OPTIMIZATION

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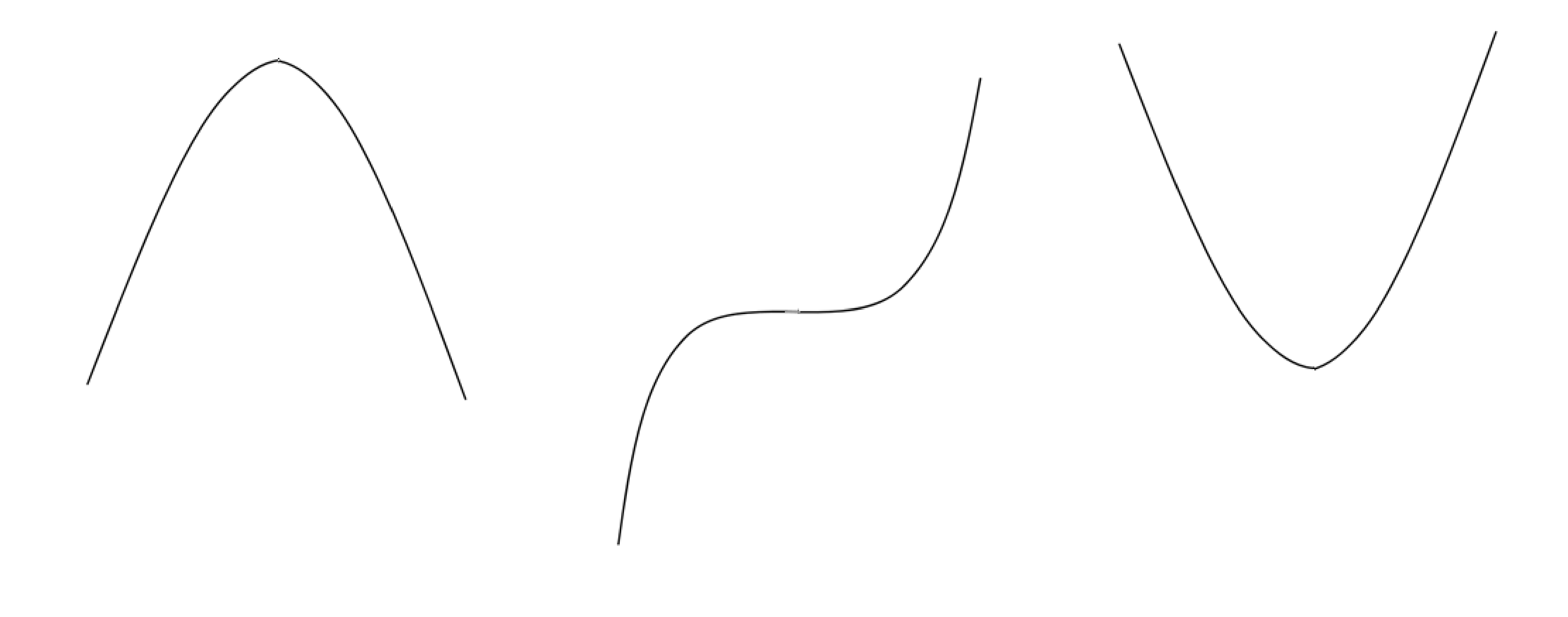
