

AP Calculus AB - Optimization - Worksheet

Common Core AP CALC AB 5.10, AP CALC AB 5.11 · maths-pdf.fr/en/

Name: _____ Class: _____ Date: ____/____/____

These 20 problems practice optimization problems with fences, boxes, cans, closest points and revenue, including justifying a maximum or minimum (AP Calculus AB, topics 5.10, 5.11). The early problems build the basic skill, and each one uses a different function or situation so that no two feel alike.

Later problems cover cans, closest points, margins on a poster and pricing situations such as ticket sales. Work in pencil, show every step, and check the answer key only after a full attempt.

AP Calculus AB · Common Core State Standards: **AP CALC AB 5.10, AP CALC AB 5.11**

Exercise 1 - Maximum product

Two positive numbers have a sum of 20. Find the numbers that make their product as large as possible.

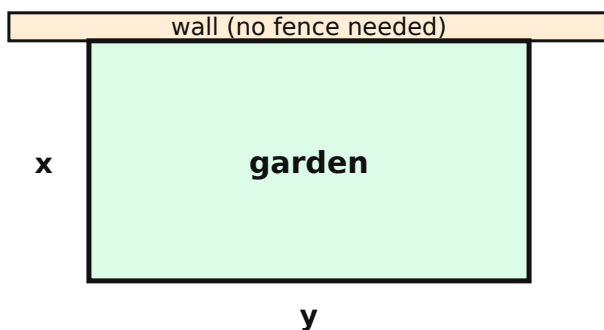
Exercise 2 - Minimum sum of squares

Two numbers add to 10. Find them so that the sum of their squares is as small as possible.

Exercise 3 - Maximum area, fixed perimeter

A rectangle has a perimeter of 200 ft. What dimensions give the greatest area?

Exercise 4 - Fence against a wall



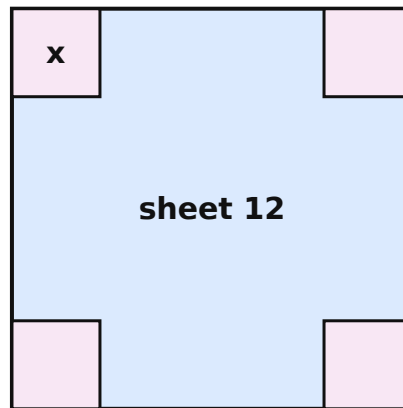
120 ft of fence for three sides.

A farmer has 120 ft of fence to enclose a rectangular pen against a barn wall (no fence is needed along the wall). Find the dimensions that maximize the area.

Exercise 5 - Minimum fence, fixed area

A rectangular field must have an area of 800 ft^2 . Find the dimensions that use the least fencing.

Exercise 6 - Open box from a square sheet



cut a square of side x from each corner, then fold up

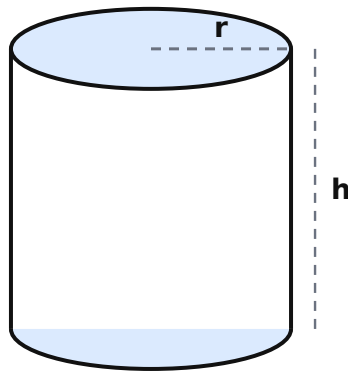
A 12-inch square sheet.

A square sheet of cardboard 12 in on a side has a square of side x cut from each corner, and the sides are folded up to make an open box. Find x that maximizes the volume.

Exercise 7 - Open box from a rectangle

A 10 in by 16 in piece of cardboard has squares of side x cut from the corners to make an open box. Find the maximum volume.

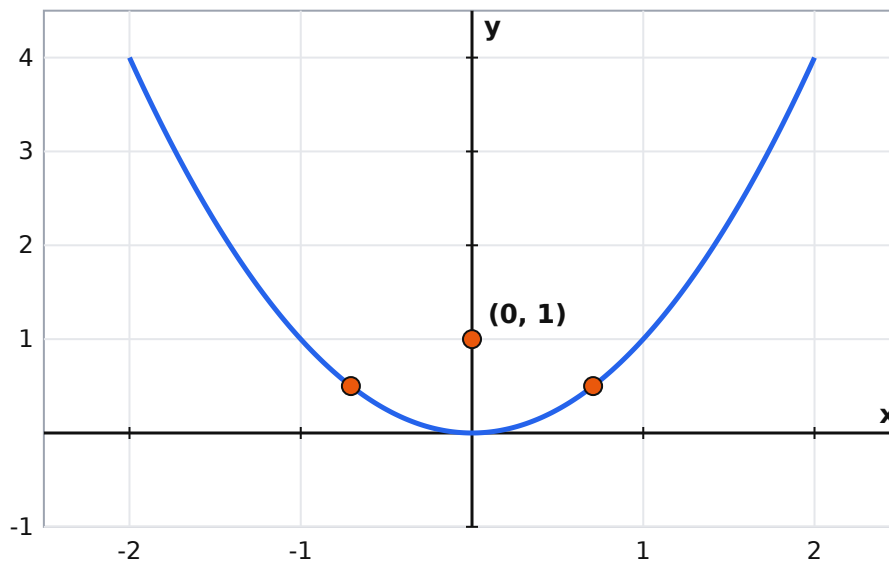
Exercise 8 - Can with least material



A closed can: volume 500 cm^3 .

A closed can must hold 500 cm^3 . Find the radius and height that use the least metal.

Exercise 9 - Closest point on a parabola



Parabola and the point $(0, 1)$.

Find the points on $y = x^2$ closest to $(0, 1)$.

Exercise 10 - Closest point on a line

Find the point on the line $y = 2x + 1$ closest to the origin.

Exercise 11 - Price for maximum revenue

A shop finds that at price p dollars it sells $q = 500 - 10p$ backpacks a week. What price maximizes revenue, and what is the revenue?

Exercise 12 - Maximizing profit

A bakery sells x pies at price $p = 20 - 0.01x$ dollars each, and the cost is $C(x) = 50 + 4x$. Find the number of pies that maximizes the profit.

Exercise 13 - Rectangle in a semicircle

A rectangle is inscribed in the upper half of the circle $x^2 + y^2 = 25$ with its base on the x -axis. Find the largest possible area.

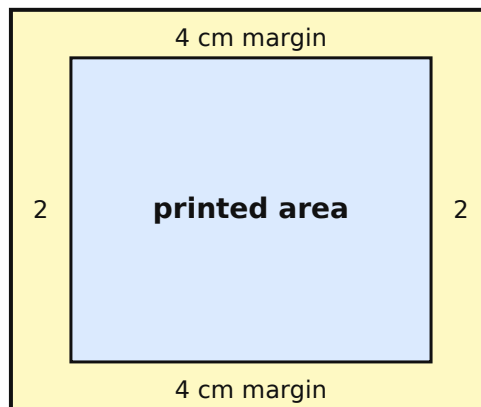
Exercise 14 - Rectangle under a parabola

A rectangle has its base on the x -axis and its upper corners on $y = 12 - x^2$. Find the greatest area.

Exercise 15 - Fencing with two prices

A rectangular lot of 800 ft^2 is fenced. Two opposite sides cost \\$5 per foot and the other two cost \\$10 per foot. Find the dimensions with the least cost.

Exercise 16 - Poster margins



Poster with margins.

A poster has a printed area of 200 cm^2 with 4 cm margins at the top and bottom and 2 cm margins on each side. Find the dimensions of the poster that use the least paper.

Exercise 17 - Open-top box

A box with a square base and no top must hold 1000 in^3 . Find the base side that uses the least material.

Exercise 18 - Closest point to (4, 0)

Find the point on $y = \sqrt{x}$ closest to (4,0).

Exercise 19 - Two adjacent pens

A rancher has 1000 ft of fence to make two adjacent rectangular pens sharing a middle fence (three parallel sides of length x and two of length y). Find the dimensions that maximize the total area.

Exercise 20 - Ticket price

A school play sells 200 tickets at \\$12 each. For every \\$1 increase in price, 10 fewer tickets are sold. What price gives the greatest revenue?