1. (10 pts) Solve the following equation. (Leave logs on your answer)

\[ 7^{3x} = 3^{x+4} \]

\[ x = \frac{4 \ln 3}{3 \ln 7 - \ln 3} \]

or

\[ x = \frac{4 \log 7}{3 \log 7 - \log 3} \]

2. (10 pts) Line A goes through the points (1, 2) and (4, 8). Line B has twice the slope of line A and hits the y-axis at y = 3.

(a) What is the equation of line B? Give the answer in the form \( y = mx + b \).

(b) What is the x coordinate of the point where line A meets the line \( x + y = 2 \).

3. (10 pts) A tank initially contains 1000 liters of pure water. Then water containing 4 mg of detergent per liter starts to enter the tank at the rate of 20 liter per hour. How long until the average concentration of detergent in the tank is 2 mg per liter? How long until the average concentration of detergent in the tank is \( x \) mg per liter?

4. (10 pts) The half life of a certain element is 100 years. Initially there are 48 grams. How much remains after 250 years?

5. (10 pts) (a) If \( \log 2 = a \) and \( \log 3 = b \), what is \( \log 24 \) in terms of \( a, b \)?

(b) Express \( 5^x \) as a power of 9.

(c) What's average rate of change of \( f(x) = x^2 \) from \( x = 1 \) to \( x = 1 + h \)?

\[ (a) \quad 3a + b \]

\[ (b) \quad 9 \frac{h}{\ln 9} x \]

\[ (c) \quad h + 2 \]
Circle your TA’s name and Discussion time: 
John Cloutier, Martin Harrison, Pat Plunkett, David Valdman
T 8am; 4pm; 12noon; 5pm;  R 8am; 5pm; 6pm; 7pm
Total Score: 50
Your Total

Books, notes are NOT allowed. READ the problems carefully. No calculators are allowed.
Put final answers on boxes on this page. Put high quality work in the blue book for all answers.
Points might be awarded for this: Number your solutions in the blue book; At the end of exam STAPLE this page to the INSIDE front blue cover of the blue book, so that this side faces the white writing pages of the blue book.

1. (10 pts) Solve the following equation. (Leave logs on your answer)

\[ 3^{7x} = 7^{x+4} \]

\[ x = \frac{4 \ln 7}{7 \ln 3 - \ln 7} \quad \text{or} \quad x = \frac{4 \log 7}{7 \log 3 - \log 7} \]

2. (10 pts) Line A goes through the points (1, 2) and (4, 8). Line B has half the slope of Line A and hits the y-axis at y = 3
(a) What is the equation of Line B? Give the answer in the form \( y = mx + b \).
(b) What is the y coordinate of the point where Line A meets the line \( x + y = 2 \)

(a) \( y = x + 3 \) 
(b) \( y = \frac{4}{3} \)

3. (10 pts) A tank initially contains 500 liters of pure water. Then water containing 4 mg of detergent per liter starts to enter the tank at the rate of 20 liter per hour. How long until the average concentration of detergent in the tank is 2 mg per liter? How long until the average concentration of detergent in the tank is \( x \) mg per liter?

\[ 2 \text{5} \quad \text{hours} \quad \frac{2x}{4 - x} \quad \text{hours} \]

4. (10 pts) The half life of a certain element is 100 years. Initially there are 40 grams. How much remains after 350 years?

\[ 40 \left(\frac{1}{2}\right)^{3 \cdot 5} \text{ grams} \]

5. (10 pts) (a) If \( \log 2 = a \) and \( \log 3 = b \), what is \( \log 36 \) in terms of \( a, b \)?
(b) Express \( 9^x \) as a power of 5
(c) What’s average rate of change of \( f(x) = x^2 \) from \( x = 1 \) to \( x = 1 + h \)?

(a) \( 2a + 2b \) 
(b) \( \frac{5}{\ln 5} \cdot x \) 
(c) \( h + 2 \)