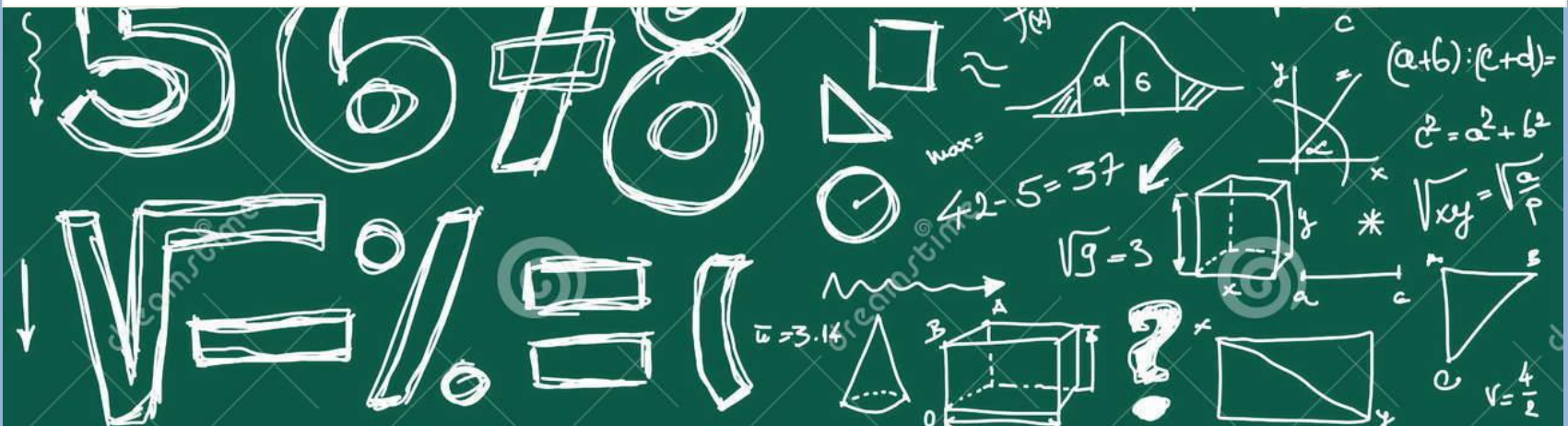
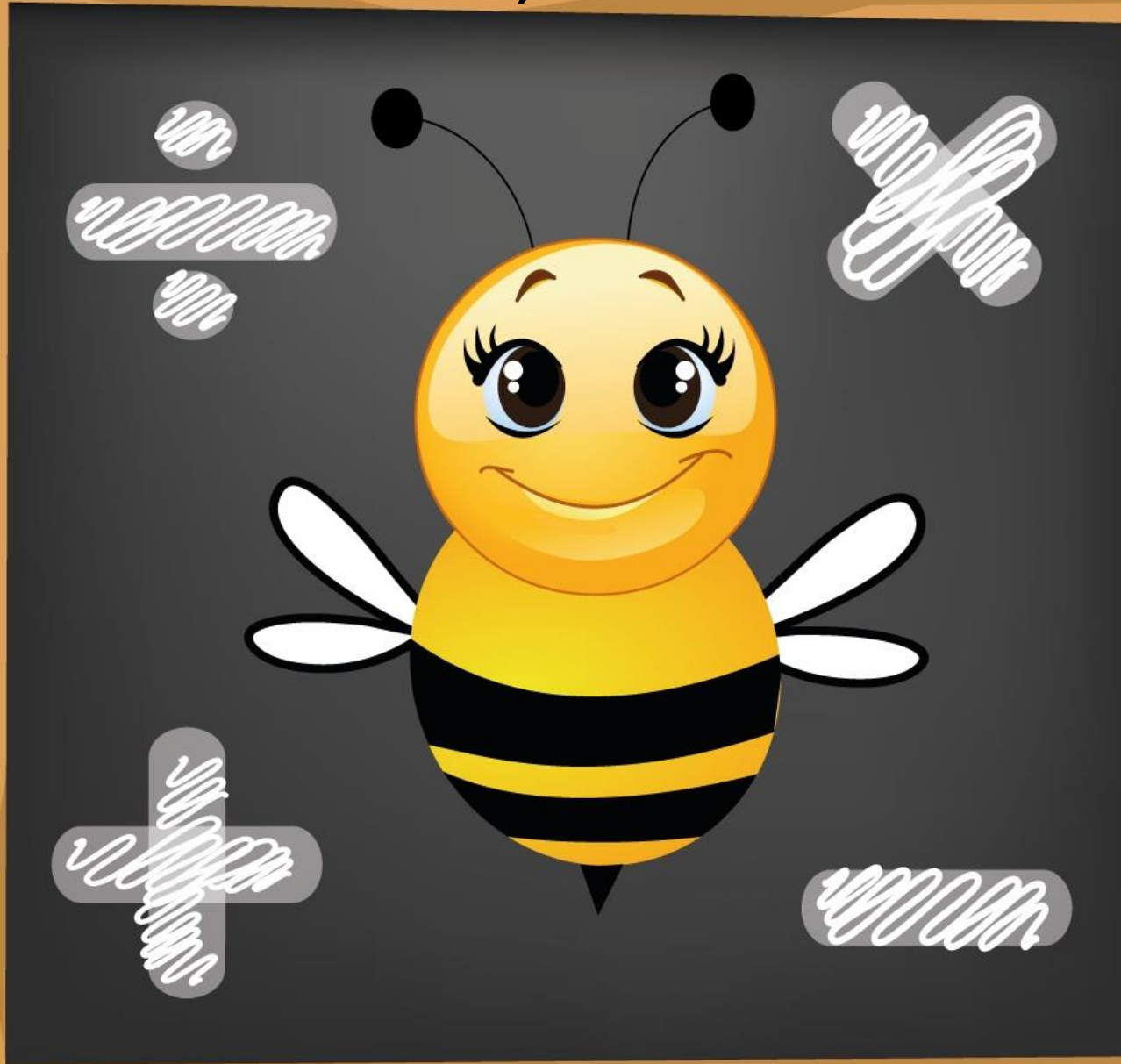




