Advanced Techniques

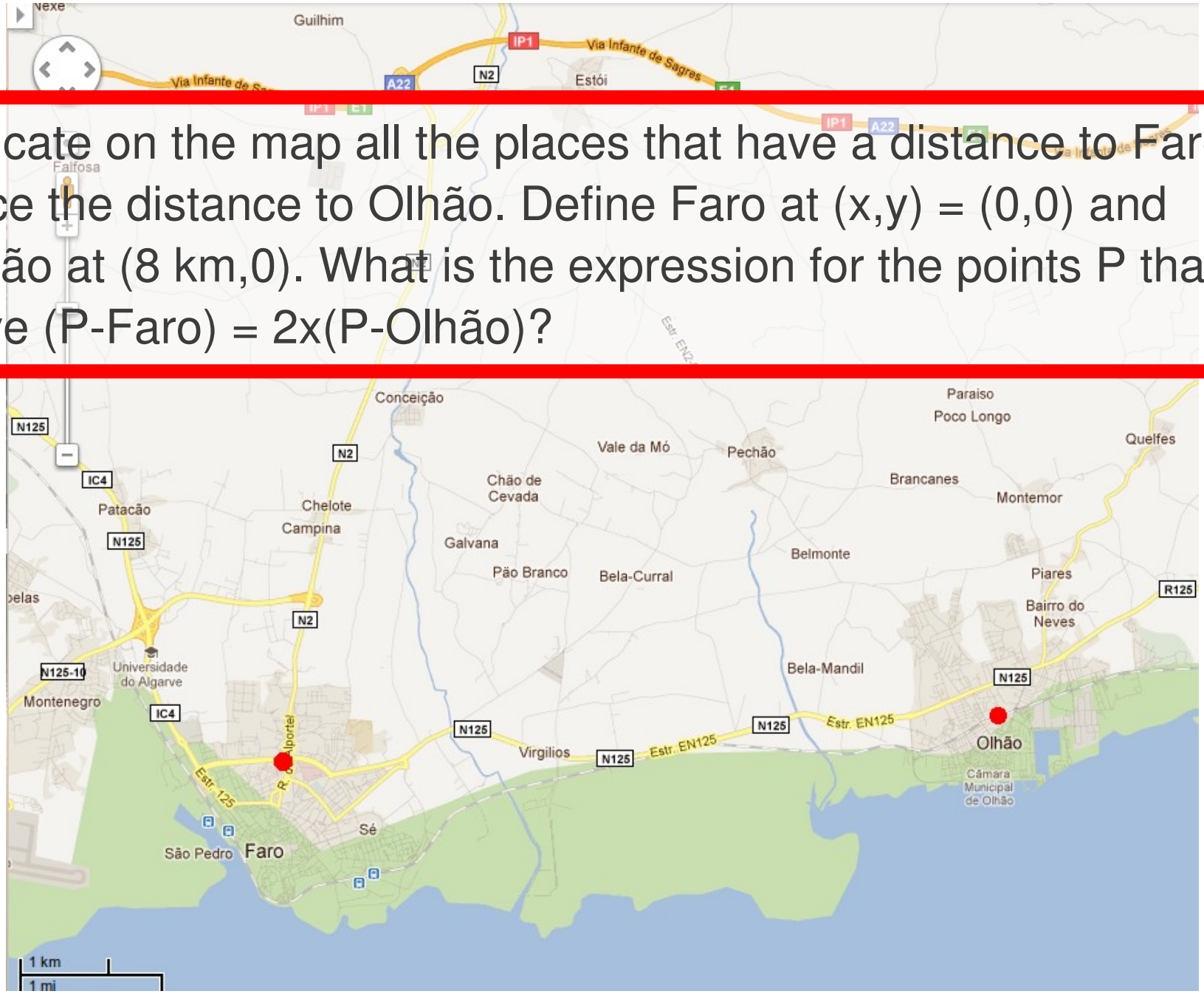
MIEET 1º ano

UAlg UNIVERSIDADE DO ALGARVE

30 anos 1979 | 2009

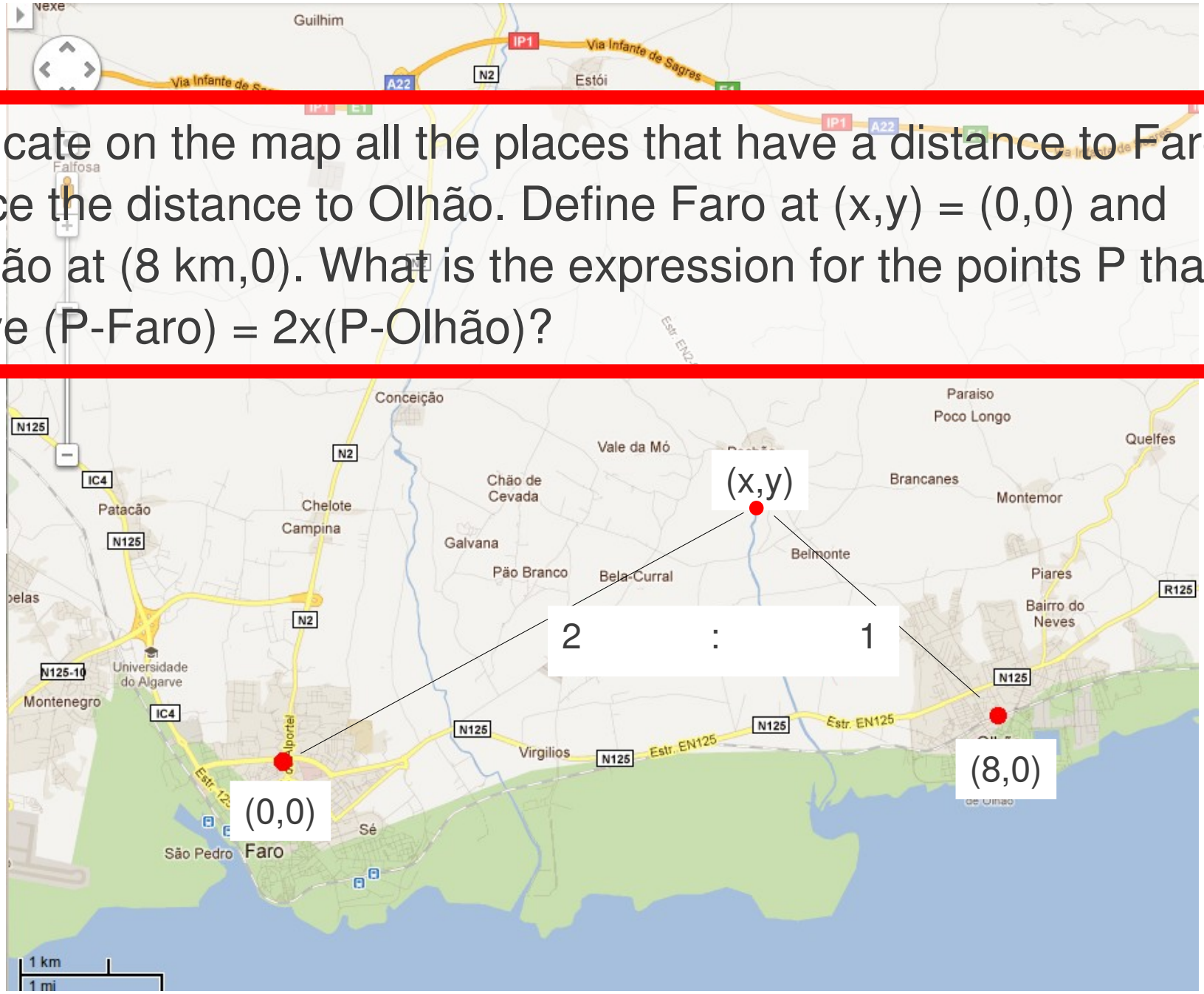
Beyond simple programming ....

Indicate on the map all the places that have a distance to Faro twice the distance to Olhão. Define Faro at (x,y) = (0,0) and Olhão at (8 km,0). What is the expression for the points P that have (P-Faro) = 2x(P-Olhão)?