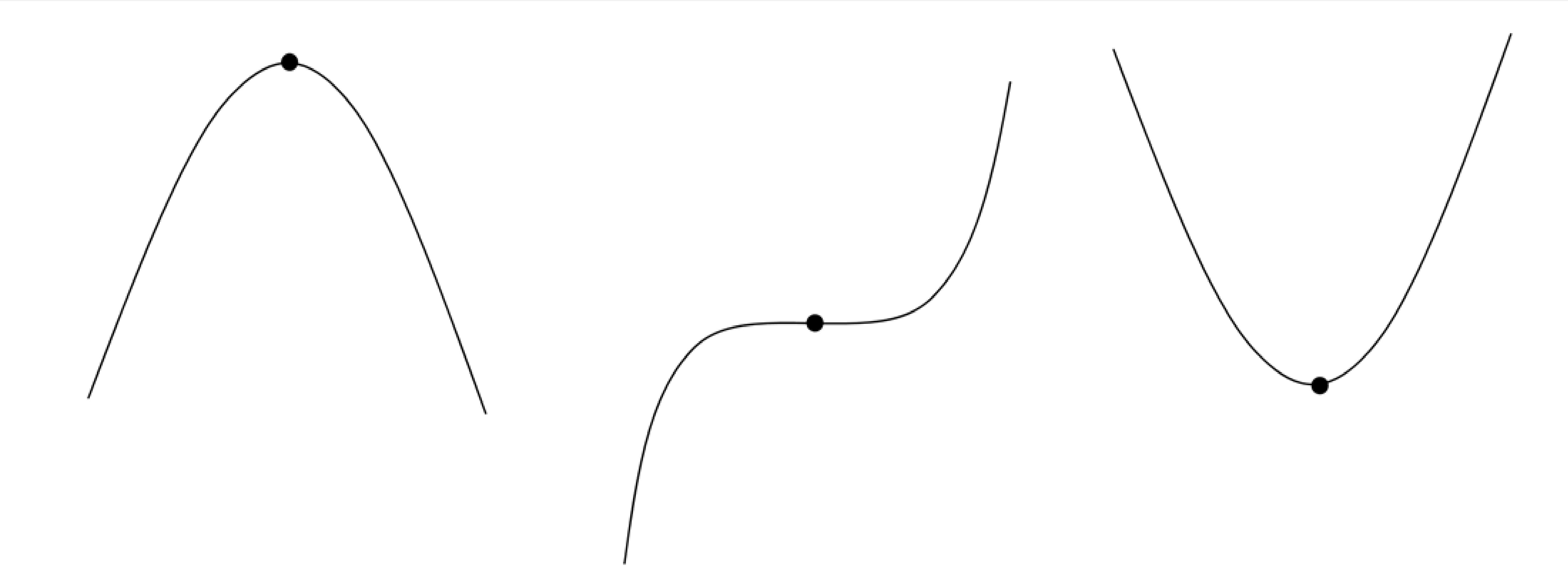
We should sell our house
Ok
Ok


