
Problem 1.

1. **(10 points)** Library/Union/setDervOptimization/4-5-23.pg

Find the absolute maximum and absolute minimum values of the function

$$f(x) = x^3 + 12x^2 - 27x + 11$$

over each of the indicated intervals.

(a) Interval = $[-10, 0]$.

1. Absolute maximum = _____
2. Absolute minimum = _____

(b) Interval = $[-7, 2]$.

1. Absolute maximum = _____
2. Absolute minimum = _____

(c) Interval = $[-10, 2]$.

1. Absolute maximum = _____
2. Absolute minimum = _____

Correct Answers:

- 497
- 11
- 445
- -3
- 497
- -3

Problem 2.

2. **(10 points)** Library/UVA-Stew5e/setUVA-Stew5e-C03S11-LinApprox/3-11-22.pg

Let $y = e^{x/4}$.

Find the differential dy when $x = 4$ and $dx = 0.5$ _____

Find the differential dy when $x = 4$ and $dx = 0.02$ _____

Correct Answers:

- 0.339785228557381
- 0.0135914091422952

Problem 3.

3. **(10 points)** Library/Hope/Calc1/03-11-Differentials/Differentials-04/Differentials-04.pg

The figure shows how a function $f(x)$ and its linear approximation (i.e., its tangent line) change value when x changes from x_0 to $x_0 + dx$.

Suppose $f(x) = x^2 + 4x$, $x_0 = 3$ and $dx = 0.01$. Your answers below need to be very precise, so use many decimal places.

(a) Find the change $\Delta f = f(x_0 + dx) - f(x_0)$.

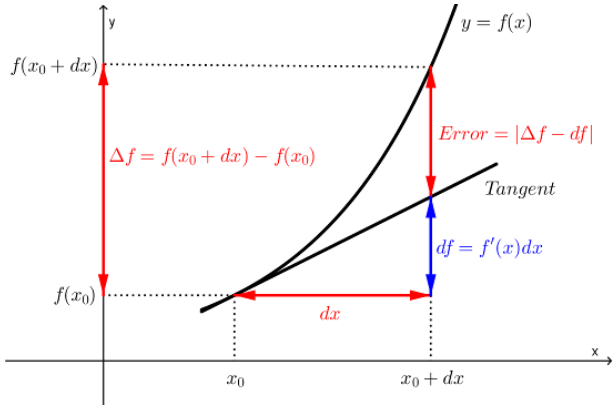
Δf = _____

(b) Find the estimate (i.e., the differential) $df = f'(x_0)\,dx$.

df = _____

(c) Find the approximation error $|\Delta f - df|$.

Error = _____



(Click on graph to enlarge)

Correct Answers:

- 0.1001
- 0.1
- 0.0001

Problem 4.

4. **(10 points)** Library/UVA-Stew5e/setUVA-Stew5e-C04S02-MeanValThm/4-2-13a.pg

Consider the function $f(x) = \frac{1}{x}$ on the interval $[4, 7]$.

(A) Find the average or mean slope of the function on this interval.

Average Slope = _____

(B) By the Mean Value Theorem, we know there exists a c in the open interval $(4, 7)$ such that $f'(c)$ is equal to this mean slope. Find all values of c that work and list them (separated by commas) in the box below.

List of values: _____

Correct Answers:

- -0.0357142857142857
- 5.29150262212918

Problem 5.

5. **(5 points)** Library/UCSB/Stewart5_4_4/Stewart5_4_4_10.pg

Find the limit. Use l'Hospital's Rule if appropriate. Use INF to represent positive infinity, NINF for negative infinity, and D for the limit does not exist.

$\lim_{x\to 0} \frac{x+\tan x}{-10\sin x} =$ _____

Correct Answers:

- -0.2

Problem 6.

6. **(5 points)** Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/4_Applications_of_the_Derivative/4.5_LHopitals_Rule/4.5.22.pg

Use L'Hôpital's Rule (possibly more than once) to evaluate the following limit

$\lim_{x\to\infty}(\frac{14x^3+5x^2}{12x^3-11}) =$ _____

If the answer equals ∞ or $-\infty$, write INF or -INF in the blank.