Using Numbers to Better Understand your Bees; It All Adds Up



Bee math mentor; she has the answers



Warm up question



How many right antenna on this queen?

How many wings on this queen?

When is the answer zero wings?



BEE MATH Question #1: You capture a swarm and hive it including at least one drawn frame.



What is the **minimum** number of days
before checking to see if you have a **mated**
queen?

1 2 3 **4** 5 6 7 8 9 10 11 12 13





What is the **minimum** number of days before checking to see if you have a mated queen?

1 2 3 4 5 6 7 8 9 10 11 12 13

1. She was slimmed down prior to swarming; egg laying determined by amount of food fed. Slim = no egg laying
2. 4 days for her to start laying eggs and 4 more for the first larva; easier to see than eggs.

If you do not see eggs on day 4, you suspect a virgin queen. If so, what day would you expect to see eggs?

1 2 3 4 5 6 7 8 9 10 11 12 13





If you do not see eggs on day 4, you suspect a virgin queen. If so, what day would you expect to see eggs?

1 2 3 4 5 6 7 8 9 10 11 12 13

1. 5 to 6 days for her exoskeleton to harden
2. She has to go on her mating flight
3. Her plumbing has to mature which takes another 5 to 6 days



Follow up questions: What could you learn about the queen's status if you checked on day 15?

- If you captured a virgin queen in the swarm, you would find recently hatched eggs
- If you captured a mated queen, you would find capped brood
- You can evaluate her brood pattern
- If no brood, she did not get mated

You find a swarm with a marked queen. She has a yellow dot on her thorax. How old is she?