Prices
30
25
20
15
10
5
0
1
3
5
7
9
11
y = 0.0076x4 - 0.2165x3 + 1.8017x2 - 3.5454x + 18.081

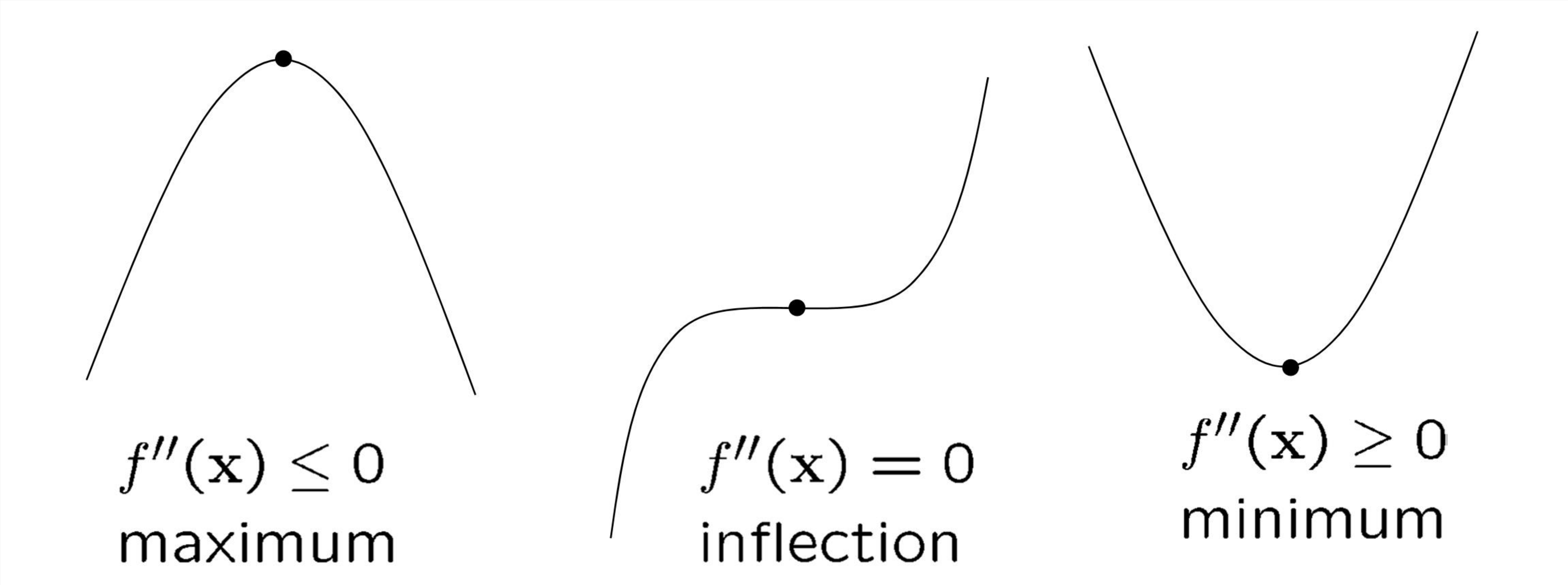
Unconstrained optimization



$f(\mathbf{x})$



$$f'(x) = 0$$


$f''(\mathbf{x}) \leq 0$
maximum
$f''(\mathbf{x}) = 0$
inflection
$f''(\mathbf{x}) \geq 0$
minimum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Constrained Optimization