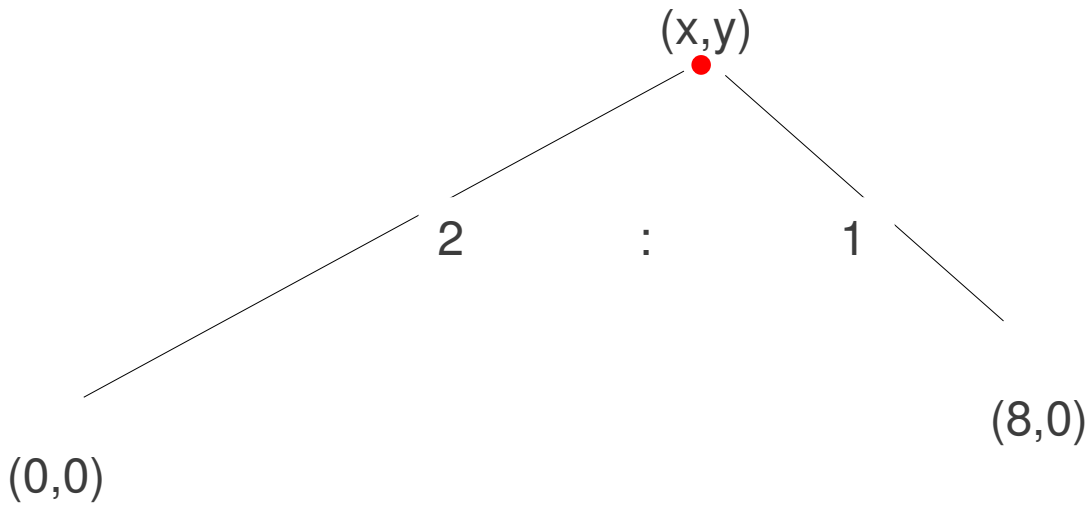


Example (T6)

Indicate on the map all the places that have a distance to Faro twice the distance to Olhão. Define Faro at (x,y) = (0,0) and Olhão at (8 km,0). What is the expression for the points P that have (P-Faro) = 2x(P-Olhão)?



