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MAT 106:
Mathematics for Health Science
Final Exam

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Please print the requested information in the spaces provided:

Student:

Name:

Student Id:

Email: *include to receive the final grade via email* ONLY *if you are not getting email updates*

- *Notes and books are permitted on this exam.*

- *Graphing calculators, computers, cell phones and any communication-capable devices are prohibited. Their mere presence in the open (even without use) is a sufficient reason for an immediate dismissal from this exam with a failing grade.*

- *You will not receive full credit if there is no work shown, even if you have the right answer. Please don't attach additional pieces of paper: if you run out of space, please ask for another blank final.*

Problem 1. Tamiflu (generic name: oseltamivir phosphate) is an oral anti-viral drug approved for the treatment of acute, uncomplicated influenza in patients 2 weeks of age and older whose flu symptoms have not lasted more than two days. It belongs to the class of drugs called *neuraminidase inhibitors*. These drugs work by stopping the spread of the influenza (flu) virus in the body, and help shorten the time you have flu symptoms, by about one third on average.

The full course of recommended treatment consists of 10 doses, taken twice daily in the course of 5 days. Each dose depends on the weight and age of the patient, as outlined in the following table:

Patient's Age	Patient's Weight	Single Dose
2 weeks to 1 year	any	3 mg/kg
1 to 12 years	15 kg or less	30 mg
1 to 12 years	15.1 to 23 kg	45 mg
1 to 12 years	23.1 to 40 kg	60 mg
any	40.1 kg or more	75 mg

Suppose you have the drug available in the form of oral suspension:
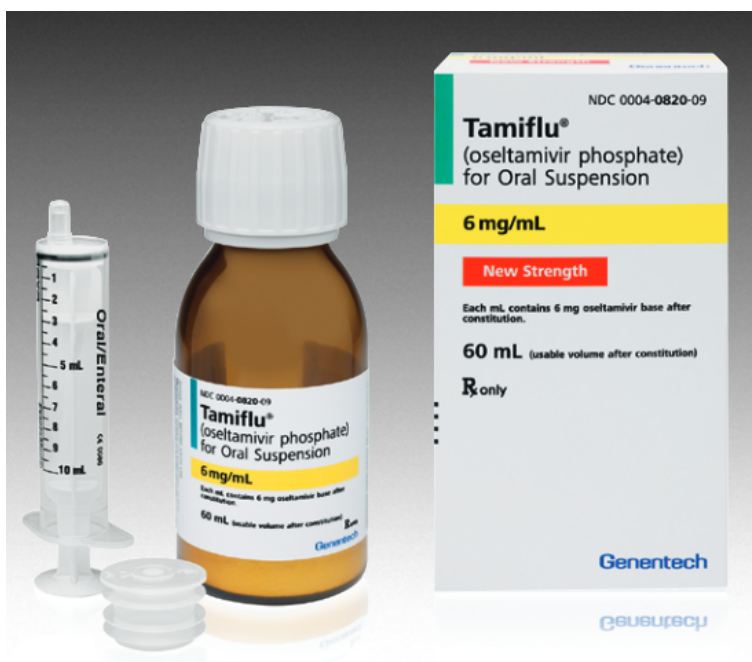
(1). Determine the single dose needed for a 5 year old child that weighs 20 kg. (Remember that the "dose" is what you directly administer, so it must be in the units you can use in the field.)

Space for your solution:

(2). Determine the single dose needed for a 6 month old baby that weighs 6.5 kg.

Space for your solution:

Problem 2. Sickle cell anaemia is an autosomal recessive disorder. It affects erythrocytes (the red blood cells that transport oxygen). Individuals with two normal alleles have normal erythrocytes, but are easily infected with the malaria.

Those who have two defective alleles suffer from the anaemia. Their erythrocytes develop abnormally and may collapse when deoxygenated. However, malaria parasite cannot grow in those abnormal erythrocytes. Therefore people with anaemia are protected from malaria, but suffer from the effects of the erythrocyte defect.

Those who are heterozygous (i.e. are carriers: have one normal and one defective allele) have some sickling of erythrocytes, but do not suffer any ill effects from it, except when severely dehydrated or deprived of oxygen. In addition, malaria parasite cannot reproduce well within these their partially defective erythrocytes. Thus, heterozygous individuals tend to reproduce at a higher rate than those who have one of the two homozygous genotypes.

Compute all probabilities with at least four digits after the decimal.

(1). In a particular family, one parent is healthy and another one has sickle cell anaemia.

They had a child who also suffers from the anaemia. What is the probability that their next child will have sickle cell anaemia?

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(2). Sickle cell anaemia is estimated to occur in 1 in 500 African Americans. What are the frequencies of the normal and defective sickle cell anaemia alleles in the African American population?

Space for your solution:

(3). Using the information from the previous subproblem, determine the probability of an African American to be a (healthy) carrier of sickle cell anaemia allele.

Space for your solution:

(4). In a particular family, one parent is a healthy African American and another one has sickle cell anaemia. Determine the probability that their child will have sickle cell anaemia.

Space for your solution:

(5). In a particular family, one parent is a healthy African American and another one has sickle cell anaemia. They had a child who is healthy. Determine the probability of their next child having sickle cell anaemia.

Space for your solution: