1. - List any roots, their degree, and the behavior of the graph at the roots.
   - Find the y-intercept, if possible.
   - List all asymptotes, and the degree of all vertical asymptote.
   - Find any points where the graph intersects a horizontal or oblique asymptote.
   - Find the leading term and use it to determine the long term behavior.
   - Graph the function and label your axes

   (a) $f(x) = \dfrac{x^2}{(x-1)}$

   - Roots: $x = 0$ degree 2, touches
   - y-int: $(0, 0)$
   - VA: $x = 1$ degree 1
   - HA/OA: $y = x + 1$, Does not intersect
   - Leading term and behavior: x, $f(x) \to \infty$ as $x \to \infty$, $f(x) \to -\infty$ as $x \to -\infty$.

   (b) $p(x) = -2x(x + 2)(x - 1)^2$

   - Roots: $x = 0$, degree 1, $x = -2$, degree 1, $x = 1$, degree 2
   - y-int:$(0, 0)$
   - VA: None
   - HA/OA: None
   - Leading term and behavior: $-2x^4$, $p(x) \to -\infty$ as $x \to \pm\infty$

   (c) $h(x) = \dfrac{3x - 2}{x + 2}$

   - Roots: $x = \frac{2}{3}$, degree 1
   - y-int: $(0, -1)$
   - VA: $x = -2$, degree 1
   - HA/OA: $y = 3$, does not intersect
   - Leading term and behavior: 3, $h(x) \to 3$ as $x \to \pm\infty$.

   (d) $g(x) = \dfrac{(x + 1)^2}{(x - 3)^2(x + 2)}$

   - Roots: $x = -1$, degree 2
   - y-int:$(0, \frac{1}{18})$
   - VA: $x = 3$, degree 2, $x = -2$, degree 1
   - HA/OA: $y = 0$, intersects at root
   - Leading term and behavior: $\frac{1}{x}$, $g(x) \to 0$ as $x \to \pm\infty$

(e) $p(x) = (5-x)^3(x+2)^2$

- Roots: $x = 5$, degree 3, $x = -2$, degree 2
- y-int: $(0, 500)$
- VA: None
- HA/OA: None
- Leading term and behavior: $-x^5$, $p(x) \to -\infty$ as $x \to \infty$ and $p(x) \to \infty$ as $x \to -\infty$

2. Simplify.

   (a) $\log_3 27^{\frac{1}{3}}$ 1

   (b) $\log_2 8^2$ 6

   (c) $\log_{10} 10$ 1

   (d) $\ln e^{\frac{1}{2}}$ $\frac{1}{2}$

   (e) $3^{\log_3 10}$ 10

   (f) Challenge Question: $\dfrac{\log_2 25}{\log_2 5}$ 2

3. Write as a sum or difference of logarithms without any exponents.

   (a) $\log_3(x^2y^3)$ $2\log_3 x + 3\log_3 y$

   (b) $\log_{10}\left(\frac{\sqrt{x}}{10}\right)$ $\frac{1}{2}\log_{10} x - 1$

   (c) $\ln(x^2-4)$ $\ln(x-2) + \ln(x+2)$

4. Write as a single logarithm

   (a) $2\ln x + \ln y$ $\ln x^2 y$

   (b) $\frac{1}{2}(\ln x - \ln 4)$ $\ln\left(\frac{\sqrt{x}}{2}\right)$

   (c) $3\log_2 x + \log_2 y$ $\log_2 x^3 y$