dx/dt must be equal to zero. Looking at a graph of dx/dy

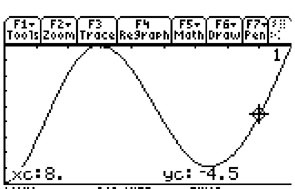


shows us that at t = 0 the dx/dt is zero.

2c. Since $y = \frac{5}{9}x - 2$,

$$\frac{dy/dt}{dx/dt} = \frac{5k}{9k}$$

Looking at the graph of x'(t) and specifically at x'(8)



we can see that when t = 8 dx/dt = -4.5.

Therefore -4.5 = 9k or k = -0.5. So dy/dt = -2.5.

The velocity vector is $\langle -4.5, -2.5 \rangle$

The speed of the particle is

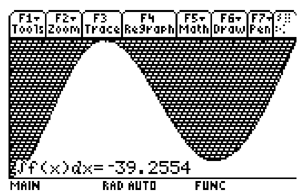
$$\sqrt{(-4.5)^2 + (-2.5)^2} = 5.14782$$

2d.

$$x(t) = \int_0^t -9\cos\left(\frac{\pi x}{6}\right)\sin\left(\frac{\pi\sqrt{x+1}}{2}\right)dx + x_A$$

$$x(0) = \int_0^0 -9\cos\left(\frac{\pi x}{6}\right)\sin\left(\frac{\pi\sqrt{x+1}}{2}\right)dx + x_A$$

$$= x_A$$



$$x(0) = \int_0^9 -9\cos\left(\frac{\pi x}{6}\right)\sin\left(\frac{\pi\sqrt{x+1}}{2}\right)dx + x_A$$

$$= -39.2554 + x_A$$

So the particle has moved -39.2554 units to the left.