

- Question 1

2 points

How Did I Do?

The **half-life** of a drug in the blood is the amount of time it takes for half the drug to be eliminated from the body. This amount of time is fixed per individual and is independent of the initial amount of the drug. So, for example, if the half-life of a certain drug is 3 hours, and 25 mg of the drug is in the blood at 5 p.m., then 12.5 mg (half of 25 mg) of the drug is left at 5 p.m., and 6.25 mg (half of 12.5 mg) is left at 11 p.m.

Recall Question 4 from the in-class lesson: "The rate of elimination of caffeine from the human body varies greatly from individual to individual. Suppose that Jacob drinks a 16-ounce coffee drink that contains about 310 mg of caffeine. His body eliminates about 13% of the caffeine every hour." You created an algebraic model for this situation. Use your algebraic model to help you answer the questions below. (Hint: You may find it helpful to make a table (or use a spreadsheet) with two columns, one labelled "Time Since Drinking Coffee" and the second labelled "Amount of Caffeine in Body.")

Make sure that you fill in each answer area before checking "How Did I Do?"

- a. Approximately how long will it take for Jacob's body to eliminate half of the caffeine? (As mentioned above, this amount of time is called the caffeine's "half-life.")

Round to the nearest hour.

Number hours

- b. If Jacob drank a 12-ounce Pepsi containing 38 mg of caffeine instead of the coffee drink, how would the amount of time it would take to eliminate half of the caffeine change?
- ☐ (i) It would take a shorter time.
- ☐ (ii) It would take the same time.
- ☐ (iii) It would take a longer time.

Question 2

6 points

How Did I Do?

Joan quit her job at GM when she was 35 years old. Her friend, who is a financial advisor, recommended that she leave her 401(k) retirement savings in GM's retirement plan rather than withdrawing or transferring the money to a new plan. Her friend said that, on average, Joan could expect a 6% increase per year if she left her money in the plan for many years, based on the past performance of GM's plan. Joan will not be able to add more money to the GM 401(k) account, but can open a new one at her new job.

Make sure that you fill in each answer area before checking "How Did I Do?".

- a. Create a model for the amount of money Joan will have in her 401(k) after any number of years. Use A for the accumulated amount of money, t for the number of years, and P for the amount of money in the plan when she quit, which is called the principal.

Do not include percent sign in your answer.

$A =$  

- b. What percent of the principal will Joan have if she leaves the money in the account for the 32 years until she retires? What percent increase does this represent?

Round each answer to the nearest hundredth of a percent (2 decimal places).

Joan will have % of her principal, which is an increase of %.

- c. If Joan's original principal was \$20,100, how much would be in the account when she retires?

Round to the nearest cent (2 decimal places).

\$

- d. Approximately how many years will it take the principal to double? How long to quadruple? Round to the nearest year.

years to double

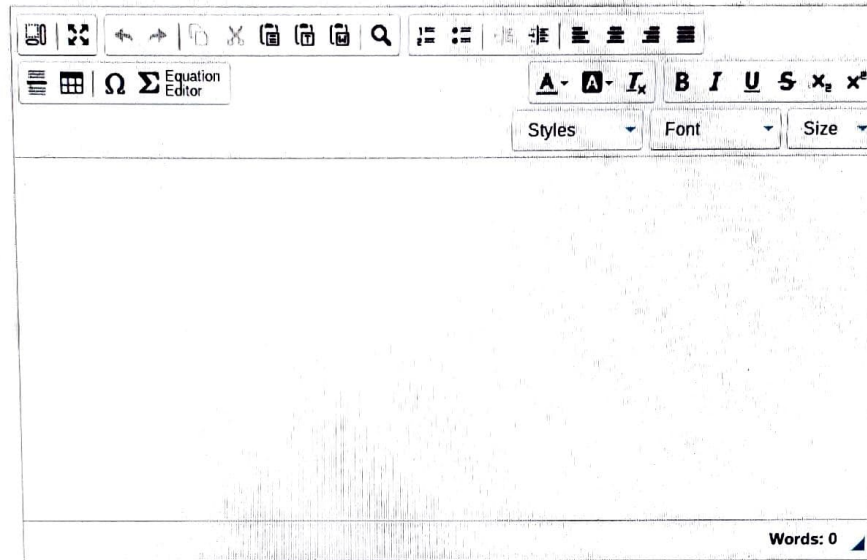
years to quadruple

- Question 3

3 points

In the earlier question, we assumed that the body could eliminate 13% of the caffeine present every hour. Wikipedia states that the half-life of caffeine in a healthy adult is often between 4.9 and 6 hours.[†] (Remember, the "half-life" refers to the amount of time it takes for the body to eliminate half of the caffeine currently present in the body.)

