

Homework Key for Section 1

1. Sketch the graphs and find any absolute max/mins as well as local max/mins .

(a) none

(b) absolute min at $x = 0$

(c) absolute min at $x = 0$, absolute max at $x = 2$

2. Find the critical numbers of the function:

(a) $f(x) = 5x^2 + 4x$
 $-2/5$

(b) $f(x) = x^3 + 3x^2 - 24x$
 $-4, 2$

(c) $f(x) = 3x^4 + 4x^3 - 6x^2$
 $0, 1/2(-1 \pm \sqrt{5})$

3. Find the absolute mins and absolute maxs of f on the given intervals

(a) $f(-1) = 8$, $f(2) = -19$

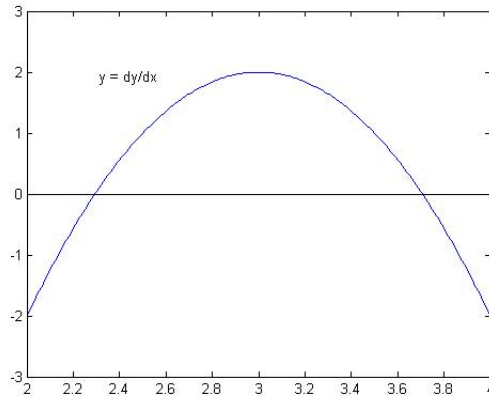
(b) $f(\sqrt{2}) = 2$, $f(-1) = -\sqrt{3}$

Homework Key for Section 2

1. Verify that $f(x) = 5 - 12x + 3x^2$ satisfies Rolle's Theorem and find any c that satisfies the conclusion.
 $c = 2$
2. Let $f(x) = 1 - x^{2/3}$. Show that $f(-1) = f(1)$ but there is no c in $(-1, 1)$ such that $f'(c) = 0$. Why is this not a counterexample?
f is not differentiable
3. Verify that $f(x) = 3x^2 + 2x + 5$ satisfies the MVT for $[-1, 1]$ and find any c that satisfies the conclusion.
 $c = 0$
4. Show that $f(x) = 1 + 2x + x^3 + 4x^5 = 0$ has exactly one real root.
use IVT
5. If $f(1) = 10$ and $f'(x) \geq 2$ for $1 \leq x \leq 4$, how small can $f(4)$ possibly be?
16
6. Does there exist a function f such that $f(0) = -1$, $f(2) = 4$ and $f'(x) \leq 2$ for all values of x ?
no

Homework Key for Section 3

1. The graph of f' is below. On what intervals is f increasing? Decreasing? What values of x are a local max? min?



Inc on (2.3, 3.7) Dec on (2, 2.3) and (3.7, 4) local max at $x = 3.7$ local min at $x = 2.3$

2. If $f(x) = x^4 - 2x^2 + 3$

(a) Find the intervals where f is increasing and decreasing

Inc on $(-1, 0)$ and $(1, \infty)$ Dec on $(-\infty, -1)$ and $(0, 1)$

(b) Find any local max and min

local max at $x = 0$, local min at $x = \pm 1$

(c) Find the intervals of concavity and inflection points.

CU on $(-\infty, -\sqrt{3}/3), (\sqrt{3}/3, \infty)$ CD on $(-\sqrt{3}/3, \sqrt{3}/3)$ IP at $x = \pm \sqrt{3}/3$

3. Find any local max/min of $f(x) = x^5 - 5x + 3$ **using the 2nd derivative test**
local max at $x = -1$, local min at $x = 1$

4. If $f(x) = 2x^3 - 3x^2 - 12x$

(a) Find the intervals where f is increasing and decreasing

Inc on $(-\infty, -1)$ and $(2, \infty)$ Dec on $(-1, 2)$

(b) Find any local max and min

local max at $x = -1$, local min at $x = 2$

(c) Find the intervals of concavity and inflection points.