THE CLOSED INTERVAL
METHOD

$$\min_{x} f(x) \text{ such that } x_1 < x < x_2.$$

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x = fminbnd(fun,x1,x2)
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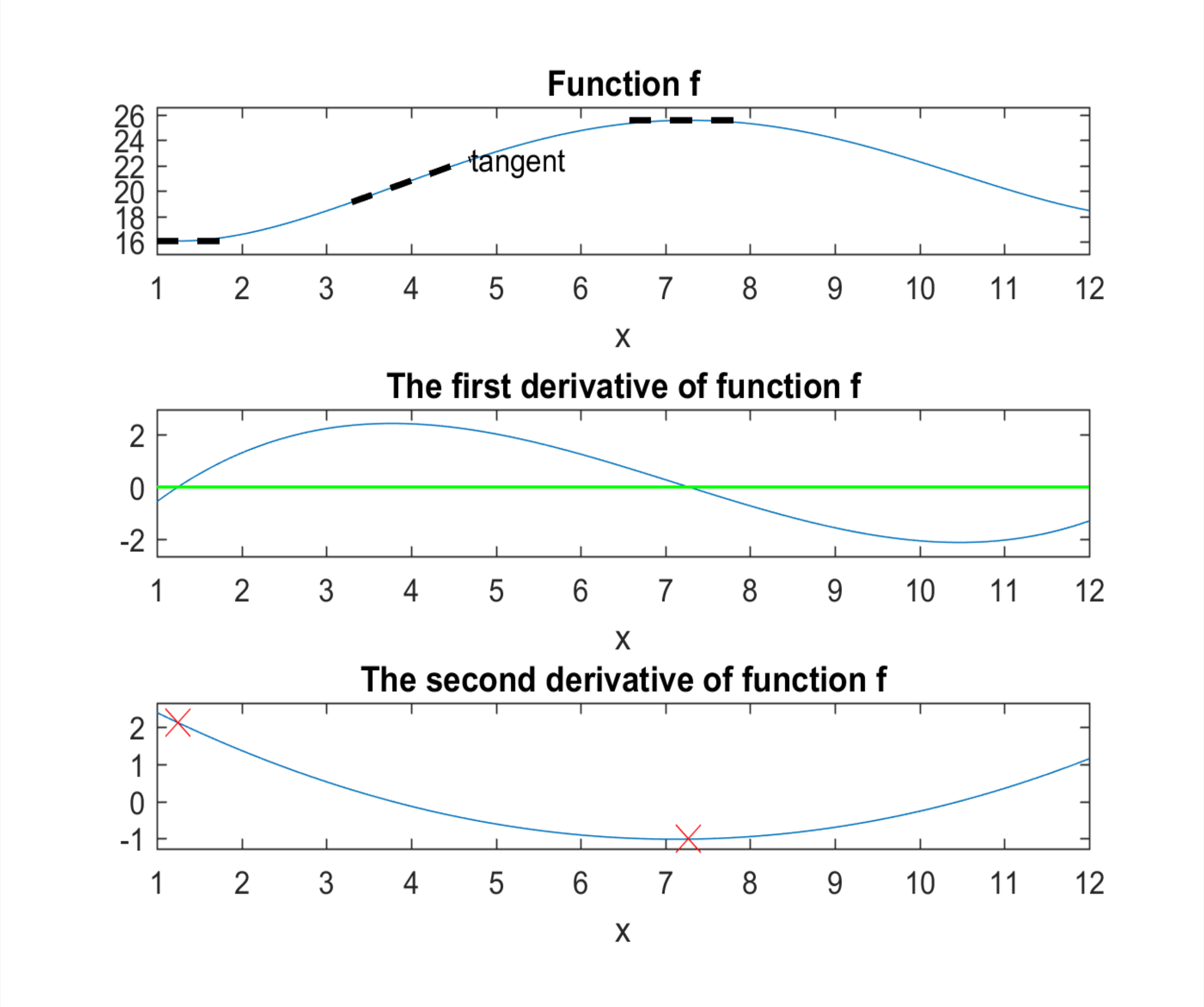
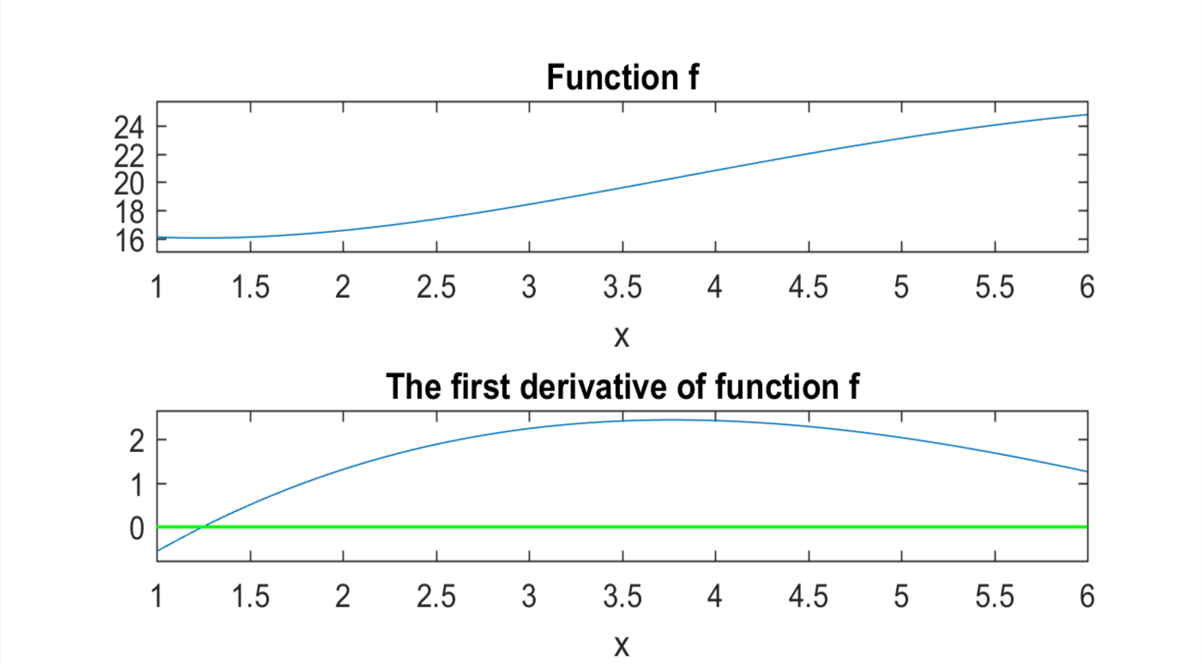
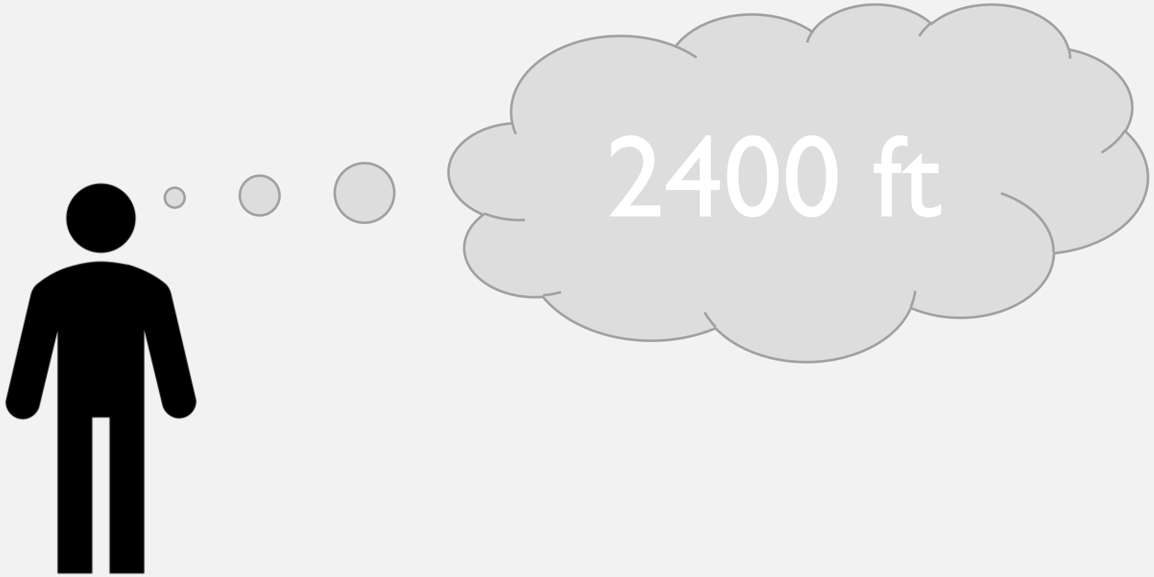
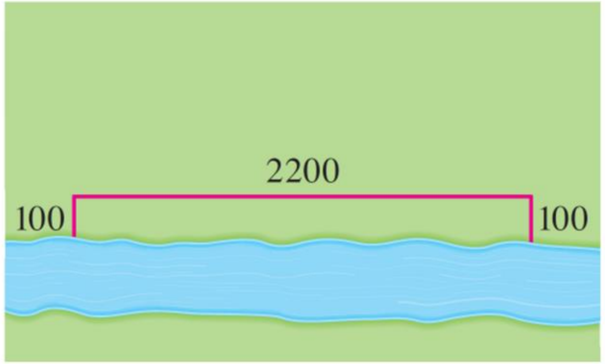
Function handle

