MAT 1330, Fall 2016 Assignment 1
Due Thursday September 22 by 8:00pm.
Late assignments will not be accepted; nor will unstapled assignments. Professors in the math department will not lend you a stapler; do not ask for one.

Instructor (circle one): F. Lutscher X. Wang Y. Samia R. Mikkelborg

DGD (circle one): 1 2 3 4

Student Name _____ Student Number _____

Student Name _____ Student Number _____

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By signing below, we declare that this work is our own and that we have not copied from any other individual or other source.

Signatures _____

QUESTION 1. For any function f, we denote by D_f the maximal domain. Consider the two functions

$$f(x) = \frac{x}{x+1}, \qquad g(x) = \cot(x) = \frac{\cos(x)}{\sin(x)}.$$

Find the domains of the functions f, g, $f \circ g$, and $g \circ f$.

Answer:

$D_f =$ [ ]

$D_g =$ [ ]

$D_{f\circ g} =$ [ ]

$D_{g\circ f} =$ [ ]

QUESTION 2. (a) Solve the following inequality.

$$\left|\frac{2}{5x^2+6x+7}\right| < \frac{1}{3}$$

Answer:

(b) Solve the following inequality.

$$\frac{1}{x+1} < \frac{1}{x^2+4x+3}.$$

Answer:

QUESTION 3. Suppose that a population of bacteria is monitored daily. Its volume is multiplied by the same number every day. Hence, the volume V_t on day t satisfies the DTDS

$$V_{t+1} = rV_t.$$

Suppose that the initial volume is $V_0 = 8$ml and the volume at day 17 is $V_{17} = 16$ml.
(a) Find the value of r.

Answer:

(b) On which day is the volume equal to 64ml?

Answer:

QUESTION 4. Suppose that when you finish your studies and it is time to pay back your loans, you have a debt of $ 100,000. From now on, at the beginning of each month, the bank adds 0.5% of the current value in interest. At the end of each month, you pay $1,000. You receive a monthly statement of the remaining value of your loan, denoted L_t, immediately after your t-th payment and before any interest is applied. (In particular, $L_0 = 100,000$.)
(a) Write down the DTDS for L_t and the updating function.

The DTDS is: $L_{t+1} =$

The updating function is: $f(L) =$

(b)When you receive the statement for L_{16}, you realize that you have lost the statement for L_{15}. Find the formula that calculates L_{15} from L_{16}.

$L_{15} =$

(c) Write down the general solution formula for the DTDS.

Answer:

(d) How many months does it take to pay down the entire loan? Calculate the smallest t for which $L_t \leq 0$.

Answer:

(e) Your bank changes its mailing policies: To save money, they only send out a statement every other month. Your payment schedule does not change. Find the corresponding updating function.

Answer: $L_{t+2} =$