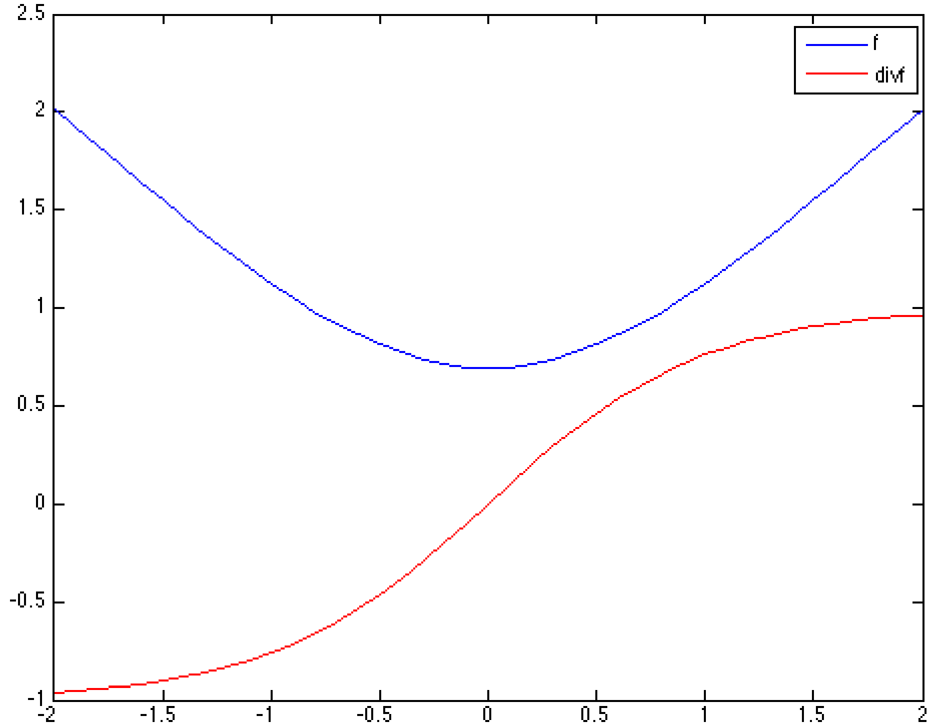
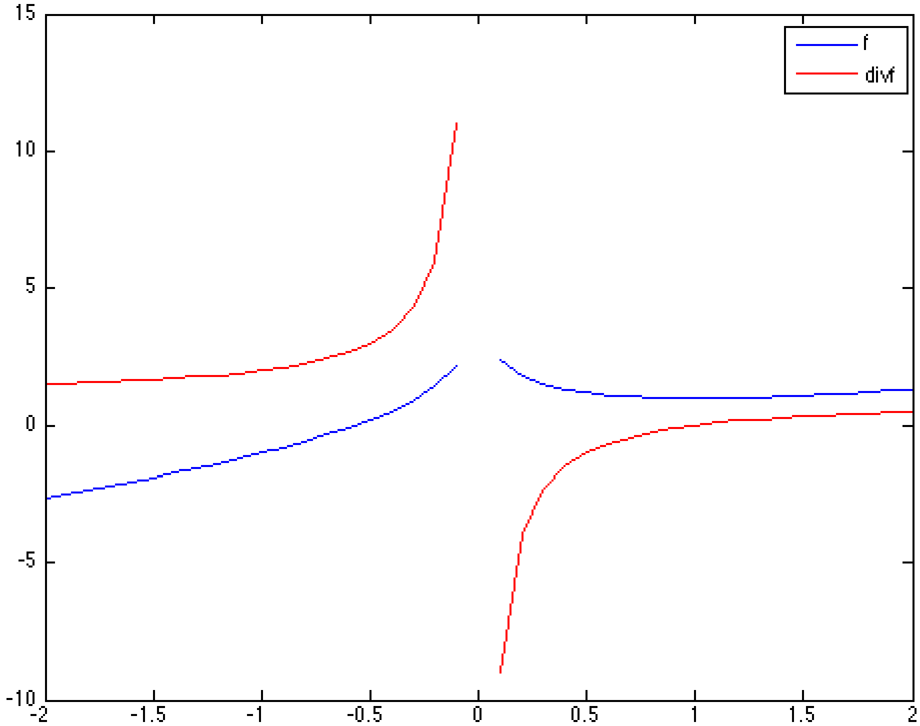
```matlab
% This is for the question 9.10 from bv_cvxhook
% pure Newon method: Newton?s method with fixed step size t = 1 can diverge
% if the initial point is not close to x?. consider two examples.

% (a) f(x) = log(ex + e?x) has a unique minimizer x? = 0. Run Newton?s
% method with fixed step size t = 1, starting at x(0) = 1 and at x(0) = 1.1.

x = -2:0.1:2;
y = @(x) log(exp(x)+exp(-x));
g = @(x) (exp(x)-exp(-x))./(exp(x)+exp(-x));
h = @(x) ((exp(x)+exp(-x)).^2-(exp(x)-exp(-x)).^2)./(exp(x)+exp(-x)).^2;
tol = 10^-12;
for x0 = [1 1.1]
    itn = 0;
    while abs(g(x0)) >= tol && itn<=10;
        x0 = x0 - h(x0)\g(x0);
        itn = itn+1;
        fprintf('%2.0f  %3.2e  %3.2e\n',itn,g(x0),x0);
    end
end
figure;plot(x,y(x));hold on; plot(x,g(x),'r');legend('f','divf');

% (b) f (x) = ? log x + x has a unique minimizer x? = 1. Run Newton?s method
% with fixed step size t = 1, starting at x(0) = 3.
clear;
x = -2:0.1:2;
y = @(x) -log(x) + x;
g = @(x) -1./x + 1;
h = @(x) 1/x^2;
tol = 10^-12;
for x0 = [3]
    itn = 0;
    while abs(g(x0)) >= tol && itn<=10;
        x0 = x0 - h(x0)\g(x0);
        itn = itn+1;
        fprintf('%2.0f  %3.2e  %3.2e\n',itn,g(x0),x0);
    end
end
figure;plot(x,y(x));hold on; plot(x,g(x),'r');legend('f','divf');
```

```
 1  -6.71e-01  -8.13e-01
 2  3.88e-01  4.09e-01
 3  -4.73e-02  -4.73e-02
 4  7.06e-05  7.06e-05
 5  -2.35e-13  -2.35e-13
 1  -8.11e-01  -1.13e+00
 2  8.44e-01  1.23e+00
 3  -9.35e-01  -1.70e+00
 4  1.00e+00  5.72e+00
 5  NaN  -2.30e+04
 1  1.33e+00  -3.00e+00
 2  1.07e+00  -1.50e+01
```

```
  3   1.00e+00   -2.55e+02

  4   1.00e+00   -6.55e+04
  5   1.00e+00   -4.29e+09
  6   1.00e+00   -1.84e+19
  7   1.00e+00   -3.40e+38
  8   1.00e+00   -1.16e+77
  9   1.00e+00   -1.34e+154
 10   1.00e+00   -Inf
 11   1.00e+00   -Inf
Warning: Imaginary parts of complex X and/or Y arguments ignored
```





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