Math 162
Exam 1

Justify all answers with neat and organized work. Clearly indicate your answers.
100 points possible

Units! Units! Units! From Problem 7 on, your answers should include the correct units.

Label all numeric answers. A number is useless without a label. Models are also useless without a concise explanation of their variables.

Example: Suppose a problem asks for a model, and suppose this is the answer:

$Tax = 2538.90 + 540.37t$ dollars, where t is the number of years since 1989.

To receive full credit, this answer must include **all** of the following:
(1) the correct model (i.e., $Tax = 2538.90 + 540.37t$),
(2) the correct label for the output (i.e., "dollars"), and
(3) the correct explanation of the input variable (i.e., "where t is the number of years since 1989").
(A possible grading scheme for this answer might be two points for each of the three required features.)

Example: Here is another correct way to write the same answer.

$D = 2538.90+540.37x$, where D = dollars of tax, and x = number of years since 1989.

Some useful (?) formulas:

$A = P\left(1 + \dfrac{r}{n}\right)^{nt}$
$A = Pe^{rt}$
APY (as a decimal) $= \left(1 + \dfrac{r}{n}\right)^{n} - 1$
APY (as a decimal) $= e^{r} - 1$

Typeset by $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX

1. (5 pts.) Determine if the table below represents a function. Assume the input is in the top row.

Age	16–19	20–24	25–34	35–44	45–54	55–64	over 64
Percent with flex schedules	10.6	12.0	15.7	16.5	15.7	12.2	16.4

2. (5 pts.) $P(m)$ is the median sale price of existing one-family homes in metropolitan area m in 1993. Write the following statement in function notation:

The median sale price in Honolulu was $358,500.

3. (5 pts.) Consider $R(w) = 39.4(1.998)^w$; $w = 5.35$
(a) Is $w = 5.35$ an input or an output value?

(b) Find the output or input that corresponds to $w = 5.35$. Round your answer to four decimal places.

4. (5 pts.) Consider $R(w) = 39.4(1.998)^w$; $R(w) = 394$
(a) Is $R(w) = 394$ an input or an output value?

(b) Find the output or input that corresponds to $R(w) = 394$. Round your answer to four decimal places.

5. (5 pts.) Consider $Q(x) = 0.32x^3 - 7.9x^2 + 100x - 15$; $Q(x) = 714.68$
(a) Is $Q(x) = 714.68$ an input or an output value?

(b) Find the output or input that corresponds to $Q(x) = 714.68$. Round your answer to four decimal places.

6. Rewrite each pair of functions as one composite function (using the order naturally suggested by the choice of letters for the variables).

(a) (5 pts.) $f(t) = 3e^t \qquad t(p) = 4p^2$

(b) (5 pts.) $g(x) = \sqrt{7x^2 + 5x - 2} \qquad x(w) = 4e^w$

(c) (5 pts.) $C(p) = \sqrt{p} \qquad p(t) = 1000(0.4t^2 + 2.5)$

7. (10 pts.) The percentage of funding for public elementary and secondary education provided by the federal government during the 1980's is given below (based on data from *Statistical Abstracts of the U.S.*, Bernan Press, 1992 and 1994):

Year	81–82	82–83	83–84	84–85	85–86	86–87	87–88	88–89	89–90
% Funding	7.4	7.1	6.8	6.6	6.7	6.4	6.3	6.2	6.1

(a) Find the best-fitting **linear** model. Do not round.

(b) Based on the model, estimate the % of funding provided by the federal government in the 1993–94 school year. Round your answer.

8. (10 pts.) The approximate numbers of patents for plow sulkies between 1865 and 1925 are given in the table below.

Years	Cumulative number of plow sulky patents
1866-1871	200
1872-1877	340
1878-1883	980
1884-1889	1800
1890-1895	2200
1896-1901	2400
1902-1907	2500
1908-1913	2550
1914-1919	2620
1920-1925	2700

(a) Find a **logistic** model to fit the data. Do not round.

(b) *Briefly* discuss why it is logical that the number of patents for a new invention would increase according to a logistic equation.

9. (5 pts.) A certificate of deposit (CD) is bought for \$2500 and held for 5 years. What is its future value at the end of the 5 years if it earns interest compounded quarterly at a nominal rate of 7.4%?

10 (10 pts.) Your credit card statement indicates a finance charge of 1.6% per month on the outstanding balance. Assume that the interest is compounded monthly.

(a) What is the nominal rate?

(b) What is the effective rate of interest?

11. (10 pts.) The amount of money (in billions of dollars) spent on pollution control in the United States from 1983 to 1990 is given in the table below.

Year	1983	1984	1985	1986	1987	1988	1989	1990
Amount	60.0	66.4	70.9	74.2	76.7	81.1	85.4	90.0

(a) Find a **cubic** model to fit the data. Do not round.

(b) What does the model predict that the amount will be in 1999? Round your answer.

12. (15 pts.) The amount in a bank account is given by

$$A(t) = 1600(1.063962)^t \quad \text{dollars}$$

where t is the number of years after opening the account.

(a) How much did the amount change from 2 years after the account was opened to 8 years after it was opened?

(b) On average, how rapidly did the amount change from 4 years to 7 years after the account was opened?

(c) On average, how rapidly did the amount change during the first half year after opening the account?