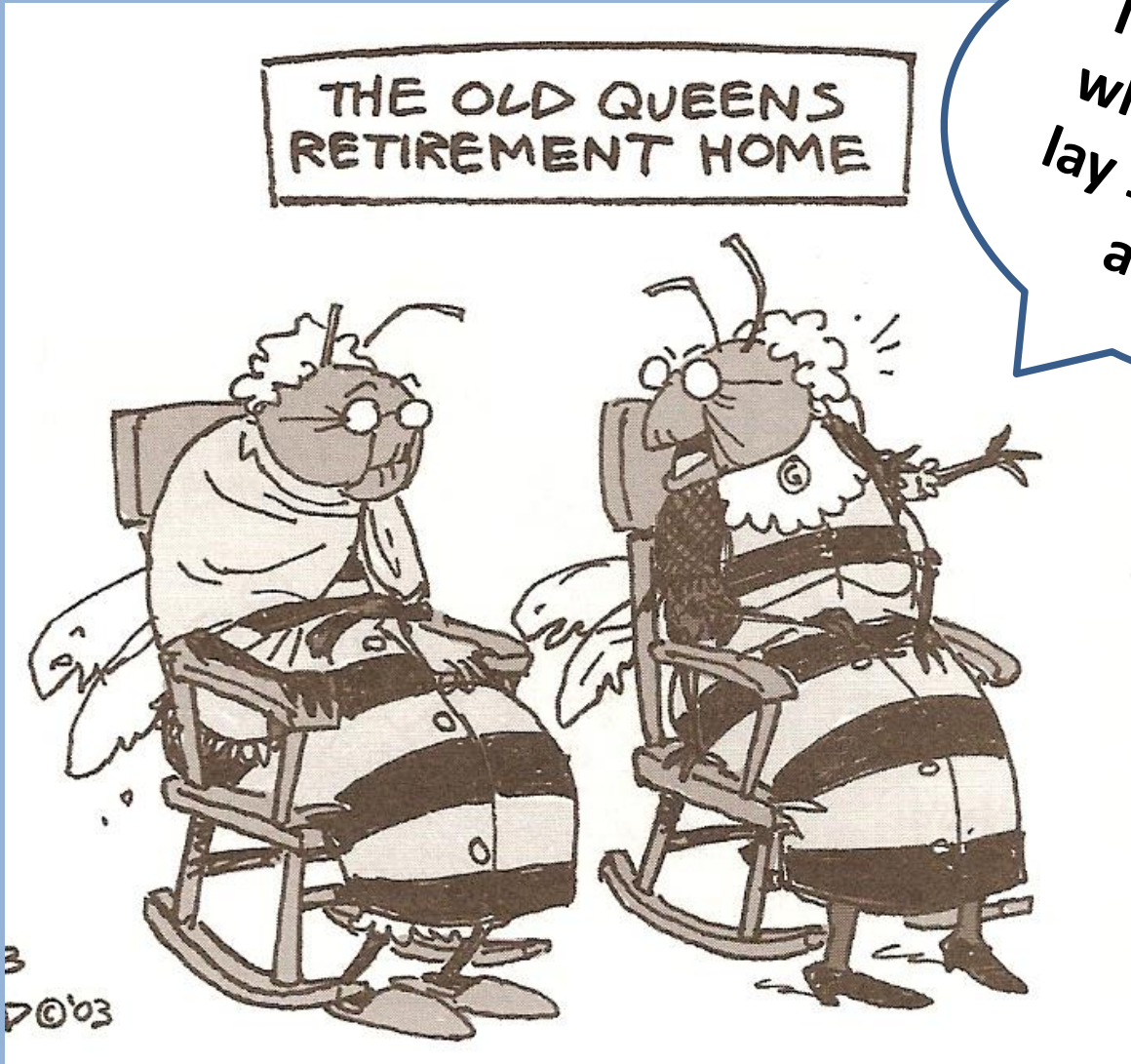


Will you raise good bees

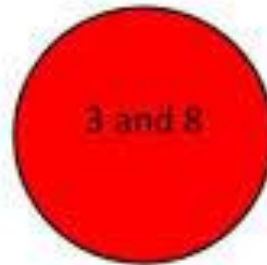
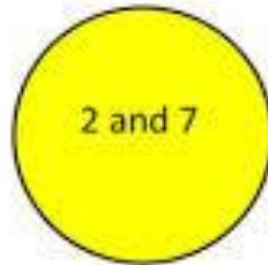
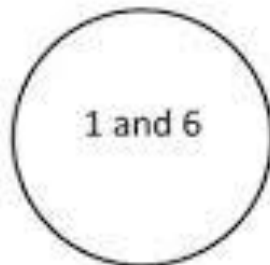


Years ending:
1 or 6 - **WHITE**
2 or 7 - **YELLOW**
3 or 8 - **RED**
4 or 9 - **GREEN**
5 or 0 - **BLUE**

If these **very old** queens are marked with yellow, in what year were they raised?



2017



Bee Math question #2: In 2022 for all of Oregon
what % of backyard colonies died?

28%

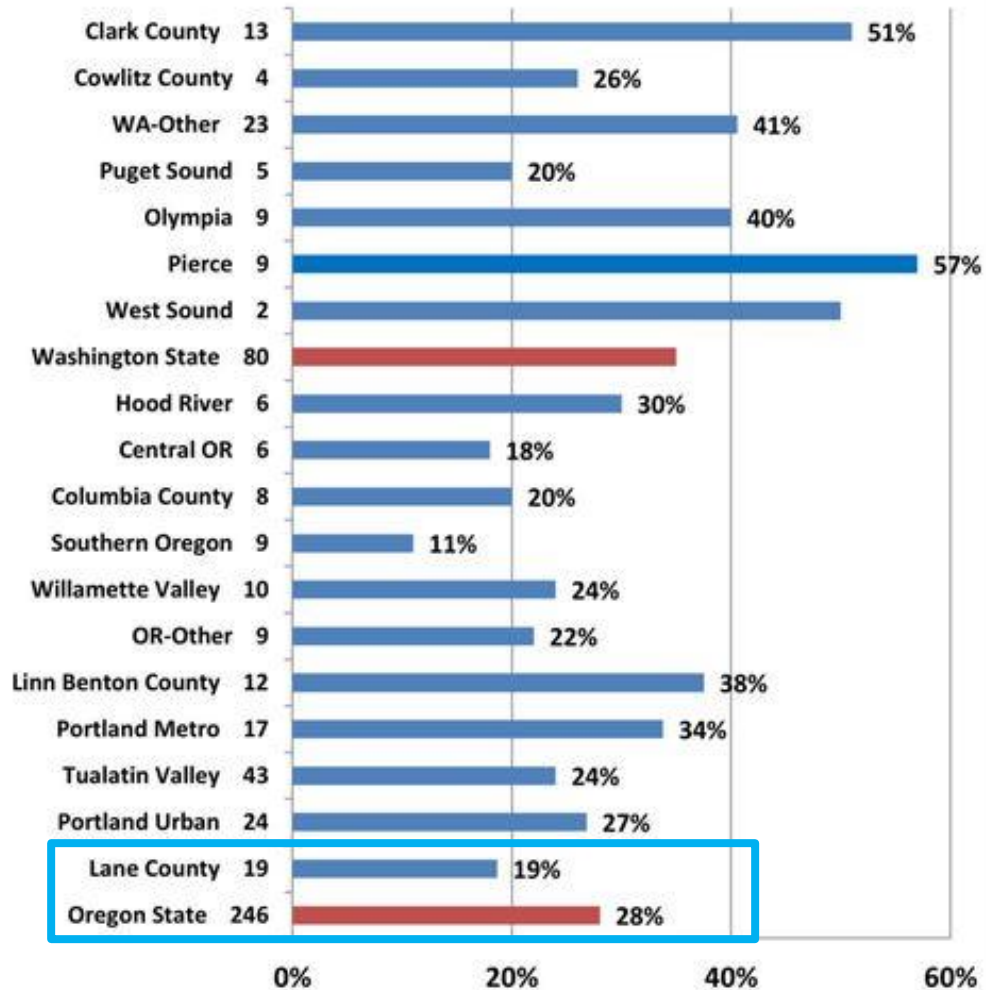
38%

48%

68%

80%

Overwinter Honeybee Loss by Association of PNW Honeybee Survey Participants 2021-22



Time to take the survey

Pacific NW Annual Honey Bee Annual Loss Survey 2022 - 2023

Attention all beekeepers! Reminder that the survey is available to take throughout the month of April.