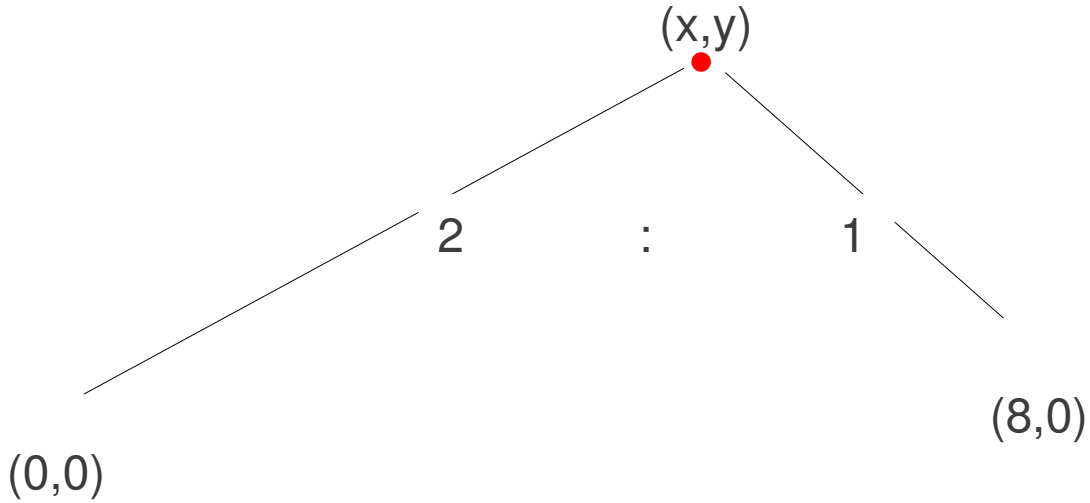
Equation



$$\sqrt{(x-0)^2+(y-0)^2}=2\sqrt{(x-8)^2+(y-0)^2}$$

$$x^2+y^2=4(x-8)^2+4y^2$$

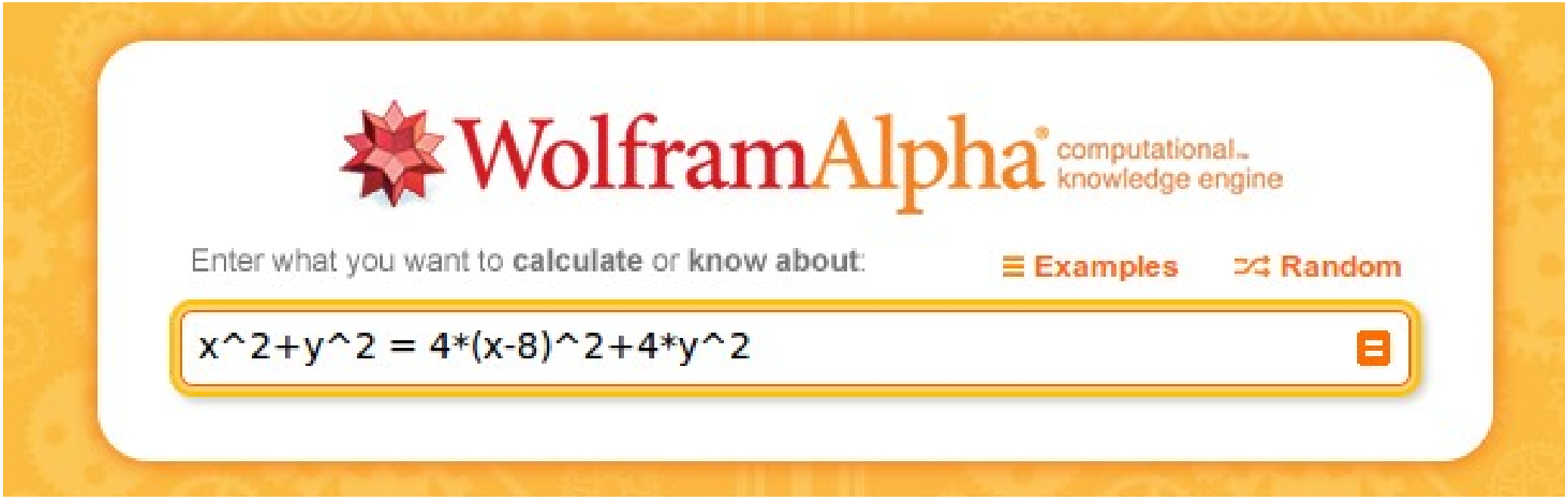
Equation

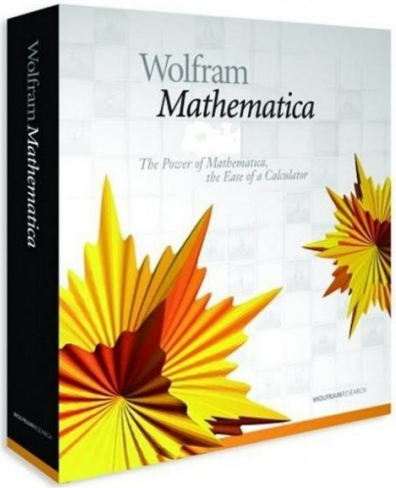


http://www.wolframalpha.com/

$$x^2 + y^2 = 4(x-8)^2 + 4y^2$$

Wolfram Alpha





*: Wolfram are the makers of Mathematica

Wolfram Alpha

WolframAlpha computational... knowledge engine

Enter what you want to calculate or know about:

x^2+y^2 = 4*(x-8)^2+4*y^2

Examples Random

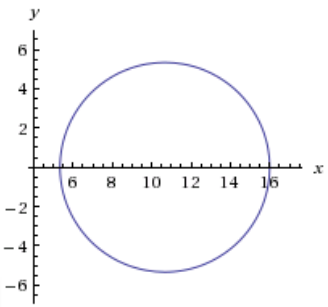
Input:

$x^2 + y^2 = 4\,(x - 8)^2 + 4\,y^2$

Geometric figure: Properties

circle

Implicit plot:



Alternate forms: More

$-3\,x^2 + 64\,x - 3\,y^2 = 256$

$-3\,x^2 + 64\,x - 3\,y^2 - 256 = 0$

$x^2 + y^2 = 4\left((x - 8)^2 + y^2\right)$

Expanded form: Show steps

$x^2 + y^2 = 4\,x^2 - 64\,x + 4\,y^2 + 256$

Integer solution:

