

Finding solutions of equations

Above we defined the quadratic function $f = 3x^2 + 4x - 7$. We can use MATLAB to find a solution to this function. The OCTAVE function “solve (expression, variable)” will try to find the values of “variable” which satisfy the equation “expression = 0”. For example, type “solve (f == 0, x)” or `vpasolve(f == 0, x)`:

You must type ‘`pkg load symbolic`’ command and after that ‘`syms x`’ command.

```
>> solve(f, x)
```

Exercise

1. Solve for x,

i) $x^2 - 13x = 30$

ii) $2x^2 - 13x = -20$

iii) $1/x = 0$

iv) $x^3 - 6x^2 + 11x - 6 = 0$

2. Solve the following simultaneous equations using solve command,

$$\begin{array}{l} 3x + 2y = 36 \dots\dots\dots eqn\ 1 \\ 5x + 4y = 64 \dots\dots\dots eqn\ 2 \end{array}$$

[Use **solve (eqn1==0, ..., eqnN==0, var1, ..., varM)** Command]

Substitution

You can substitute a numerical value for a symbolic variable using “subs (f, a)” function. For example, define the symbolic expression:

```
>> f = 2*x^2 - 3*x + 1
```

```
>> subs(f, 2)
```

Exercise

Let $f(x) = x^2 - 13x - 30$ and $g(x) = (x^2 + 1)^{0.5}$

Find ,

- a) $f(2)$
- b) $f(3)$
- c) $g(\sqrt{3})$
- d) $f(g(\sqrt{8}))$

Differentiation

You can take the derivative of an expression with the "diff (f, x)" function. For example, to find the first derivative of $y = x^4$ with respect to x .

```
>> syms x
```

```
>> y = x^4
```

```
>> diff(y,x)
```

Differentiate followings

i) $y = 2t^3 - t^4 + t^{-2} + 9$

ii) $f(x) = \frac{x^2 + 3x + 2}{x^2 - 3x + 2}$

iii) $g(x) = \frac{2x^3 + 3x^2 - x + 5}{x^2}$

iv) $y = \sqrt{x}(x^2 - 5x + 2)$

v) $y = x^n$

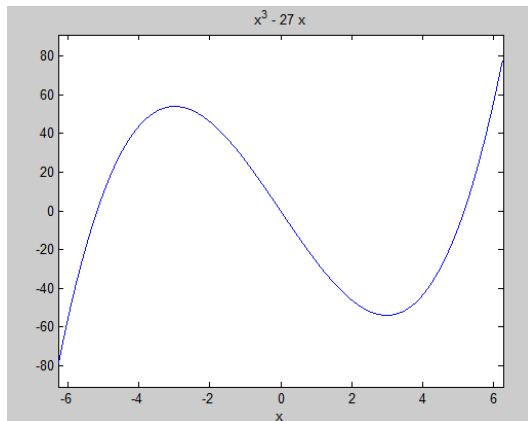
Plot

You can use the "ezplot" function to make 2D graphs from your symbolic variables.

For example:

```
>> y = x^3 - 27*x
```

```
>> ezplot(y)
```

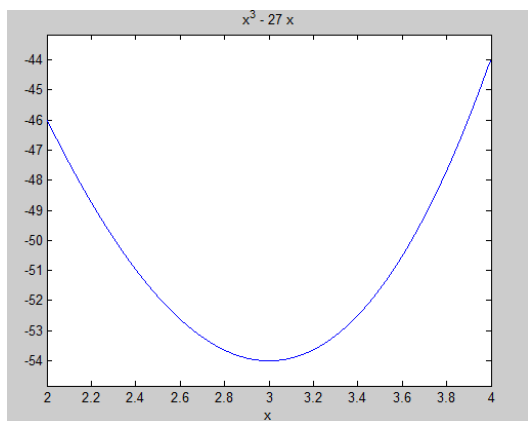


By default, ezplot graphs from $x=-2\pi$ to $x=+2\pi$. You can change the domain by adding a second argument to the call to ezplot.

For example, to plot the above function from $x=2$ to $x=4$

type:

```
>> ezplot(y,[2,4])
```



Integration

Int (expr,var) computes the indefinite integral of `expr` with respect to the symbolic scalar variable `var`. Specifying the variable `var` is optional. If you do not specify it, `int` uses the default variable determined by `symvar`. If `expr` is a constant, then the default variable is `x`.

Example 01:

```
syms x
f = -2*x/(1+x^2)^2;
int(f)

ans =
2/(2x^2 + 2)
```

Example 02:

```
>> syms x
f = -2*x/(1+x^2)^2;
int(f,2,3)

ans = -1/10
```

1) Integrate following questions manually and check your answer with Octave output.

i) $\int (2x^3 - 5x + 4).dx$

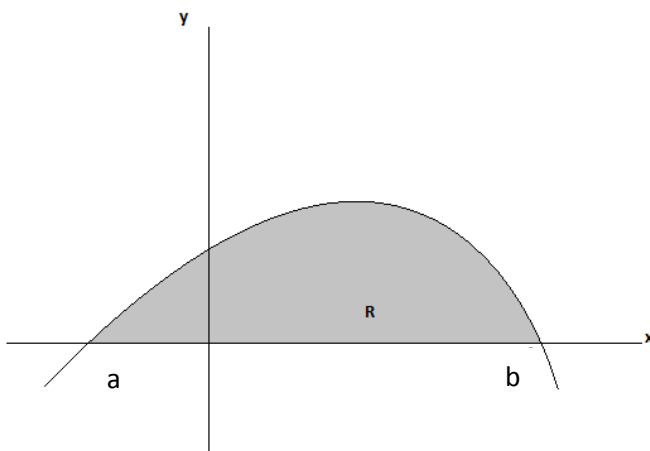
ii) $\int \left(\frac{x^4 + 2x^2 + 1}{x^2} \right) dx$

iii) $\int (x - 2)^2 dx$ [is $\int (x - 2)^2 dx = \frac{(x-3)^3}{3} + c ??$]

iv) $\int_2^4 (2x^3 - 5x + 4).dx$

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

2) The following figure shows the curve C with the equation, $y = -x^2 + 3x + 4$



The curve intersects the x axis at $x = a, x = b$. The region shown painted in the figure is bounded by C and the x axis.

Find a and b and Show that area of R is 20.833...