THE VALUE OF BATS

UT DALLAS

Challenge

Calculate the positive impact bats have on our livelihood & well-being.

Calculate this!

Read the information about the Mexican free-tailed bat and the Little brown bat below. Then, use math to solve each of questions on the page(s) that follow.

The Mexican free-tailed bats that roost in Bracken Cave in Texas eat huge number of insects during the seven months they live there. These insects include crop pests, such as corn earworm moth and the cucumber beetle, which cost American farmers billions of dollars each year. A mother Mexican free-tailed bat eats up to 10 grams of insects in a night, and one of her favorite foods is a moth that weighs one-quarter of a gram each. This means that it takes four moths to make one gram.

Little brown bats are often found living near people, and they eat many kinds of insects, including pest such as mosquitoes, moths, and beetles. Just one little brown bat can easily catch 1,000 mosquito-sized insects in an hour, and a nursing mother eats approximately 4,500 insects every night.

Going Further

How can you creatively and persuasively convey the importance of the quantities of insects a bat can eat in a single night, month, or whole summer? For example, you could create interesting bat facts similar to the "55 elephants" statistics stated in the background information. You could also create a physical model, demonstration, or write a short story.

Bats are our most important natural predators of night-flying insects consuming mosquitoes, moths, beetles, crickets, leafhoppers, chinch bugs, and much more! Many of these insects are serious agricultural or forests pests, and others spread disease to humans or livestock.

Insect pests that attack farmers' crops can lay hundreds of eggs in just a few hours or days. This means that if a bat eats a female insect before she lays eggs, the bat is actually protecting local farmers from hundreds of this insect's offspring – the grubs and caterpillars that eat crops and gardens.

If a mosquito can lay 200 eggs that take a week to hatch and become new adults, and half (100) of those new adults are females, within just one month that one mosquito's eggs, along with those of her daughters and their daughters, could result in 100,000,000 (100 x 100 x 100 x 100) new female mosquitoes. Yikes! But imagine if those mosquitoes were eaten by predators like bat.

While some small bats can catch 1,000 or more small insects an hour, a nursing mother bat can eat more than 4,000. Little brown bats (myotis lucifugus) eat a wide variety of insects, including pests such as mosquitoes, moths, and beetles. If each little brown bat in your neighborhood had 500 mosquitoes in its evening meal, how many would a colony of 100 bats eat in a night? In a month?

Bracken Cave, just north of San Antonio, is home to about 20 million Mexican free-tailed bats. How many insects do you think 20 million bats can eat in a night or a month? We know that one mother Mexican free-tailed bat can eat approximately 10 grams of insects (equal to the weight of two nickels) in a night. That doesn't sound like much, but for the whole colony it actually adds up to 220 tons of insects – the approximate weight of 55 elephants!

Now you can see why we need these important

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1. If a young little brown bat catches 15 insects in a minute, how many does it catch in one hour if it continues to catch insects at that rate? (60 minutes = one hour)

2. If a bat house in your neighborhood attracts 20 little brown bats and they each catch 1,000 mosquitoes in one hour, how many could all 20 bats catch in one hour?

3. If one evening, instead of eating mosquitoes, your 20 bats ate a kind of moth that weighs one-tenth of a gram (it takes 10 moths to make one gram), and each bat ate 10 grams of food, how many moths would these bats eat?

BONUS

1. If you build a bat house that attracts 200 little brown mother bats, and each bat eats approximately 4,500 insects each night, how many insects would these bats eat in one night? In one week?

2. Assume that one-quarter of the insects caught by this colony in a single night are mosquitoes. How many mosquitoes would have been caught by little brown bats? If half of the mosquitoes caught are females, and each female could have laid 200 eggs, how many eggs would the mosquitoes have laid if they had not been caught?