$x = 16\,, \quad y = 0$

This is (like) cheating …

… but it gives the answer

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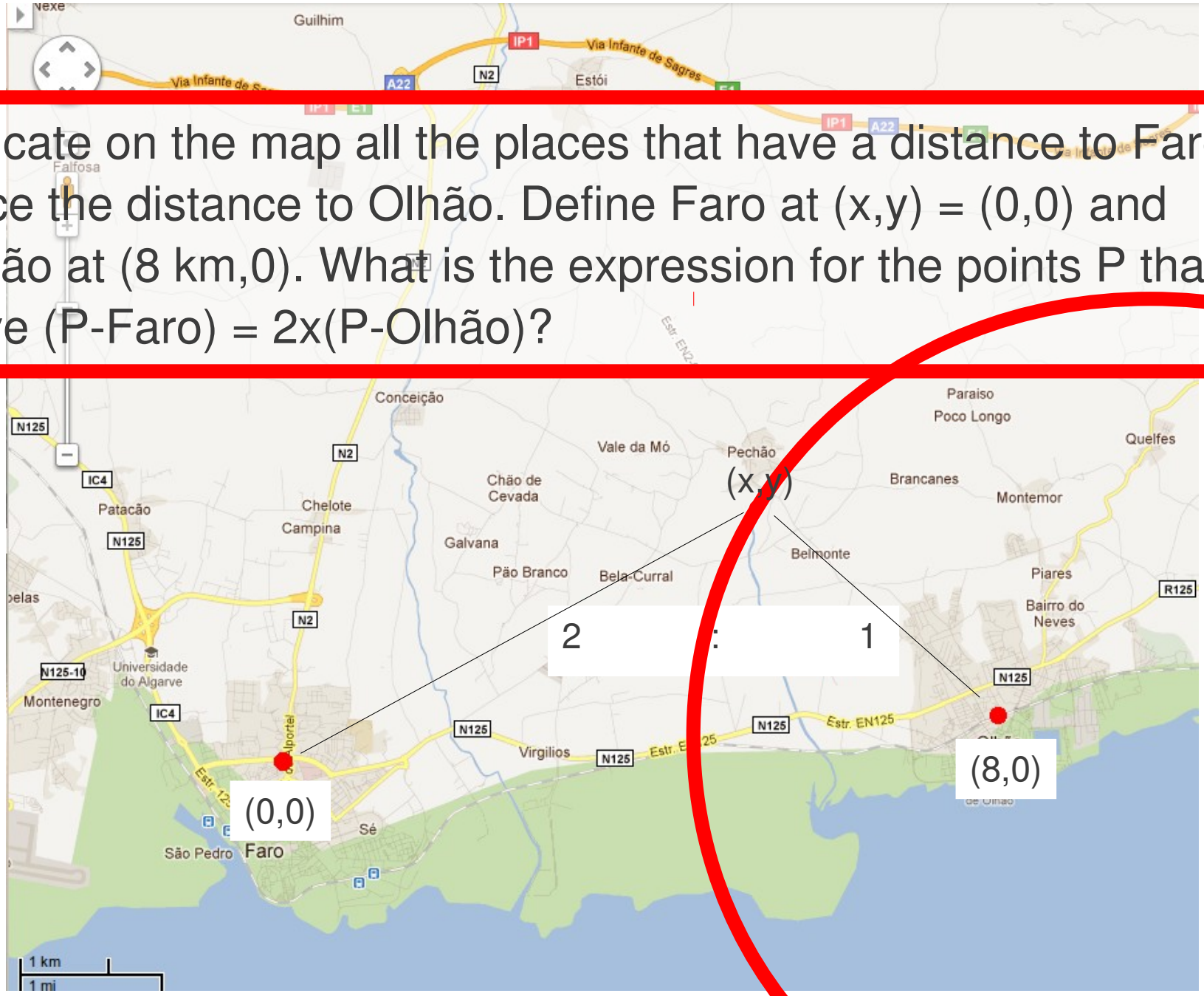
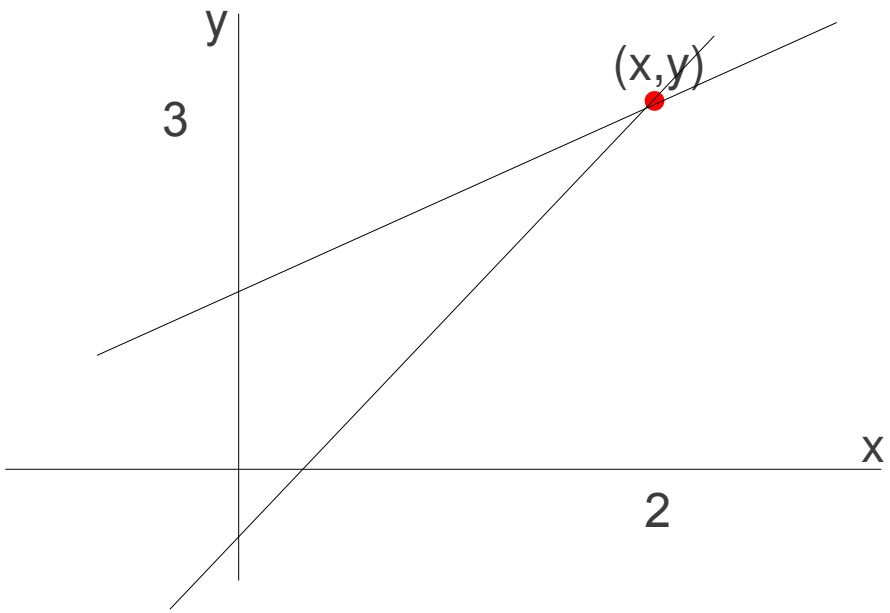


