Matlab – Inline Function

- Matlab has many built-in functions that can be readily used:

  `sin(x), cos(x), sqrt(x), …`

- Custom functions can also be defined
- Easiest method is the inline function definition:

  »

$$f(x) = 2 + \sqrt{x}$$

Matlab "for" Loops

`for index=start-val: increment: end-val`

a single line or block of code separated by commas or semi-colons

`end`

1. The variable `index` is initialized with the value of _____
2. After each pass through the "for" loop the value of _____ will be added to the current value of `index`
3. Continue iterating around the loop with new values for `index` until _____

"for loop" Example

Try this Matlab code

```
a = 0.5;
b = 1.9;
delta_x = 0.2;
n = _____
for i = _____
     x_left = a + i*delta_x
     x_right = x_left + delta_x
end
```

Example #1

- Use Matlab to numerically integrate

$$f(x) = 2 + \sqrt{x}$$

- from $a=0.5$ to $b=1.9$ with step size $\Delta x = 0.2$
  - left Riemann sum

Example #1 – Left Riemann Sum

Add this Matlab code

```
a =0.5; b =1.9; delta_x = 0.2;
n = (b – a) / delta_x;

for i = 0 : 1 :
     x_left = a + i*delta_x;
     x_right = x_left + delta_x;

end
```

In-Class Example #2

- Use Matlab to numerically integrate

$$f(x) = 2 + \sqrt{x}$$

- from $a=0.5$ to $b=1.9$ with step size _____
  - right Riemann sum
  - center Riemann sum
  - trapezoidal rule

Matlab – "While" Iteration Methods

WHILE Repeat statements an indefinite number of times.

```
WHILE expression,
  statement1;
  statement2;
     :
  statement1;
END
```

- The statements are executed while the real part of the expression has all non-zero elements.

Matlab – "While" Iteration Methods

`WHILE expression,`

- The `expression` is usually the result of a logical test

`expr1` _____ `expr2`

- where _____ is
  - == (equals) ~= (does not equal)
  - < (less than) <= (less than or equal to)
  - > (greater than) >= (greater than or equal to)

"While" Example

Try this Matlab code

```
t = 0
v_final = -180.0
delta_t = 0.5
v = 0
while _____________________________
     t = t + delta_t
     v = (-32.2)*t
end
```

Matlab Example #3

- An expression has been developed for the vertical acceleration of a human body during free-fall:

$$a(t) = -32.2\frac{\text{ft}}{\text{s}^2}\cdot \text{e}^{\left(-0.052\cdot t^{1.623}\right)}$$

- Use Left Riemann sum with a step size of $\Delta t = 0.5sec$ to find
  - time to reach terminal velocity of -180 ft/s if initial velocity = 0 ft/s
  - distance traveled during this time interval

"While" Example – Left Riemann Sum

Add this Matlab code

```
t = 0; v_final = -180.0; delta_t = 0.5
v = 0; ____________
_____________________________________
while v > v_final,
     ________________________
     ________________________
     t = t + delta_t
end
```

Matlab Example #4

- An expression has been developed for the vertical acceleration of a human body during free-fall:

$$a(t) = -32.2\frac{\text{ft}}{\text{s}^2}\cdot \text{e}^{\left(-0.052\cdot t^{1.623}\right)}$$

- Use trapezoidal method with a step size of $\Delta t = 0.1sec$ to find
  - time to reach terminal velocity of -180 ft/s if initial velocity = 0 ft/s
  - distance traveled during this time interval