Math 30 Challenge Exam Review

In order to successfully pass a challenge exam, a test taker must be well versed in one of its components, algebraic skills. It is suggested to prepare/ recap the following topics: linear equations, quadratic equations, exponential equations, logarithmic equations, solving for the roots of a function, laws of exponents, polynomials, rational exponents, function modeling and graph. Furthermore, this reviewer is designed to benchmark the test taker's current skills or preparedness. It does not necessarily reflect the exam format nor content of the questions in the actual challenge exam.

Directions: For numbers 1 – 14, solve the problems without the use of calculator.

1. Complete the table below and find the linear equation represented by the table:

x	-2	0	2	3	4	7	10
y	10		0				

   Equation: _____

2. Solve for the value of x: $-3(2x - 4) - 10 = 5(x + 2) + 6$

3. Simplify $\left(\sqrt[4]{64}\right)\left(\sqrt[3]{16}\right)$

4. Simplify completely: $\dfrac{\left(3x^5 y^{-2} z^4\right)^{-2}}{5x^{-4} y^2 z}$

5. Solve the value of x: $20(3)^x = 5(27)^x$

6. Find the roots or zeros of the given equation by factoring : $-6x^2 - x + 2 = 0$

7. Solve for the value of x : $log_4(x + 1) = 6$

8. Explain why the given equation is not a function: $2x^2 - 3y^2 = 1$

9. Graph and label appropriately the given equation: $f(x) = \frac{2}{3}x + 7$

10. Find the intercepts and use it to graph the given equation : $5x - 3y = 30$

11. The table below represents an exponential equation. Complete the table and write the appropriate equation and sketch a graph complete with labels:

x	0	1	2	3	4
y	100	110	121		

12. Find the exact solution: $\ln(2x + 11) = e$

13. Simplify $(5x - 1)(2x^2 - 3x + 7)$

14. Find the exact solution: $2\log_5(3x) = 12$

For numbers 15 – 23, calculators are permitted

15. The population of a town (in thousands) is modeled by the equation $P(t) = 10t + 125$, where t is the number of years since year 2000.

   a) Find $P(2)$ and explain what this value means in this situation.

   b) Solve $P(t) = 335$ and explain what this value means in this situation.

   c) Explain the meaning of the constants in the equation.

16. Taxicab fares in New York City are governed by the New York City Taxi and Limousine Commission. The fare is determined by the distance you travel, assuming that traffic is moving at 6 miles per hour or more. If the taxi is stuck in traffic, you pay by the minute. Additional fees accrue for late night hours or peak time between 4 p.m. and 8 p.m. On Monday at noon, Bobby took a taxicab in New York. He noticed that after travelling 2.4 miles, the fare is $7.30 and after 3 miles, the fare is $8.50. Assuming that fare increases by the same amount per mile, find an equation to model the cab fare in terms of the number of miles travelled.

17. Two companies offer starting employees incentives to stay with the company after they are trained for their new jobs. Company A offers an initial hourly wage of $10.00, then increases the hourly wage by $0.15 per month. Company B offers an hourly wage of $10.65 after two months and $11.05 after 6 months.
   a) Find the linear equations for each company. Clearly define your variables.
   b) When will the hourly wage for each company be the same? Solve this algebraically.
   c) Graph the system of equations and explain how you are using the graph to check your answer in part b.

18. A company's annual production of ethanol, used as fuel for automobiles, was 5.1 million gallons in 2007 and has grown by about 2.4% per year since then.

   a) Write an equation for the company's annual ethanol production t years since 2007.

   b) Use your equation to determine the company's annual ethanol production this year.

   c) Determine when annual ethanol production will reach or have reached 37 million gallons. Document your process.

19. A cancer patient's white blood cell count grew exponentially after she had completed chemotherapy treatments. The equation $C(d) = 63(1.17)^d$

    describes C, her white blood cell count per milliliter, d days after the treatment was completed.

    a) Find $C(5)$ and explain its meaning in the context of the scenario.

    b) Explain the meaning of the constants 1.17 and 63 in the context of the scenario.

    c) Use an algebraic method to solve find the number of days after treatment when the white blood cell count of the patient reaches 200 per milliliter.

20. The table below shows the balance in Donna's savings account in terms of the number of years since she started saving. Assume that Donna has neither deposited any new money nor withdrew any money since she enrolled in this savings account. Also, assume that her savings account balance increases by the same percent every year.

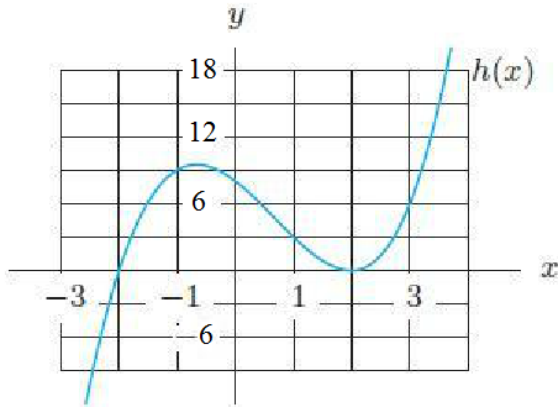| Number of Years	0	1	2	3	4	5
Savings Account Balance ($)	10000	10300	10609			

    a) Fill in the missing values in the table.

    b) Find the equation that models this situation. Document your process.

    c) Explain the meaning of the constants in the equation.

21. Phosphorous-32 is used to mark cells in biological experiments. It can be quite dangerous to work with if the experimenter fails to use the proper shields, since its high-energy radiation extends out to 610 cm. Because disposal of radioactive wastes is increasingly difficult and expensive, laboratories often store the waste until it is within acceptable radioactive levels for disposal with non-radioactive trash. The rule of thumb for the laboratories of a large East Coast university and medical center is that any waste containing radioactive material with a half-life under 65 days must be stored for 10 half-lives before disposal with the nonradioactive trash. Assume that phosphorous-32 decreases by 5.3% per day. If a scientist has 150 mg of phosphorous-32 today, how long does it take for the amount to reach less than 2 mg? Write an equation and use this to solve the problem. Document the problem solving process.

22. The function $f(x) = 0.05x^2 - 5.5x + 250$ determines the number of daytime accidents for every 200 million kilimeters driven as a function of the travel speed in kilometers per hour.

   a) Find the number of daytime accidents that occur at 50 km/h.

   b) Find the vertex and interpret its meaning.

   c) Create a complete and accurate graph of the function.

   d) Find the value/s of x when $f(x) = 200$.

   e) Explain how to use the graph to check your answer for part d.

23. Use the graph of $h(x)$ to find the following values.

   a) $h(1)$

   b) $h(3)$

   c) The value/s of x when $h(x) = 0$.