Correct Answers:

- 1.16666666666667

Problem 7.

7. **(10 points)** Library/ASU-topics/setImplicitDerivatives/5-5-14.pg

The radius of a spherical balloon is increasing at a rate of 2 centimeters per minute. How fast is the surface area changing when the radius is 12 centimeters?

Hint: The surface area is $S = 4\pi r^2$.

Rate of change of surface area = _____

Correct Answers:

- 603.18578948928

Problem 8.

8. **(20 points)** Library/ASU-topics/setSecondDerivative/4-4-72.pg

Suppose that

$$f(x) = \frac{2x^2}{x^2+25}.$$

(A) List all the critical values of $f(x)$. Note: If there are no critical values, enter 'NONE'.

_____

(B) Use interval notation to indicate where $f(x)$ is increasing.

Note: Use 'INF' for ∞, '-INF' for $-\infty$, and use 'U' for the union symbol. If there is no interval, enter 'NONE'.

Increasing: _____

(C) Use interval notation to indicate where $f(x)$ is decreasing.

Decreasing: _____

(D) List the x values of all local maxima of $f(x)$. If there are no local maxima, enter 'NONE'.

x values of local maximums = _____

(E) List the x values of all local minima of $f(x)$. If there are no local minima, enter 'NONE'.

x values of local minimums = _____

(F) Use interval notation to indicate where $f(x)$ is concave up.

Concave up: _____

(G) Use interval notation to indicate where $f(x)$ is concave down.

Concave down: _____

(H) List the x values of all the inflection points of f. If there are no inflection points, enter 'NONE'.

x values of inflection points = _____

(I) Find all horizontal asymptotes of f, and list the y values below. If there are no horizontal asymptotes, enter 'NONE'

y values of horizontal asymptotes = _____

(J) Find all vertical asymptotes of f, and list the x values below. If there are no vertical asymptotes, enter 'NONE'

x values of vertical asymptotes = _____

(K) Use all of the preceding information to sketch a graph of f. When you're finished, enter a "1" in the box below.

Graph complete: _____

Correct Answers:

- 0
- (0,infinity)
- (-infinity,0)
- none
- 0
- (-2.88675134594813,2.88675134594813)
- (-infinity,-2.88675134594813) U (2.88675134594813,infinity
- -2.88675134594813, 2.88675134594813
- 2
- none
- 1

Problem 9.

9. **(20 points)** Library/ASU-topics/setSecondDerivative/4-4-50.pg

Suppose that $f(x) = x^4 - 3x^3$.

(A) List all the critical values of $f(x)$. Note: If there are no critical values, enter 'NONE'.

_____

(B) Use interval notation to indicate where $f(x)$ is increasing.

Note: Use 'INF' for ∞, '-INF' for $-\infty$, and use 'U' for the union symbol.

Increasing: _____

(C) Use interval notation to indicate where $f(x)$ is decreasing.
Decreasing: _____

(D) List the x values of all local maxima of $f(x)$. If there are no local maxima, enter 'NONE'.
x values of local maximums = _____

(E) List the x values of all local minima of $f(x)$. If there are no local minima, enter 'NONE'.
x values of local minimums = _____

(F) Use interval notation to indicate where $f(x)$ is concave up.
Concave up: _____

(G) Use interval notation to indicate where $f(x)$ is concave down.
Concave down: _____

(H) List the x values of all the inflection points of f. If there are no inflection points, enter 'NONE'.
x values of inflection points = _____

(I) Use all of the preceding information to sketch a graph of f. When you're finished, enter a "1" in the box below.

_____

Correct Answers:

- `0, 2.25`
- `(2.25,infinity)`
- `(-infinity,2.25)`
- `none`
- `2.25`
- `(-infinity,0) U (1.5,infinity)`
- `(0,1.5)`
- `0, 1.5`
- `1`