This is not a complete list of the types of problems to expect on the final exam. Review all Tests and Quizzes as part of your preparation.

Questions

1. Determine the domain of the function $f(x) = \sqrt{x - 12}$.

2. Determine the domain of the function $f(x) = \dfrac{\sqrt{x}}{\ln x}$.

3. Find a formula $f^{-1}(x)$ for the inverse of the function $f(x) = 4e^{3x-9}$ (you do not have to discuss domain and range).

4. Write an equation for the linear function f that satisfies the conditions $f(-3) = -7$ and $f(5) = -11$.

5. Given the functions $f(x) = x^2 - 4$ and $g(x) = \sqrt{x} + 4$, determine the following compositions (simplify as much as possible). You do not have to discuss domains.

(a) $(f \circ f)(x)$
(b) $(g \circ f)(x)$

6. For the quadratic function $f(x) = x^2 - 4x + 5$, convert to the vertex form $f(x) = a(x - h)^2 + k$ by completing the square.

7. Given the function $f(x) = -(12x - 7)^2(34x + 89)^3$. State the degree of the polynomial, and the zeros with their multiplicity. Describe the end behaviour of this function, and determine $\lim\limits_{x \to -\infty} f(x)$. Sketch the polynomial.

8. Solve the inequality $\dfrac{2(x - 1)}{(x + 1)(x - 3)} \le 0$ using a sign chart.

9. Given the function $f(x) = ax^2 + bx + c$, simplify the following expression as much as possible:

$$\frac{f(x_0 + h) - f(x_0)}{h}$$

10. Sketch the rational function $f(x) = \dfrac{(3 - x)(3 + x)^2}{(12 - 4x)^2}$.

11. Sketch the polynomial $f(x) = 4x^3 - 16x^2 + 13x - 3$ knowing $f(3) = 0$.

12. Sketch $y = -3\ln(-4x)$ using graphical transformations of $f(x) = \ln x$. Clearly describe in words each graphical transformation you use.

13. Assuming x, y, and z are positive, use properties of logarithms to write the expression as a single logarithm.

$$\ln(xy) + 2\ln(yz^2) - \ln(xz)$$

14. Solve the equation $\dfrac{44}{1 + 4e^{-x/7}} = 32$ algebraically.

15. Sketch the ellipse $\dfrac{(x + 1)^2}{4} + (y - 1)^2 = 1$ and determine the center, vertices, and foci.

16. Solve the equation $\ln x - \dfrac{1}{2}\ln(x + 4) = 0$ algebraically. Be sure to eliminate any extraneous solutions.

17. Given $f(x) = \frac{1}{2}\ln(x + 2)$, $g(x) = e^x$. Find $(g \circ f)(x)$, and simplify as much as possible. Your final answer should **not** have exponentials and logarithms in them.

18. Solve the system of equations and sketch the situation.

$$y^2 = -x + 9$$
$$y = -x$$

19. Sketch the ellipse $(x + 3)^2 + 16(y - 2)^2 = 4$ and determine the center, vertices, and foci.

20. Solve the system of equations and sketch the situation.

$$y^2 = x$$
$$x^2 = -8y$$

21. Determine the average rate of change $\dfrac{\Delta y}{\Delta x}$ of the function $f(x) = \dfrac{1}{\sqrt{x}}$ on the interval $[x, x + h]$.

22. Determine the inverse function $f^{-1}(x)$ given $f(x) = \dfrac{2x + 1}{4 - 5x}$. Verify $f(f^{-1}(x)) = x$.

23. Sketch $y = 3e^{-4x}$ using graphical transformations of $f(x) = e^x$. Clearly describe in words each graphical transformation you use.

24. Sketch the polynomial $f(x) = 3x^3 - 11x^2 + 2x + 12$ knowing $f(3) = 0$.

25. Sketch the rational function $f(x) = \dfrac{(x - 1)(x - 2)^2}{(x - 3)(x - 4)}$.

26. Sketch the region which satisfies the following inequalities, and determine the points of intersection

$$x^2 \leq -y + 1$$
$$y \geq -2x - 2$$

27. A population of bunny rabbits doubles every 24 days. If the population was initially 123 rabbits, what is the population after t days? When will the population be 1000 rabbits?

28. Determine the interval which satisfies the inequality $f(x) = \dfrac{(x - 1)(x - 2)^2}{(x - 4)} \leq 0$ using a sign chart.

29. Sketch the parabola $y^2 - 6y + 1 + 8x = 0$ and determine the focus and directrix.

30. Sketch the hyperbola $4x^2 + 54y = 41 + 8x + 9y^2$ and determine the center, vertices, and foci.