CU on $(1/2, \infty)$ CD on $(-\infty, 1/2)$ IP at $x = 1/2$

5. Sketch a graph that satisfies the following conditions:

answers vary

Homework Key for Section 4

1. Find two numbers whose difference is 100 and whose product is a minimum.

$$-50, 50$$

2. Find two positive numbers whose product is 100 and whose sum is a minimum.

$$10, 10$$

3. Find the dimensions of a rectangle with perimeter 100 whose area is as large as possible.

$$25 \text{ by } 25$$

4. Farmer Joe wants to fence 1.5 million square feet in a rectangular field and then divide it in half with a fence parallel to one of the sides of the rectangle. How can he do this with a minimum cost for the fence?

$$1000 \text{ by } 1500$$

5. A rectangular storage container is to have a volume of 10 m^3 . The length of its base is twice the width. Material for the base costs \$10 per square meter. Material for the sides and top costs \$6 per square meter. Find the cost of the materials for the cheapest container.

$$\$191.28$$

6. A right circular cylinder is inscribed in a sphere of radius r . Find the largest possible surface area of such a cylinder.

$$\pi r^2(1 + \sqrt{5})$$

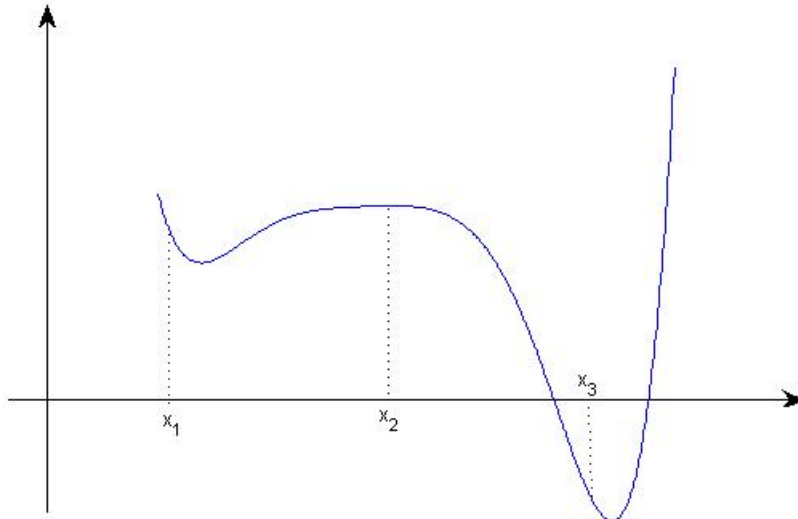
Homework Key for Section 5

1. Determine graphically what happens if Newton's method is used for each initial approximation.

(a) x_1 *doesn't work*

(b) x_2 *doesn't work*

(c) x_3 *works*



2. Find x_3 if $x^3 + 2x - 4 = 0$ and $x_1 = 1$

1.1797

3. Approximate the root of $x^4 - 2x^3 + 5x^2 - 6 = 0$ to six decimal places in the interval $[1, 2]$

1.217562

4. Why would Newton's method not work to find the root of $x^3 - 3x + 6 = 0$ if $x_1 = 1$

$f'(1) = 0$ *horizontal tangent line*

Homework Key for Section 6

1. Find the most general antiderivative of the following:

(a) $F(x) = \frac{1}{2}x^2 - 3x + C$

(b) $F(x) = \frac{1}{2}x + \frac{1}{4}x^3 - \frac{1}{5}x^4 + C$

(c) $F(x) = \frac{2}{3}x^3 + \frac{1}{2}x^2 - x + C$

(d) $F(x) = \frac{-5}{4x^8} + C$

(e) $F(x) = \frac{x^3}{3} - \frac{6}{\sqrt{x}} + C$

2. Find f for the following:

(a) $f(x) = x^3 + x^4 + Cx + D$

(b) $f(x) = (3/20)x^{8/3} + CX + D$

(c) $f(x) = e^x + \frac{1}{2}Cx^2 + Dx + E$

(d) $f(x) = 2 \sin x + \tan x + 4 - 2\sqrt{3}$

(e) $f(x) = \frac{3}{2}x^{2/3} - \frac{1}{2}$ if $x > 0$ $f(x) = \frac{3}{2}x^{2/3} - \frac{5}{2}$ if $x < 0$

(f) $f(x) = 2x^4 + \frac{1}{3}x^3 + 5x^2 + 20x - \frac{67}{3}$

3. If a particle's velocity is $v(t) = \sin t - \cos t$, find its position if $s(0) = 0$.

$$s(t) = 1 - \cos t - \sin t$$