This online survey, developed by Dr. Dewey Caron , is in it's 14th year. It measures honey bee survival/losses with diverse management variables.

There are other regional and national surveys out there, but the Pacific Northwest is a unique area. It is important for the local beekeepers to know what is happening specifically in their area and across Oregon and Washington.

Thank you for participating in the survey.

TAKE THE SURVEY »

www.pnwhoneybeesurvey.com

Varroa mites can be found in how many honey bee life cycle stages?

1

2

3

4



Phoretic mite on adult (Adult)

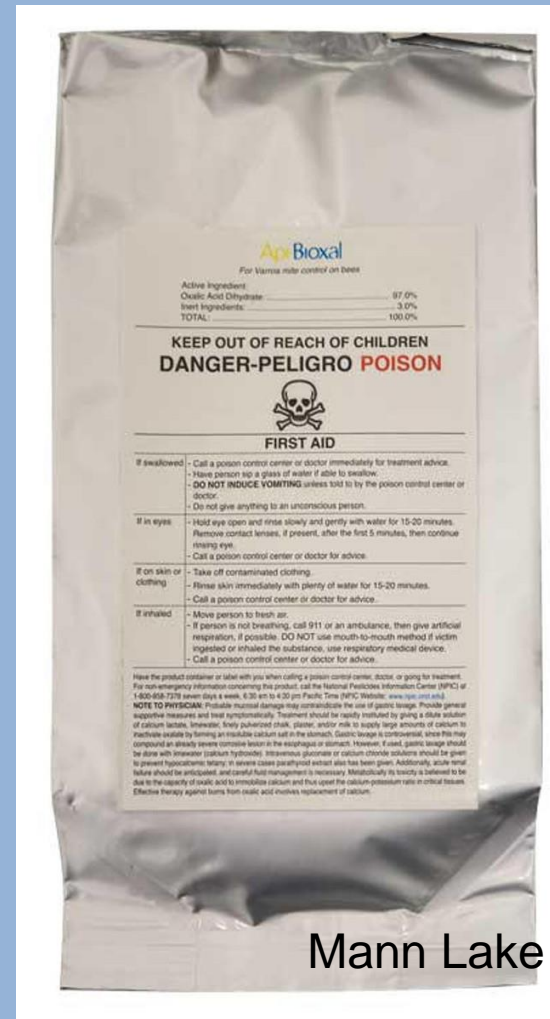


Varroa mites reproduce under capped (Pupae)

Why doesn't vaporizing with Oxalic acid **one time** a week for **3 weeks** control Varroa mites?



Mann Lake



Mann Lake

Like a conveyer belt
mites emerge daily with
workers and drones

Approximately every 4.5 days
new foundress mites
ready to enter uncapped cell

Worker $21/4.5 = \text{treat } 5$
times at intervals of 4 days

Daily Varroa Delivery



Why doesn't once a week
for 3 weeks work for
drones?

6X

Need an application every
4 days during the
development of drones

Math question #4:

If Varroa can double their population every month and you have a colony with 100 mites on March 15th, **what will the Varroa population be by mid-September?**



1600

600

★
6400

3500



Bonus Question: How many times can you extract honey in the kitchen before your significant other says, “no more”?

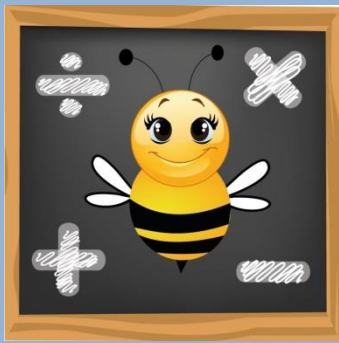


You saw a capped queen cell. When you checked **10** days later, you didn't see eggs? **Why didn't you see eggs?**



10 days is too soon for her to lay eggs





Bonus questions

When could you expect to see eggs?

Earliest Day 11

What could add days before you see eggs?

