Math 116 - Spring 2016
Final Exam - Version A

MULTIPLE CHOICE: Indicate your answer on the Scantron sheet provided and circle your answer in this test booklet. No partial credit will be given in this section.

#1 A	#7 B	#13 B	#19 D
#2 C	#8 A	#14 A	#20 A
#3 B	#9 D	#15 D	#21 E
#4 D	#10 A	#16 C	#22 B
#5 C	#11 C	#17 B	#23 D
#6 E	#12 E	#18 E	#24 C

SHORT ANSWER: Be sure to show all work, define all variables, label all units. Graphs should be drawn in appropriate windows and should include axes that are labeled and scaled. Partial credit may be given for partially correct answers. Answers without justification will not receive full credit.

1. Sales of a new model of blu-ray player are approximated by the function

$$S(x) = 1800 - 400e^{-0.8x},$$

where $S(x)$ is in appropriate units and x represents the number of years the blu-ray player has been on the market

(a) *(2 points)* Find the sales during year 0.

$S(0) = 1800 - 400e^{-0.8(0)}$
$S(0) = 1400$

(b) *(5 points)* In how many years will sales reach 1700 units? Round to two decimal places as needed.

Algebraic Solution:
Sales reach 1700 units when $S = 1700$.
$1700 = 1800 - 400e^{-0.8x}$
$\frac{100}{400} = e^{-0.8x}$
$\ln(\frac{1}{4}) = -0.8x$
$x = \frac{\ln(1/4)}{-0.8} = 1.73$ years

Calculator Solution:
Sales reach 1700 units when $S = 1700$.
$1700 = 1800 - 400e^{-0.8x}$
Set $Y_1 = 1700$ and $Y_2 = 1800 - 400e^{-0.8x}$
and use the `intersect` feature on the TI
to find $x = 1.73$ years
(or something similar).

(c) *(3 points)* Is there a limit on sales for this product? If so, what is it?

$$\lim_{x\to\infty} S(x) = \lim_{x\to\infty} (1800 - 400e^{-0.8x})$$

$$1800 - 400(\lim_{x\to\infty} e^{-0.8x}) = 1800$$

2. A local club is arranging a charter flight to Hawaii. The cost of the trip is \$720 each for 60 passengers, with a refund of \$6 per passenger for each passenger in excess of 60.

   (a) *(3 points)* Let x denote the number of passenger in excess of 60. Find an expression for the total revenue from the flight.

   \# of Passengers: $(60 + x)$
   Revenue from Each Pass.: $(720 - 6x)$
   Total Revenue: $R(x) = (60 + x)(720 - 6x)$
   or $R(x) = -6x^2 + 360x + 43200$.

   (b) *(5 points)* Find the number of passengers that will maximize the revenue received from the flight. (Note: to receive full credit, you must demonstrate that your answer is an absolute maximum.)

   We will find the maximum by
   1st: finding all critical points
   2nd: testing the critical points and endpoints.

   We find critical points by finding $R'(x)$ and determining where it is zero or undefined.
   $R'(x) = -12x + 360$
   $R'(x)$ is never undefined, and is zero when $x = 30$.

   From the context, we see that a maximum cannot occur if x is less than zero, nor if x is more than 120.

   Now we test the critical point and endpoints:
   $R(0) = 43,200$, $R(30) = 48,600$, $R(120) = 0$
   so the absolute maximum occurs at $x = 30$, which corresponds to 90 passengers.

   (c) *(2 points)* What is the maximum revenue?

   The maximum revenue is \$48,600.

3. The rate of a continuous money flow starts at \$5300 and increases exponentially at 4.8% per year for 7 years. Assume a 7-year period at 2.9% compounded continuously.

   (a) *(6 points)* Find the present value of the money flow at the end of 7 years. Round your answer to the nearest cent.

   The continuous money flow is given by
   $f(t) = 5300e^{0.048t}$.

   The present value of this money flow is
   $$P = \int_0^7 5300e^{0.048t}e^{-0.029t}dt$$
   $$P = \int_0^7 5300e^{0.019t}dt = \left[5300\frac{e^{0.019t}}{0.019}\right]_0^7$$
   $P = \$39,680.26$

   (b) *(4 points)* Find the accumulated amount of money flow at the end of 6 years. Round your answer to the nearest cent.

   We use the present value computed above to
   find the accumulated amount
   $A = e^{0.029T}P = e^{0.029(7)}(39,680.26)$
   $A = \$48,611.19$