3. Assume that in the last six years, White-Nose Syndrome has killed 90% of the little brown bats in this colony. Use your answers from questions 2 and 3 to determine: How many insects would not be caught in a night and a week? How many mosquitoes would not be caught? How many eggs would those mosquitoes lay?
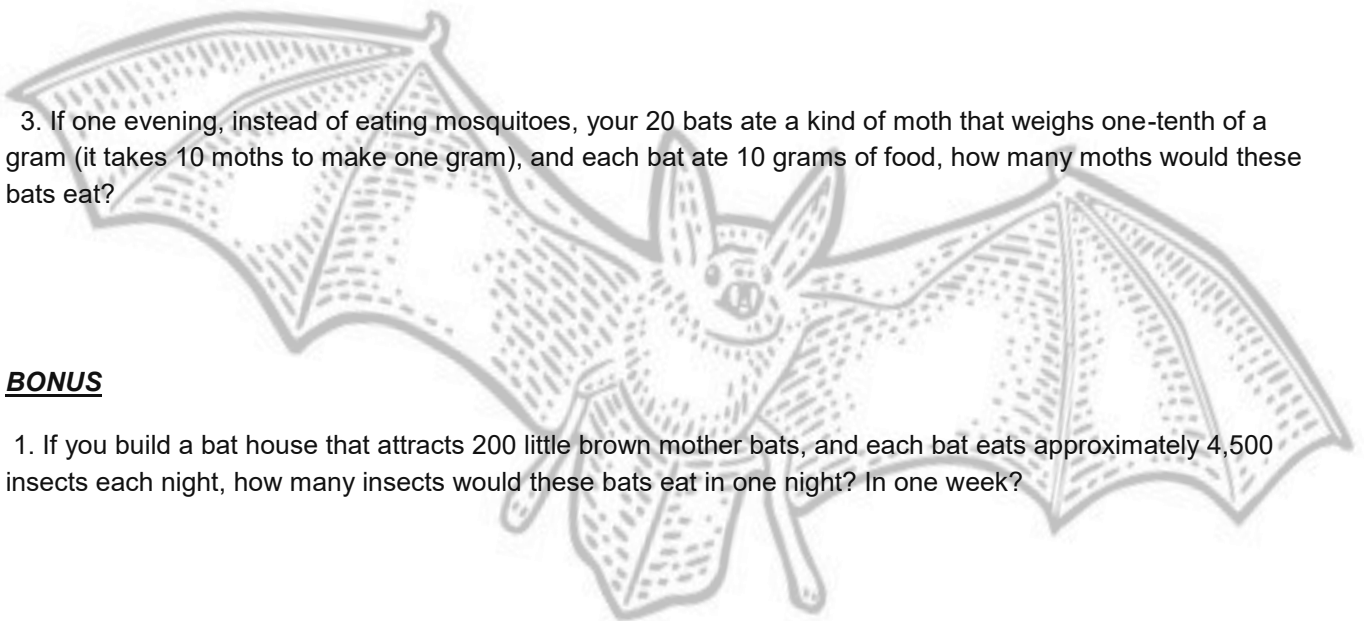
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1. How many of these moths does one mother Mexican free-tailed bat have to catch to equal 10 grams?

2. If half of the moths eaten are females and each female could have laid 500 eggs, how many eggs would 20 females have laid if they had not been caught?

3. If 20 female moths in one acre of crops can cause a farmer to spray pesticides to kill them, how much does each female moth cost the farmer? Assume that it costs $13 per acre to spray the pesticides.

4. At the above rate, what would a mother Mexican free-tailed bat feeding on moth pests over a farmer's crops be worth each night? Assume that half of the moths caught were females and the bats catch 20 female moths in one acre.

5. Large colonies of Mexican free-tailed bats eat many thousands of pounds of insects nightly. How many moths would it take to make one pound if four moths weigh one gram and 454 grams equal one pound?

