

Name: _____

Fractions Inheritance Math Problem

Background information: A major Arab mathematician named **Muhammad ibn Musa al-Khwarizmi** wrote an influential textbook around the year 820 AD called *Hisab al-jabr w'al-muqabala* (Calculation by Restoration and Reduction) that is known today as the *Algebra*. This book was the starting point for Arab work in algebra, and it is credited for giving the subject its name. Al-Khwarizmi was probably born in Soviet Central Asia but he did most of his work in algebra in Baghdad, where he was an astronomer and head of the library at the House of Wisdom.

Al-Khwarizmi was a Muslim and the second half of his book *Algebra* contains problems about the **Islamic law of inheritance**. According to the law, when a woman dies her husband receives one-quarter of her estate, and the rest is divided among her children so that a son receives twice as much as a daughter. If the woman chooses to leave money to a stranger, the stranger cannot receive more than one-third of the estate without the approval of the heirs. If only some of the heirs approve, the approving heirs must pay the stranger out of their own shares the amount that exceeds one-third of the estate. Whether approved by all heirs or not, the stranger's share must be paid before the rest is shared out among the heirs.

Here is an example problem from Al-Khwarizmi's *Algebra*:

A woman dies leaving a husband, a son, and three daughters. She also leaves a bequest consisting of $\frac{1}{8} + \frac{1}{7}$ of her estate to a stranger. She leaves \$224,000. Calculate the shares of her estate that go to each of her beneficiaries.

Solution: The stranger receives $\frac{1}{8} + \frac{1}{7} = \frac{15}{56}$ of the estate, leaving $\frac{41}{56}$ to be shared out among the family.

The husband receives one-quarter of what remains, or $\frac{1}{4}$ of $\frac{41}{56}$. So $\frac{1}{4}$ multiplied by $\frac{41}{56} = \frac{41}{224}$.

The son and the three daughters receive their shares in the ratio 2:1:1:1 so the son's share is **two fifths** of the estate after the stranger and husband have been given their bequests and each daughter's share is **one fifth**. ($2+1+1+1=5$).

If the **total estate is \$224,000**, the shares received by each beneficiary will be:

| | |
|----------------|---|
| Stranger: | $\frac{15}{56}$ of \$224,000 = \$60,000. |
| Husband: | $\frac{41}{224}$ of \$224,000 = \$41,000. |
| Son: | $\frac{2}{5}$ of (\$224,000 - 101,000) = \$49,200. |
| Each daughter: | $\frac{1}{5}$ of (\$224,000 - 101,000) = \$24,600. |
| | TOTAL = \$224,000. |

Your Project:

1) Solve the following Islamic law inheritance problem:

A man's estate totals \$57,000. He dies leaving a father, mother, and two daughters. In his will, he states that he has \$27,000 in debt that has to be taken from his total estate and repaid to the lender. From the remaining amount, he leaves a bequest of $\frac{1}{5} + \frac{6}{30}$ of his estate to a stranger. Calculate how much of his estate each of his beneficiaries will receive. Write out all of your calculations. Check to make sure your beneficiary sums equal the total estate.

2) The stranger decided to hold a competition for the students at Nur Islamic School of Louisville, and use $\frac{1}{100}$ of his share as a prize to be given to the winners who are able to solve this problem. The prize money will be divided among the top 3 students. The first place winner will get $\frac{2}{3}$ of the prize money, while the rest of it will be divided equally between the 2nd and 3rd place winners. Calculate how much money each of the 1st, 2nd, and 3rd place winners gets as a prize.

*Verses 11 & 12 from Surah An-Nisaa' (4:11 and 4:12) may be used as a reference. See attached page. A calculator may **NOT** be used to solve this problem.

Helpful terms & definitions:

- **Estate:** all of the things that a person owns. The things left by someone who has died.
- **Bequest:** the property or money that you promise in your will to give to another person or organization after you die.
- **Beneficiary:** a person, organization, etc., that receives money or property when someone dies.
- **Lender:** An organization or person that lends money.