m-File

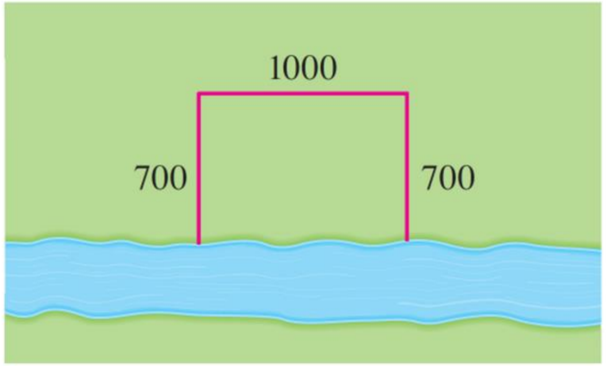

Function f
tangent
x
The first derivative of function f
x
The second derivative of function f
x


Function f
x
The first derivative of function f
x

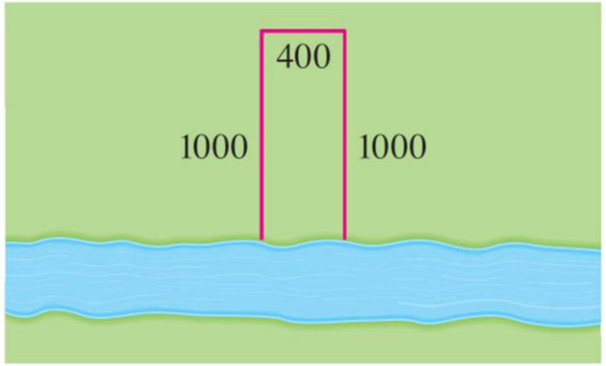




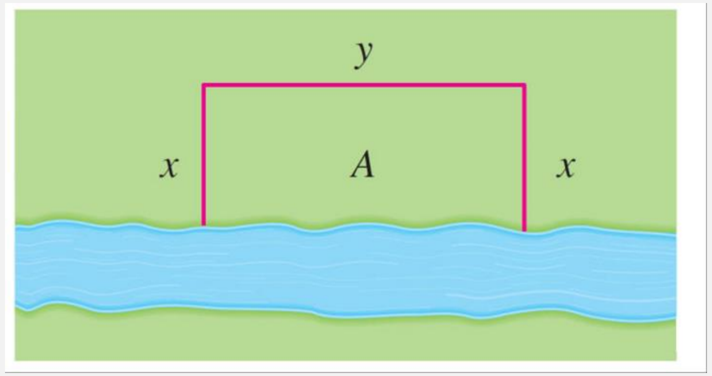
Area = $100 \cdot 2200 = 220{,}000$ ft^2



Area = $700 \cdot 1000 = 700{,}000$ ft^2



Area = $1000 \cdot 400 = 400{,}000$ ft^2



$$\text{Maximize: } A = xy$$

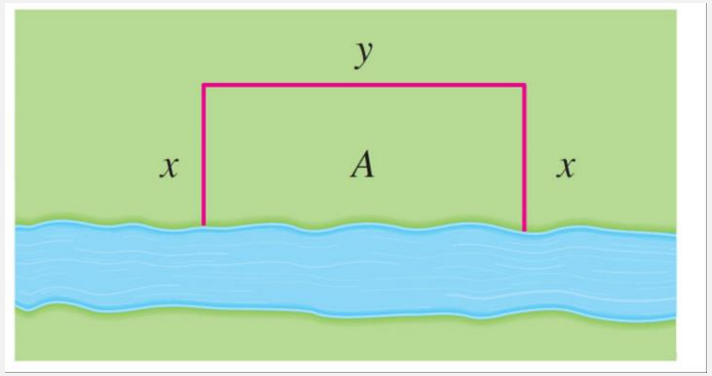
$$\text{Constraint: } 2x + y = 2400$$

$$y = 2400 - 2x$$

$$A = xy = x(2400 - 2x) = 2400x - 2x^2$$

$$y \geq 0 \implies 2400 - 2x \geq 0 \implies 1200 \geq x$$

$$x \geq 0.$$



Maximize: $A = 2400x - 2x^2$

Constraint: $x \in [0,1200]$

THE CLOSED INTERVAL METHOD

$$A'(x) = (2400x - 2x^2)' = 2400 - 4x$$

$$2400 - 4x = 0 \implies x = \frac{2400}{4} = 600$$

$$A(0) = 0, \quad A(600) = 2400 \cdot 600 - 2 \cdot 600^2 = 720,000, \quad A(1200) = 0$$

$$x = 600 \text{ ft}, \; y = 2400 - 2 \cdot 600 = 1200 \text{ ft}.$$