SOLVING EQUATIONS RELATED TO RATIONAL FUNCTIONS

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- A RATIONAL FUNCTION IS A RATIO OF TWO POLYNOMIAL FUNCTIONS. AN EQUATION THAT IS RELATED TO A GIVEN FUNCTION, F(X), IS ONE IN WHICH THE VALUE OF THE DEPENDENT VARIABLE IS KNOWN AND YOU NEED TO DETERMINE THE VALUE(S) OF THE INDEPENDENT VARIABLE THAT GENERATES IT.
- FOR A RATIONAL FUNCTION WITH DEGREE ONE OR TWO POLYNOMIALS IN THE NUMERATOR OR DENOMINATOR THERE WILL EITHER BE ZERO, ONE, OR TWO PAIRS OF VALUES FOR WHICH THIS IS TRUE.

SOLVING EQUATIONS RELATED TO RATIONAL FUNCTIONS

- GRAPHICALLY, LOCATE A POINT ON THE GRAPH OF F(X) THAT HAS A Y-COORDINATE EQUAL TO THE GIVEN FUNCTION VALUE. THE X-COORDINATE OF THIS POINT IS THE X-VALUE PAIRED WITH THAT FUNCTION VALUE. THIS X-VALUE IS A SOLUTION TO THE EQUATION IF IT IS INCLUDED IN THE DOMAIN OF THE FUNCTION.

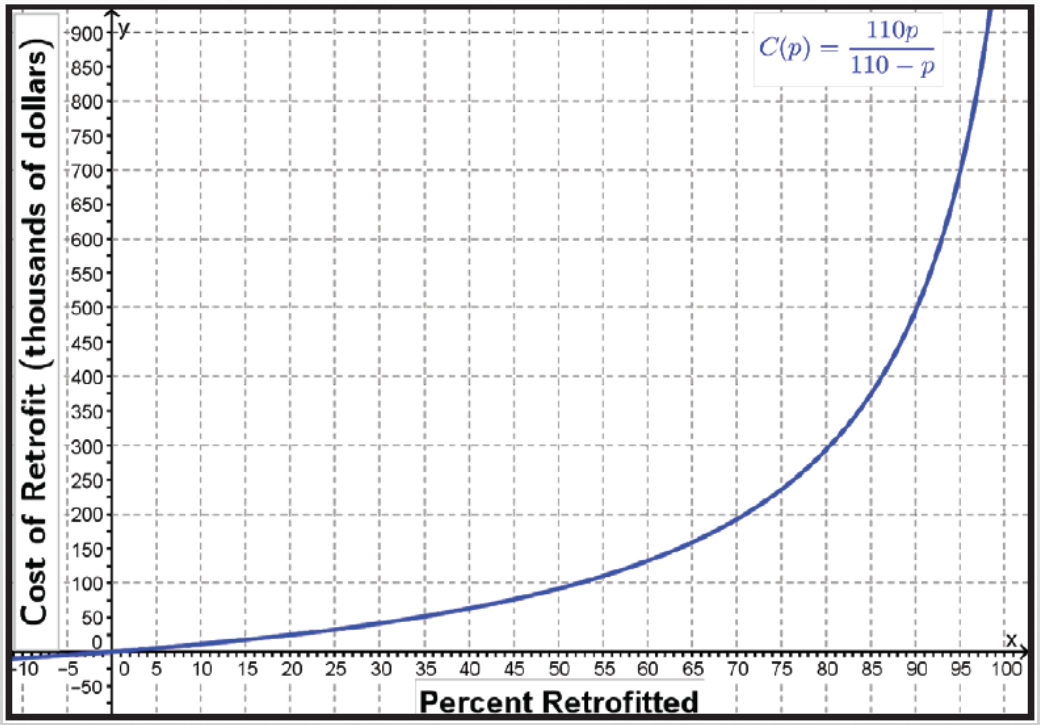
SOLVING EQUATIONS RELATED TO RATIONAL FUNCTIONS

- TABULARLY, LOCATE THE FUNCTION VALUE IN THE DEPENDENT VARIABLE COLUMN OR ROW. THE VALUE IN THE INDEPENDENT VARIABLE COLUMN OR ROW ASSOCIATED WITH THIS FUNCTION VALUE IS A SOLUTION TO THE EQUATION IF IT IS INCLUDED IN THE DOMAIN OF THE FUNCTION.

