

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

$$f'(3) = \underline{\hspace{2cm}}$$

Answer(s) submitted:

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

(correct)

Correct Answers:

- 352.910971762277

**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  $(3, f(3))$ .

$$y = \underline{\hspace{2cm}}$$

Answer(s) submitted:

- $0.281843 - 0.049536x$

(correct)

Correct Answers:

- $\text{sqrt}(3) / (-8+7*3) + -0.0495359698417134*(x-3)$

**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  $(1, 1)$ .

$$m = \underline{\hspace{2cm}}$$

Answer(s) submitted:

- $-(7/15)$

(correct)

Correct Answers:

- $-0.4666666666666667$

**Problem 4. 4.** (1 pt) Let  $f(x) = 3x^2 \cos(6x)$ .

Then  $f'(x)$  is  $\underline{\hspace{2cm}}$

and  $f'(4)$  is  $\underline{\hspace{2cm}}$

$f''(x)$  is  $\underline{\hspace{2cm}}$

and  $f''(4)$  is  $\underline{\hspace{2cm}}$

Answer(s) submitted:

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

(correct)

Correct Answers:

- $2*3*x*\cos(6*x) - 3*(x**2)*\sin(6*x)*6$
- 270.986864433996
- $2*3*\cos(6*x) - 4*3*x*\sin(6*x)*6 - 3*(x**2)*\cos(6*x)*(6**2)$
- -469.629682376401

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

$$\frac{dx}{dt} = \underline{\hspace{2cm}}$$

Answer(s) submitted:

- 12

(correct)

Correct Answers:

- 12

**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 =  $\underline{\hspace{2cm}}$

2. Absolute minimum =  $\underline{\hspace{2cm}}$

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

1. Absolute maximum =  $\underline{\hspace{2cm}}$

2. Absolute minimum =  $\underline{\hspace{2cm}}$

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

1. Absolute maximum =  $\underline{\hspace{2cm}}$

2. Absolute minimum =  $\underline{\hspace{2cm}}$

Answer(s) submitted:

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

(correct)

Correct Answers:

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

**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)

Correct Answers:

- $6*(x**5)/5 - 6*(x**(-5+1))/(-5+1) - 3*x$

**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)

Correct Answers:

- $x^{(\cos(x))}*(\cos(x)/x - \sin(x)*\ln(x))$

**Problem 9. 9.** (1 pt)

Evaluate the limit using L'Hospital's rule if necessary

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

Answer: \_\_\_\_\_

Answer(s) submitted:

- $(2/4)$

(correct)

Correct Answers:

- $2/4$

**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)

Correct Answers:

- 9
- 9

**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)

Correct Answers:

- 8
- 16

**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)

Correct Answers:

- 3.936

**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)

Correct Answers:

- -346
- 6.444444444444444

**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  $\infty$ , '-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)
- $(-\infty, 0) \cup (4, \infty)$
- 4
- 0

- $(-\infty, 2)$
- $(2, \infty)$
- 2
- 1

(correct)

Correct Answers:

- 0, 4
- (0, 4)
- $(-\infty, 0) \cup (4, \infty)$
- 4
- 0
- $(-\infty, 2)$
- $(2, \infty)$
- 2
- 1

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

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

$x$ -coordinate of absolute minimum = \_\_\_\_\_

Answer(s) submitted:

- $-3e$

(incorrect)

Correct Answers:

- 2.71828182845905