Name:______________________________

Codename:______________________________

Open book, calculators allowed. SHOW ALL OF YOUR WORKING.

1. [5 points] Solve the equation

\[5x^3 + 30x^2 + 45x = 0.\]

[Hint: check your answer(s) by substituting into the equation.]

Solution: Remove a common factor (1 point)

\[5x(x^2 + 6x + 9) = 0.\]

Then either factor further to get

\[5x(x + 3)(x + 3) = 0,\]

OR set \(x = 0\) and \(x^2 + 6x + 9 = 0\) and use the quadratic formula (both approaches worth 2 points).

Finally, the answer should be \(x = 0, -3\) (2 points for both solutions).

2. [5 points] Simplify the rational expression

\[\frac{1}{x+1} + \frac{1}{\frac{3}{x} + \frac{x}{x+1}}.\]

[Hint: Stuck? Try \(\frac{1}{x} + \frac{1}{\frac{3}{x} + \frac{x}{x+1}}\). If that still doesn’t help try \(\frac{1}{2} + \frac{1}{3} + \frac{1}{2}\).]

Solution:

\[
\begin{align*}
\frac{1}{x+1} + \frac{1}{\frac{3}{x} + \frac{x}{x+1}} &= \frac{2(x+1)}{2(x+1)} + \frac{3x}{3(x+1)} \\
&= \frac{x + 2}{x + 1} \cdot \frac{5x + 2}{3(x + 1)} \\
&= \frac{x + 2}{x + 1} \cdot \frac{3(x + 1)}{5x + 2} \\
&= \frac{3(x + 2)}{5x + 2}\end{align*}
\]

2 points for getting both LCD’s correct

1 point for adding numerators correctly

1 point for taking reciprocal

1 point for cancelling common factor