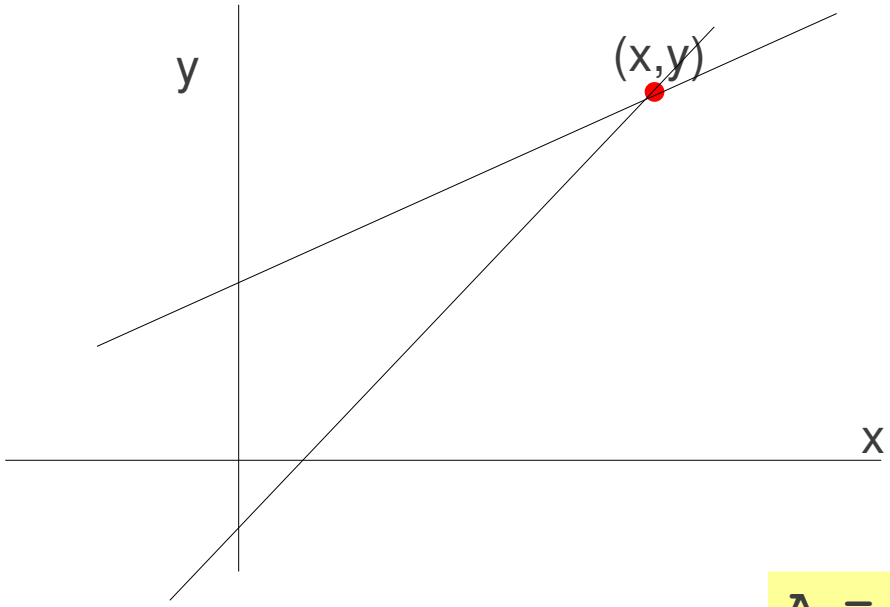
Set of linear equations



$$y = x + 1$$

$$y = 2x - 1$$

Set of linear equations



$$x - y = -1$$

$$2x - y = 1$$

```
A = [
   1, -1;
   2,-1
];

B = [
   -1;
   1
];

A\B
```

```
Ans =

     2
     3
```

