

Name _____

RULES FOR THIS TEST:

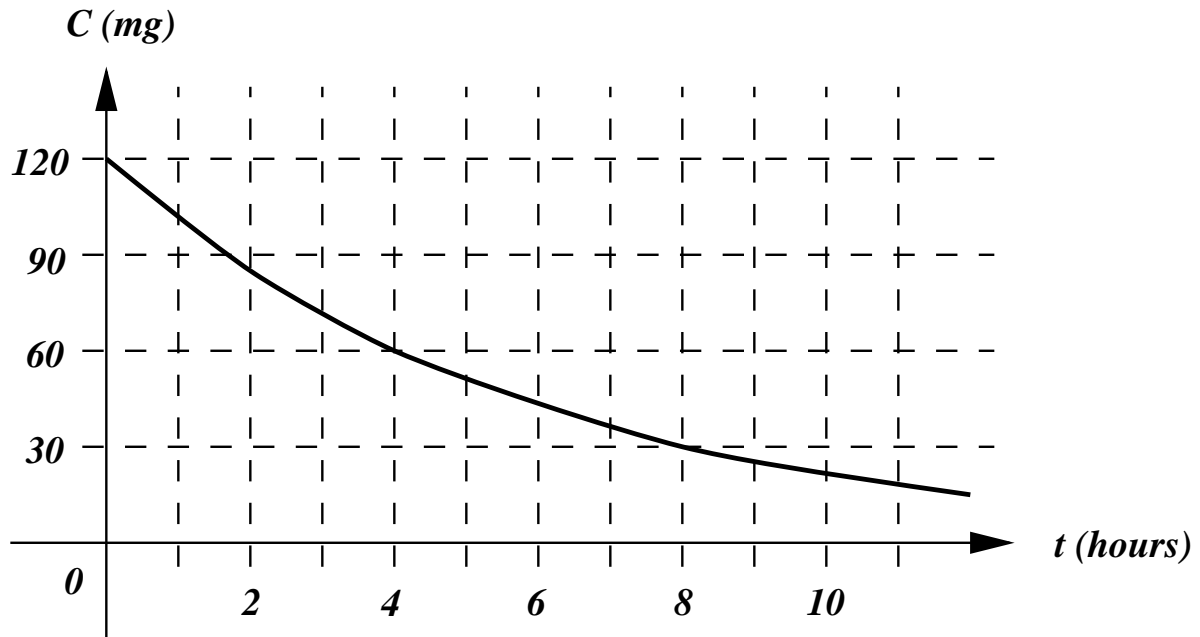
- Do not borrow another student's calculator.
 - Circle each final answer.
 - A correct answer will only be given full credit if enough work is shown to justify that answer.
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1. (12 points) In 1900, there were 800 people living in a small city. Write a formula for $P(t)$, the population of this city t years after 1900, under the assumption that

(a) the city's population has been **increasing** by 3% per year since 1900.

(b) the city's population has been **decreasing** by 3% per year since 1900.

2. (15 points) The figure below shows the amount of caffeine, $C = f(t)$, in mg , in a person's bloodstream as a function of the time, t , in hours, since the person finished a cup of coffee.



- (a) Estimate $f(6)$ and interpret it using a complete English sentence. This sentence should be easily understood by someone who knows very little mathematics.
- (b) Find the average rate of change in the caffeine levels between $t = 0$ and $t = 6$. Interpret your answer using a complete English sentence.

- (c) About how many hours have passed before the caffeine level in the bloodstream has been reduced to 30 *mg*?
- (d) For the graph shown, what is the value of the vertical intercept. Interpret your answer using a complete English sentence.
- (e) If this graph had a horizontal intercept, use an English sentence to state what it would represent.

3. (12 points) A company manufactures and sells footballs. The cost and revenue functions are each **linear** and are given in the table below where q represents the number of footballs, and cost and revenue are given in dollars.

q	0	50	100	150	200	250
$C(q)$	846	1006	1166	1326	1486	1646
$R(q)$	0	250	500	750	1000	1250

- (a) Give formulas for the cost function $C(q)$ and the revenue function $R(q)$.
- (b) If this company produces and sells 250 footballs, do they earn a profit or suffer a loss? What is the dollar amount of that profit (or loss)?
- (c) What is the exact number of footballs which this company must produce and sell in order to break even? (i.e., to have a profit of \$0)?

4. (12 points) This morning, Eric has invested \$2000 in a bank account which earns 7.5% interest compounded continuously.

(a) Find a formula for the balance in Eric's bank account t years from today.

(b) How much money will Eric have in his account 5 years from now? Round off your answer to two decimal places.

(c) How many years will it take for the balance in Eric's account to reach \$8000? Round off your answer to one decimal place.

5. (15 points) Tables for the five functions, $f(x)$, $g(x)$, $h(x)$, $p(x)$, and $q(x)$, are shown below. To the right of each table, circle one of the words **linear**, **exponential**, or **neither**. You should circle **linear** if the function could be linear, you should circle **exponential** if the function could be exponential, and you should circle **neither** if it is impossible for the function to be either linear or exponential. You do not need to find formulas for any of the functions.

x	$f(x)$
0	25
6	23
12	21
18	19

linear, **exponential**, **neither**

x	$g(x)$
0	10
6	46
12	154
18	334

linear, **exponential**, **neither**

x	$h(x)$
0	0.07
6	0.21
12	0.63
18	1.89

linear, **exponential**, **neither**

x	$p(x)$
0	0.03
6	0.25
12	0.47
18	0.69

linear, **exponential**, **neither**

x	$q(x)$
0	27
6	18
12	12
18	8

linear, **exponential**, **neither**

6. (12 points) H. Graver Packing Co. was formed in Chicago in the early 1900's. The table below shows the number of workers employed by the company in the given year.

year	1920	1930	1940	1950	1960	1970
number of employees	25	30	40	64	90	115

- (a) On average, how quickly was the number of employees increasing between 1920 and 1960? Round off your answer to one place after the decimal point and be sure to include proper units.
- (b) On average, how quickly was the number of employees increasing between 1950 and 1960? Round off your answer to one place after the decimal point and be sure to include proper units.
- (c) If the number of employees continues to increase at the same rate as it did between 1950 and 1960, then in precisely what year will the company have 200 employees?

7. (12 points) Iodine-131 has a half-life of 8 days and is used in the treatment of hyperthyroid. Due to a strike at UPS, it took 10 days for a shipment of Iodine-131 to be sent from the producer to a hospital. What percentage of the original amount shipped actually arrived at the hospital?

8. (10 points) Without using a calculator, solve for t in the equation $1000e^{0.3t} = 4500$. You may use a calculator though to check your final answer.