Instructions: Show all work. Box all answers. Write all **real number solutions in simplest rational or radical form**, unless otherwise specified. All **complex number solutions should be written in $a + bi$** form. You may use a calculator, unless otherwise specified. This practice test is not comprehensive by any means. However, you should focus on Questions $1 - 4, 7, 8, 11 - 13$, and 16 on the Final Exam Review. Otherwise, use similar questions on WeBWorK.

1. [10] Solve the inequality Show answer on number line and in interval notation.
   $\frac{(x-5)(3x+7)}{(x-5)(2x-9)} \geq 0$

2. A. [5] Solve for x without a calculator. $3^{x+17} = 81^{x+8}$
   B. [5] Solve for x. $4^{-x} = 7^{2x-5}$

3. [10] Solve for x. $\log_4(x) + \log_4(x-12) = \log_4(64)$

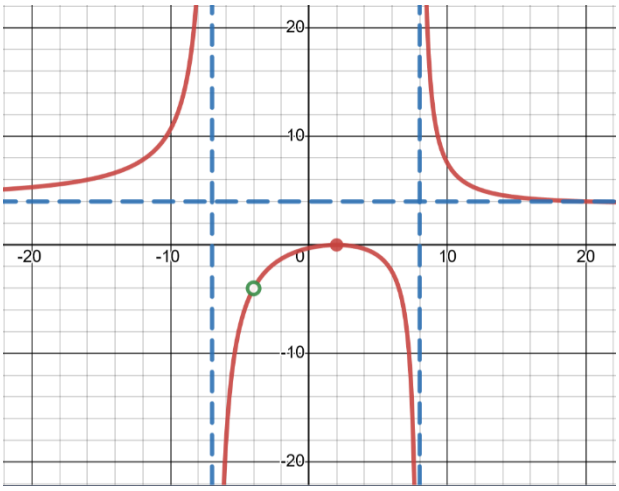
4. [5 points each]
   a. Write this logarithm in fully expanded form.
      $\ln\left(\frac{\sqrt[3]{x^5}}{y^7}\right)$
   b. Condense into a single logarithm without rational exponents.
      $-5\log(w) + \log(x) + 3\log(y) - 8\log(z)$

5. At the end of the 2010 census, the Koopa Troopa population on Donut Plains was 28 thousand and was increasing at a rate of 3.1% per year.
   a. [5] What would be the predicted population by 2023 to the nearest Koopa Troopa?
   b. [5] If this rate of growth continues, how long (to the nearest tenth of a year) would it take for the population to double?
   c. [1] In which year would the population have doubled?

6. [10] Find a real number C so that the polynomial has the indicated root. For this C, find all remaining roots of the polynomial algebraically and write the roots in simplest radical form.
   $f(x) = x^3 - 8x^2 + 9x + C$ has a root at $x = 2$

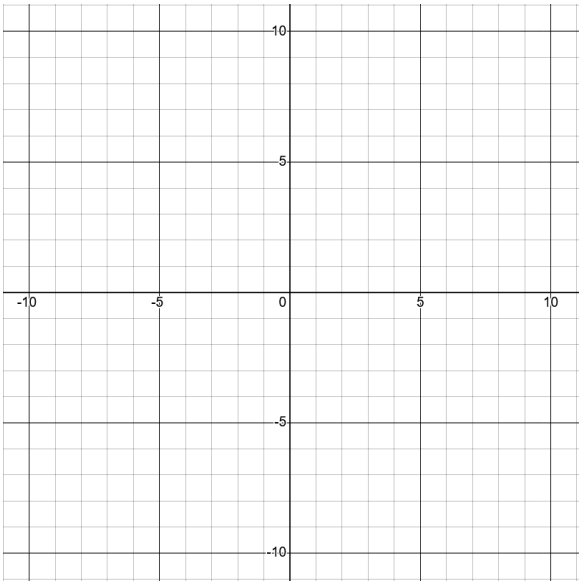
7. [10] Let $P(x)$ be a 3rd degree polynomial with roots at $x = -2$ and and $x = 3 - 2i$. It is also known that $P(0) = 130$. Write a polynomial for $P(x)$ **in factored form, using only real number constants**.

8. [10] Consider the graph of $f(x)$.



Find any x-intercept, hole, asymptote, and the domain of f. Find a formula for the function f.

9. [10] Calculate the **domain, asymptotes, and x-intercepts** of $y = \log_2(10 - 2x)$, then sketch its graph. Label asymptotes and x-intercepts.

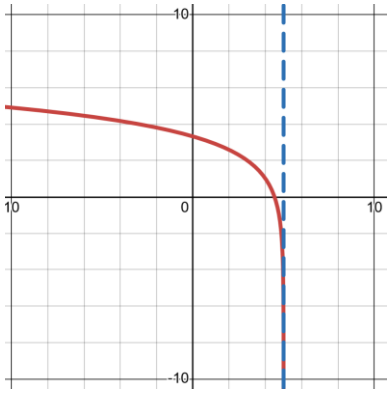


10. [10] Find the difference quotient $\frac{f(x+h)-f(x)}{h}$ if $f(x) = 2x^2 - 7x + 2024$

11. [10] Given $y = \frac{8x-5}{9-4x}$. Find the inverse function.

Answer Key

1. $x \in \left(-\infty, -\frac{7}{3}\right] \cup \left(\frac{9}{2}, 5\right) \cup (5, \infty)$
2. A. $x = -5$ B. $x = \frac{5\ln(7)}{2\ln(14)}$
3. $x = 16, x \neq -4$
4. A. $\frac{5}{3}\ln(x) - 7\ln(y)$ B. $\log\left(\frac{xy^3}{w^5z^8}\right)$
5. A. 41641 or 41897 Koopa Troopas
   B. $t = \frac{\ln(2)}{\ln(1.031)} \approx 22.7$ years or $t = \frac{\ln(2)}{.031} \approx 22.5$ years
   C. 2032
6. $C = 6$ roots: $3 + 2\sqrt{3}, 3 - 2\sqrt{3}$
7. $f(x) = 5(x + 2)(x^2 - 6x + 13)$
8. x-int: (2,0) hole:$(-4, -4)$ HA: $y = 4$ VA:$x = -7, x = 8$ $f(x) = \frac{4(x-2)^2(x+4)}{(x+7)(x-8)(x+4)}$
9. Domain: $(-\infty, 5)$ VA: $x = 5$ x-int:$\left(\frac{9}{2}, 0\right)$



10. $4x + 2h - 7$
11. $y = \frac{9x+5}{8+4x}$