

MATLAB

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Lecture 19

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Finding the Indefinite Integral of a Function in MATLAB prog.

Example (1): Find the indefinite integral of the function $g(x) = \sin x$ in MATLAB prog. (or Find $\int \sin x dx$ in MATLAB prog.)

Answer:

```
>> syms x ↵  
>> g = sin(x); ↵  
>> int(g) ↵  
ans =  
    -cos(x)
```

Example (2): Find $\int (x^2 + x + 2) dx$ in MATLAB prog.

Answer:

```
>> syms x ↵  
>> y = x^2 + x + 2; ↵  
>> int(y) ↵  
ans =  
(x*(2*x^2 + 3*x + 12))/6
```

Example (3): Find $\int \sqrt{x} dx$ in MATLAB prog.

Answer:

```
>> syms x ↵  
>> f = sqrt(x); ↵  
>> int(f) ↵  
ans =  
(2*x^(3/2))/3
```

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Example (4): Find $\int \frac{1}{t+2} dt$ in MATLAB prog.

Answer:

\gg syms t \leftarrow

\gg y = 1/(t+2) ; \leftarrow

\gg int(y) \leftarrow

ans =

log(t+2)

Finding the Definite Integral of a Function in MATLAB prog.

Example (1): Find $\int_0^1 e^t dt$ in MATLAB prog.

Answer:

\gg syms t \leftarrow

\gg h = exp(t) ; \leftarrow

\gg int(h, 0, 1) \leftarrow

ans =

exp(1) - 1

Example (2): Find $\int_{-1}^2 (x+2) dx$ in MATLAB prog.

Answer:

\gg syms X \leftarrow

\gg y = X+2 ; \leftarrow

\gg int(y, -1, 2) \leftarrow

ans = 15/2

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Example (3): Find $\int_0^4 \sqrt{x} dx$ in MATLAB prog.

Answer:

\Rightarrow syms x \leftarrow

\Rightarrow y = sqrt(x); \leftarrow

\Rightarrow int(y, 0, 4) \leftarrow

ans = 16/3

Example (4): Find $\int_0^{10} \frac{1}{t+2} dt$ in MATLAB prog.

Answer:

\Rightarrow syms t \leftarrow

\Rightarrow y = 1/(t+2); \leftarrow

\Rightarrow int(y, 0, 10) \leftarrow

ans = log(6)

Exercises: Find each of the following in MATLAB prog. :

1) $\int \cos x dx$

2) $\int_{-1}^1 (x^2 + 4x + 1) dx$

3) $\int (e^x + x) dx$

4) $\int_0^2 (\tan x + \sqrt{x}) dx$

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Finding the Limit of a Function in MATLAB prog.

1) Finding the limit of a function $f(x)$ at $x \rightarrow 0$:

Example (1): Find $\lim_{x \rightarrow 0} \frac{1}{x+1}$ in MATLAB prog.

Answer:

```
>> syms x  
>> y = 1/(x+1);  
>> limit(y)  
ans =  
1
```

Example (2): Find $\lim_{x \rightarrow 0} \cos x$ in MATLAB prog.

Answer:

```
>> syms x  
>> y = cos(x);  
>> limit(y)  
ans =  
1
```

Example (3): Find $\lim_{x \rightarrow 0} \frac{7}{x^2-1}$ in MATLAB prog.

Answer:

```
>> syms x  
>> y = 7/(x^2-1);  
>> limit(y)  
ans =  
-7
```

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2) Finding the limit of a function $F(x)$ at $x \rightarrow a$:

Example (1) : Find $\lim_{x \rightarrow 2} \frac{1}{x+3}$ in MATLAB prog.

Answer :

```
>> syms X ↵  
>> y = 1/(X+3); ↵  
>> limit(y, 2) ↵  
ans =  
1/5
```

Example (2) : Find $\lim_{x \rightarrow 1} (x^2 + 3x - 1)$ in MATLAB prog.

Answer :

```
>> syms X ↵  
>> y = X^2 + 3*X - 1; ↵  
>> limit(y, 1) ↵  
ans =  
3
```

Example (3) : Find $\lim_{x \rightarrow 5} \cos x$ in MATLAB prog.

Answer :

```
>> syms X ↵  
>> y = cos(X); ↵  
>> limit(y, 5) ↵  
ans =  
cos(5)
```

Exercises : Find each of the following in MATLAB prog.

1) $\lim_{x \rightarrow 0} \frac{x^2 + 9}{x + 6}$ (ans. = 3/2) 2) $\lim_{x \rightarrow 1} \frac{(x+1)^2}{x+6}$ (ans. = 4/7)

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Finding the Sum of Finite Terms in MATLAB prog.

Example (1): Find the sum of the numbers from 1 to 9 in MATLAB prog.

Answer:

```
>> syms x ↵  
>> symsum(x, 1, 9) ↵  
ans = 45
```

Example (2): Find $\sum_{t=1}^6 \frac{1}{t}$ in MATLAB prog.

Answer:

```
>> syms t ↵  
>> symsum(1/t, 1, 6) ↵  
ans = 49/20
```

Example (3): Find $\sum_{x=1}^3 \frac{x+1}{2}$ in MATLAB prog.

Answer:

```
>> syms x ↵  
>> symsum((x+1)/2, 1, 3) ↵  
ans = 9/2
```

Exercises: Find each of the following in MATLAB prog.

1) $\sum_{x=1}^{100} x$ (ans. = 5050)

3) $\sum_{t=1}^5 t^2$ (ans. = 55)

2) $\sum_{r=1}^4 \frac{1}{r+1}$ (ans. = 77/60)

4) $\sum_{x=10}^{15} (x+1)$ (ans. = 81)

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Simplifying a Function in MATLAB prog.

Example (1): Simplify the function

$$f(x) = 2x^2 - 5x - 4x^2 + 3x - 44 \text{ in MATLAB prog.}$$

Answer:

>> syms x ↵

>> f = 2*x^2 - 5*x - 4*x^2 + 3*x - 44 ; ↵

>> simplify(f) ↵

ans =
$$-2*x^2 - 2*x - 44$$

Example (2): Simplify the function

$$y = \sin x + 3\cos x + 2x^2 + 2\sin x - \cos x + 3x^2 \text{ in MATLAB prog.}$$

Answer:

>> syms x ↵

>> y = sin(x) + 3*cos(x) + 2*x^2 + 2*sin(x) - cos(x) + 3*x^2 ; ↵

>> simplify(y) ↵

ans =
$$3*\sin(x) + 2*\cos(x) + 5*x^2$$