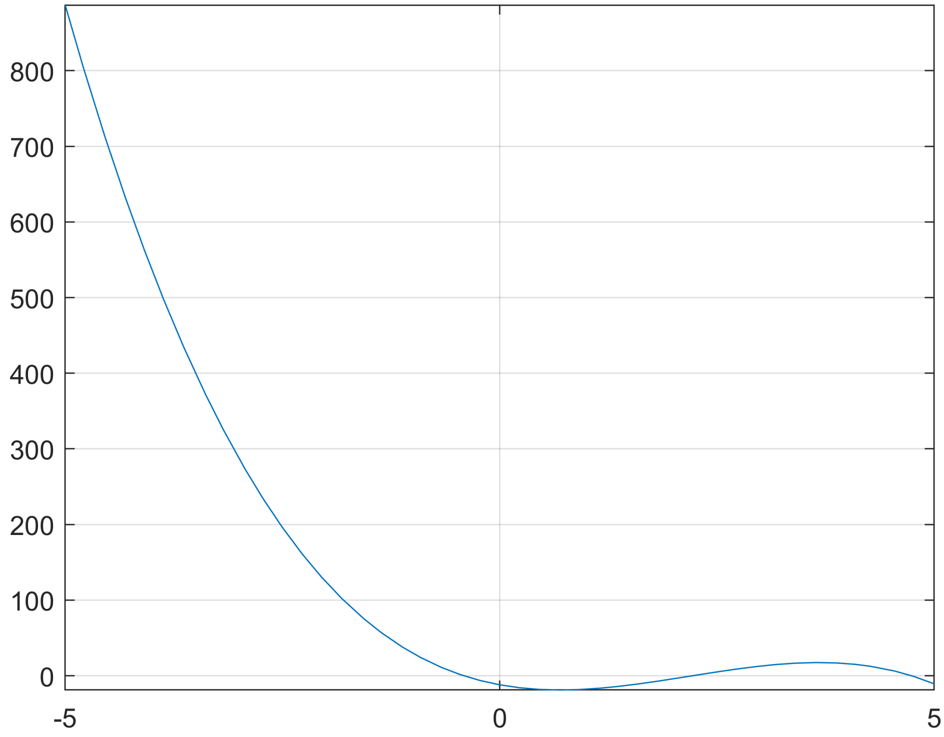
Ejercicios raíces

5.7 Determine the roots of f (x) = −12 − 21*x + 18*x^2 − 2.75*x^3 graphically. In addition, determine the first root of the function with bisection (linear interpolation and Newton-Raphson)

```
f = @(x) -12 - 21*x + 18*x.^2 - 2.75*x.^3;

fplot(f);
grid on;
```



This plot indicates that roots are located at about –0.4, 2.25 and 4.7. La primera raíz está en [-1,0].

```
[x, i] = biseccion(f, -1, 0)
```

```
x = -0.4147
i = 54
```

```
[x, i] = interpolacionLineal(f, -1, 0)
```

```
x = -0.4147
i = 55
```

```
[x, i] = newtonRaphson(f, -1, 0)
```

```
x = -0.4147
i = 4
```

```
[x, i] = biseccion(f, 2, 2.5)
```

```
x = 2.2198
i = 50
```

```
[x, i] = interpolacionLineal(f, 2, 2.5)
```

```
x = 2.2198
i = 55
```

```
[x, i] = newtonRaphson(f, 2, 2.5)
```

```
x = 2.2198
i = 3
```

```
[x, i] = biseccion(f, 4.5, 5)
```

```
x = 4.7403
i = 47
```

```
[x, i] = interpolacionLineal(f, 4.5, 5)
```

```
x = 4.7403
i = 16
```

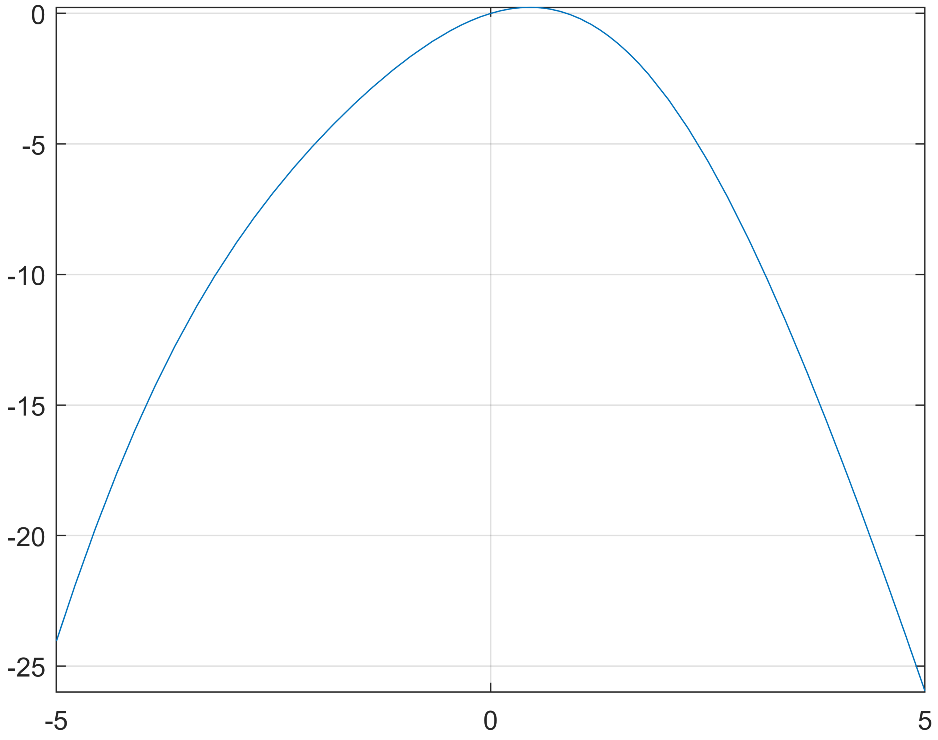
```
[x, i] = newtonRaphson(f, 4.5, 5)
```

```
x = 4.7403
i = 3
```

5.8 Locate the first nontrivial root of sin(x) = x^2 where x is in radians. Use a graphical technique and a numerical algorithm..

```
f = @(x) sin(x) - x.^2;

fplot(f);
grid on;
```



La raíz trivial es 0; la no trivial está en [0.5, 1].

