Week 9 Friday Homework (1328490)

Question **1234567891011121314151617181920**

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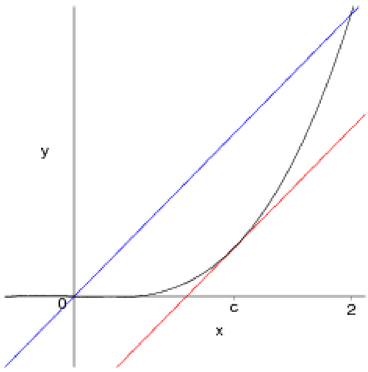
1. Question DetailsSCalcET6 4.2.AE.03. [1290377]



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EXAMPLE 3 To illustrate the Mean Value Theorem with a specific function, let's consider $f(x) = 5x^3 - x$, $a = 0$, $b = 2$. Since f is a polynomial, it is continuous and differentiable for all x, so it is certainly continuous on [0, 2] and differentiable on (0, 2). therefore, by the Mean Value Theorem, there is a number c in (0, 2) such that

$$f(2) - f(0) = f'(c)(2 - 0)$$

Now $f(2) =$ ____, $f(0) =$ ____, and $f'(x) =$

____ , so this equation becomes

$38 = ($ ____ $)2 =$ ____ $c^2 -$ ____

Which gives $c^2 =$

____ , that is, $c = \pm$ ____ . But c must be in (0, 2), so $c \approx$ ____.

The figure illustrates this calculation: the tangent line at this value of c is parallel to the secant line.

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2. Question DetailsSCalcET6 4.2.AE.05. [703915]

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EXAMPLE 5 Suppose that $f(0) = -4$ and $f'(x) \leq 5$ for all values of x. How large can $f(5)$ possibly be?

SOLUTION We are given that f is differentiable (and therefore continuous) everywhere. In particular, we can apply the Mean Value Theorem on the interval [0, 5]. There exists a number c such that

$f(5) - f(0) = f'(c)($ ____ $- 0)$

$f(5) = f(0) +$ ____ $f'(c) =$ ____ $+ 5f'(c)$

We are given that $f'(x) \leq 5$ for all x, so in particular we know that $f'(c) \leq$ ____. Multiplying both sides of this inequality by 5, we have $5f'(c) \leq$ ____, so

$f(5) =$ ____ $+ 5f'(c) \leq -4 +$ ____ $=$ ____

The largest possible value for $f(5)$ is ____.

3. Question DetailsSCalcET6 4.2.Tut.03. [708874]

4. Question DetailsSCalcET6 4.2.Tut.05. [708869]

5. Question DetailsSCalcET6 4.2.011. [703918]

Find the number *c* that satisfies the conclusion of the Mean Value Theorem.

$f(x) = 2x^2 + 2x + 1$

[-1, 1]

c = ____

6. Question DetailsSCalcET6 4.2.014. [1290378]

Find the number *c* that satisfies the conclusion of the Mean Value Theorem.

$$f(x) = \frac{x}{x+4}$$

[1, 8]

c = ____

7. Question DetailsSCalcET6 4.2.023. [703680]

If $f(2) = 12$ and $f'(x) \geq 2$ for $2 \leq x \leq 4$, how small can $f(4)$ possibly be?

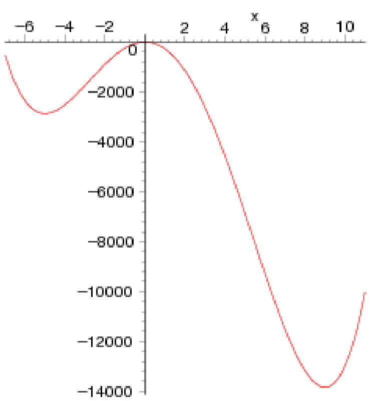
____

8. Question DetailsSCalcET6 4.2.024. [703814]

Suppose that $3 \leq f'(x) \leq 5$ for all values of x. Complete the inequality below.

____ $\leq f(6) - f(2) \leq$ ____

9. Question DetailsSCalcET6 4.3.AE.01. [1315409]



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EXAMPLE 1 Find where the function $f(x) = 3x^4 - 16x^3 - 270x^2 + 9$ is increasing and where it is decreasing.

