**Math 1325 - Calculus with Application *Exam* 3 *Review***

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1. Find the critical numbers and the open intervals on which the function is increasing or decreasing:
2.  ***b.***  ***c*.** 

***d*.**  ***e*.**  ***f*.** 

1. Find all relative extrema of:
2. 
3. 
4. 
5. 
6. Find the absolute extrema of
7. **** on the closed interval [0, 3]
8. **** on the closed interval [−6, 8]
9. **** on the closed interval [−2, 2]
10. Find the point(s) of inflection and determine the concavities of
11. 
12. 
13. 

**Applications**

5. Suppose the resident population *P*(in millions) of the United States can be modeled by

; , where *t* = 0 corresponds to 1800. Analytically find the minimum and maximum populations in the U.S. for 

6. The number of milligrams *x* of a medication in the bloodstream *t* hours after a dose is taken can be modeled by ; t > 0. Find the maximum value of *x.* Round your answer to two decimal places

7. The concentration (in milligrams/cubic centimeter) of a certain drug in a patient’s body *t* hr after injection is given by



At what time is the concentration the maximum?

8. The number of people who denoted to a certain organization between 1990 and 2007 can be modeled by the equation:  donors, where *t* is the number of year after 1990. Find the point of inflection 0 ≤ t ≤ 17

9. Suppose that the total number of units produced by a worker in *t* hours of an 8-hour shift can be modeled by the production function *P*(*t*) : P(t) = 54t + 24t2 – 2t3 . Find the number of hours before the rate of production is maximized. That is, find the point of diminishing returns.

10. If the cost function for a product is dollars. Determine how many units ***x*** should be produced to minimize the average cost per unit.

11. A travel agency will plan a tour for groups of size 28 or larger. If the group contains exactly 28 people, the price is $500 per person. However, each person’s price is reduced by $10 for each additional person above the 28 . If the travel agency incurs a price of $100 per person for the tour, what size group will give the agency the maximum profit?

12. A rectangular box with a square base is to be formed from a square piece of paper with 42” sides. If a square piece with side a is cut from each corner of the paper and the sides are folded up to from an open box the volume of the box is V = (42 – 2*x*)2 *x*. What value of ***x*** will maximize the volume of the box?

13. Determine the dimensions of a rectangular solid (with a square base) with maximum volume if its surface area is 400 square feet.

***Solution***

1. *a*. CN: *x* = ± 1; 

*b*. CN: *x* = 0, ±3; 

*c*. CN: *x* = 0; 

*d*. CN: *x* = ± 1, ; 

*e*. CN: *x* = 0, ±2; 

*f*. CN: *x* = 2; 

1. *a*. RMAX: (1,) ; RMIN: (-1, −)
2. RMAX: (0, 2) ; RMIN: (4, −62)
3. RMAX: (2, 25) ; RMIN: (0, 9) & (4, 9)
4. RMIN: (3/2, −0.69)
5. *a*. Absolute Max: (0, 0); Absolute Min: (2, −16)

*b*. Absolute Max: 4.95; Absolute Min: 0

*c*. Absolute Max: (−2, 25); Absolute Min: (1, −2)

4. *a*.  *Concave up:*  *Concave down:* 

*b*.  *Concave up:*  *Concave down:* 

*c*.  *Concave up:*  *Concave down:* 

5. The population is minimum at *t* = −4 and maximum at *t* = 197

6. 577.35 mg

7. maximum at *t* = 1 sec

8. There is one inflection point @ *t* = 6.49

9. *t* = 4

10. 79 units

11. 34

12. 7

13. square base side ; height 

1-***b***  Domain: 



 





***You have to consider what make the denominator is equal to zero as CN.***

Solve for *x*



|  |  |
| --- | --- |
| -3 0 3 | |
|  |  |





**6. Suppose the resident population *P* (in millions) of the United States can be modeled by**

**; , where *t* = 0 corresponds to 1800. Analytically find the minimum and maximum populations in the U.S. for **





 But since t is 

That imply the population is minimum @ t = -4 and maximum @ t =197

**7. The number of milligrams *x* of a medication in the bloodstream *t* hours after a dose is taken can be modeled by ; t > 0. Find the maximum value of *x.* Round your answer to two decimal places**

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****

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**8. The concentration (in milligrams/cubic centimeter) of a certain drug in a patient’s body *t* hr after injection is given by  At what time is the concentration the maximum?**

****

**** t = 1

**9. The number of people who denoted to a certain organization between 1990 and 2007 can be modeled by the equation:  donors, where t is the number of year after 1990. Find the point of inflection 0 ≤ *t* ≤ 17**





**10. Suppose that the total number of units produced by a worker in *t* hours of an 8-hour shift can be modeled by the production function *P*(*t*) : P(t) = 54t + 24t2 – 2t3 . Find the number of hours before the rate of production is maximized. That is, find the point of diminishing returns.**





**11. If the cost function for a product is C(x) = 500 + 3x + 0.08x2 dollars. Determine how many units x should be produced to minimize the average cost per unit.**









**12. A travel agency will plan a tour for groups of size 28 or larger. If the group contains exactly 28 people, the price is $500 per person. However, each person’s price is reduced by $10 for each additional person above the 28 . If the travel agency incurs a price of $100 per person for the tour, what size group will give the agency the maximum profit?**













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For x = 21 ⇒  is not a solution

For x = 7 

**14. Determine the dimensions of a rectangular solid (with a square base) with maximum volume if its surface area is 400 square feet.**

Area for the base = x2.

Area of each side = xh



 