EXAMPLES

- THE COST, C, IN THOUSANDS OF DOLLARS, FOR A UTILITY COMPANY TO RETROFIT *P* PERCENT OF ITS EXISTING COAL POWER PLANTS IN NORTH AMERICA TO REDUCE THEIR EMISSION OF TOXINS INTO THE ATMOSPHERE CAN BE MODELED BY THE RATIONAL FUNCTION $C(P) = \frac{110p}{110-p}$. A UTILITY COMPANY HAS BUDGETED $228,500 TO RETROFIT ITS EXISTING COAL POWER PLANTS. APPROXIMATELY WHAT PERCENT OF ITS COAL POWER PLANTS WILL THE COMPANY BE ABLE TO RETROFIT TO REDUCE THEIR EMISSION OF TOXINS INTO THE ATMOSPHERE? WRITE AN EQUATION WHOSE SOLUTION WOULD ANSWER THE QUESTION AND USE THE GRAPH TO FIND AN APPROXIMATE SOLUTION TO THE EQUATION.

EXAMPLES

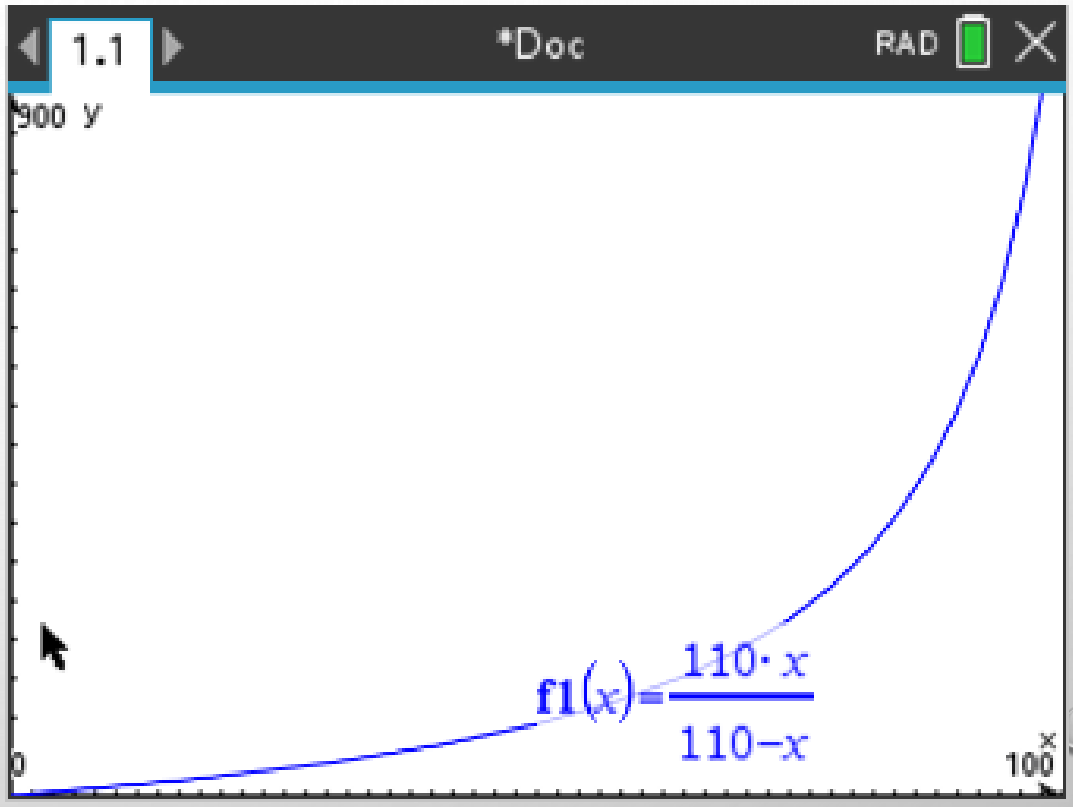

$C(p) = \frac{110p}{110 - p}$
Cost of Retrofit (thousands of dollars)
Percent Retrofitted
y
x
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
-50
-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100

EXAMPLES

- **STEP 1** TYPE THE EQUATION IN THE FUNCTION EDITOR

- IN THE CALCULATOR:
- ADD GRAPH
- TYPE $\frac{110p}{110-p}$

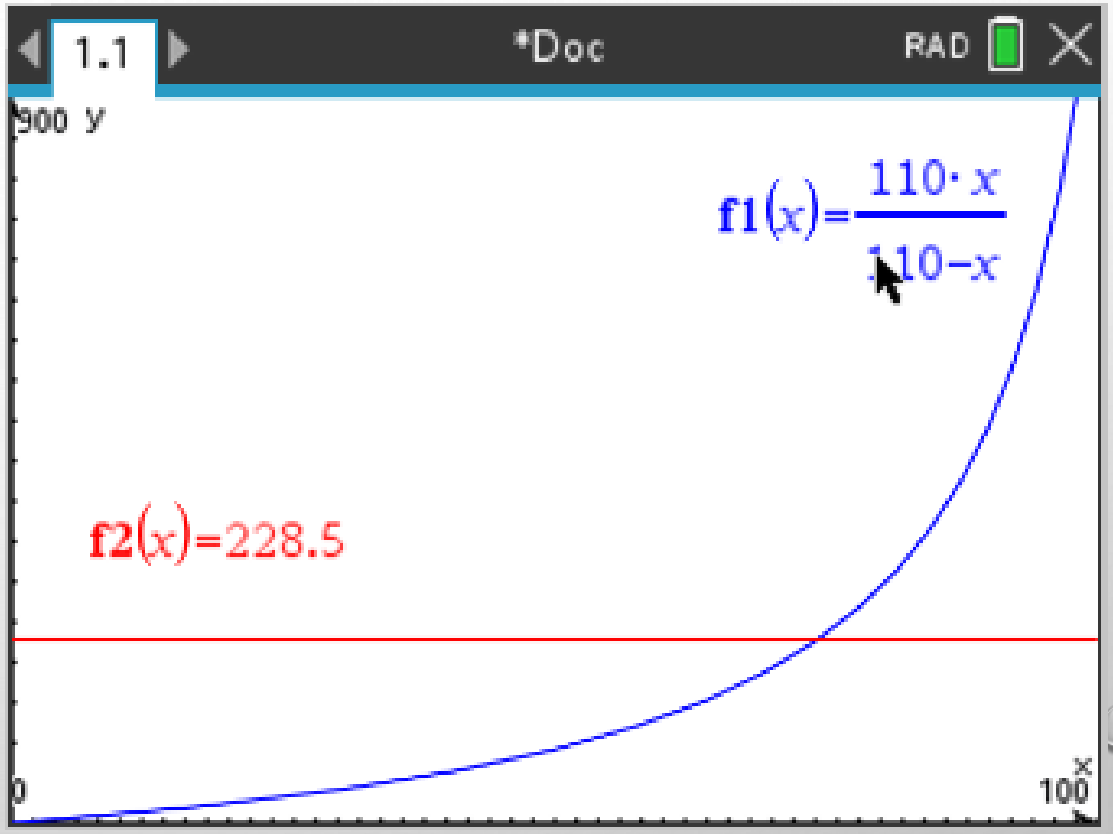
- MAKE SURE TO CHANGE THE WINDOW SETTINGS IF NECESSARY TO SEE THE FULL GRAPH



EXAMPLES

- **STEP 2** SINCE THE BUDGET IS FOR $228,500, MAKE A SECOND EQUATION EQUAL TO 228.5 (THE GRAPH IS IN THOUSANDS OF DOLLARS)

