Don't forget to write down clearly your Name:

and **ID number**:

1. Multiple choices (10 points). Mark the box in front of the correct answer.

(1) What is the arclength integral for f(x) = x from x = 0 to x = 1?

 \Box 1 \Box $\sqrt{2}$ \Box π \Box 2

(2) If we rotate the curve $y = \sqrt{9 - x^2}$, $-3 \le x \le 3$ about the x-axis, what's the surface area obtained?

 \square π \square 4π \square 9π \square 36π

(3) If four particles of equal mass are placed on the points (1,0), (-1,0), (0,1) and (0,-1) what's the coordinates of the center of mass?

 $\square \quad (0,0) \qquad \square \quad (1,1) \qquad \square \quad (0,-1) \qquad \square \quad (1,0)$

(4) Which of the following is **not** a probability density function?

 $\Box \quad f(x) = \left\{ \begin{array}{ll} 0.1 & x \in [0, 10] \\ 0 & \text{otherwise} \end{array} \right. \qquad \Box \quad f(x) = \left\{ \begin{array}{ll} 0.2e^{-0.2x} & x \geq 0 \\ 0 & \text{otherwise} \end{array} \right.$

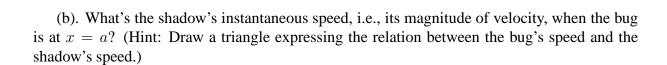
 $\Box \quad f(x) = \left\{ \begin{array}{ll} xe^{-x} & x \ge 0 \\ 0 & \text{otherwise} \end{array} \right. \qquad \Box \quad f(x) = \left\{ \begin{array}{ll} \cos x & x \in [0, \frac{5}{2}\pi] \\ 0 & \text{otherwise} \end{array} \right.$

(5) If a random variable has probability density function $f(x), x \in \mathbb{R}$, what's the mean μ of it?

 $\Box \quad \mu = \int_{-\infty}^{\infty} f(x) \qquad \qquad \Box \quad \mu = \int_{-\infty}^{\infty} x f(x)$ $\Box \quad \mu = \int_{-\infty}^{\infty} x^2 f(x) \qquad \qquad \Box \quad \mu = \int_{-\infty}^{\infty} f^2(x)$

2. We will use the Brazilian bug model to rederive the arclength formula (10 points). Suppose a bug is crawling along the x-axis in unit speed (1m/s), and a uniform light is placed below it. There is a screen in the plane along the wire y = f(x), (f(x) > 0) to catch its shadow.

(a). When the bug is at the point x=a, what's the direction of the velocity of the bug shadow on the wire-screen? You can express the direction in terms of the tangent of the angle it makes with the x-axis.



(c). Use the speed-distance equation from physics $d=\int_0^a|v(t)|dt$ to find the formula for the arclength of the curve y=f(x) when x lies in [0,a].