Directions: *You must show all of your work to receive full credit—solutions submitted without showing work will receive no credit.*

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1. Find an equation of the line that passes through the point $(2, 2)$ and is parallel to $y = 2x + 1$.

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2. If a town starts with a population of $20,500$ that declines by 500 people each year, construct an equation to model its population over time. How long would it take for the the population to drop to $15,00$?

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3. Solve for x

   (a) $2^{-3}2^{-5} = 2^x$

   (b) $\log x - \log(x + 1) = 1$

   (c) $\ln x = 3 \ln 2 + 2 \ln 6$

(d) $10(3)^{3x} = 20$

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4. Simplify and express with positive exponents

(a) $\dfrac{x^{-3}y^4}{(x^{-2})^3 y^{-7}}$

(b) $\left(\dfrac{\sqrt{ab^2}}{\sqrt{b}}\right)^{-1}$

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5. Suppose you invest \$500 in a bank that earns 10% per year. Construct the function if the interest is compounded
   (a) Continuously
   (b) Quarterly
   (c) Every other month

6. An apparel company sells custom made T-shirts to organizations. The cost C(x) and revenue R(x) equations for x T-shirts are

$$C(x) = 15x + 1000$$
$$R(x) = 20x$$

Find the break even point and sketch the graph.

7. Construct an exponential function that goes through the points $(0, 6)$ and $(1, 12)$. Sketch the graph and identify the y-intercept

8. Given the quadratic equation $y = x^2 - x - 6$.
   (a) Determine the concavity of this parabola (concave up or concave down?) explain.
   (b) Find the x-intercepts
   (c) Find the vertex. Is it a minimum or a maximum?
   (d) Sketch its graph and label on the graph information found above.

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9. Find the roots of the following quadratic equations
   (a) $y = x^2 + 2x + 2$

(b) $y = 2x^2 + 8x - 10$

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10. Express your answer as a single logarithm
    (a) $2\ln x - 3\ln y$

    (b) $3\ln 2 + 2\ln 3 - \ln 5$

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11. Cambridge college has proposed a parking fee increase. The college administration recommended gradually increasing the daily parking fee to \$7.00 by year 2008 followed by an increase of 5% every year after that. Call this plan A. Another plan B recommends every year after 2008 the rate be increased by 50 cents. Write the equation for both plan A and B as a function of time, t. Sketch the graph of plan B.

12. Create a new function by performing the following transformation on $f(x) = x^2$.
    (a) $g(x)$ is $f(x)$ shifted right 2 units, stretched by a factor of 3 and shifted down by 1 unit.

    (b) $h(x)$ is $f(x)$ shifted left 3 units, stretched by a factor of 2 and reflected across the x-axis and finally shifted up by 5 units.

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13. Match each graph with it's equation.

14. For the graph of the following logarithmic functions, state 3 observations that are true for both $\ln x$ and $\log x$. No more than 3, otherwise I'll consider your first 3 statements only.

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15. Name 3 candidates that are running for the presidency in 2008