

## Differentiation

```
syms x
f(x) = x^2*cos(x)/(1+x^2);
g(x) = exp(-3*x);
dfg(x) = diff(f(x)*g(x),x)
```

dfg(x) =

$$\frac{2x e^{-3x} \cos(x)}{x^2 + 1} - \frac{3x^2 e^{-3x} \cos(x)}{x^2 + 1} - \frac{2x^3 e^{-3x} \cos(x)}{(x^2 + 1)^2} - \frac{x^2 e^{-3x} \sin(x)}{x^2 + 1}$$

```
simplify(dfg(x))
```

ans =

$$-\frac{x e^{-3x} (3x^3 \cos(x) - 2 \cos(x) + x^3 \sin(x) + 3x \cos(x) + x \sin(x))}{(x^2 + 1)^2}$$

```
d2f(x) = simplify(diff(f(x),x,2))
```

d2f(x) =

$$-\frac{7x^2 \cos(x) - 2 \cos(x) + 2x^4 \cos(x) + x^6 \cos(x) + 4x^3 \sin(x) + 4x \sin(x)}{(x^2 + 1)^3}$$

## Integration

```
f(x) = x^2*exp(-3*x);
F(x) = int(f(x),x)
```

F(x) =

$$-\frac{e^{-3x} (9x^2 + 6x + 2)}{27}$$

## Integration with limits

```
f(x) = x^3/sqrt(9-x^2);
g(x) = exp(cos(x));
fA = int(f(x),x,0,2)
```

fA =

$$18 - \frac{22\sqrt{5}}{3}$$

```
gA = int(g(x),x,-1,4)
```

gA =

$$\int_{-1}^4 e^{\cos(x)} dx$$

```
gAn = vpa(gA,8)
```

```
gAn = 6.6764823
```

## Taylor series

```
f(x) = log(4+x);  
g(x) = sin(x)/x;  
fT1(x) = taylor(f(x),x,1)
```

```
fT1(x) =
```

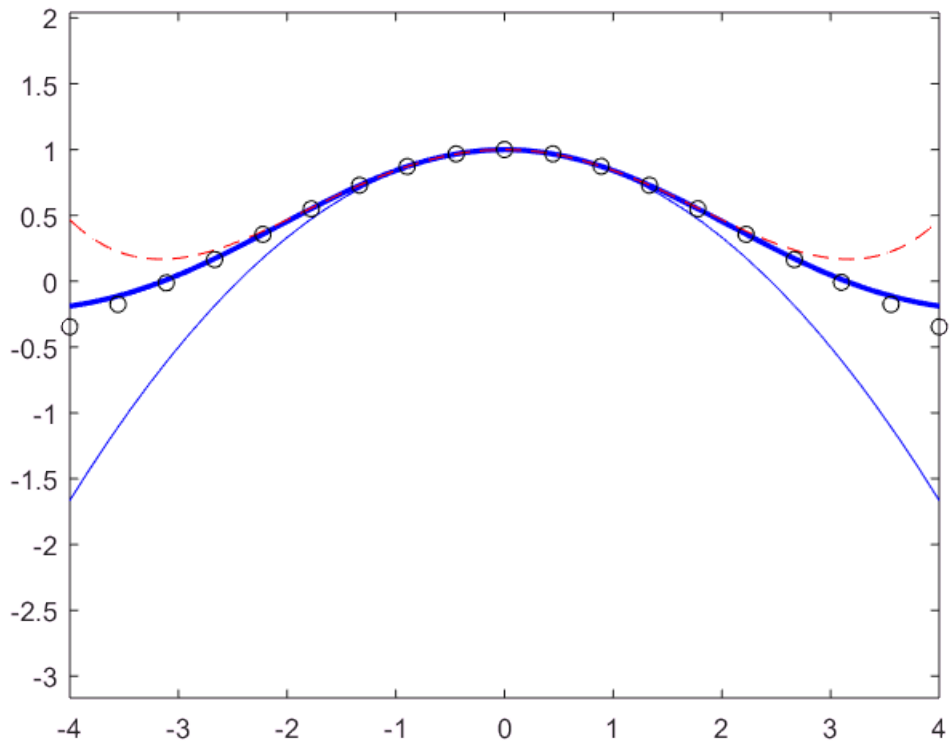
$$\frac{x}{5} + \log(5) - \frac{(x-1)^2}{50} + \frac{(x-1)^3}{375} - \frac{(x-1)^4}{2500} + \frac{(x-1)^5}{15625} - \frac{1}{5}$$

```
fT2(x) = taylor(f(x),x,-3,'Order',10)
```

```
fT2(x) =
```

$$x - \frac{(x+3)^2}{2} + \frac{(x+3)^3}{3} - \frac{(x+3)^4}{4} + \frac{(x+3)^5}{5} - \frac{(x+3)^6}{6} + \frac{(x+3)^7}{7} - \frac{(x+3)^8}{8} + \frac{(x+3)^9}{9} + 3$$

```
g4(x) = taylor(g(x),x,0,'Order',4);  
g6(x) = taylor(g(x),x,0,'Order',6);  
g8(x) = taylor(g(x),x,0,'Order',8);  
fplot(g(x),'b-','LineWidth',2)  
hold on  
fplot(g4(x),'b-')  
hold on  
fplot(g6(x),'r--')  
hold on  
fplot(g8(x),'ko')  
hold off  
xlim([-4 4])
```



```
%fplot([g(x) g4(x) g6(x) g8(x)])
```