

Multiple-Choice Test Length of Curve

1. The arc length of a smooth cartesian curve $f(x)$ from a to b is given by

- (A) $\int_a^b f(x)dx$
- (B) $(b - a)^2 + (f(b) - f(a))^2$
- (C) $\int_a^b \sqrt{1 + \frac{dy}{dx}} dx$
- (D) $\int_a^b \sqrt{1 + \left(\frac{dy}{dx}\right)^2} dx$

2. Which of these definite integrals gives the length of the arc of the function

$f(x) = 3x + \sin x$ from $x = 2$ to $x = 5$

- (A) $\int_2^5 (3x + \sin x) dx$
- (B) $\int_2^5 \sqrt{1 + (3 + \cos x)} dx$
- (C) $\int_2^5 \sqrt{1 + (3 + \cos x)^2} dx$
- (D) $\int_2^5 \sqrt{1 + (3x + \sin x)^2} dx$

3. The length of the curve $y = \sqrt{1 - x^2}$ from $x = 0$ to $x = 1$ is most nearly equal to

- (A) 0.7854
- (B) 1.414
- (C) 1.518
- (D) 1.571

4. A robotic drawing pencil is using linear spline interpolation to trace a path consecutively through three data points (4,20), (6,10) and (9,25). What is the length of the path that the pencil traces if it begins at the first data point and ends at the last?

- (A) 15.297
- (B) 10.198
- (C) 7.071
- (D) 25.495

5. A path is traversed consecutively through three points (2,4), (5,11), (8,3) using a quadratic polynomial. Estimate the exact length of the path up to at least 4 significant digits. Use only MATLAB or some other program to do this problem - do not do it manually as it will take time.

(A) 16.701

(B) 6.0827

(C) 16.160

(D) 51.387

6. A cable hangs between two poles that are 50 feet apart. The shape of the cable is given by

$$f(x) = a \cosh\left(\frac{x}{a}\right), -25 \leq x \leq 25,$$

where a is dependent on the tension in the cable and the weight per unit length of the cable, and x is measured between the poles but from the center of cable. If the length of the cable is 60 feet, the formula that will allow us to find the value of a is

(A) $2 a^2 \sinh\left(\frac{25}{a}\right) = 60$

(B) $2 a \sinh\left(\frac{25}{a}\right) = 60$

(C) $2 a \sinh\left(\frac{25}{a}\right) = 50$

(D) $2 a^2 \sinh\left(\frac{25}{a}\right) = 50$