SOLUTION $f'(x) = 12x^3 - 48x^2 - 540x = 12x(x -$ ____ $)(x +$ ____ $)$

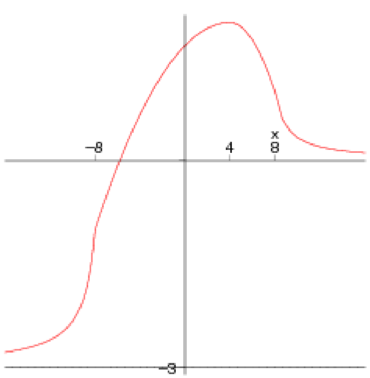
To use the I/D Test, we have to know where $f'(x) > 0$ and where $f'(x) < 0$. This depends on the signs of the three factors of $f'(x)$, namely, $12x$, $x - 9$, and

____ . we divide the real line into intervals whose endpoints are the critical numbers -5, 0 and 9 and arrange our work in a chart. A plus sign indicates that the given expression is positive, and a negative sign indicates that it is negative. The last column of the chart gives the conclusion based on the I/D Test. For instance, $f'(x) < 0$ for $0 < x < 9$, so *f* is ---Select--- on (0, 9). It would also be true to say that *f* is decreasing on the closed interval [0, 9].)

Interval	$12x$	$x - 9$	$x + 5$	$f'(x)$	f
$x < -5$	-	-	-	-	
$-5 < x < 0$	-	-	+	+	
$0 < x < 9$	+	-	+	-	
$x > 9$	+	+	+	+	

The graph of *f* shown in the figure confirms the information in the chart.

10. Question DetailsSCalcET6 4.3.AE.05. [703618]



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EXAMPLE 5 Sketch a possible graph of a function *f* that satisfies the following conditions:

(i) $f'(x) > 0$ on $(-\infty, 4)$, $f'(x) < 0$ on $(4, \infty)$

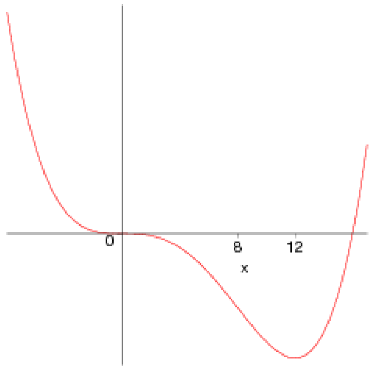
(ii) $f''(x) > 0$ on $(-\infty, -8)$ and $(8, \infty)$, $f''(x) < 0$ on $(-8, 8)$

(iii) $\lim_{x \to -\infty} f(x) = -3$, $\lim_{x \to \infty} f(x) = 0$

SOLUTION Condition (i) tells us that *f* is increasing on $(-\infty, 4)$ and decreasing on $(4, \infty)$. Condition (ii) says that *f* is concave upward on $(-\infty,$ ____ $)$ and $($ ____ $, \infty)$, and concave downward on $($ ____ , ____ $)$. From (iii) we know that the graph of *f* has two horizontal asymptotes: $y =$ ____ and $y = 0$.

First we draw the horizontal asymptote $y = -3$ as a black line (see the figure). We then draw the graph of *f* approaching this asymptote at the far left, increasing to its maximum point at $x = 4$ and decreasing toward the *x*-axis at the far right. We also make sure that the graph has inflection points when $x = -8$ and ____ . Notice that we made the curve open upward for $x < -8$ and $x > 8$, and bend downward when *x* is between ____ and 8.

11. Question DetailsSCalcET6 4.3.AE.06. [1291432]



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EXAMPLE 6 Discuss the curve $y = 2x^4 - 32x^3$ with respect to concavity, points of inflection, and local maxima and minima. Use this information to sketch the curve.

SOLUTION If $f(x) = 2x^4 - 32x^3$, then

$f'(x) =$ ____ $= 8x^2(x - 12)$

$f''(x) =$ ____ $= 24x(x - 8)$

To find the critical numbers we set $f'(x) = 0$ and obtain $x = 0$ and $x =$ ____. To use the Second Derivative Test we evaluate f'' at these critical numbers:

$f''(0) =$ ____

$f''(12) =$ ____

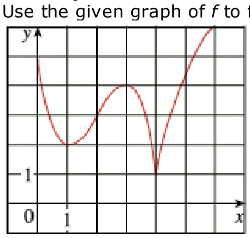
Since $f'(12) =$ ____ and $f''(12) > 0$, $f(12) =$ ____ is a local minimum. Since $f''(0) =$ ____, the Second Derivative Test gives no information about the critical number 0. But since $f'(x) < 0$ for $x < 0$ and also for $0 < x < 12$, the First Derivative Test tells us that f does not have a local maximum or minimum at 0. [In fact, the expression for $f'(x)$ shows that f decreases to the left of 12 and increase to the right of 12.]

Since $f''(x) = 0$ when $x = 0$ or ____, we divide the real number line into intervals with these numbers as endpoints and complete the following chart.