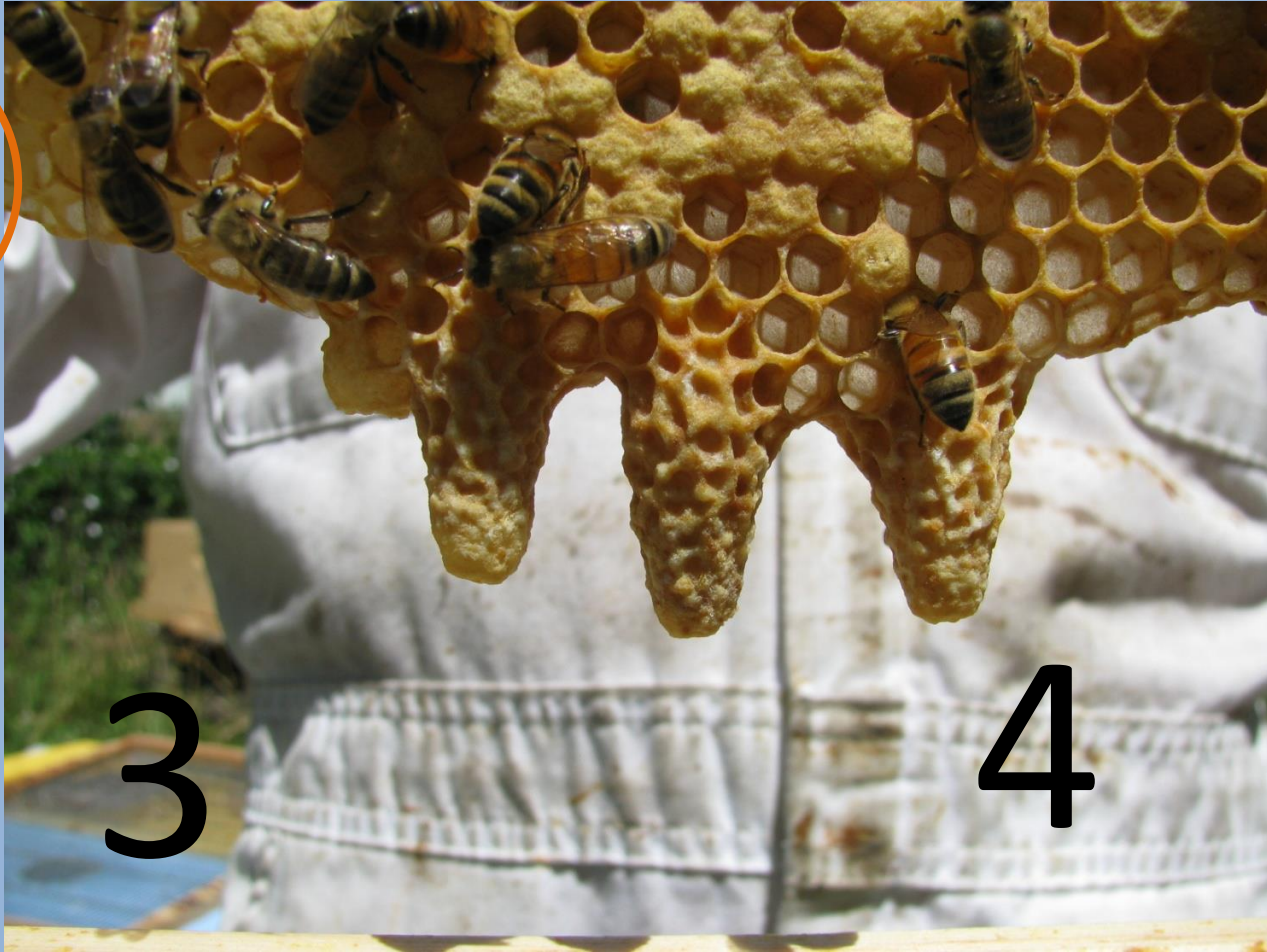
Weather

What might complicate seeing eggs?

Eyesight; i.e. TMBD

You find 4 queen cells on bottom of a frame.
You place the frame into a mating nuc with 2 frames of brood
and lots of workers. **How many queens will you get?**

