Math 1148
Autumn 2017
Final Exam
Form A

Name: _____

Name.nn: _____

Lecturer: _____

Rec. Instructor: _____

Rec. Time: _____

Instructions:

- You have **1 hour and 45 minutes** to complete this exam. It consists of 12 questions on 11 pages including this cover sheet and is worth a total of 200 points. The value of each question is listed below and with each question. Partial credit might not be awarded on some questions.

- You may not use any books, notes or self-supplied scratch paper during this exam.

- Calculators are permitted EXCEPT those calculators that have symbolic algebra or calculus capabilities. In particular, the following calculators and their upgrades are not permitted: TI-89, TI-92, and HP-49. In addition, neither PDAs, laptops nor cell phones are permitted.

- Make sure to read each question carefully.

- Please **write clearly** and make sure to **justify your answers**. Correct answers with no supporting work may receive no credit. If you find a solution to a problem using a graph from your calculator (where appropriate), you need to sketch that graph and label all relevant information.

- Unless otherwise specified, make sure your answers are in **exact form** (i.e. not decimal approximations).

- Make sure to **circle** your answers.

Some useful formulas:

$$A = P\left(1 + \frac{r}{n}\right)^{nt} \qquad A = Pe^{rt} \qquad A = P(a)^t \qquad A = P(1+r)^t$$

Question:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	Total
Points:	28	16	16	9	12	12	10	10	21	24	24	18	200
Score:													

(1). Solve the following inequalities and write your solution in interval notation.

(**a**) (16 points)
$$\frac{7}{6-x} \le \frac{5}{9-x}$$

(**b**) (12 points)
$$3|8-y| + 3 \ge 18$$

(**2**). The following questions concern properties of logarithms:

(**a**) (8 points) Expand the following logarithmic expression as much as possible:

$$\ln\left(\frac{(3-x)^5(x^2-9)}{\sqrt{4+x}}\right)$$

(**b**) (8 points) Write the following expression as a single logarithm:

$$\frac{1}{5}\ln(x-5) - 3[\ln(4-x) + \ln(25-x^2)]$$

(3). Suppose

$$f(x) = 10^{x-3} + 6$$

(**a**) (3 points) What are the domain and range of $f(x)$ in interval notation?

Domain of $f(x)$: _____　　　　　Range of $f(x)$: _____

(**b**) (8 points) Find the inverse function $f^{-1}(x)$

(**c**) (5 points) What are the domain and range of $f^{-1}(x)$ in interval notation?

Domain of $f^{-1}(x)$: _____　　　　　Range of $f^{-1}(x)$: _____

(4). Suppose that $f(x) = 3x^2 - 12x + 11$

    (a) (7 points) Write $f(x)$ in vertex form by completing the square.

    (b) (2 points) Identify the vertex.

(5). (12 points) Find the average rate of change of $f(x) = \dfrac{3}{x}$ from $x = a$ to $x = a + h$. **Simplify your answer as much as possible.**

(6). (12 points) Use long division to divide the following polynomials. *Note: synthetic division will not work.*

$$\frac{2x^3 - 4x^2 + 3x - 5}{x^2 + 2}$$

Quotient polynomial $= Q(x) =$ _____

Remainder polynomial $= R(x) =$ _____

(7). (10 points) Suppose the population of a city has been growing at a rate of 2.5% per year for each of the last 8 years. If the current population is 220, 000, estimate the population 8 years ago. *Round your answer to the nearest person.*

(8). (10 points) A pickup truck gets 14 mpg in the city and 26 mpg on the highway. Suppose that the driver drives 250 miles using 11 gal of gas. Setup, but **DO NOT SOLVE**, a system of equations to find how many city miles and how many highway miles that the truck was driven. *Make sure to clearly identify your variables.*

(9). Solve the given linear system for the given variables:

(**a**) (9 points)

$$-8r + 6s = 2$$
$$5r + 2s = 16$$

(**b**) (12 points)

$$-4c + 5v + 3z = -20$$
$$-3c - 2v + 12z = 51$$
$$3c - 4v - 3z = 12$$

(10). The following questions concern radioactive decay:

(**a**) (12 points) A sample 55mg of Cs-137 decays to 30mg in 26.4 years. Find a function of the form $Q(t) = Q_0 e^{-kt}$ which models the amount $Q(t)$ of this sample of Cs-137 left after t years. *Round k to four decimal places.*

(**b**) (12 points) Suppose that $Q(t) = 25e^{-0.5924t}$ models the amount $Q(t)$, in mg, of a highly radioactive sample remaining after t minutes. How long will it take until there is only 5mg remaining? *Round your answer to four decimal places.*
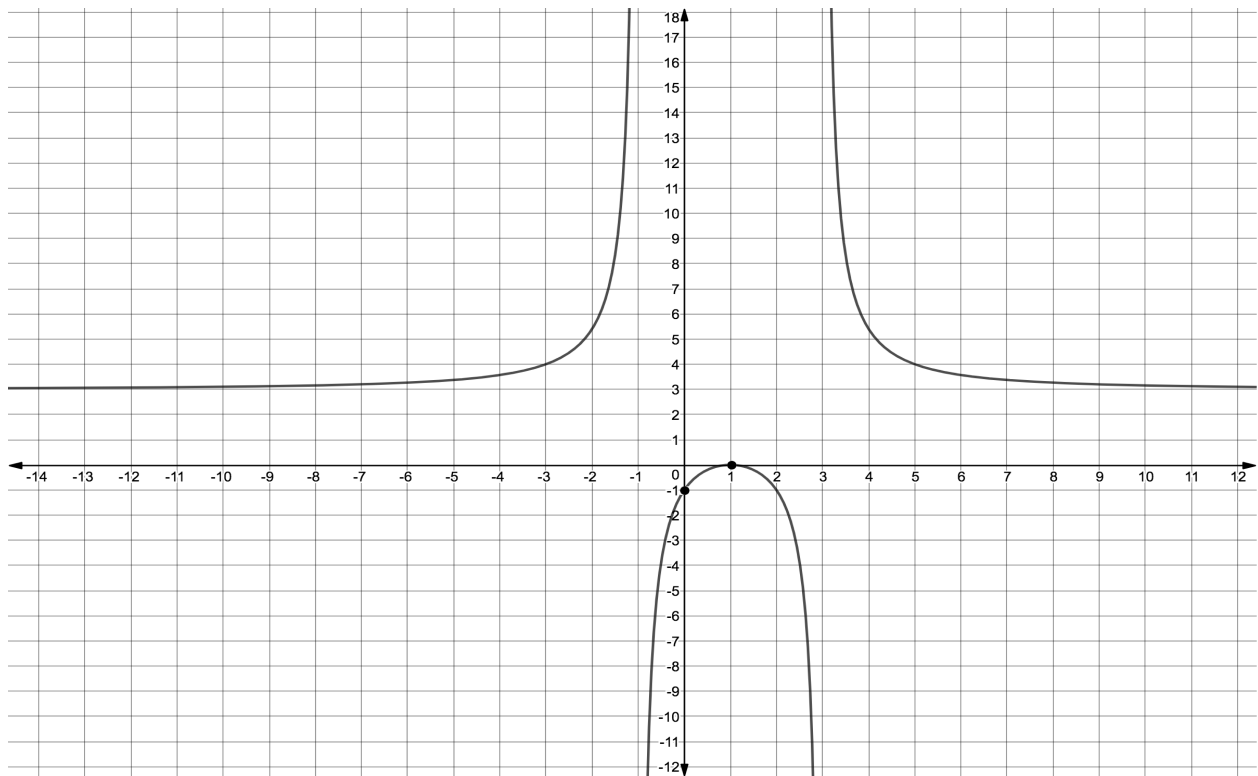
(11). Solve for x:

(**a**) (12 points)

$$e^{2x} - 3e^x = 10$$

(**b**) (12 points)

$$\ln x + \ln(x - 7) = \ln(9x - 55)$$

(12). Consider the rational function r whose graph is given below.

(a) (2 points) Find the y-intercept(s). Indicate if there are none.

(b) (4 points) Find the x-intercept(s). Indicate if there are none.

(c) (4 points) Find the **equations** of any vertical asymptotes.

(d) (2 points) Find the **equation** of the horizontal asymptote (you may assume it has one).

(e) (6 points) Write an equation for the rational function r:

$$r(x) = \underline{\hspace{5cm}}$$