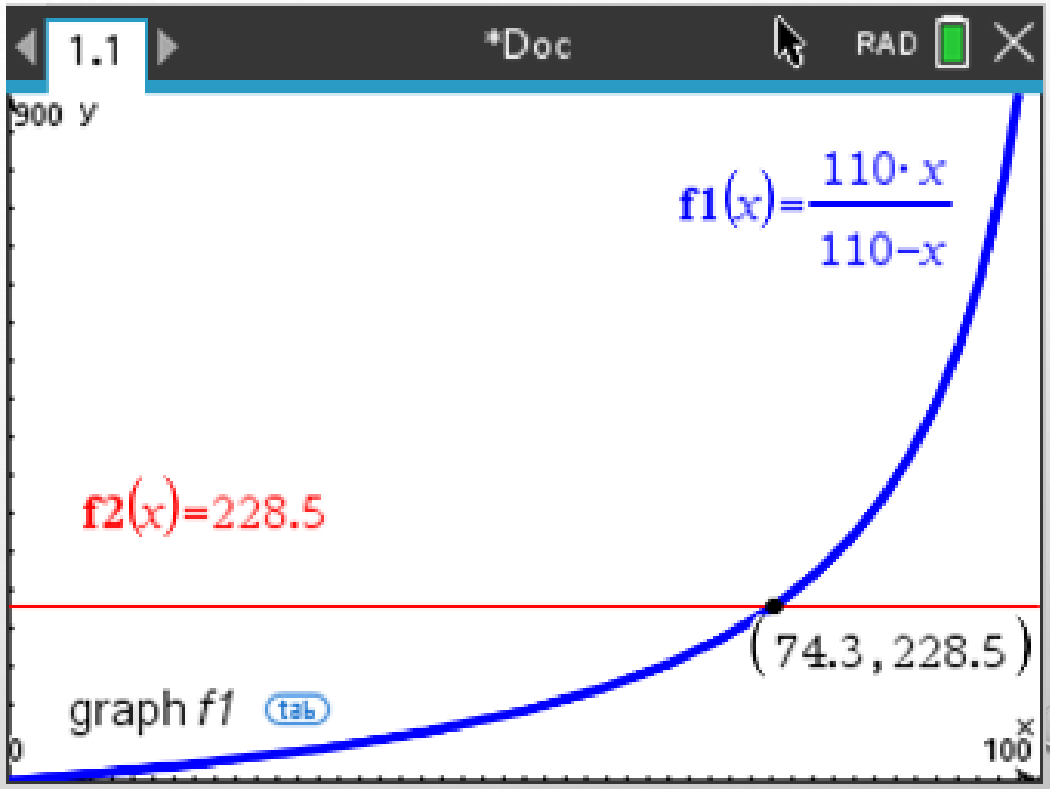
- IN THE CALCULATOR
- TAB 228.5



EXAMPLES

- **STEP 3** DETERMINE THE POINT OF INTERSECTION BETWEEN THE TWO EQUATIONS

- MENU, 6, 4
- GET THE LOWER AND UPPER BOUNDS



EXAMPLES

- **STEP 4** INTERPRET THE INTERSECTION POINT IN TERMS OF THE SITUATION

- THE MODEL PREDICTS THAT 74% OF THE COAL PLANTS CAN BE RETROFITTED.

EXAMPLES

- A NURSE CHARTS THE CONCENTRATION, C, IN MILLIGRAMS PER LITER OF IBUPROFEN IN A PATIENT'S BLOOD PLASMA OVER TIME, *T*, IN HOURS USING THE RATIONAL FUNCTION $C(T) = \frac{400t}{\quad}$.

