DeVry University Spring 2005

Math 230: Applied Calculus II Matlab Assignment #2A

Due Wednesday Week #6 (4/15/2003)

Title: Computing Arc Lengths

Objectives: To learn how to use Matlab to approximate arc lengths in two ways,
To become familiar with the trapezoid rule for numerical integration
To learn how use Matlab's script m-files

Instructions:

(1) All of your instructions should be listed in a script m-file. A completed assignment will consist of this m-file, the text output and any resulting figures.

(2) The point of this assignment is to numerically compute the arc length of a curve. We noticed that it is difficult to compute the arc length of most curves analytically.

(3) Construct an array of 11 equally spaced numbers beginning at 0 and ending at $\frac{2\pi}{3}$. (*Hint*: Use **linspace**)

(4) For each of these x-values determine y-values using the formula $y = \sin(3x)$.

(5) Use the **diff** command and the distance formula to determine the distances between the points described by these (x,y) pairs.

(6) Sum these distances to approximate the arc length of the curve $y = \sin(3x)$ on $[0, \frac{2\pi}{3}]$.

(7) Alternatively, analytically calculate an expression for **ds** at any given x-value using the formula $ds = \sqrt{1 + [f'(x)]^2}dx$.

(8) Use this formula to numerically approximate the arc length of the curve $y = \sin(3x)$ using the **trapezoid rule** described in the **Matlab workshop**.

(9) Now, repeat these calculations using arrays of 101 and 1001 equally spaced numbers respectively.

(10) Finally, using the arrays that you have already created, plot three approximations to the curve $y = \sin(3x)$ using 11, 101 and 1001 points each.

```
%% Approximates the Arc Length of the curve y = sqrt(16 - 4x^2) on the interval[0,1].
clc
format compact
format long g
a=0, b=1, n=10, dx1=(b-a)/n
x1=linspace(a,b,n+1) % Break up the interval into n=10 parts
y1=2*sqrt(4-x1.^2) % Determines the height at each point x1
dist1 = sqrt(diff(x1).^2+diff(y1).^2) % Computes distances between points
arclength1 = sum(dist1) % sums the distances
% Alternate method using ds = sqrt(1 + [dy/dx]^2) dx,
% Where dy/dx = -2x/sqrt(4-x^2), and ds = sqrt((4+3x^2)/(4-x^2))
ds = sqrt((4+3*x1.^2)./(4-x1.^2))
otherarclength1 = dx1*(sum(ds)-(ds(1)+ds(end))/2)
abs(arclength1-otherarclength1)
exact = 1.1706509330085367745 % The exact answer (to 15+ decimals) using elliptic integrals.
```

DeVry University Spring 2005

Math 230: Applied Calculus II Matlab Assignment #2B

Due Wednesday Week #6 (4/15/2003)

Title: Computing Arc Lengths

Objectives: To learn how to use Matlab to approximate arc lengths in two ways,
To become familiar with the trapezoid rule for numerical integration
To learn how use Matlab's script m-files

Instructions:

(1) All of your instructions should be listed in a script m-file. A completed assignment will consist of this m-file, the text output and any resulting figures.

(2) The point of this assignment is to numerically compute the arc length of a curve. We noticed that it is difficult to compute the arc length of most curves analytically.

(3) Construct an array of 11 equally spaced numbers beginning at 0 and ending at $\frac{2\pi}{5}$. (*Hint*: Use **linspace**)

(4) For each of these x-values determine y-values using the formula $y = \sin(5x)$.

(5) Use the **diff** command and the distance formula to determine the distances between the points described by these (x,y) pairs.

(6) Sum these distances to approximate the arc length of the curve $y = \sin(5x)$ on $[0, \frac{2\pi}{5}]$.

(7) Alternatively, analytically calculate an expression for **ds** at any given x-value using the formula $ds = \sqrt{1 + [f'(x)]^2}dx$.

(8) Use this formula to numerically approximate the arc length of the curve $y = \sin(5x)$ using the **trapezoid rule** described in the **Matlab workshop**.

(9) Now, repeat these calculations using arrays of 101 and 1001 equally spaced numbers respectively.