*Write your solution in the box below. You may use an additional paper if you need more space:

يُوصِيكُمُ اللَّهُ فِي أَوْلَادِكُمْ لِلذَّكَرِ مِثْلُ حَظِّ الْأُنثِيَيْنِ فَإِنْ كُنَّ
نِسَاءً فَوْقَ اثْنَتَيْنِ فَلَهُنَّ ثُلُثَا مَا تَرَكَ وَإِنْ كَانَتْ وَاحِدَةً فَلَهَا
النِّصْفُ وَلِأَبَوَيْهِ لِكُلِّ وَاحِدٍ مِّنْهُمَا السُّدُسُ مِمَّا تَرَكَ إِنْ كَانَ لَهُ
وَلَدٌ فَإِنْ لَمْ يَكُنْ لَهُ وَلَدٌ وَوَرِثَهُ أَبَوَاهُ فَلِأُمِّهِ الثُّلُثُ فَإِنْ كَانَ لَهُ
إِخْوَةٌ فَلِأُمِّهِ السُّدُسُ مِنْ بَعْدِ وَصِيَّةٍ يُوصِي بِهَا أَوْ دَيْنٍ لِأَبَائِكُمْ
وَأَبْنَاؤُكُمْ لَا تَدْرُونَ أَيُّهُمْ أَقْرَبُ لَكُمْ نَفْعًا فَرِيضَةٌ مِّنَ اللَّهِ إِنْ
اللَّهُ كَانَ عَلِيمًا حَكِيمًا



Allah commands you as regards your children's (inheritance); to the male, a portion equal to that of two females; if (there are) only daughters, two or more, their share is two thirds of the inheritance; if only one, her share is half. For parents, a sixth share of inheritance to each if the deceased left children; if no children, and the parents are the (only) heirs, the mother has a third; if the deceased left brothers or (sisters), the mother has a sixth. (The distribution in all cases is) after the payment of legacies he may have bequeathed or debts. You know not which of them, whether your parents or your children, are nearest to you in benefit, (these fixed shares) are ordained by Allah. And Allah is Ever All-Knower, All-Wise. (4:11)

﴿۱۲﴾ وَلَكُمْ نِصْفُ مَا تَرَكَ أَزْوَاجُكُمْ إِن لَّمْ يَكُن لَّهُنَّ
 وَلَدٌ فَإِن كَانَ لَهُنَّ وَلَدٌ فَلَكُمْ الرُّبْعُ مِمَّا تَرَكَنَّ مِن
 بَعْدِ وَصِيَّةٍ يُوصِيَنَّ بِهَا أَوْ دَيْنٍ وَلَهُنَّ الرُّبْعُ مِمَّا
 تَرَكَتُمْ إِن لَّمْ يَكُن لَّكُمْ وَلَدٌ فَإِن كَانَ لَكُمْ وَلَدٌ
 فَلَهُنَّ الثُّمُنُ مِمَّا تَرَكَتُمْ مِن بَعْدِ وَصِيَّةٍ تُوصُونَ بِهَا
 أَوْ دَيْنٍ وَإِن كَانَ رَجُلٌ يُورَثُ كَلَالَةً أَوْ امْرَأَةٌ وَلَهُ أَخٌ أَوْ
 أُخْتٌ فَلِكُلِّ وَاحِدٍ مِّنْهُمَا السُّدُسُ فَإِن كَانُوا أَكْثَرَ مِن
 ذَلِكَ فَهُمْ شُرَكَاءُ فِي الثُّلُثِ مِن بَعْدِ وَصِيَّةٍ يُوصَى بِهَا أَوْ
 دَيْنٍ غَيْرِ مُضَارٍّ وَصِيَّةً مِّنَ اللَّهِ وَاللَّهُ عَلِيمٌ حَلِيمٌ

In that which your wives leave, your share is a half if they have no child; but if they leave a child, you get a fourth of that which they leave after payment of legacies that they may have bequeathed or debts. In that which you leave, their (your wives) share is a fourth if you leave no child; but if you leave a child, they get an eighth of that which you leave after payment of legacies that you may have bequeathed or debts. If the man or woman whose inheritance is in question has left neither ascendants nor descendants, but has left a brother or a sister, each one of the two gets a sixth; but if more than two, they share in a third; after payment of legacies he (or she) may have bequeathed or debts, so that no loss is caused (to anyone). This is a Commandment from Allah; and Allah is Ever All-Knowing, Most-Forbearing. (4:12)