1



2

3

4



One queen



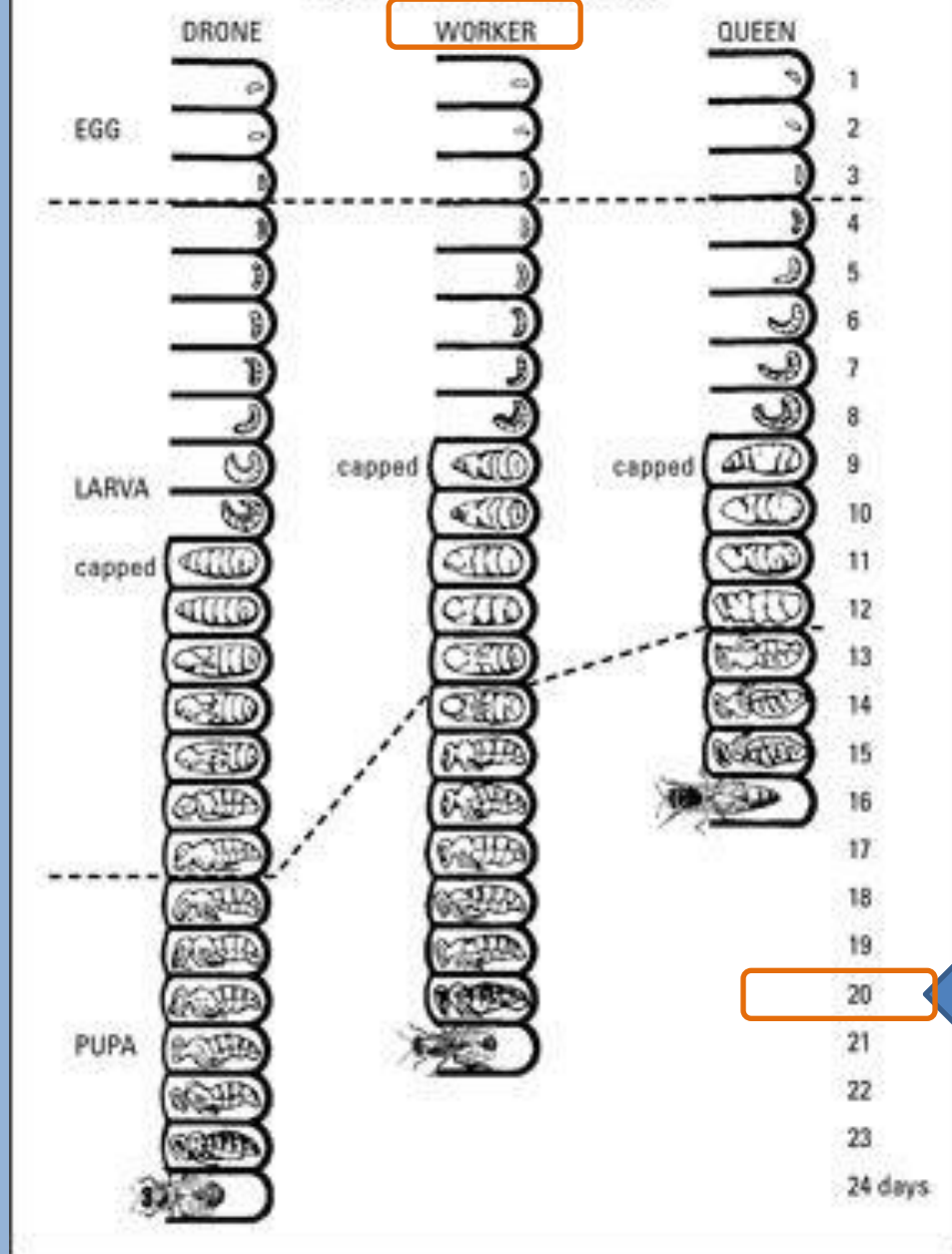
First to emerge

Bonus question

How do you know it has been less than 21 days since the bees swarmed?



The Honey Bee Life Cycle



Still have capped brood

Bonus question to tickle your fancy

At what age can a dog be
taught to read a bee
magazine?

**No age but I like
this picture**



What fraction of mites are found in capped brood?



$\frac{1}{3}^{\text{rd}}$ adult
bees (phoretic)



$\frac{2}{3}^{\text{rds}}$ in brood
(reproductive)

What fraction of mites from the parent colony leave with a swarm?

$1/2$

$1/6$

$1/3$

$1/4$





	% Total mites	Phoretic mites	Mites under caps
Colony	100%	1/3rd	2/3rds
Swarm	16.7%	1/6th	0

- Swarms leaves with $\frac{1}{2}$ of the colony
- $\frac{1}{3}^{\text{rd}}$ of the Varroa mites are on the workers (are phoretic)
- 50% of $\frac{1}{3}^{\text{rd}} = \frac{1}{6}^{\text{th}}$

What's the practical application for these fractions?

- Swarm doesn't have any mites protected by caps
- The mites are 100% phoretic and 100% vulnerable to any miticide
- No danger of killing brood
- **Take home message:** you can give your new colony a healthy, mite-free start by treating prior to first capped brood

Little known Varroa Fact: Less than 1% of
Varroa are found on beekeepers



BONUS Math Question

If that swarm came from a bee tree,
what is average volume of cavity?

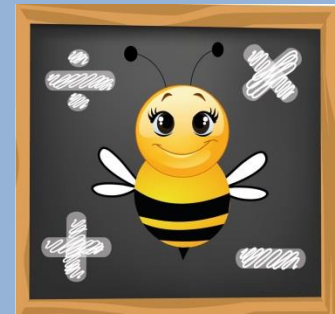
40
qtrs.

15
qtrs.



30
qtrs.

20
qtrs.



40 quarts –
same as standard
Langstroth box

Extra bonus math question: When is the best time range to treat a swarm for Varroa?

1 2 3 4 5 6 7 8 9 10 11 12

Uncapped brood



What's the problem waiting until after day 7?

1 2 3 4 5 6 7 8 9 10 11 12

Being capped



What was Langstroth's mathematical observation?





Bee Space



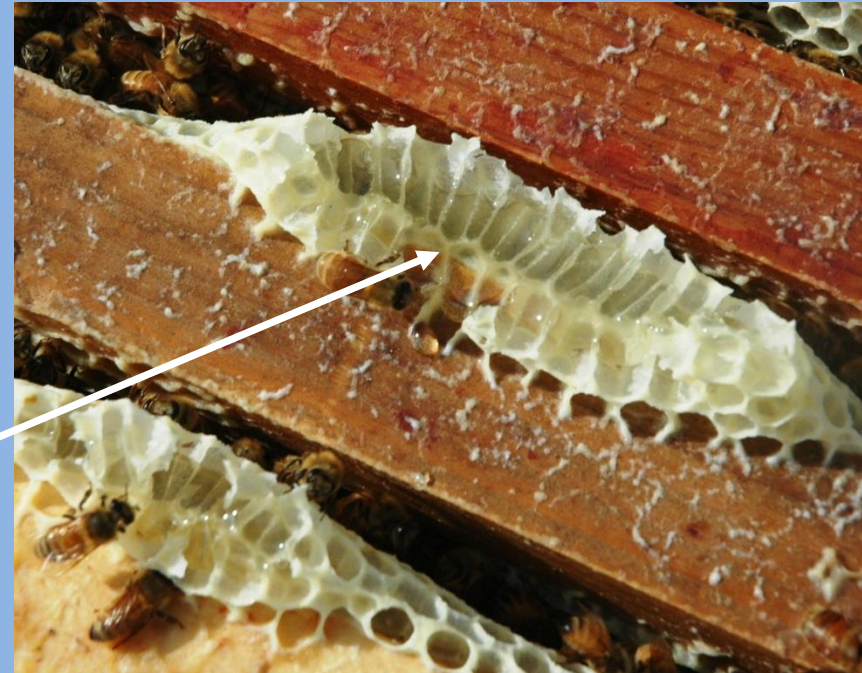
What happens when frame spacing is different than bee space...?



