

[non-calculator problems]

How do problems #1 and #2 differ from each other?

1. The polynomial function f has selected values for its second derivative f'' given in the table below. Based on the table, which of the following statements must be true?

x	0	1	2	3
f''	5	0	-7	4

- (A) f is increasing on the interval $(0, 2)$
 (B) f is decreasing on the interval $(0, 2)$
 (C) f has a local maximum at $x = 1$
 (D) The graph of f has a point of inflection at $x = 1$
 (E) The graph of f changes concavity in the interval $(0, 2)$

2. The function f has selected values for its second derivative f'' given in the table below. f'' is a strictly decreasing function for the interval $[0, 3]$. Based on the table, which of the following statements must be true?

x	0	1	2	3
f''	5	0	-3	-4

- (A) f is increasing on the interval $(0, 2)$
 (B) f is decreasing on the interval $(0, 2)$
 (C) f has a local maximum at $x = 1$
 (D) The graph of f has a point of inflection at $x = 1$
 (E) The graph of f changes concavity in the interval $(0, 2)$

How do problems #3 and #4 differ from each other?

3. The function f is continuous for $-2 \leq x \leq 2$ with selected values given in the table below. Based on the table, which of the following statements must be true?

x	-2	-1	0	2
$f(x)$	0	5	-5	0

- (A) There is some $c, -2 < c < 2$ such that $f'(c) = 0$
 (B) There is some $c, -2 < c < 2$ such that $f(c) = 10$
 (C) There is some $c, -2 < c < 2$ such that $f(c) = -10$
 (D) There is some $c, -1 < c < 0$ such that $f(c) = 0$
 (E) There is some $c, -2 < c < 2$ such that $f''(c) = 0$

4. The function f is differentiable for $-2 \leq x \leq 2$ with selected values given in the table below. Based on the table, which of the following statements must be true?
- (A) There is some $c, -2 < c < 2$ such that $f'(c) = 0$
 - (B) There is some $c, -2 < c < 2$ such that $f(c) = 10$
 - (C) There is some $c, -2 < c < 2$ such that $f(c) = -10$
 - (D) There is some $c, -1 < c < 0$ such that $f'(c) = 0$
 - (E) There is some $c, -1 < c < 0$ such that $f''(c) = 0$

How can you easily get “tricked” by problem #5?

5. Let f be a twice-differentiable function whose second derivative, f'' is defined by $f''(x) = x(x+3)(x-3)^2$. Where does f have point(s) of inflection?
- (A) At $x = 0$ only
 - (B) At $x = -3$ only
 - (C) At $x = 0$ and $x = -3$ only
 - (D) At $x = 0, x = -3,$ and $x = 3$
 - (E) At $x = 0$ and $x = 3$ only

Don't get “horizontal” and “vertical” mixed up! [Likewise, $-\infty$ and ∞]

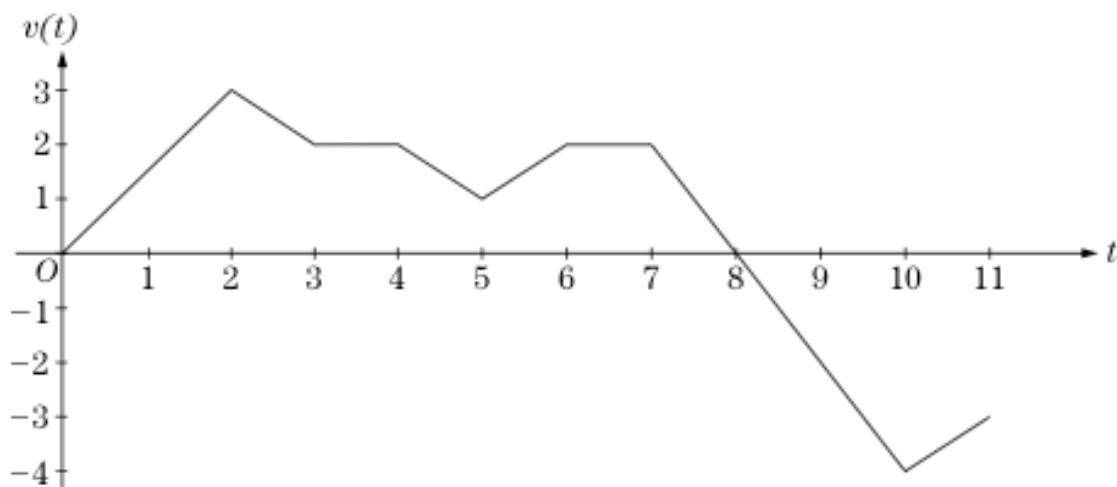
6. Let f be the function defined by $f(x) = \frac{x^2 - 4}{x^2 + x - 2}$. Which of the following statements is/are true about f ?
- I. $\lim_{x \rightarrow -2} f(x)$ does not exist
 - II. $y = 1$ is a horizontal asymptote of f
 - III. $x = 1$ is a vertical asymptote of f
- (A) I only
 - (B) II only
 - (C) III only
 - (D) II and III only
 - (E) I, II, and III

7. What are all of the horizontal asymptotes of the graph of $y = \frac{7-3^x}{14+3^x}$?
- (A) $y = 0$ only
 - (B) $y = \frac{1}{2}$ only
 - (C) $y = -1$ only
 - (D) $y = 0$ and $y = -1$
 - (E) $y = 0$, $y = \frac{1}{2}$, and $y = -1$

What do you mean by “average”?

8. Let f be the function defined by $f(x) = \frac{1}{x^2}$. What is the average rate of change for the closed interval $[1, 2]$?
- (A) 0.75
 - (B) -0.75
 - (C) 0.50
 - (D) -0.50
 - (E) 1
9. What is the average value of $y = \frac{1}{x^2}$ on the closed interval $[1, 2]$?
- (A) 0.75
 - (B) -0.75
 - (C) 0.50
 - (D) -0.50
 - (E) 1
10. Let f be a twice-differentiable function on the closed interval $[3, 7]$ with $f(3) = f(7)$. Which of the following statements must be true about f ?
- (A) f is concave down on $[3, 7]$
 - (B) There is a c , $3 < c < 7$, such that $f(c) = 0$
 - (C) There is a c , $3 < c < 7$, such that $f'(c) = 0$
 - (D) There is a c , $3 < c < 7$, such that $f''(c) = 0$
 - (E) $f'(3) > f'(7)$

Those motion problems will never go away!



A bug is crawling along a straight wire. The velocity, $v(t)$, of the bug at time t , $0 \leq t \leq 11$, is given in the graph above.

11.

According to the graph, at what time t does the bug change direction?

- (A) 2
- (B) 5
- (C) 6
- (D) 8
- (E) 10

12.

According to the graph, at what time t is the speed of the bug greatest?

- (A) 2
- (B) 5
- (C) 6
- (D) 8
- (E) 10