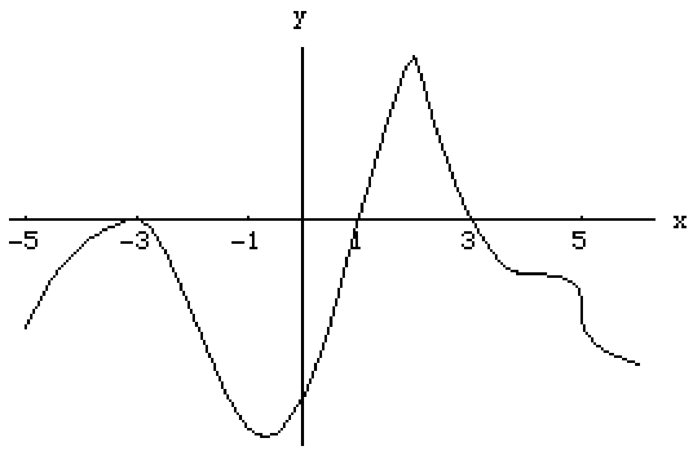
AP Calculus BC
Section 4.3 – Olsen Curve Sketching

1. Find A and B so that $f(x) = Axe^{Bx}$ has a local minimum of 6 when $x = 2$.

2. The graph below is the graph of f', the derivative of f. The domain of the derivative is $-5 \le x \le 6$.



1) The critical points for f are $x =$

2) The critical points for f' are $x =$

3) f has a local maximum when $x =$

4) f has its maximum value on $[-5, 6]$ when $x =$

5) f is decreasing on the interval(s)

6) The graph of f is concave up on the interval(s)

7) The x-coordinates of the points of inflection are $x =$

8) f' has its maximum value when $x =$

9) f'' has its maximum value when $x =$

10) Does f' have a minimum value on $[-5, 6]$? Explain.

11) Does f'' have a minimum value on $[-5, 6]$? Explain.

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3. Given that f, f', and f'' are continuous for all x, use the information in the table to answer the questions that follow.

x	$f(x)$	$f'(x)$	$f''(x)$
2	6	2	−8
4	12	0	−1
6	15	3	0
8	20	4	5
10	25	2	6

Determine whether each statement is TRUE, FALSE, or CANNOT BE DETERMINED.

1) f has a local minimum at $x = 8$

2) f has a local maximum at $x = 4$

3) f has a POI when $x = 6$

4) f has a POI on the interval $6 < x < 10$

5) f is increasing on $[2, 10]$

6) $f(x) = 17$ has a solution in $[2, 10]$

7) $f'(x) = 2.25$ has a solution in $[6, 8]$

8) $f'(x) = 2.50$ has a solution in $[6, 8]$

9) $f'(x) = 2.75$ has a solution in $[6, 8]$

10) The line $y = 15$ is a horizontal asymptote.

11) The line $x = 7$ is a vertical asymptote.

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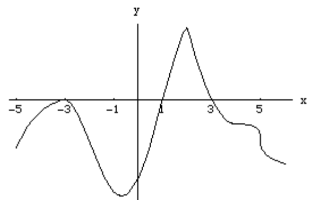
1. Find A and B so that $f(x) = Axe^{Bx}$ has a local minimum of 6 when $x = 2$.

   There are no values of *A* and *B* that will give a local minimum. Set $f'(x) = 0$ and do a sign test: $f'(x) = Ae^{Bx}(Bx+1) = 0$. The only critical point occurs when $Bx + 1 = 0$. At *x* = 2, you get $B(2) + 1 = 0 \Rightarrow B = -1/2$. Use the original function to solve for *A*: $6 = A(2)e^{-1/2(2)} \Rightarrow A = 3e$. Thus, $f'(x) = (3e)e^{-1/2x}(-\frac{1}{2}x + 1)$. However, if you do a sign test on this derivative, you will find that there is a relative <u>max</u> at *x* = 2.

2. The graph below is the graph of f', the derivative of *f*; The domain of the derivative is $-5 \le x \le 6$.



   1) The critical points for f are $x =$ **-3, 1, 3**. **(Find the values where $f'(x) = 0$)**

   2) The critical points for f' are $x =$ **-3, -1, 2, 4, 5. (Find the values where the slope of $f'(x)$ = 0 or is undefined.**

   3) f has a local maximum when $x =$ **3 ($f'(x)$ changes from positive to negative.)**

   4) f has its maximum value on $[-5, 6]$ when $x =$ **-5. (Don't worry about this yet.)**

   5) f is decreasing on the interval(s) $[-5,1] \cup [3,6]$ **(This is where $f'(x)$ is negative.)**

   6) The graph of *f* is concave up on the interval(s) (-5, -3) and (-1, 2). **(This is where the slope of $f'(x)$ is positive.)**

   7) The *x*-coordinates of the points of inflection are $x =$ **-3, -1, 2 (This is where the slope of $f'(x)$ changes from + to – or – to +.)**

   8) f' has its maximum value when $x =$ **2 (Just look at the graph!)**

   9) f'' has its maximum value when $x =$ **1 (This is where the slope of f' is steepest.)**

   10) Does f' have a minimum value on $[-5, 6]$? Explain. **Yes, by the EVT.**

   11) Does f'' have a minimum value on $[-5, 6]$? Explain. **No – vertical tangent at *x* = 5.**

AP Calculus BC
Section 4.3 – Olsen Curve Sketching (Answers)

3. Given that f, f', and f'' are continuous for all *x*, use the information in the table to answer the questions that follow.

x	$f(x)$	$f'(x)$	$f''(x)$
2	6	2	–8
4	12	0	–1
6	15	3	0
8	20	4	5
10	25	2	6

Determine whether each statement is TRUE, FALSE, or CANNOT BE DETERMINED.

1) f has a local minimum at $x = 8$ **False – not a critical point since $f'(8) = 4$.**

2) f has a local maximum at $x = 4$ **True – $f'(4) = 0$ and $f''(4) < 0$ (2nd derive. Test)**

3) f has a POI when $x = 6$ **Can't be determined.**

4) f has a POI on the interval $6 < x < 10$ **True - f' changes from increasing to decreasing on the interval, so f'' changes sign.**

5) f is increasing on $[2, 10]$ **False – local max from #2 means it must also decrease**

6) $f(x) = 17$ has a solution in $[2, 10]$ **True - IVT**

7) $f'(x) = 2.25$ has a solution in $[6, 8]$ **Can't be determined.**

8) $f'(x) = 2.50$ has a solution in $[6, 8]$ **True – MVT: look at the slope of the secant line between 6 and 8 - $f'(x) = 2.50$ for some value of *x* in the interval.**

9) $f'(x) = 2.75$ has a solution in $[6, 8]$ **True – *f* must have all slopes between 2.5 (from #8) and 4 (from $f'(8)$).**

10) The line $y = 15$ is a horizontal asymptote. **Can't be determined.**

11) The line $x = 7$ is a vertical asymptote. **False – *f* is continuous.**