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Find the number  $c$  that satisfies the conclusion of the Mean Value Theorem for the function  $f(x) = 2\sqrt{x}$  on the interval  $[0, 25]$ .

- A. 0
- B.  $\frac{25}{4}$
- C.  $\frac{1}{5}$
- D. 5
- E. None of the above

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Find the value of the limit

$$\lim_{x \rightarrow 0} \frac{\sin 4x - 4x}{x^3}.$$

- A.  $-\frac{2}{3}$
- B.  $-\frac{16}{3}$
- C.  $-\frac{32}{3}$
- D.  $-\frac{4}{3}$
- E. None of the above

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Find two positive numbers  $x$  and  $y$  whose sum is 7 so that  $x^2y - 8x$  is a maximum.

- A.  $\frac{3}{2}, \frac{11}{2}$
- B. 5, 2
- C.  $\frac{7}{2}, \frac{7}{2}$
- D. 4, 3
- E. 6, 1

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Find the intervals where  $f(x) = \frac{\ln(2x)}{x}$  is increasing and where it is decreasing.

- A. increasing on  $(20, \infty)$ , decreasing on  $(0, 20)$ .
- B. increasing on  $(0, \frac{e}{2})$ , decreasing on  $(\frac{e}{2}, \infty)$
- C. increasing on  $(2e, \infty)$ , decreasing on  $(0, 2e)$
- D. increasing on  $(0, \frac{1}{5})$ , decreasing on  $(\frac{1}{5}, \infty)$
- E. None of the above

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Find the critical number(s) of the function  $f(x) = e^{x^2-10x}$ .

- A. 5
- B.  $\sqrt{10}$  and  $-\sqrt{10}$
- C. 5 and  $-5$
- D.  $\sqrt{10}$
- E. The function has no critical numbers.

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Find the local maxima and local minima, if any, of the function  $f(x) = 2x^3 - 3x^2 - 36x - 5$ .

- A. The local maximum is  $f(3) = 86$  and the local minimum is  $f(-2) = -39$ .
- B. The local maximum is  $f(-3) = 22$  and the local minimum is  $f(2) = -73$ .
- C. The local maximum is  $f(2) = 73$  and the local minimum is  $f(-3) = -22$ .
- D. The local maximum is  $f(-2) = 39$  and the local minimum is  $f(3) = -86$ .
- E. None of the above.

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Suppose that  $f'(x) = x^2(x+2)(x-2)(x-4)$ . Find the open interval or open intervals where  $f$  is decreasing. (Read the problem carefully. The given function is  $f'(x)$ , not  $f(x)$ .)

- A.  $(-2, 2) \cup (4, \infty)$
- B.  $(-\infty, -2) \cup (2, \infty)$
- C.  $(-2, 2) \cup (4, \infty)$
- D.  $(2, 4)$
- E.  $(-\infty, -2) \cup (2, 4)$

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You are given that  $f'(x) = x^2(x+2)(x-2)(x-4)$ . Find the values of  $x$  that give the local maximum and local minimum values of the function  $f(x)$ . (Read the problem carefully. The given function is  $f'(x)$ , not  $f(x)$ .)

- A. Local maximum value of  $f$  at  $x = 0$  and local minimum values of  $f$  at  $x = -2, 4$ .
- B. Local maximum values of  $f$  at  $x = -2, 4$  and local minimum value of  $f$  at  $x = 0$ .
- C. Local maximum value of  $f$  at  $x = 2$  and local minimum values of  $f$  at  $x = -2, 4$ .
- D. Local maximum values of  $f$  at  $x = -2, 2$  and local minimum values of  $f$  at  $x = 0, 4$ .
- E. Local maximum values of  $f$  at  $x = 0, 4$  and local minimum values of  $f$  at  $x = -2, 2$ .

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Assume that  $f''(x) = x^2(x-2)(x-4)$ . Find the points of inflection of the function  $f$ . (Read the problem carefully. The given function is  $f''(x)$ , not  $f(x)$ .)

- A.  $x = 4$
- B.  $x = 2, 4$
- C.  $x = 2$
- D.  $x = 0, 2, 4$
- E.  $x = 0, 4$

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If  $f''(x) = 18x + 36x^2$ , find  $f(x)$ .