Narrower than bee space

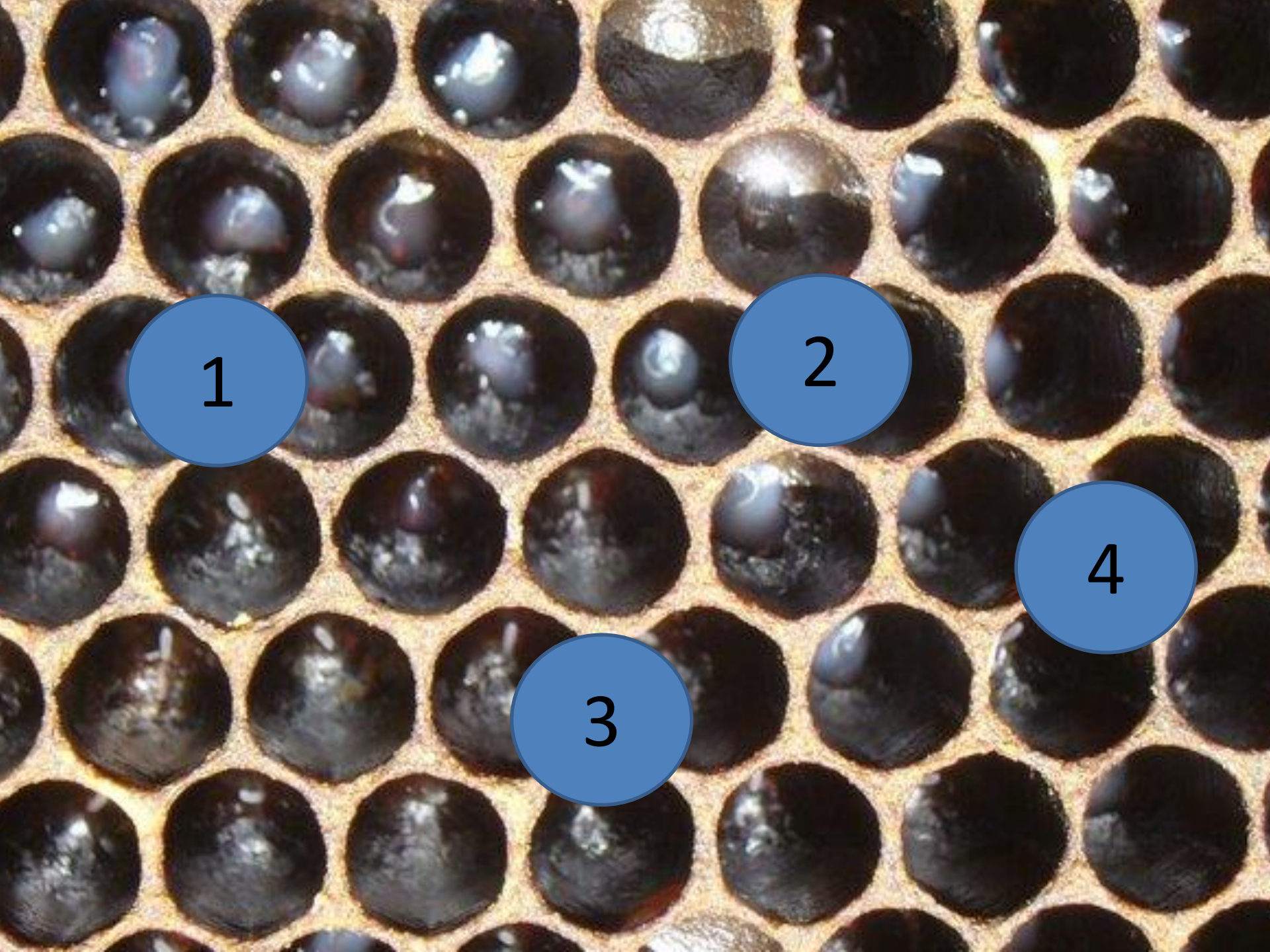
Propolis

Greater than bee space
Burr Comb



You want to try raising queens. How many days old should the **larvae** be when you start?





1

2

3

4



1
day
old

Methods to monitor mite numbers



Sugar shake



Alcohol/soapy water wash



How many bees = sample number?



300 bees from
the **brood area**

How do you collect the sample?



$\frac{1}{2}$ cup



Bonus Question: How is percentage of infestation calculated?

$$\frac{\text{Number of mites}}{\text{Sample size}}$$

9 mites/300 bees



300 bees

Does this % = economic threshold?



Yes

9 Varroa mites

300 Bees

=3% infestation

Alcohol wash = Gold Standard

Goal = Between 1 – 3%



Fall 1-3%

Spring 1%

What number is associated with the term “complete metamorphosis”?