(10) Finally, using the arrays that you have already created, plot three approximations to the curve $y = \sin(5x)$ using 11, 101 and 1001 points each.

```
%% Approximates the Arc Length of the curve y = sqrt(16 - 4x^2) on the interval[0, 1].
clc
format compact
format long g
a=0, b=1, n=10, dx1=(b-a)/n
x1=linspace(a,b,n+1) % Break up the interval into n=10 parts
y1=2*sqrt(4-x1.^2) % Determines the height at each point x1
dist1 = sqrt(diff(x1).^2+diff(y1).^2) % Computes distances between points
arclength1 = sum(dist1) % sums the distances
% Alternate method using ds = sqrt(1 + [dy/dx]^2) dx,
% Where dy/dx = -2x/sqrt(4-x^2), and ds = sqrt((4+3x^2)/(4-x^2))
ds = sqrt((4+3*x1.^2)./(4-x1.^2))
otherarclength1 = dx1*(sum(ds)-(ds(1)+ds(end))/2)
abs(arclength1-otherarclength1)
exact = 1.1706509330085367745 % The exact answer (to 15+ decimals) using elliptic integrals.
```

DeVry University Spring 2005

Math 230: Applied Calculus II Matlab Assignment #2C

Due Wednesday Week #6 (4/15/2003)

Title: Computing Arc Lengths

Objectives: To learn how to use Matlab to approximate arc lengths in two ways,
To become familiar with the trapezoid rule for numerical integration
To learn how use Matlab's script m-files

Instructions:

(1) All of your instructions should be listed in a script m-file. A completed assignment will consist of this m-file, the text output and any resulting figures.

(2) The point of this assignment is to numerically compute the arc length of a curve. We noticed that it is difficult to compute the arc length of most curves analytically.

(3) Construct an array of 11 equally spaced numbers beginning at 0 and ending at $\frac{2\pi}{7}$. (*Hint*: Use **linspace**)

(4) For each of these x-values determine y-values using the formula $y = \sin(7x)$.

(5) Use the **diff** command and the distance formula to determine the distances between the points described by these (x,y) pairs.

(6) Sum these distances to approximate the arc length of the curve $y = \sin(7x)$ on $[0, \frac{2\pi}{7}]$.

(7) Alternatively, analytically calculate an expression for **ds** at any given x-value using the formula $ds = \sqrt{1 + [f'(x)]^2}dx$.

(8) Use this formula to numerically approximate the arc length of the curve $y = \sin(7x)$ using the **trapezoid rule** described in the **Matlab workshop**.

(9) Now, repeat these calculations using arrays of 101 and 1001 equally spaced numbers respectively.

(10) Finally, using the arrays that you have already created, plot three approximations to the curve $y = \sin(7x)$ using 11, 101 and 1001 points each.

```
%% Approximates the Arc Length of the curve y = sqrt(16 - 4x^2) on the interval[0,1].
clc
format compact
format long g
a=0, b=1, n=10, dx1=(b-a)/n
x1=linspace(a,b,n+1) % Break up the interval into n=10 parts
y1=2*sqrt(4-x1.^2) % Determines the height at each point x1
dist1 = sqrt(diff(x1).^2+diff(y1).^2) % Computes distances between points
arclength1 = sum(dist1) % sums the distances
% Alternate method using ds = sqrt(1 + [dy/dx]^2) dx,
% Where dy/dx = -2x/sqrt(4-x^2), and ds = sqrt((4+3x^2)/(4-x^2))
ds = sqrt((4+3*x1.^2)./(4-x1.^2))
otherarclength1 = dx1*(sum(ds)-(ds(1)+ds(end))/2)
abs(arclength1-otherarclength1)
exact = 1.1706509330085367745 % The exact answer (to 15+ decimals) using elliptic integrals.
```

DeVry University Spring 2005

Math 230: Applied Calculus II Matlab Assignment #2D

Due Wednesday Week #6 (4/15/2003)

Title: Computing Arc Lengths

Objectives: To learn how to use Matlab to approximate arc lengths in two ways,
To become familiar with the trapezoid rule for numerical integration
To learn how use Matlab's script m-files

Instructions:

(1) All of your instructions should be listed in a script m-file. A completed assignment will consist of this m-file, the text output and any resulting figures.

(2) The point of this assignment is to numerically compute the arc length of a curve. We noticed that it is difficult to compute the arc length of most curves analytically.

(3) Construct an array of 11 equally spaced numbers beginning at 0 and ending at $\frac{2\pi}{9}$. (*Hint*: Use **linspace**)

(4) For each of these x-values determine y-values using the formula $y = \sin(9x)$.