Interval	$f''(x) = 24x(x - 8)$	Concavity
$(-\infty, 0)$	+	upward
$(0, 8)$	-	downward
$(8, \infty)$	+	upward

The point (0, 0) is an inflection point since the curve changes from concave upward to concave downward there. Also, (8, -8192) is an inflection point since the curve changes from concave downward to concave upward there. Using the local minimum, the intervals of concavity, and the inflection points, we sketch the curve in the figure.

12. Question DetailsSCalcET6 4.3.001. [703694]
Use the given graph of f to find the following.



(a) The open intervals on which f is increasing. (Enter the interval that contains smaller numbers first.)
(____ , ____) ∪ (____ , ____)

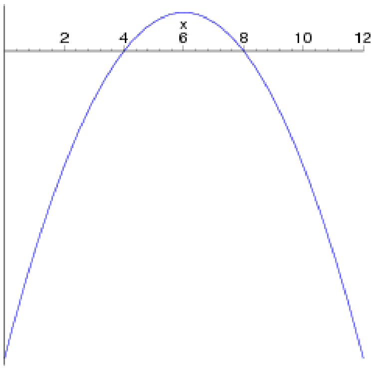
(b) The open intervals on which f is decreasing. (Enter the interval that contains smaller numbers first.)
(____ , ____) ∪ (____ , ____)

(c) The open interval on which f is concave upward.
(____ , ____)

(d) The open interval on which f is concave downward. (Enter the interval that contains smaller numbers first.)
(____ , ____) ∪ (____ , ____)

(e) The coordinates of the point of inflection.
(____ , ____)

13. Question DetailsSCalcET6 4.3.005. [703884]
The graph of the derivative *f* ' of a function *f* is shown.



(a) On what interval is *f* increasing?
(___ , ___)

(b) On what intervals is *f* decreasing? (Enter the interval that contains smaller numbers first.)
(___ , ___) ∪ (___ , ___)

(c) At what values of *x* does *f* have a local maximum or minimum?
x = ___ (smaller value)
x = ___ (larger value)

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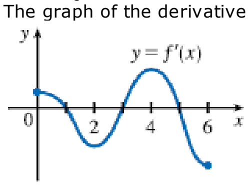
14. Question DetailsSCalcET6 4.3.006. [703846]
The graph of the derivative *f* ' of a function *f* is shown.

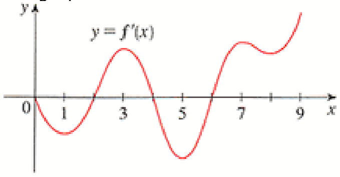


(a) On what intervals is *f* increasing? (Enter the interval that contains smaller numbers first.)
(___ , ___) ∪ (___ , ___)

(b) On what intervals is *f* decreasing? (Enter the interval that contains smaller numbers first.)
(___ , ___) ∪ (___ , ___)

(c) At what values of *x* does *f* have a local maximum or minimum?
x = ___ (smallest value)
x = ___
x = ___ (largest value)

15. Question DetailsSCalcET6 4.3.008. [657230]
The graph of the first derivative *f* ' of a function *f* is shown.



(a) On what interval(s) is *f* increasing? (Select all that apply.)

- (2,4)
- (6,9)
- (4,6)
- (1,3)
- (5,7)
- (0,2)
- (0,1)
- (3,5)

(b) At what value(s) of *x* does *f* have a local maximum? (Select all that apply.)

- 5
- 6
- 1
- 2
- 7
- 8
- 9
- 4
- 3
- 0

(c) At what value(s) of *x* does *f* have a local minimum? (Select all that apply.)

- 9
- 6
- 4
- 5
- 2
- 7
- 1
- 3
- 8
- 0

(d) On what interval(s) is *f* concave upward? (Select all that apply.)

- (7,8)
- (5,7)
- (8,9)
- (3,5)
- (1,3)

- ☐ (0,1)

(e) On what interval(s) is f concave downward? (Select all that apply.)

- ☐ (1,3)
- ☐ (0,1)
- ☐ (3,5)
- ☐ (7,8)
- ☐ (8,9)
- ☐ (5,7)

(f) What are the x-coordinate(s) of the inflection point(s) of f ? (Select all that apply.)

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9

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16. Question DetailsSCalcET6 4.3.010. [703799]

Consider the equation below. (If you need to use $-\infty$ or ∞, enter -INFINITY or INFINITY.)

$f(x) = 4x^3 + 9x^2 - 54x + 3$

(a) Find the intervals on which f is increasing. (Enter the interval that contains smaller numbers first.)