6. The Mexican free-tailed bats at Bracken Cave in Texas eat approximately 400,000 pounds of insects nightly. How many moths that weigh one-quarter of a gram each would these bats have to catch to equal the weight of 400,000 pounds of insects?
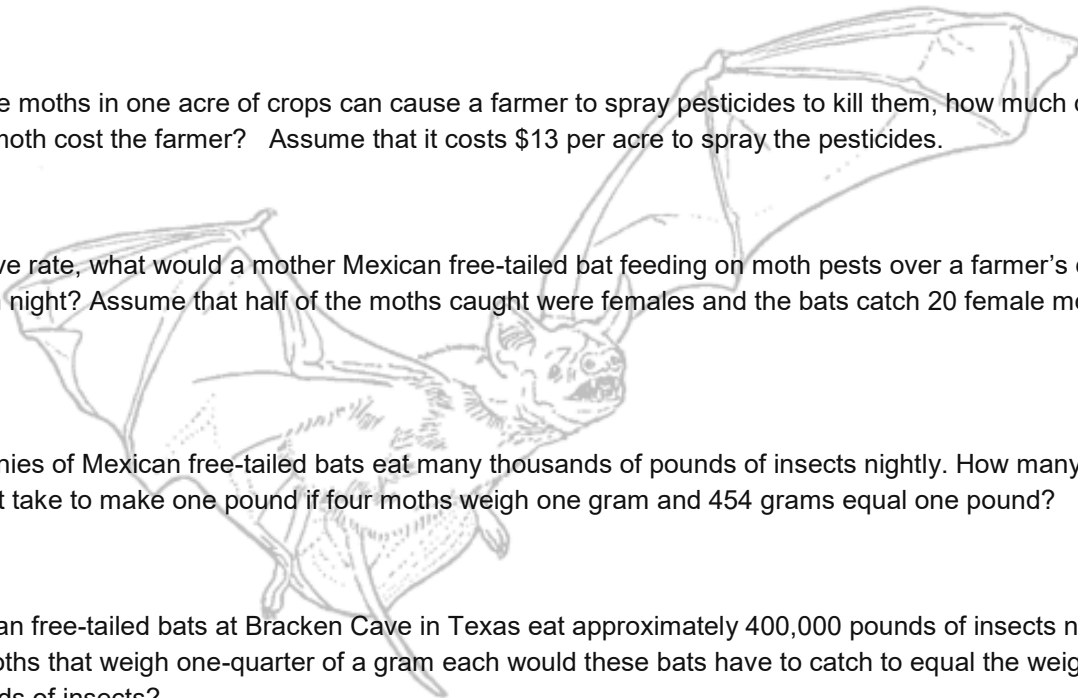
BONUS

1. There are approximately 100 million Mexican free-tailed bats in central Texas. If the estimated 20 million bats from Bracken Cave eat 400,000 pounds of insects in one night, how many pounds would the 100 million free-tailed bats from all of central Texas eat in one night?

2. Large numbers of moths are not always available, forcing the bats to switch to other varieties of smaller in-sects. On a night when they feed mostly on insects that weigh just one tenth of a gram each, it takes 4,540 of the smaller insects to make one pound. How many of these insects would the 100 million Mexican free-tailed bats of central Texas eat in one night?

Mexican free-tailed bats (Tadarida brasiliensis)

1) 4 x 10 = 40 moths

2) 20 x 500 = 10,000 eggs

3) 13 ÷ 20 = $0.65

4) 20 x $0.65 = $13

5) 4 x 454 = 1,816 moths

6) 1,816 x 400,000 = 726,400,000 moths (7.264 x 108 moths)

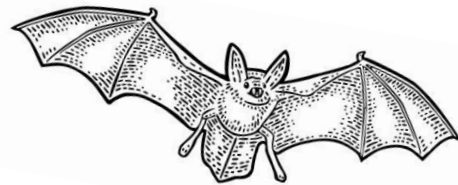### Bonus questions

1) 5 x 400,000 = 2,000,000 pounds (2 x 106 pounds)

2) 4,540 x 2,000,000 = 9,090,000,000 insects (9.08 x 109 insects)

Little brown bats (Myotis lucifugus lucifugus)

1) 15 x 60 = 900 insects

2) 20 x 1,000 = 20,000 mosquitoes (2 x 104 mosquitoes)

3) 10 x 10 x 20 = 2,000 moths (2 x 103 moths)

Bonus questions

1) 200 x 4,500 = 900,000; 900,000 x 7 = 6,300,000 insects/week (6.3 x 106 insects/week) 900,000 ÷ 4 = 225,000 mosquitoes (2.2 x 105 mosquitoes); 225,000 mosquitoes in a night ÷ 2 = 112,500 female mosquitoes; 112,500 x 200 = 22,500,000 eggs! (2.25 x 107 eggs!)

2) 90% = 0.90; 0.90 x 900,000 = 810,000 insects/night that would not be caught; 0.90 x 6,300,000 = 5,670,000 (or 5.67 x 106) insects/week that would not be caught; 0.90 x 225,000 = 202,500 (or 2.025 x 105) mosquitoes not caught; 0.90 x 22,500,000 = 20,250,000 (or 2.025 x 107) eggs laid