(5) Use the **diff** command and the distance formula to determine the distances between the points described by these (x,y) pairs.

(6) Sum these distances to approximate the arc length of the curve $y = \sin(9x)$ on $[0, \frac{2\pi}{9}]$.

(7) Alternatively, analytically calculate an expression for **ds** at any given x-value using the formula $ds = \sqrt{1 + [f'(x)]^2}dx$.

(8) Use this formula to numerically approximate the arc length of the curve $y = \sin(9x)$ using the **trapezoid rule** described in the **Matlab workshop**.

(9) Now, repeat these calculations using arrays of 101 and 1001 equally spaced numbers respectively.

(10) Finally, using the arrays that you have already created, plot three approximations to the curve $y = \sin(9x)$ using 11, 101 and 1001 points each.

```
%% Approximates the Arc Length of the curve y = sqrt(16-4x^2) on the interval[0,1].
clc
format compact
format long g
a=0, b=1, n=10, dx1=(b-a)/n
x1=linspace(a,b,n+1) % Break up the interval into n=10 parts
y1=2*sqrt(4-x1.^2) % Determines the height at each point x1
dist1 = sqrt(diff(x1).^2+diff(y1).^2) % Computes distances between points
arclength1 = sum(dist1) % sums the distances
% Alternate method using ds = sqrt(1+[dy/dx]^2)dx,
% Where dy/dx = -2x/sqrt(4-x^2), and ds = sqrt((4+3x^2)/(4-x^2))
ds = sqrt((4+3*x1.^2)./(4-x1.^2))
otherarclength1 = dx1*(sum(ds)-(ds(1)+ds(end))/2)
abs(arclength1-otherarclength1)
exact = 1.1706509330085367745 % The exact answer (to 15+ decimals) using elliptic integrals.
```

DeVry University Spring 2005

Math 230: Applied Calculus II Matlab Assignment #2E

Due Wednesday Week #6 (4/15/2003)

Title: Computing Arc Lengths

Objectives: To learn how to use Matlab to approximate arc lengths in two ways,
To become familiar with the trapezoid rule for numerical integration
To learn how use Matlab's script m-files

Instructions:

(1) All of your instructions should be listed in a script m-file. A completed assignment will consist of this m-file, the text output and any resulting figures.

(2) The point of this assignment is to numerically compute the arc length of a curve. We noticed that it is difficult to compute the arc length of most curves analytically.

(3) Construct an array of 11 equally spaced numbers beginning at 0 and ending at $\frac{2\pi}{11}$. (*Hint*: Use **linspace**)

(4) For each of these x-values determine y-values using the formula $y = \sin(11x)$.

(5) Use the **diff** command and the distance formula to determine the distances between the points described by these (x,y) pairs.

(6) Sum these distances to approximate the arc length of the curve $y = \sin(11x)$ on $[0, \frac{2\pi}{11}]$.

(7) Alternatively, analytically calculate an expression for **ds** at any given x-value using the formula $ds = \sqrt{1 + [f'(x)]^2}dx$.

(8) Use this formula to numerically approximate the arc length of the curve $y = \sin(11x)$ using the **trapezoid rule** described in the **Matlab workshop**.

(9) Now, repeat these calculations using arrays of 101 and 1001 equally spaced numbers respectively.

(10) Finally, using the arrays that you have already created, plot three approximations to the curve $y = \sin(11x)$ using 11, 101 and 1001 points each.

```
%% Approximates the Arc Length of the curve y = sqrt(16 - 4x^2) on the interval[0,1].
clc
format compact
format long g
a=0, b=1, n=10, dx1=(b-a)/n
x1=linspace(a,b,n+1) % Break up the interval into n=10 parts
y1=2*sqrt(4-x1.^2) % Determines the height at each point x1
dist1 = sqrt(diff(x1).^2+diff(y1).^2) % Computes distances between points
arclength1 = sum(dist1) % sums the distances
% Alternate method using ds = sqrt(1 + [dy/dx]^2) dx,
% Where dy/dx = -2x/sqrt(4-x^2), and ds = sqrt((4+3x^2)/(4-x^2))
ds = sqrt((4+3*x1.^2)./(4-x1.^2))
otherarclength1 = dx1*(sum(ds)-(ds(1)+ds(end))/2)
abs(arclength1-otherarclength1)
exact = 1.1706509330085367745 % The exact answer (to 15+ decimals) using elliptic integrals.
```