

Principles of Calculus Modeling: An Interactive Approach by Donald Kreider, Dwight Lahr, and Susan Diesel
Exercises for Section 2.10

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1. (1 pt)

Let $f(x) = \frac{9}{x+1}$. Find the point (c, d) on the graph of f , with c in the open interval $(10, 12)$, such that

1. the tangent line to $y = f(x)$ at (c, d) is parallel to the chord line joining $(10, f(10))$ and $(12, f(12))$, and

2. c is the largest value in $(10, 12)$ that satisfies condition 1.

$c =$ _____

$d =$ _____

2. (1 pt)

Find the intervals of increase and decrease of the function $f(x) = 1.8x^3 + 7x + 1$.

In the answer boxes below, enter the intervals, from left to right. For each interval, indicate whether the function is increasing or decreasing by entering **I** or **D** in the appropriate box.

Use only the answer boxes that you need. Type **-infinity** for $-\infty$ or **infinity** for ∞ , without quotes.

first interval:

_____ to _____ increasing/decreasing: ____

second interval:

_____ to _____ increasing/decreasing: ____

third interval:

_____ to _____ increasing/decreasing: ____

fourth interval:

_____ to _____ increasing/decreasing: ____

3. (1 pt)

Find the intervals of increase and decrease of the function $f(x) = 10(x^2 - 4)^2$.

In the answer boxes below, enter the intervals, from left to right. For each interval, indicate whether the function is increasing or decreasing by entering **I** or **D** in the appropriate box.

Use only the answer boxes that you need. Type **-infinity** for $-\infty$ or **infinity** for ∞ , without quotes.

first interval:

_____ to _____ increasing/decreasing: ____

second interval:

_____ to _____ increasing/decreasing: ____

third interval:

_____ to _____ increasing/decreasing: ____

fourth interval:

_____ to _____ increasing/decreasing: ____

_____ to _____ increasing/decreasing: ____

4. (1 pt)

Find the intervals of increase and decrease of the function $f(x) = \frac{3}{x^2 + 11} - 1$.

In the answer boxes below, enter the intervals, from left to right. For each interval, indicate whether the function is increasing or decreasing by entering **I** or **D** in the appropriate box.

Use only the answer boxes that you need. Type **-infinity** for $-\infty$ or **infinity** for ∞ , without quotes.

first interval:

_____ to _____ increasing/decreasing: ____

second interval:

_____ to _____ increasing/decreasing: ____

third interval:

_____ to _____ increasing/decreasing: ____

fourth interval:

_____ to _____ increasing/decreasing: ____

5. (1 pt)

Find the intervals of increase and decrease of the function $f(x) = (x - 1)^3(9 - x)^2$.

In the answer boxes below, enter the intervals, from left to right. For each interval, indicate whether the function is increasing or decreasing by entering **I** or **D** in the appropriate box.

Use only the answer boxes that you need. Type **-infinity** for $-\infty$ or **infinity** for ∞ , without quotes.

first interval:

_____ to _____ increasing/decreasing: ____

second interval:

_____ to _____ increasing/decreasing: ____

third interval:

_____ to _____ increasing/decreasing: ____

fourth interval:

_____ to _____ increasing/decreasing: ____

6. (1 pt)

Find the intervals of increase and decrease of the function $f(x) = \frac{x}{7} + \sin(x)$.

In the answer boxes below, enter four intervals, **starting with the value $x = 0$** , and continuing from left to right. For each interval, indicate whether the function is increasing or decreasing by entering **I** or **D** in the appropriate box.

Use only the answer boxes that you need. Type **-infinity** for $-\infty$ or **infinity** for ∞ , without quotes.

first interval:
 _____ to _____ increas-
 ing/decreasing: ____
 second interval:
 _____ to _____ increas-
 ing/decreasing: ____
 third interval:
 _____ to _____ increas-
 ing/decreasing: ____
 fourth interval:
 _____ to _____ increas-
 ing/decreasing: ____

7. (1 pt)

Let $f(x) = 5x^3 + 8x + 0$. Find the derivative of $f(x)$.

$f'(x) =$ _____

Which properties of the derivative let you conclude that $f(x)$ has an inverse? Enter **X** in the answer box for each property that applies.

- A. $f'(x)$ is always positive
- B. $f'(x)$ is a polynomial of even degree
- C. $f'(x)$ is self-inverse
- D. the domain of $f'(x)$ is the range of $f(x)$
- E. $f'(x)$ is one-to-one

Let $y = f^{-1}(x)$ be the inverse function of f . Find its derivative y' , expressed as a function of y .

$y' =$ _____

8. (1 pt)

Let $f(x)$ be the function $2\sin(x)$ defined on the interval $[0, 2\pi)$. At what values of x does f have a local or absolute maximum or minimum? Enter values from left to right. Leave unused answer boxes blank.

local maximum at
 $x =$ _____
 absolute maximum at
 $x =$ _____
 local minimum at
 $x =$ _____

absolute minimum at

$x =$ _____

9. (1 pt)

Let $f(x) = x^3 - 4x^2 - x + 9$. At what values of x does f have a local or absolute maximum or minimum? Leave unused answer boxes blank.

local maximum at $x =$ _____
 absolute maximum at $x =$ _____
 local minimum at $x =$ _____
 absolute minimum at $x =$ _____

10. (1 pt)

Let $f(x) = x^4 - x^2 - 9$. At what values of x does f have a local or absolute maximum or minimum?

Enter multiple answers in increasing order. Leave unused answer boxes blank.

local maximum at $x =$ _____, _____
 absolute maximum at $x =$ _____, _____
 local minimum at $x =$ _____, _____
 absolute minimum at $x =$ _____, _____

11. (1 pt)

If $f(1) = -5$ and $f'(x) \geq 4.2$ for $1 \leq x \leq 6$, what is the smallest possible value of $f(6)$?

12. (1 pt)

If $f(1) = -2$ and $f'(x) \leq 1.8$ for $1 \leq x \leq 8$, what is the largest possible value of $f(8)$?

13. (1 pt)

In October, 1805, Napoleon had to decide whether to send his fleet again the British in what was to be known as the Battle of Trafalgar. First, he needed to know how many ships the British had. If his intelligence estimates indicated that the British had 155 ships 6 months earlier, and he knew the British could build new ships no faster than 10 per month, use the Mean Value Theorem to determine the maximum number of ships the British could have had when Napoleon set out to battle.

14. (1 pt)

Consider the function $f(x) = 3x^2 + 2x - 5$ on the interval $[-3, 3]$. What value c satisfies the conclusion of the Mean Value Theorem; that is, for what c is $f'(c) = \frac{f(3) - f(-3)}{3 - (-3)}$?

$c =$ _____