- A.  $f(x) = 2x^3 + x^4 + Cx + D$
- B.  $f(x) = 3x^3 + 3x^4 + Cx + D$
- C.  $f(x) = x^3 + 4x^4 + Cx + D$
- D.  $f(x) = 4x^3 + 8x^4 + Cx + D$
- E.  $f(x) = 6x^3 + 4x^4 + Cx + D$

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Use the Fundamental Theorem of Calculus to find the derivative of the function:

$$g(x) = \int_5^{x^2} t^5 \sin(t) dt.$$

- A.  $g'(x) = 2x^{11} \sin(x^2)$
- B.  $g'(x) = 10x^5 \sin(x^2)$
- C.  $g'(x) = 5x^8 \sin(x^2)$
- D.  $g'(x) = 5x^8 \cos(x^2)$
- E.  $g'(x) = x^{10} \sin(x^2)$

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An object travels with a velocity of 10 m/s for  $0 \leq t \leq 3$  seconds and a velocity of 15 m/s for  $3 < t \leq 5$  seconds. How far did it travel?

- A. 60 meters
- B. 70 meters
- C. 50 meters
- D. 65 meters
- E. None of the above.

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**13. (10 points)** Library/Valdosta/APEX\_Calculus/3.3/APEX\_3.3\_23.pg

**NOTE:** When using interval notation in WeBWorK, remember that:  
You use 'INF' for  $\infty$  and '-INF' for  $-\infty$ .  
And use 'U' for the union symbol.  
Enter **DNE** if an answer does not exist.

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

- Find the critical numbers of  $f$ . \_\_\_\_\_ (Separate multiple answers by commas.)
- Determine the intervals on which  $f$  is increasing and decreasing.  
 $f$  is increasing on: \_\_\_\_\_  
 $f$  is decreasing on: \_\_\_\_\_
- Use the First Derivative Test to determine whether each critical point is a relative maximum, minimum, or neither.  
Relative maxima occur at  $x =$  \_\_\_\_\_ (Separate multiple answers by commas.)  
Relative minima occur at  $x =$  \_\_\_\_\_ (Separate multiple answers by commas.)

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**14. (5 points)** Library/Valdosta/APEX\_Calculus/6.7/APEX\_6.7\_17.pg

Evaluate the limit, using L'Hôpital's Rule.

Enter **INF** for  $\infty$ , **-INF** for  $-\infty$ , or **DNE** if the limit does not exist, but is neither  $\infty$  nor  $-\infty$ .

$$\lim_{x \rightarrow 0} \frac{2e^x - 2x - 2}{15x^2} = \underline{\hspace{2cm}}$$

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**15. (10 points)** Library/Union/setDervConcavity/4-3-52.pg

Let  $f(x) = -x^4 - 4x^3 + 2x + 4$ . Find the open intervals on which  $f$  is concave up (down). Then determine the  $x$ -coordinates of all inflection points of  $f$ .

1.  $f$  is concave up on the intervals  $\underline{\hspace{2cm}}$
2.  $f$  is concave down on the intervals  $\underline{\hspace{2cm}}$
3. The inflection points occur at  $x = \underline{\hspace{2cm}}$

**Notes:** In the first two, your answer should either be a single interval, such as  $(0,1)$ , a comma separated list of intervals, such as  $(-\infty, 2)$ ,  $(3,4)$ , or the word "none".

In the last one, your answer should be a comma separated list of  $x$  values or the word "none".

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**16. (5 points)** Library/UCSB/Stewart5\_4\_10/Stewart5\_4\_10\_3.pg

Find the most general antiderivative of  $f(x) = -4 - 2x^3 - 8x^5 - 6x^7$ .

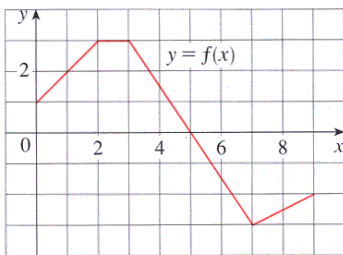
Note: Any arbitrary constants used must be an upper-case "C".

$$F(x) = \underline{\hspace{2cm}}$$

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**17. (5 points)** Library/UCSB/Stewart5\_5\_2/Stewart5\_5\_2\_33/Stewart5\_5\_2\_33.pg

Consider the graph of the function  $f(x)$ :



Evaluate the following integrals by interpreting them in terms of areas:

(a)  $\int_0^2 f(x) dx = \underline{\hspace{2cm}}$

(b)  $\int_0^5 f(x) dx = \underline{\hspace{2cm}}$

(c)  $\int_5^7 f(x) dx = \underline{\hspace{2cm}}$

(d)  $\int_0^9 f(x) dx = \underline{\hspace{2cm}}$

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**18. (5 points)** Library/Wiley/setAnton\_Section\_5.6/Anton\_5\_6\_Q60.pg

Use the Fundamental Theorem of Calculus to find the derivative.

$$\frac{d}{dx} \int_1^x \frac{dt}{8 + \sqrt{t}} = \underline{\hspace{2cm}}$$