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Write all responses on separate paper. Remember to organize your work clearly. You may *not* use your books or notes on this exam. You may use a calculator.

1. (12 points) Write without negative exponents and simplify.

- (a)  $\left(\frac{3}{x}\right)^{-4}$   
(b)  $\frac{2y^{-4}}{x^{-3}}$   
(c)  $\frac{3t^2(2t^{-3})^{-2}}{3t^{-3}}$ .

2. (12 points) Write each power in radical form.

- (a)  $(12d)^{2/3}$   
(b)  $(9 - 4x^2)^{0.5}$

3. (10 points) Write each radical as a power with a fractional exponent.

- (a)  $x\sqrt[3]{x}$   
(b)  $\frac{1}{\sqrt[3]{x^2}}$

4. (16 points) The heron population of Saltmarsh Refuge is estimated by conservationists at

$$P(t) = 400t^{-1/3}$$

where  $t$  is the number of year since the refuge was established in 2000.

(a) Complete the table (on separate paper)

$t$	0.001	1	8	27	64
$P(t)$	.	.	.	.	.

- (b) Sketch a graph for the function for  $0 \leq t \leq 64$   
(c) Approximately how many heron were there in 2012?  
(d) In what year will there be only 10 heron left?

5. (12 points) Write an equation for the circle
- (a) with radius 2 and center  $(1, 3)$ .
  - (b) centered at  $4, 5$  and passing through  $(1, 2)$ .
  - (c) with diameter from  $(-3, 2)$  to  $(5, 4)$ .
6. (12 points) Find the logarithm.
- (a)  $\log_2 64$
  - (b)  $\log_3 \frac{1}{27}$
7. (12 points) Solve for the unknown value.
- (a)  $\log_2(1 - 2x) = 4$
  - (b)  $6 \cdot 10^{2.07x} = 216$
  - (c)  $105 = \frac{1}{3}(10^{0.5x} - 1)$
8. (14 points) A obsessive saver puts 2 in a box on the first day of the month of January. 4 on the second day, 8 on the third day, and keeps doubling the number of cents she puts in the box for every day of the month thereafter.
- (a) Make a table of the number cents she puts in the box each day for the first week.
  - (b) Write a function which gives the number of cents she puts in the box on the  $n$ th day.
  - (c) How much money did she put in the box on the 15th day of the month.
  - (d) What if she had deposited the money in an account bearing 5% daily interest? How much money would she have at the end of the first week? You can write this as a sum, but you don't have to compute the sum.