Name: __Solutions__

- **Keep phones off and out sight.**
- **No calculators, notes, books, or other aids.**

- **Do not talk during the quiz.**
- **Show all work.**

1. Find the absolute maximum and absolute minimum of the function $f(x) = 4x - x^2$ on the interval $[0, 3]$.

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

Crit. pts:
$$f'(x) \text{ undefined: nowhere.}$$
$$f'(x) = 0$$
$$(\Leftrightarrow) \quad 4 = 2x$$
$$(\Leftrightarrow) \quad \underline{x = 2}$$

Candidates: $0, 3, \& 2$.

bdy. $\begin{cases} f(0) = 0 \leftarrow \min \\ f(3) = 12 - 9 = 3 \end{cases}$

$\begin{matrix} \text{crit.} \\ \text{pt.} \end{matrix}$ $\begin{cases} f(2) = 8 - 4 = 4 \leftarrow \max \end{cases}$

on $[0, 3]$:
abs. max is 4   (@x=2)
abs. min is 0   (@x=0)

2. Find all critical numbers of the function $f(x) = 3x^{2/3} - 4x$. (Only the $x$-coordinates are needed.)

$$f'(x) = 3 \cdot \frac{2}{3} x^{-1/3} - 4$$
$$= \frac{2}{x^{1/3}} - 4.$$

undefined at $x = 0$

$$f'(x) = 0$$
$$(\Leftrightarrow) \quad \frac{2}{x^{1/3}} = 4$$
$$(\Leftrightarrow) \quad \frac{1}{2} = x^{1/3}$$
$$(\Leftrightarrow) \quad \frac{1}{8} = x$$

crit. numbers are
$x = 0$ & $x = 1/8$

(problem 3 on reverse)

3. Find all critical numbers of the function $f(x) = (x-2)^3(x-7)^2$. (Only the $x$-coordinates are needed.)

   *Hint: remember to look for common factors before expanding anything!*

$$f'(x) = 3(x-2)^2(x-7)^2 + (x-2)^3 \cdot 2(x-7)$$

$$= (x-2)^2(x-7) \cdot \left[3(x-7) + 2(x-2)\right]$$

$$= (x-2)^2(x-7) \cdot \left[3x-21 + 2x - 4\right]$$

$$= (x-2)^2(x-7) \cdot (5x - 25)$$

$$= 5(x-2)^2(x-7)(x-5)$$

undefined: nowhere.

$$f'(x) = 0 \iff x-2=0, \quad x-7=0, \quad \text{or} \quad x-5=0.$$

$$\iff \boxed{x = 2, 5, \text{ or } 7.}$$