(____ , ____) ∪ (____ , ____)

Find the interval on which f is decreasing.

(____ , ____)

(b) Find the local minimum and maximum values of f.

____ (max)

____ (min)

(c) Find the inflection point.

(____ , ____)

Find the interval on which f is concave up.

(____ , ____)

Find the interval on which f is concave down.

(____ , ____)

17. Question DetailsSCalcET6 4.3.012. [808124]
You are given the following.

$$f(x) = \frac{x^2}{x^2 + 3}$$

(a) On what interval(s) is *f* increasing? (Select all that apply.)

- [ ] (-∞, -1)
- [ ] (-∞, 0)
- [ ] (-∞, 1)
- [ ] (-1, 1)
- [ ] (-1, ∞)
- [ ] (0, ∞)
- [ ] (-3, ∞)
- [ ] none of these

On what interval(s) is *f* decreasing? (Select all that apply.)

- [ ] (-∞, ∞)
- [ ] (-∞, 0)
- [ ] (-∞, 1)
- [ ] (-1, 3)
- [ ] (-1, 1)
- [ ] (0, 1)
- [ ] (-1, ∞)
- [ ] (0, ∞)
- [ ] (1, ∞)
- [ ] none of these

(b) What are the local maximum value(s) of *f*? (Select all that apply.)

- [ ] -1
- [ ] 0
- [ ] 1/4
- [ ] 1/2
- [ ] 1
- [ ] none of these

What are the local minimum value(s) of *f*? (Select all that apply.)

- [ ] -1
- [ ] 0
- [ ] 1/4
- [ ] 1/2
- [ ] 1
- [ ] none of these

(c) On what interval(s) is *f* concave upward? (Select all that apply.)

- [ ] (-∞, 0)
- [ ] (-∞, 2)
- [ ] (-∞, -1)
- [ ] (-1, 1)
- [ ] (-1, 2)

- ☐ (0, ∞)
- ☐ (-1, ∞)
- ☐ (2, ∞)
- ☐ none of these

On what interval(s) is *f* concave downward? (Select all that apply.)

- ☐ (-∞, 0)
- ☐ (-∞, 2)
- ☐ (-∞, -1)
- ☐ (-1, 2)
- ☐ (0, ∞)
- ☐ (1, ∞)
- ☐ (-1, ∞)
- ☐ none of these

What are the *x*-coordinate(s) of the inflection point(s) of *f*? (Select all that apply.)

- ☐ -2
- ☐ -1
- ☐ 0
- ☐ 1
- ☐ 2
- ☐ none of these

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18. Question DetailsSCalcET6 4.3.015. [808132]
Consider the equation below. (Round the answers to three decimal places. If you need to use -∞ or ∞, enter -INFINITY or INFINITY.)

$f(x) = e^{8x} + e^{-x}$

(a) Find the interval on which *f* is increasing.

(______ , ______)

Find the interval on which *f* is decreasing.

(______ , ______)

(b) Find the local minimum value of *f*.

______

(c) Find the interval on which *f* is concave up.

(______ , ______)

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19. Question DetailsSCalcET6 4.3.023.MI. [1387334]
Suppose f'' is continuous on (−∞, ∞).

(a) If $f'(-3) = 0$ and $f''(-3) = -5$, what can you say about *f*?

- ◯ At $x = -3$, *f* has local maximum.
- ◯ At $x = -3$, *f* has a local minimum.
- ◯ At $x = -3$, *f* has not a maximum or minimum.
- ◯ There is not enough information.

Tutorial (b) If $f'(2) = 0$ and $f''(2) = 0$, what can you say about *f*?

- ◯ At $x = 2$, *f* has local maximum.
- ◯ At $x = 2$, *f* has a local minimum.
- ◯ At $x = 2$, *f* has not a maximum or minimum.
- ◯ There is not enough information.

Tutorial

20. Question DetailsSCalcET6 4.3.039. [803603]

Consider the function below. (Round the answers to two decimal places. If you need to use -∞ or ∞, enter -INFINITY or INFINITY.)

$A(x) = x\sqrt{x + 9}$

(a) Find the interval of increase.

(______ , ______)

Find the interval of decrease.

(______ , ______)

(b) Find the local minimum value.

______

(c) Find the interval the function is concave up.

(______ , ______)

(d) Use this information to sketch the graph of the function. (Do this on paper. Your instructor may ask you to turn in this graph.)

Assignment Details

Name (AID): **Week 9 Friday Homework (1328490)**

Submissions Allowed: **5**

Category: **Homework**

Code:

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Author: **Jernigan, John (jjernigan@ccp.edu)**

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