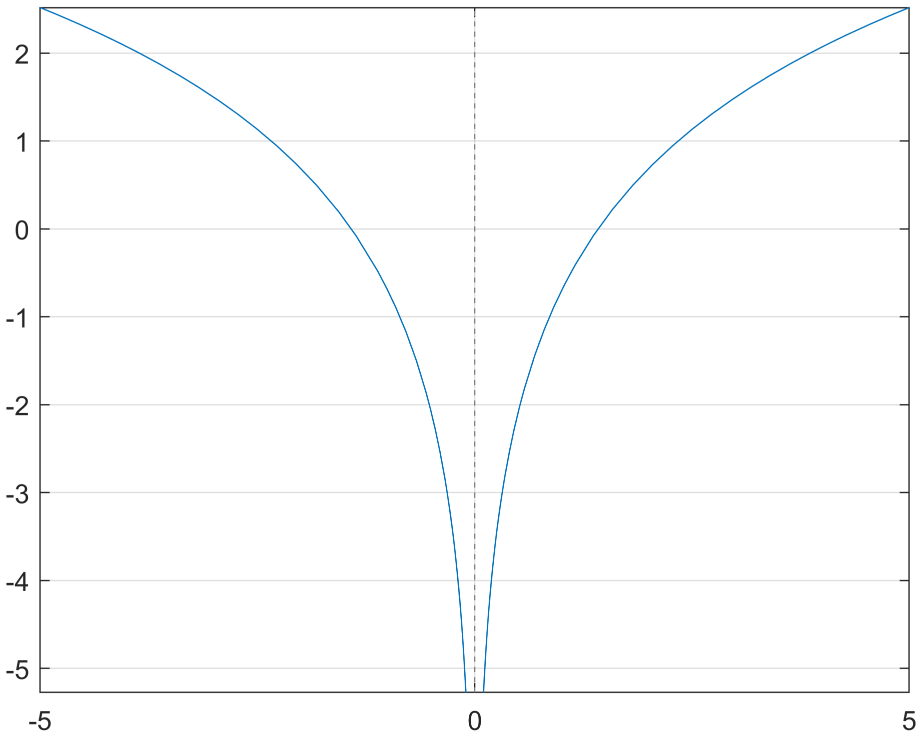
```
[x, i] = biseccion(f, 0.5, 1)
```

```
x = 0.8767
i = 51
```

5.9 Determine the positive real root of ln(x^2) = 0.7 (a) graphically, (b) using a numerical method, with initial guess in xl = 0.5 and xu = 2

```
f = @(x) log(x.^2) - 0.7;

fplot(f);
grid on;
```



La solución se encuentra en [1, 1.5].

```
[x, i] = biseccion(f, 1, 1.5)
```

```
x = 1.4191
i = 51
```

Ahora, con xl = 0.5 and xu = 2:

```
[x, i] = biseccion(f, 0.5, 2)
```

```
x = 1.4191
i = 53
```

Sí encuentra la raíz positiva pero en más iteraciones.

Escribe aquí las funciones bisección, interpolación lineal y Newton-Raphson.

```
function [xr, i] = biseccion(f, xl, xu)
    if sign(f(xl)) * sign(f(xu)) >= 0
        error('f(a) * f(b) < 0 no se satisface.')
    end

    MAX_ITER = 55;
    TOLER = eps;
    xr = (xl + xu) / 2;
    fx = f(xr);
    i = 0;
    while fx ~= 0 && abs((xu - xl) / xu) > TOLER && i < MAX_ITER
        if sign(f(xl)) == sign(fx)
            xl = xr;
        else
            xu = xr;
        end
        xr = (xl + xu) / 2;
        fx = f(xr);
        i = i + 1;
    end
end


function [x, i] = interpolacionLineal(f, a, b)
    if sign(f(a)) * sign(f(b)) >= 0
        error('f(a) * f(b) < 0 no se satisface.')
    end

    MAX_ITER = 55;
    TOLER = eps;
    fa = f(a);
    x = b - f(b) * (b - a) / (f(b) - fa);
    fx = f(x);
    i = 0;

    while abs((b - a) / x) > TOLER && fx ~= 0 && i < MAX_ITER
        if sign(fa) == sign(fx)
            a = x;
            fa = f(a);
        else
            b = x;
        end
        x = b - f(b) * (b - a) / (f(b) - fa);
        fx = f(x);
        i = i + 1;
    end
end


function [x, i] = newtonRaphson(f, a, b)
    REL_TOL = sqrt(eps);
    MAX_ITER = 53;
    x = (a + b) / 2;
    df = matlabFunction(diff(sym(f)));

    if nargin(df) == 0
        df = @(x) df();
    end

    i = 0;
    flag = true;
    while flag
        xp = x;
        x = xp - f(xp) / df(xp);
        i = i + 1;
        flag = i < MAX_ITER && abs((x - xp) / x) > REL_TOL;
    end
end
```