x
y

Differential calculus

$$y = f(x) = e^x$$

$$\frac{dy}{dx} = ?$$

$$\int (f(x)) = ?$$

What is solution to: $$\frac{dy}{dx} = f(y, x)$$

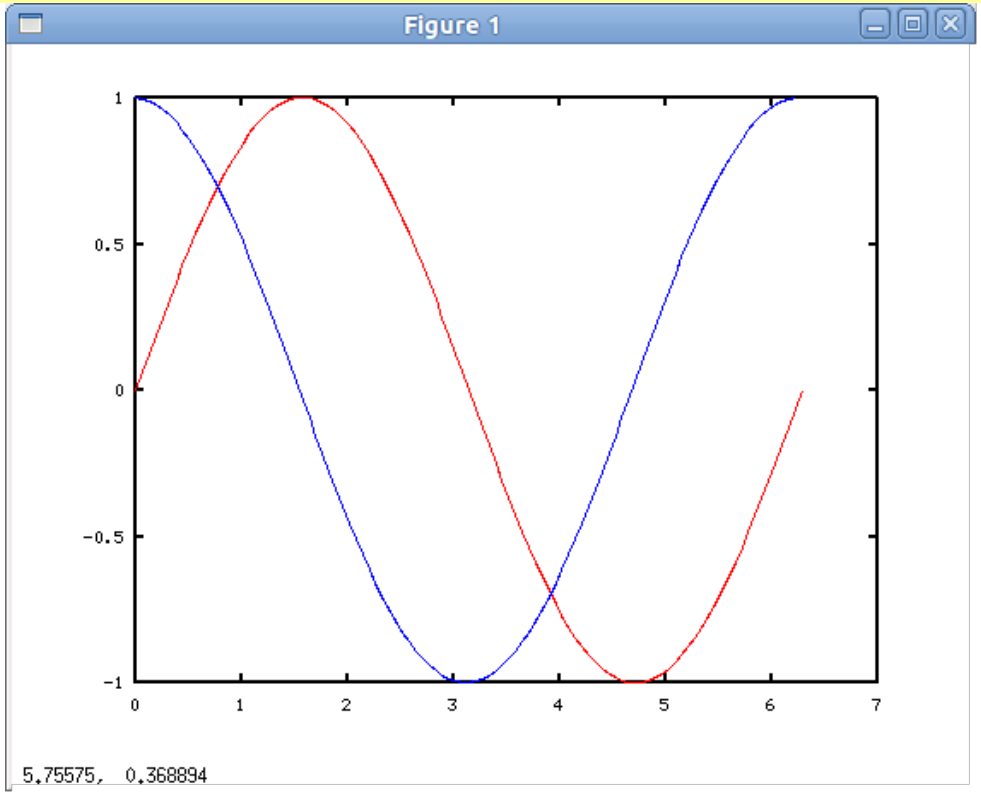
Differential calculus

$$y = f(x) = \sin(x)$$

$$\frac{dy}{dx} = ?$$

Numerical differential:

```
x = linspace(0, 2*pi, 101);
y = sin(x);
dydx = diff(y) ./ diff(x);
plot(x, y, 'r-', x(1:100), dydx, 'b-');
```



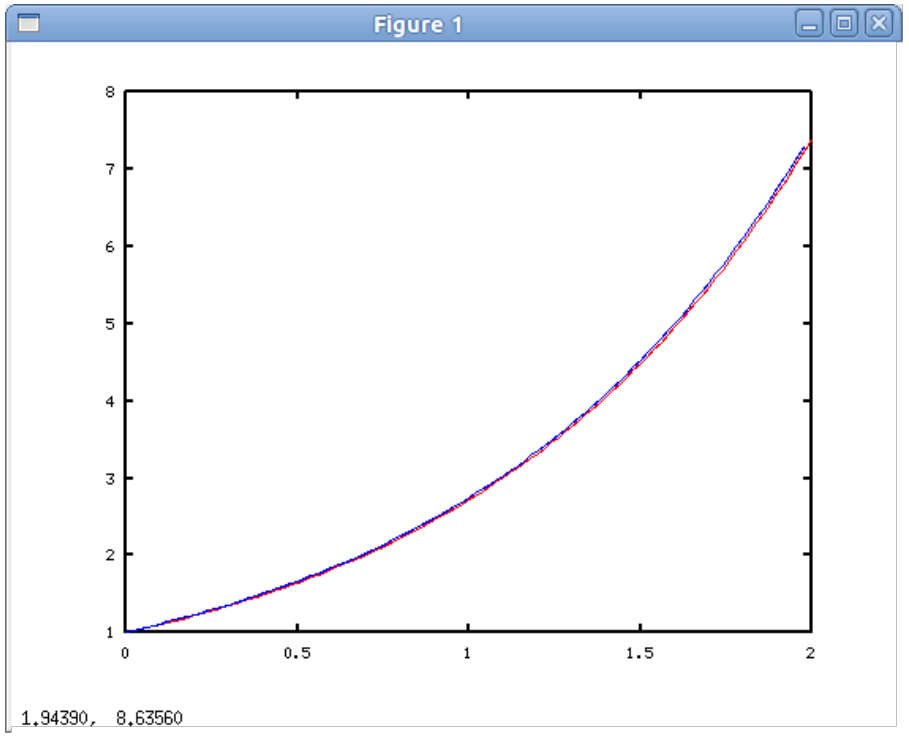
Differential calculus

$$y = f(x) = e^x$$

$$\int f(x) = ?$$

Numerical integral:

```
x = linspace(0, 2, 101);
y = exp(x);
inty = cumsum(y)*(2/100);
```



Differential equations

$$\frac{dy}{dx} = f(y, x)$$

Numerical solution:

```
y0 = 1;
x = linspace(0, 2*pi, 301);
ysol = lsode("f", y0, x);

y = ysol';
plot(x, y);
```