TIME, t (HOURS)	0	2	4	6	8	10	12
CONCENTRATION, $C(t)$ (mg/L)	0	22.86	12.21	8.25	6.21	4.98	4.16

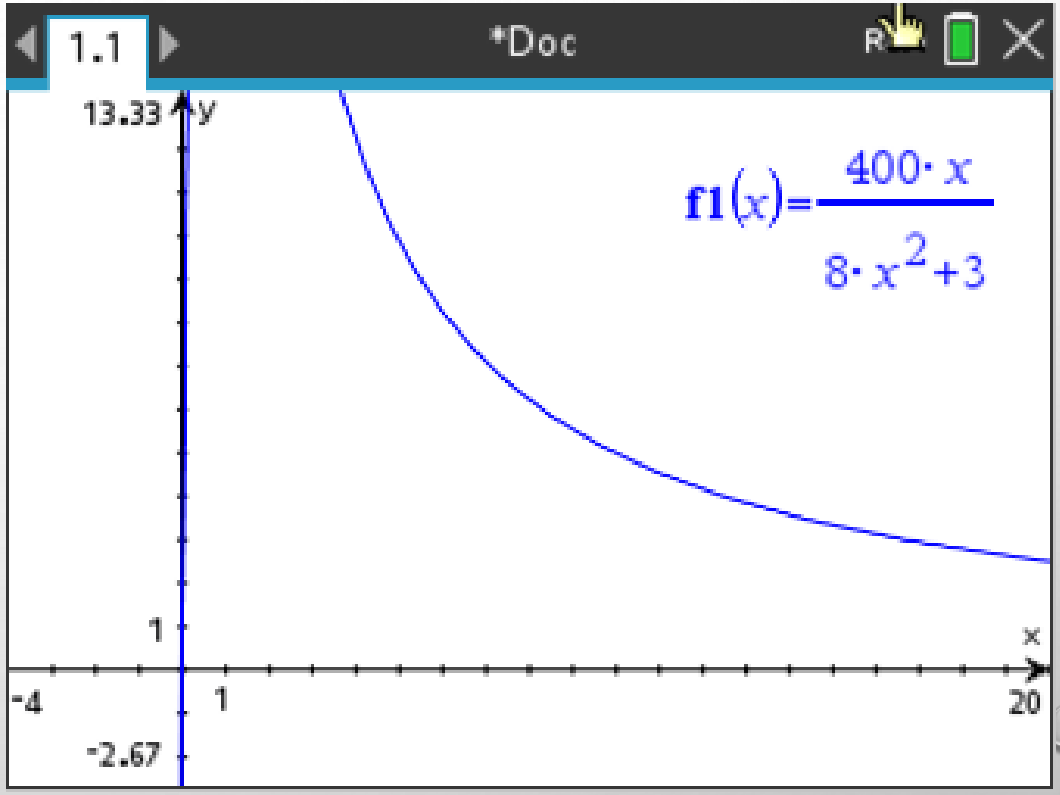
- IF THE IBUPROFEN IS ADMINISTERED AGAIN WHEN ITS CONCENTRATION REACHES 5 MG/L, WHEN SHOULD THE NURSE ADMINISTER THE NEXT DOSE OF IBUPROFEN? WRITE AN EQUATION RELATED TO C(*T*) THAT THE NURSE WOULD NEED TO SOLVE AND USE THE TABLE SHE GENERATED TO APPROXIMATE THE SOLUTION.

