**3.** [11 points] *No work or explanation is required on this page.*

**a.** [4 points] Determine which, if any, of the functions listed below satisfy ALL of the following:

- It has a zero at $x = -5$.
- Its long-run behavior satisfies $y \to -\infty$ as $x \to \infty$.
- Its long-run behavior satisfies $y \to -\infty$ as $x \to -\infty$.

(Circle all of the functions that satisfy all three conditions, if there are any; otherwise, circle NONE OF THESE.)

i. $y = -4(x-5)(x-1)^2(x+2)$

ii. $y = 2(x+5)(x+1)^2(x-2)^2$

iii. $y = -4(x+5)(x+1)^2(x-2)$

iv. $y = \dfrac{-4(x-5)(x+1)}{x+5}$

v. $y = \dfrac{-4(x+5)(x+1)^2(x-5)}{x^2+25}$

vi. $y = \dfrac{-2(x+5)(x-5)(x-2)}{x^2+25}$

vii. NONE OF THESE

**b.** [3 points] Which, if any, of the following functions have $y = 2$ as a horizontal asymptote? *Circle your answer(s).*

i. $y = \dfrac{6x^4 - 5x^2 + 3}{3x^4 + 2x - 1}$

ii. $y = \dfrac{(2x-1)(x+3)(x-5)}{(x+1)(x-4)}$

iii. $y = \dfrac{2e^x + x^2}{2 + e^x}$

iv. $y = \dfrac{2\ln x + x}{\ln x + 3}$

v. NONE OF THESE

**c.** [4 points] Data for a function $g(s)$ is given in the following table.

| $s$ | $-4$ | $-2$ | $-1$ | $1$ | $3$ |
|---|---|---|---|---|---|
| $g(s)$ | 13 | 5 | 2 | $-2$ | $-4$ |

For each property listed below, determine whether $g(s)$ could have that property on the entire domain $[-4, 3]$. (Circle each term that *could* describe $g(s)$, if there are any; otherwise, circle NONE OF THESE.)

i. INCREASING

ii. DECREASING

iii. CONCAVE UP

iv. CONCAVE DOWN

v. AN ODD FUNCTION

vi. AN EVEN FUNCTION

vii. AN INVERTIBLE FUNCTION

viii. A LINEAR FUNCTION

ix. AN EXPONENTIAL FUNCTION

x. NONE OF THESE