Test 2

1.A

$$\vec{P} = [x(t)]\,\hat{\imath} + [y(t)],\hat{\jmath}$$

$$\vec{P} = [\int x'(t)dt]\,\hat{\imath} + [\int y'(t)dt + y_0]\,\hat{\jmath}$$

$$\vec{P} = [\frac{1}{(t+1)^2} + C_x]\,\hat{\imath} + [\tanh(t) + C_y]\,\hat{\jmath}$$

Solve C_x

$$\frac{1}{(0+1)^2} + C_x = 1$$

$$1 + C_x = 1$$

$$C_x = 0$$

Solve C_y

$$\tanh(0) + C_y = 0$$

$$0 + C_y = 0$$

$$C_y = 0$$

Final vector is

$$\vec{P} = [\frac{1}{(t+1)^2}]\,\hat{\imath} + [\tanh(t)]\,\hat{\jmath}$$

1.C

The point never stops moving, as the velocity in the x direction, given by $x'(t)$ can never equal 0, as shown below

$$0 = -\frac{2}{(t+1)^2}$$

$$0 * (t+1)^2 = -(t+1)^2 * \frac{2}{(t+1)^2}$$

$$0 = -2$$

1.D

If the point moves through a finite distance, the distance it moves through must converge as T approaches infinity.
Approximating the distance as a single segment yields

$$\sqrt{x^2 + y^2}$$

$$\sqrt{[\lim_{a\to\infty} \int_0^a x'(t)dt]^2 + [\lim_{b\to\infty} \int_0^b y'(t)dt]^2}$$

$$\sqrt{[\lim_{a\to\infty} \frac{1}{(t+1)^2}|_0^a]^2 + [\lim_{b\to\infty} \frac{e^x - e^{-x}}{e^x + e^{-x}}|_0^b]^2}$$

Evaluating yields

$$\sqrt{[0-1]^2 + [1-0]^2}$$

$$\sqrt{2}$$

2.D

From part C, the non-parametric equation was determined to be $y = 1 - 2x^2$. Therefore, it should be a graph of that parabola, but range and domain restricted to $[-1, 1]$ because of the bounds of the sine and cosine functions