Name__________________________________________________________

SU ID Number____________________________________________________

Instructor: (circle one) Kim Taylor Severn Scott Baumgartner Taylor Borcz

Instructions: Do not open this booklet until instructed to do so.

Silence and put away all electronic devices, except your calculator.

You may use a graphing calculator, such as a TI-83 or TI-84, but not a TI-89.

Answer all 14 questions. Show all work on this exam to receive full credit, even when using a calculator. Label all answers and give units where appropriate. Estimate to 2 decimal places, when necessary.

When you have read these instructions, sign here ______________________

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Total
1. (10 points)

a) Perform the operation, factor, and simplify.

\[
\frac{x^2}{x - 2} \div \frac{x}{x^2 + 4x - 12}
\]

b) Simplify without negative exponents.

\[(AB)^{-2}(2A^{-2} B^3)^2\]
2. (6 points) Let \( f(x) = (x + 2)^2 + 1 \). Find the average rate of change of \( f \) over the interval from \( x = -1 \) to \( x = 2 \).

3. (12 points) Find a formula for:
   a) the line passing through the points \((-1, 6)\) and \((2, 18)\).

   b) the parabola having vertex point \((2, 6)\) and passing through the point \((1, -10)\).
4. (7 points) Given the piecewise-defined function \( f(x) \), where

\[
    f(x) = \begin{cases} 
    x + 3 & \text{for } 0 \leq x < 2 \\
    x^2 & \text{for } 2 \leq x \leq 4 
    \end{cases}
\]

a) Evaluate: 
   \( f(0) = \) 
   \( f(2) = \) 
   \( f(4) = \)

b) Sketch a graph of \( f(x) \). Label and number the axes clearly.

c) State the domain and range of \( f(x) \).

Domain: 

Range:
5. (8 points)
   a) Given \( f(x) = 2x^2 + 1 \) and \( g(x) = x - 1 \), find \( f(g(4)) \).

   b) Given \( h(x) = p(q(x)) \), \( h(x) = \sqrt{3x - 2} \), and \( q(x) = 3x \), give a function for \( p(x) \).

6. (6 points) The point (4, 6) lies on the graph of \( f(x) \). Give a point that lies on the graph of the transformation of:
   a) \( f(x) + 2 \)

   b) \( f(x + 3) \)

   c) \(-2f(x) - 1\)
7. (10 points) If the initial population of Suburbia is 15,000 people, and the population grows at a constant rate of 6.5% per year,

a) give a function to represent the population, P, as a function of time, t, in years.

b) What is the population estimated to be after 12 years?

c) After how many years will the population triple (reach 45,000)?

8. (6 points) Solve for $x$, exactly.

$$2e^{4x-1} = 10$$
9. (5 points) A child is flying a kite. The kite string is 50 feet long. The angle formed between the ground and the kite string is 38°. How high is the kite off the ground?

10. (5 points) Find the coordinates of the point corresponding to an angle of 125° on a circle of radius 4, centered at the origin.

11. (5 points) What is the length of an arc cut off by an angle of 225° on a circle of radius 12?
12. (6 points) Given the periodic function \( y = 7 \sin(4(t - 2)) - 8 \), state the amplitude, period, and midline equation of the function.

Period =

Amplitude =

Midline equation

13. (6 points) Find a formula for the third degree polynomial having a zero at \( x = 1 \), and a double zero at \( x = 3 \), and passing through the point \((5, 8)\).
14. (8 points) Given the rational function $f(x) = \frac{2x-4}{x-3}$, 

a) Give the y-intercept.

b) Give the x-intercept(s).

c) Evaluate the limit: 
$$\lim_{x \to \infty} \frac{2x-4}{x-3} =$$


d) Write the equation of the horizontal asymptote of $f(x)$.

e) Write the equation(s) of any vertical asymptote(s) of $f(x)$.

f) Evaluate the limit: 
$$\lim_{x \to 3} \frac{2x-4}{x-3} =$$

(You may wish to sketch a graph of $f(x)$.)