

Principles of Calculus Modeling: An Interactive Approach by Donald Kreider, Dwight Lahr, and Susan Diesel
Exercises for Section 3.5

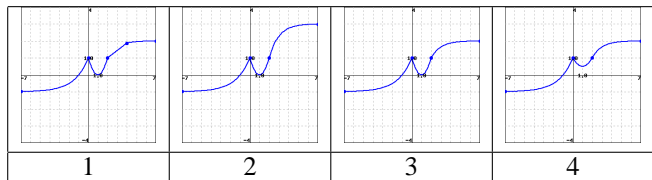
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1. (1 pt)

Here is a list of properties of the graph of some unknown function.

- A. $f(0) = 1$
- B. $f(\pm 1) = 0$
- C. $f(2) = 1$
- D. $\lim_{x \rightarrow \infty} f(x) = 2$
- E. $\lim_{x \rightarrow -\infty} f(x) = -1$
- F. $f''(x) > 0$ on the intervals $(-\infty, 0)$, $(0, 2)$
- G. $f''(x) < 0$ on the interval $(2, \infty)$
- H. $f'(x) > 0$ on the intervals $(-\infty, 0)$, $(1, \infty)$
- I. $f'(x) < 0$ on the interval $(0, 1)$

Study the graphs below. One of the graphs correctly exhibits all of these properties. The rest fail to exhibit at least one of the properties in the list.

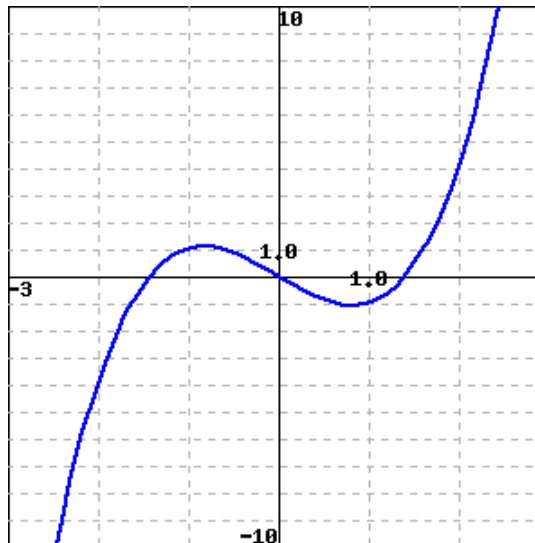


For each graph, enter the letter for the missing property. If there is more than one missing property, enter the first property in the list that is missing from that graph. For the one graph that displays all the properties, leave the answer box blank.

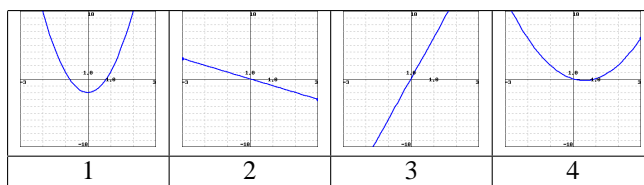
- Missing property, graph 1: _____
- Missing property, graph 2: _____
- Missing property, graph 3: _____
- Missing property, graph 4: _____

2. (1 pt)

Here is the graph of a function $y(x)$.



Which of the following is the graph of $y'(x)$? _____
Which of the following is the graph of $y''(x)$? _____



3. (1 pt)

Assume you are given the following characteristics about an unknown function $f(x)$ and its graph.

- A. Domain: all x
- B. Asymptotes: none
- C. Symmetry: about the origin
- D. Number of inflection points: 3

Which of the following functions fits all of these characteristics?

- _____
- A. $x(x^2 - 1)^2$
- B. $-\sin(x^2)$
- C. $\frac{1}{x}(x^3 - 3x)^2$
- D. $x^5 - x + 2$

4. (1 pt)

Assume you are given the following characteristics about an unknown function $f(x)$ and its graph.

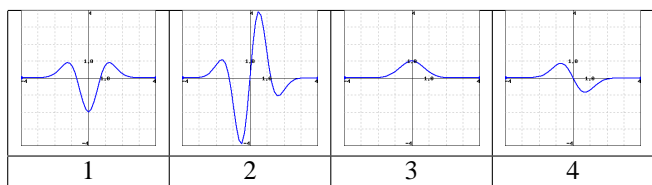
- A. Domain: all x except $\pm\sqrt{7}$
- B. Asymptotes: 2 vertical, 1 horizontal
- C. Symmetry: about the y axis
- D. Roots: none

Which of the following functions fits all of these characteristics?

- A. $\frac{1}{7-x^2}$
 B. $\frac{1}{7-x^2} - 1$
 C. $\frac{1}{49-x^2}$
 D. $\frac{1}{7-x^3}$

5. (1 pt)

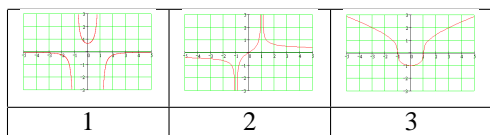
Match $f(x) = e^{-x^2}$ and each of its first three derivatives with the correct graphs.



- A. $f(x)$
 B. $f'(x)$
 C. $f''(x)$
 D. $f'''(x)$

6. (1 pt)

Match $f(x) = \sqrt[3]{x^2 - 1}$ and its first two derivatives with the correct graph.



- A. $f(x)$
 B. $f'(x)$
 C. $f''(x)$

For each of the properties listed below, enter the letter **A**, **B**, or **C** corresponding to whichever of f , f' , or f'' exhibit that property.

- this function is odd
 the slope of the tangent line to this function at $x = 0$ is 1
 this function has asymptotes but no roots
 the limit of this function as x approaches $\pm\infty$ is $\pm\infty$
 this function is defined for all x

7. (1 pt)

For the following, type **-infinity** for $-\infty$ and **infinity** for ∞ , if needed.

Let $f(x) = x(x-7)^2$.

What are the critical points of $f(x)$? Enter values of x in increasing order. Leave unused answer boxes blank.

What are the intervals on which $f(x)$ is increasing? Enter the intervals from left to right. Leave unused answer boxes blank.

_____ to _____
 _____ to _____
 _____ to _____
 _____ to _____

What are the intervals on which $f(x)$ is decreasing?

_____ to _____
 _____ to _____
 _____ to _____
 _____ to _____

8. (1 pt)

Let $f(x) = x + \sin(x)$.

What are the local and global maximum **values** of $f(x)$ on the interval $[0, 2\pi]$? Enter answers in order as x increases from left to right. Leave unused answer boxes blank.

What are the local and global minimum **values** of $f(x)$ on the interval $[0, 2\pi]$? Enter answers in order as x increases from left to right. Leave unused answer boxes blank.

9. (1 pt)

For the following questions, type **-infinity** for $-\infty$ and **infinity** for ∞ , if needed.

Let $f(x) = \frac{x^3}{(x^2 - 9)}$.

What are the x -coordinates of the inflection points of $f(x)$? Enter answers in increasing order. Leave unused answer boxes blank.

What are the intervals on which $f(x)$ is concave up? Enter the intervals in increasing order.

_____ to _____
 _____ to _____
 _____ to _____
 _____ to _____

What are the intervals on which $f(x)$ is concave down?

_____ to _____
 _____ to _____
 _____ to _____
 _____ to _____

10. (1 pt)

Find the point on $y = 7x + 5$ that is closest to the point $(3, 8)$ by using the distance formula.

$x =$ _____
 $y =$ _____