EXAMPLES

- **STEP 1** TYPE THE EQUATION IN THE FUNCTION EDITOR

- IN THE CALCULATOR:
- ADD GRAPH
- TYPE $\frac{400t}{8t^2+3}$

- MAKE SURE TO CHANGE THE WINDOW SETTINGS IF NECESSARY TO SEE THE FULL GRAPH



EXAMPLES

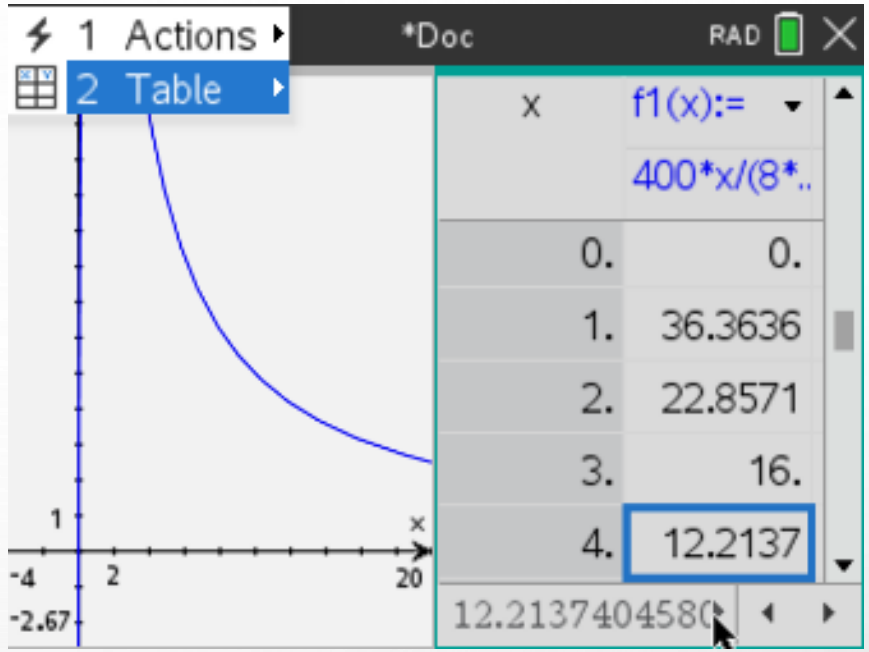
- **STEP 2** CREATE A TABLE OF FUNCTION VALUES FOR THE IBUPROFEN CONCENTRATION.

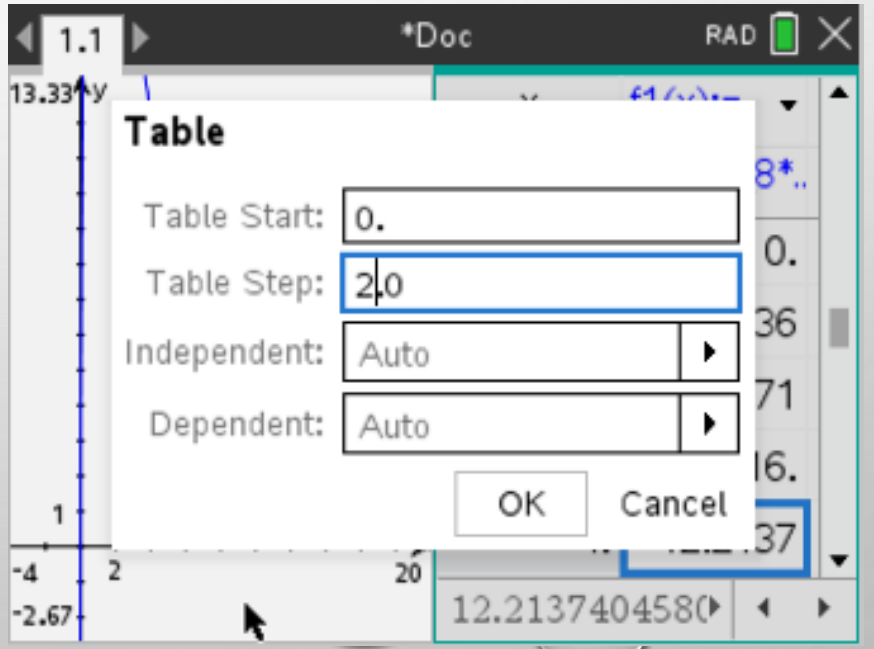
- IN CALCULATOR:
- **CTRL T** TO GET TO THE TABLE

