Problem 1. 1. (1 pt) Suppose that $f(x) = 20e^x - ex^e$. Find $f'(3)$.

$f'(3)$ = _____

Answer(s) submitted:

- `(-1/3)((e^2)((3^e) - 60e))`

(correct)

Problem 2. 2. (1 pt) Find an equation for the line tangent to the graph of

$$f(x) = \frac{\sqrt{x}}{7x-8}$$

at the point $(3, f(3))$.

y = _____

Answer(s) submitted:

- `0.281843 - 0.049536x`

(correct)

Problem 3. 3. (1 pt) Use implicit differentiation to find the slope of the tangent line to the curve

$$4xy^3 + 3xy = 7$$

at the point $(1,1)$.

m = _____

Answer(s) submitted:

- `-(7/15)`

(correct)

Problem 4. 4. (1 pt) Let $f(x) = 3x^2\cos(6x)$.
Then $f'(x)$ is _____
and $f'(4)$ is _____
$f''(x)$ is _____
and $f''(4)$ is _____

Answer(s) submitted:

- `6x(cos(6x) - 3xsin(6x))`
- `24(cos(24) - 12sin(24))`
- `6((1 - (18x^2))cos(6x) - (12x)sin(6x))`
- `-6(48sin(24) + 287cos(24))`

(correct)

Problem 5. 5. (1 pt) Suppose $xy = -4$ and $\frac{dy}{dt} = 3$. Find $\frac{dx}{dt}$ when $x = -4$.

$\frac{dx}{dt}$ = _____

Answer(s) submitted:

- `12`

(correct)

Problem 6. 6. (1 pt) Find the absolute maximum and absolute minimum values of the function

$$f(x) = x^3 + 12x^2 - 27x + 9$$

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 = _____

Answer(s) submitted:

- `495`
- `9`
- `443`
- `-5`
- `495`
- `-5`

(correct)

Problem 7. 7. (1 pt) Find the most general antiderivative for the function $\left(6x^4 - \frac{6}{x^5} - 3\right)$.
Note: Don't enter the **+C** . It's included for you.
Antiderivative = _____ + C.

Answer(s) submitted:

- `(((6x^5)/5) + (3/(2x^4)) - 3x)`

(correct)

Problem 8. 8. (1 pt) Find $\frac{dy}{dx}$ for the function $y = x^{\cos(x)}$.

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

Answer(s) submitted:

- `(x^(cos(x) - 1)(cos(x) - (x(ln(x))sin(x))`

(incorrect)

Problem 9. 9. (1 pt)
Evaluate the limit using L'Hospital's rule if necessary

$$\lim_{x\to 1}\frac{x^2-1}{x^4-1}$$

Answer: _____

Answer(s) submitted:

- (2/4)

(correct)

Problem 10. 10. (1 pt) Find two positive numbers whose product is 81 and whose sum is a minimum.

Answer: _____, _____

Answer(s) submitted:

- 9
- 9

(correct)

Problem 11. 11. (1 pt) Let $y = 4x^2 + 8x + 2$.
Find the differential dy when $x = 4$ and $dx = 0.2$ _____
Find the differential dy when $x = 4$ and $dx = 0.4$ _____

Answer(s) submitted:

- 8
- 16

(correct)

Problem 12. 12. (1 pt) Use linear approximation, i.e. the tangent line, to approximate $\frac{1}{0.254}$ as follows: Let $f(x) = \frac{1}{x}$ and find the equation of the tangent line to $f(x)$ at a "nice" point near 0.254. Then use this to approximate $\frac{1}{0.254}$.

_____

Answer(s) submitted:

- 3.936

(correct)

Problem 13. 13. (1 pt) Consider the function

$$f(x) = -3x^3 + 2x^2 + 2x + 2$$

Find the average slope of this function on the interval $(2, 10)$.
_____

By the Mean Value Theorem, we know there exists a c in the open interval $(2, 10)$ such that $f'(c)$ is equal to this mean slope. Find the value of c in the interval which works _____

Answer(s) submitted:

- -346
- (58/9)

(correct)

Problem 14. 14. (1 pt) Suppose that

$$f(x) = 6x^2 - x^3 + 2.$$

(A) Find all critical numbers of f. If there are no critical numbers, enter 'NONE'.
Critical numbers = _____

(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-coordinates of all local maxima of f. If there are no local maxima, enter 'NONE'.
x values of local maxima = _____

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

(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 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.
Graph Complete: _____

Answer(s) submitted:

- 0, 4
- (0,4)
- (-INF, 0) U (4, INF)
- 4
- 0
- (-INF, 2)
- (2, INF)
- 2
- 1

(correct)

Problem 15. 15. (1 pt) Find the x-coordinate of the absolute minimum for the function

$$f(x) = 3x\ln(x) - 6x, \qquad x > 0.$$

x-coordinate of absolute minimum = _____

Answer(s) submitted:

- -3e

(incorrect)