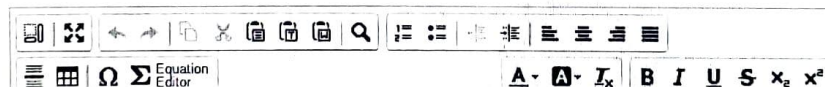
- a. If 13% of the caffeine is eliminated every hour, does this imply a half-life between 4.9 and 6 hours? Explain. Does this answer agree with your answer to the earlier question?



- b. The Wikipedia article goes on to say "Heavy cigarette smokers show a decrease in [caffeine] half-life of 30-50%, oral contraceptives can double it, and pregnancy can raise it even more, to as much as 15 hours during the last trimester." Create a model of caffeine elimination from the body of a heavy cigarette smoker that is consistent with the facts found in the Wikipedia article. Please give your answer as an algebraic model (an equation), and define your variables.

Hint: There are many specific models that would work, but you only need to provide one.

Hint: As we learned in the in-class lesson, you may choose any starting (initial) value without changing the half-life. You may wish to create a table using a spreadsheet application to show the amount of caffeine remaining hourly, to help you find and check your solution. (In this case, round to 2 decimal places. And recall that decreasing by 15% every hour is the same as multiplying by 0.85 every hour.) Please include this table if you created one, along with your algebraic model.

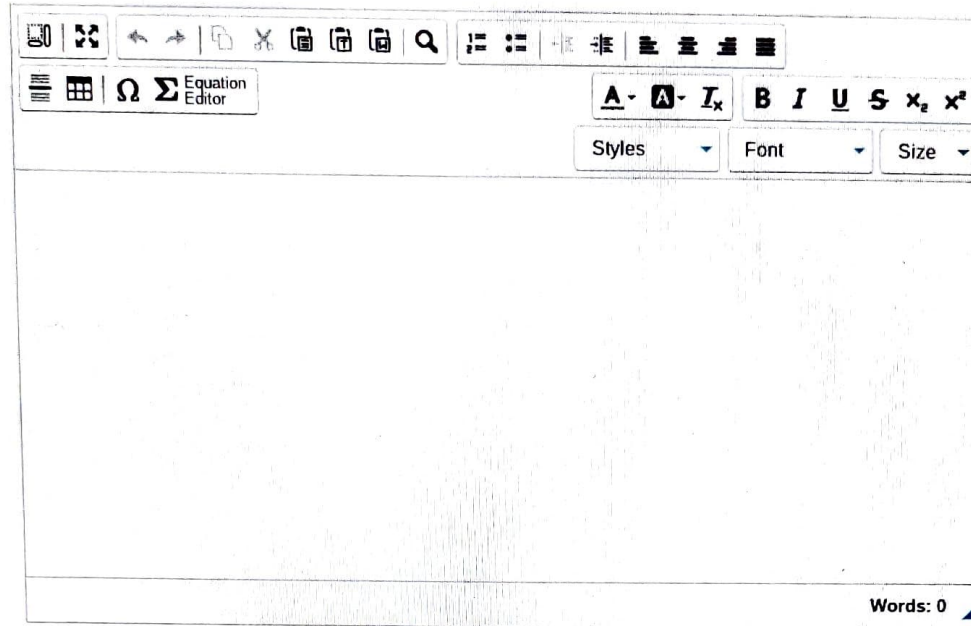


Submit Assignment

Quit & Save

Question 3

- c. Now create a model of caffeine elimination from the body of a woman, pregnant in her last trimester, that is consistent with the upper limits presented in the Wikipedia article.



[†]"Caffeine," Wikipedia, The Free Encyclopedia, accessed August 23, 2012

- Question 4

4 points

How Did I Do?

The antibiotic tetracycline is used for treatment against many different bacterial infections. Suppose that an individual is given 300 mg of tetracycline every 6 hours, and the half-life of tetracycline is 8 hours. (Hint: Assume all tetracycline is absorbed into the body immediately.)

Round each answer to the nearest milligram.

Make sure that you fill in each answer area before checking "How Did I Do?".

- a. If the individual takes his first dose at noon, how much tetracycline remains in his body just before he takes his second dose?

 mg

- b. How much tetracycline is in the individual's body just right after he takes his second dose?

Submit Assignment

Quit & Save

Words: 0

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Question 4

4 points

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The antibiotic tetracycline is used for treatment against many different bacterial infections. Suppose that an individual is given 300 mg of tetracycline every 6 hours, and the half-life of tetracycline is 8 hours. (Hint: Assume all tetracycline is absorbed into the body immediately.)

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   mg

- b. How much tetracycline is in the individual's body just right after he takes his second dose?

   mg

- c. How much tetracycline is in the individual's body just before he takes his third dose? Just after?

   mg just before his third dose, and    mg just after his third dose.