- NOTICE THAT 5 MG/L WILL BE IN BETWEEN 8 AND 10

EXAMPLES

- YOU MAY NOTICE THAT THE EXAMPLE GIVES A TABLE WHERE THE TIME GOES EVERY 2 HOURS AND THE CALCULATOR SHOWS EVERY HOUR. YOU CAN CHANGE THIS IF YOU NEED TO.
- MENU, 2, 5 → THIS OPENS TABLE SETTINGS
- ON TABLE STEP, TYPE 2

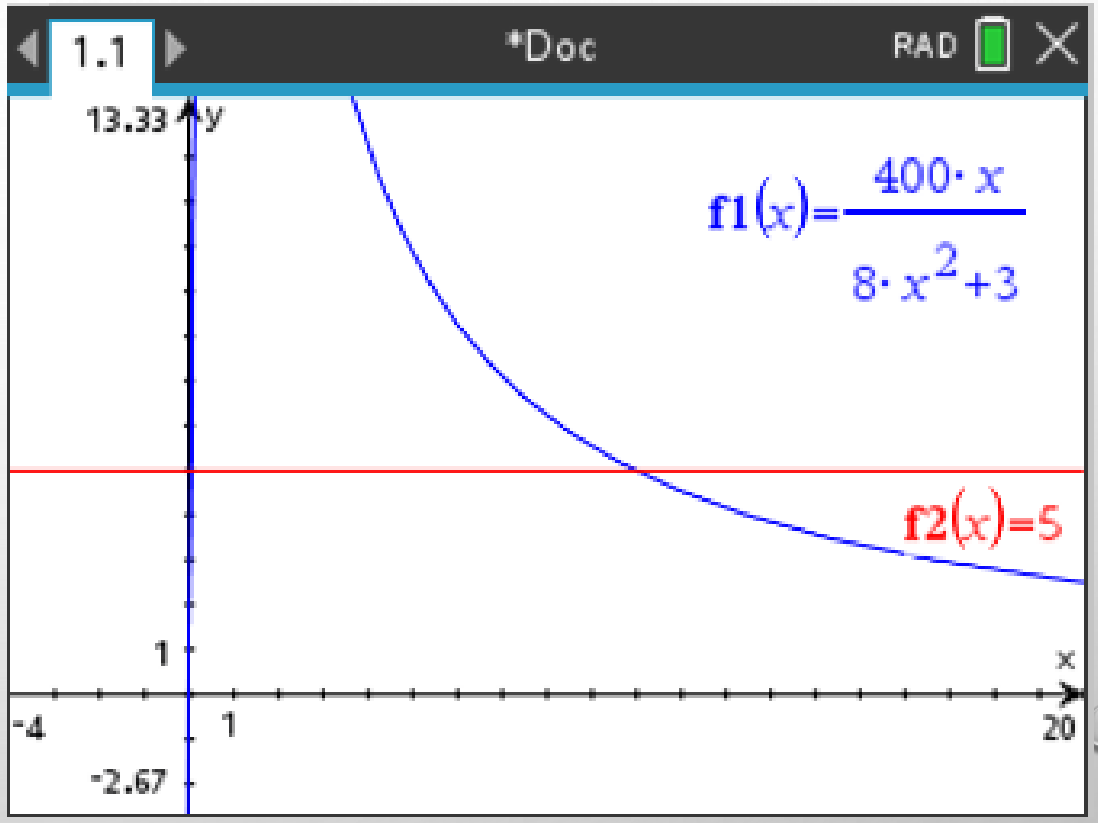




EXAMPLES

- **STEP 3** SINCE THE DESIRED CONCENTRATION IS 5 MG/L, MAKE A SECOND EQUATION FOR THIS VALUE

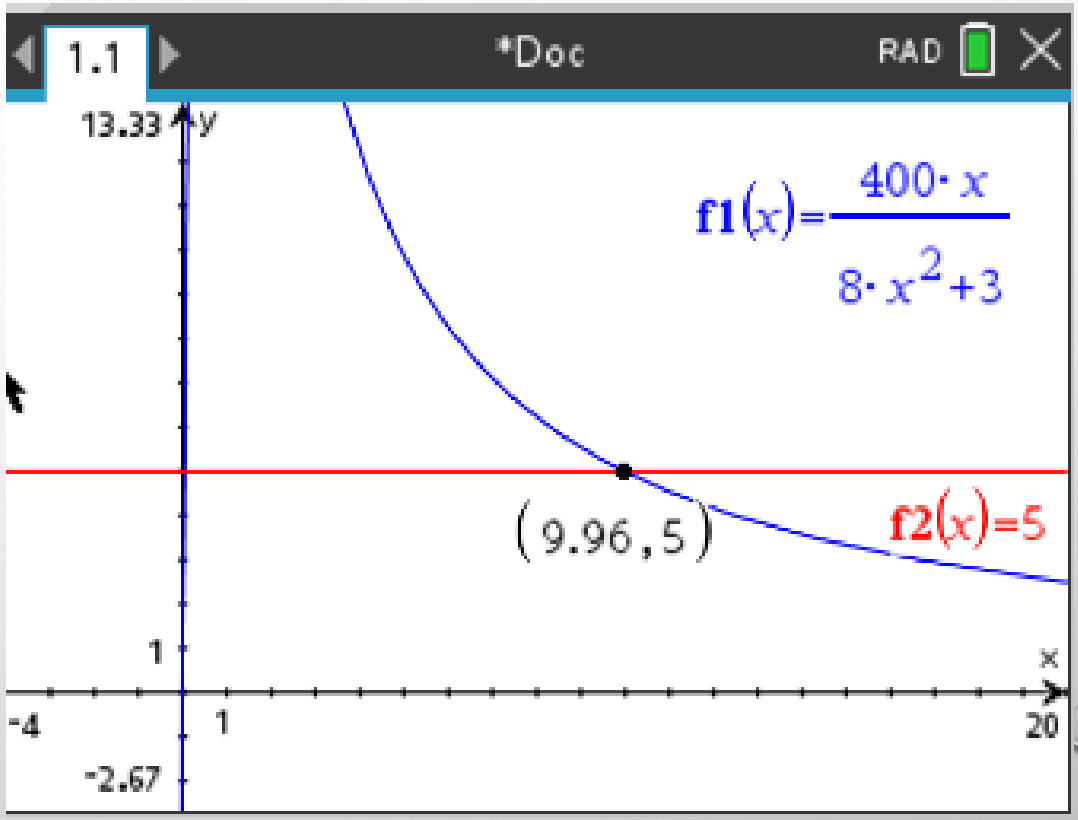
- IN THE CALCULATOR
- CTRL T TO EXIT THE TABLE
- TAB, 5



EXAMPLES

- **STEP 4** DETERMINE THE POINT OF INTERSECTION BETWEEN THE TWO EQUATIONS

- MENU, 6, 4
- GET THE LOWER AND UPPER BOUNDS



EXAMPLES

- **STEP 5** INTERPRET THE INTERSECTION POINT IN TERMS OF THE SITUATION.
- THE EQUATION $5 = \frac{400t}{8t^2+3}$ WILL YIELD THE TIME IN HOURS WHEN THE NURSE SHOULD ADMINISTER THE NEXT DOSE OF IBUPROFEN. THE MODEL C(T) SHOWS THAT THE NURSE SHOULD ADMINISTER THE NEXT DOSE OF IBUPROFEN 9.96, OR APPROXIMATELY 10, HOURS AFTER THE FIRST DOSE IS ADMINISTERED.