Name: ______________________ **Section**: ____________

Clear your desk of everything excepts pens, pencils and erasers. **Show all your work.**
If you have a question raise your hand and I will come to you.

1. (2 points) **Fill-in-the-Blank.**

   Find all the critical numbers of the function $f(x) = x(x+1)^2$

   The critical numbers of f are: $-1, -1/3$ ______________.

Solution: The critical numbers are where the derivative is equal to zero. So differentiate:

$$f'(x) = (x+1)^2 + 2x(x+1) = 3x^2 + 4x + 1$$

Now we solve the equation $f'(x) = 0$ (using the quadratic formula):

$$\begin{aligned} x &= \frac{-4 \pm \sqrt{4^2 - 4(3)(1)}}{6} \\ &= \frac{-4 \pm \sqrt{4}}{6} \\ &= \frac{-4 \pm 2}{6} \\ &= \frac{-2 \pm 1}{3} \end{aligned}$$

So the solutions are -1 and $-1/3$.

2. (2 points) **Multiple Choice. Circle the best answer. No partial credit available**

   Where are the critical number(s) of $y = |x-1|$?

   A. $x = -1$

   B. $x = 0$

   C. $x = 1$

   D. There are no critical numbers

   E. None of the above

Solution: The critical number is just $x = 1$, since this is where the function is *not* differentiable.

Continue on to back side

3. (3 points) Find the absolute maximum and minimum of $f(x) = x^2 - 4x + 5$ on the interval $[1, 4]$.

Solution:

$$f'(x) = 2x - 4$$

Which has a critical number at $x = 2$. Now we compare this with the endpoints to find:

$$f(1) = 2$$
$$f(2) = 1$$
$$f(4) = 5$$

Giving us the absolute maximum of 5 at $x = 4$, and an absolute minimum of 1 at $x = 2$.

4. (3 points) Use linearization to estimate $\sqrt{26}$.

Solution: Since 25 is close to 26, we'll use the tangent line to $f(x) = \sqrt{x}$ at $x = 25$:

$$L(x) = f(25) + f'(25) \cdot (x - 25) = 5 + \frac{x - 25}{10}$$

Plugging in $x = 26$, we get that

$$\sqrt{26} \approx L(26) = 5 + \frac{1}{10}$$