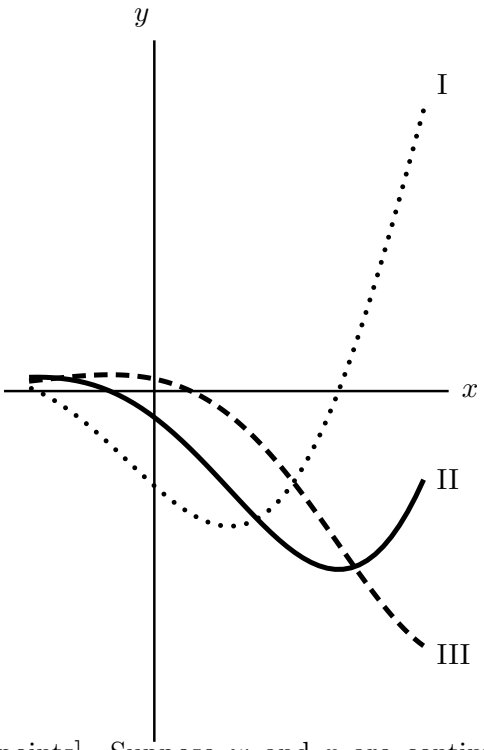
10. [5 points] Shown on the axes below are the graphs of $y = f(x)$, $y = f'(x)$, and $y = f''(x)$.



Determine which graph is which and circle the ONE correct response below.

i. • $f(x)$: I, $f'(x)$: II, and $f''(x)$: III

ii. • $f(x)$: I, $f'(x)$: III, and $f''(x)$: II

iii. • $f(x)$: II, $f'(x)$: I, and $f''(x)$: III

iv. • $f(x)$: II, $f'(x)$: III, and $f''(x)$: I

v. • $f(x)$: III, $f'(x)$: I, and $f''(x)$: II

vi. • $f(x)$: III, $f'(x)$: II, and $f''(x)$: I

11. [4 points] Suppose w and r are continuous functions on $(-\infty, \infty)$, $W(x)$ is an invertible antiderivative of $w(x)$, and $R(x)$ is an antiderivative of $r(x)$.
Circle all of the statements I-VI below that must be true.
If none of the statements must be true, circle NONE OF THESE.

I. $W(x) + R(x) + 2$ is an antiderivative of $w(x) + r(x)$.

II. $W(x) + R(x)$ is an antiderivative of $w(x) + r(x) + 2$.

III. $\cos(W(x))$ is an antiderivative of $\sin(w(x))$.

IV. $e^{W(x)}$ is an antiderivative of $w(x)e^{w(x)}$.

V. $e^{R(x)}$ is an antiderivative of $r(x)e^{R(x)}$.

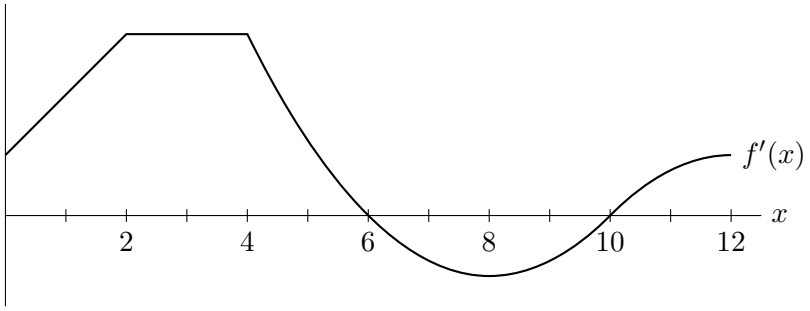
VI. If w is never zero, then $W^{-1}(R(x))$ is an antiderivative of $\dfrac{r(x)}{w(W^{-1}(R(x)))}$.

Solution: To see that VI is true, we check that

$$\frac{d}{dx}\left(W^{-1}(R(x))\right) = R'(x)\frac{1}{W'(W^{-1}(R(x)))} = \frac{r(x)}{w(W^{-1}(R(x)))}.$$

VII. NONE OF THESE

10. [10 points] The graph of $f'(x)$, the ***derivative*** of a function $f(x)$, is shown below.



For each of the following questions, circle ALL correct answers. You do not need to show work for this problem.

a. [2 points] On which of the following intervals is $f(x)$ increasing?

$\boxed{0 < x < 2}$ $\boxed{2 < x < 4}$ $\boxed{4 < x < 6}$ $6 < x < 8$ $8 < x < 10$ $\boxed{10 < x < 12}$

b. [2 points] On which of the following intervals is $f(x)$ concave down?

$0 < x < 2$ $2 < x < 4$ $\boxed{4 < x < 6}$ $\boxed{6 < x < 8}$ $8 < x < 10$ $10 < x < 12$

c. [2 points] On which of the following intervals is $f(x)$ linear?

$0 < x < 2$ $\boxed{2 < x < 4}$ $4 < x < 6$ $6 < x < 8$ $8 < x < 10$ $10 < x < 12$

d. [2 points] On which of the following intervals is $f''(x)$ increasing?

$0 < x < 2$ $2 < x < 4$ $\boxed{4 < x < 6}$ $\boxed{6 < x < 8}$ $\boxed{8 < x < 10}$ $10 < x < 12$

e. [2 points] Suppose $f(0) = -4$. Which of the following statements could be true?

$f(6) < -4$ $f(6) = -4$ $\boxed{f(6) > -4}$

9. [9 points] A pharmaceutical company just released a new medication to reduce the cold symptoms in children between 18 months old and 12 years of age. Let $D(z)$ be the dose (in ounces) recommended for a child that is z years old. A table with some values of $D(z)$ is shown below.

z	1.5	3	5	8	10	12
$D(z)$	2	5.2	8.6	11.4	14.5	20.2

a. [3 points] Find a formula for $D(z)$ on $3 \leq z \leq 5$ assuming it is a linear function in this interval.

Using the points $(3, 5.2)$ and $(5, 8.6)$, we can find the slope $m = \dfrac{8.6 - 5.2}{5 - 3} = 1.7$. Applying the point slope formula for the linear function we get $D(z) = 5.2 + 1.7(z - 3)$.

Answer: $D(z) =$ $5.2 + 1.7(z - 3)$ **or** $1.7z + 0.1$

b. [3 points] Suppose that $D(z)$ is invertible. Give a practical interpretation of the equation

$$D^{-1}(9) = 6.5.$$

Answer: A child whose recommended dose is 9 ounces is six and a half years old.

c. [3 points] Below is the first part of a sentence that will give a practical interpretation of the equation $D'(2) = 1.2$ in the context of this problem. Complete the sentence so that the practical interpretation can be understood by someone who knows no calculus. Be sure to include the appropriate units in your answer.

As the age of an child increases from 2 years to 25 months, the recommended dose increases by about 0.1 ounces.