- Egg
- Larva
- Pupa
- Adult



Butterflies, moths, ants, beetles, flies

Bonus Question

What number is associated with simple or incomplete metamorphosis?



3

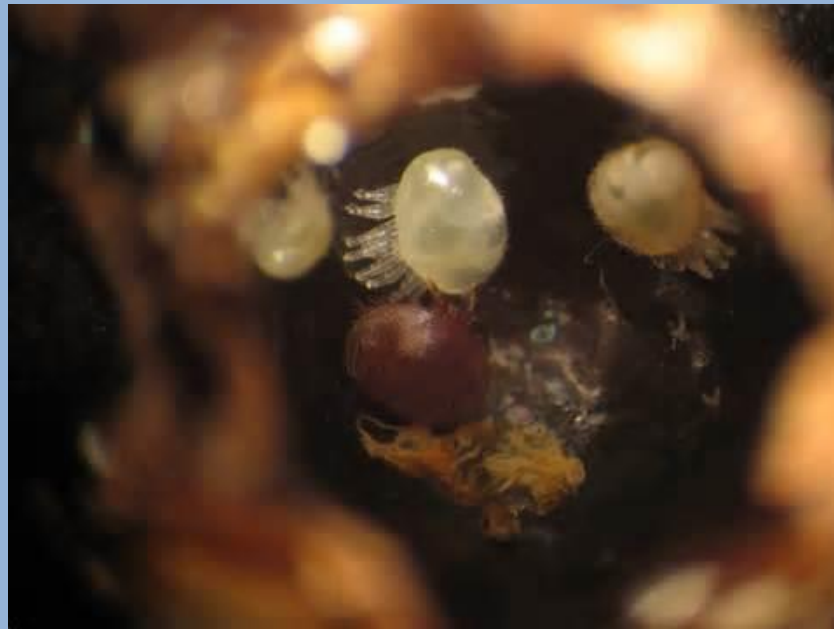
- Egg
- Nymph
- Adult

Grasshoppers, earwigs, aphids

A Foundress Varroa mite enters a **worker cell** just before it is capped at approximately 8.5/9 days. How many days does that leave for the mother mite to raise her family?

15.5/16

18.5/19

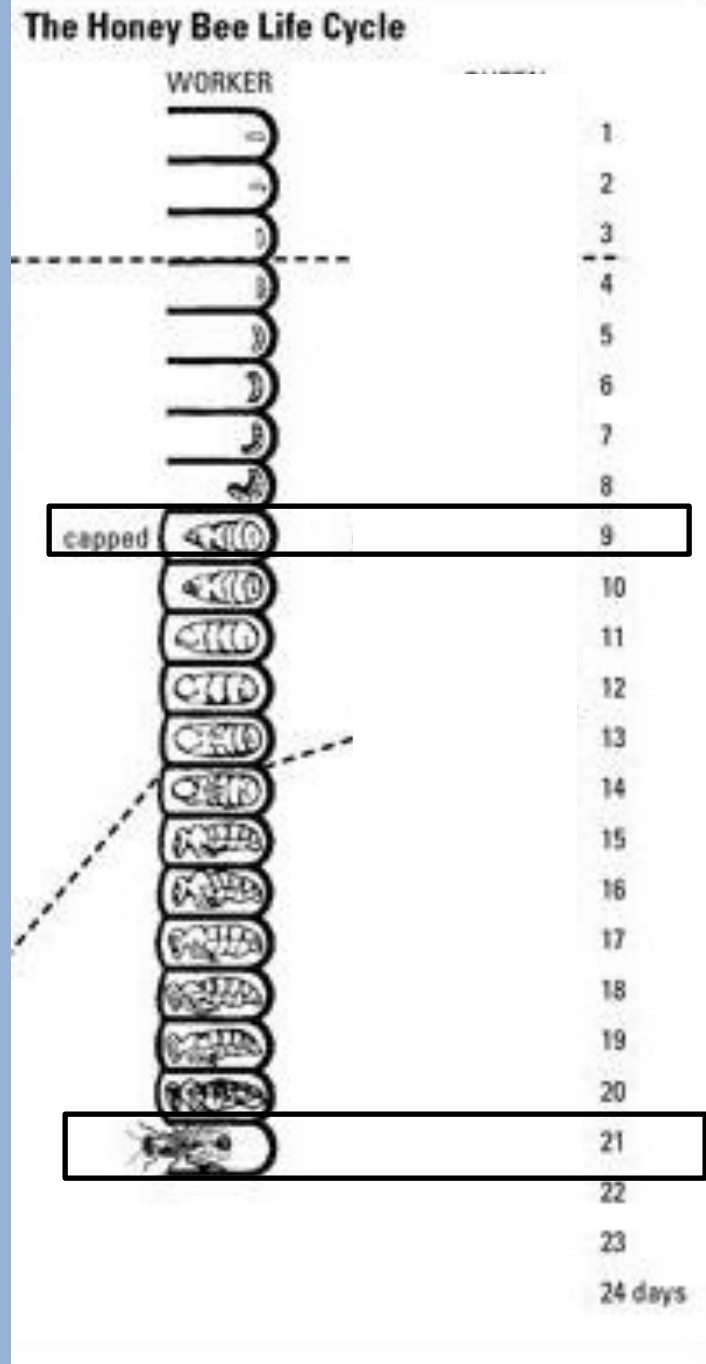


12.5/13

21.5/22

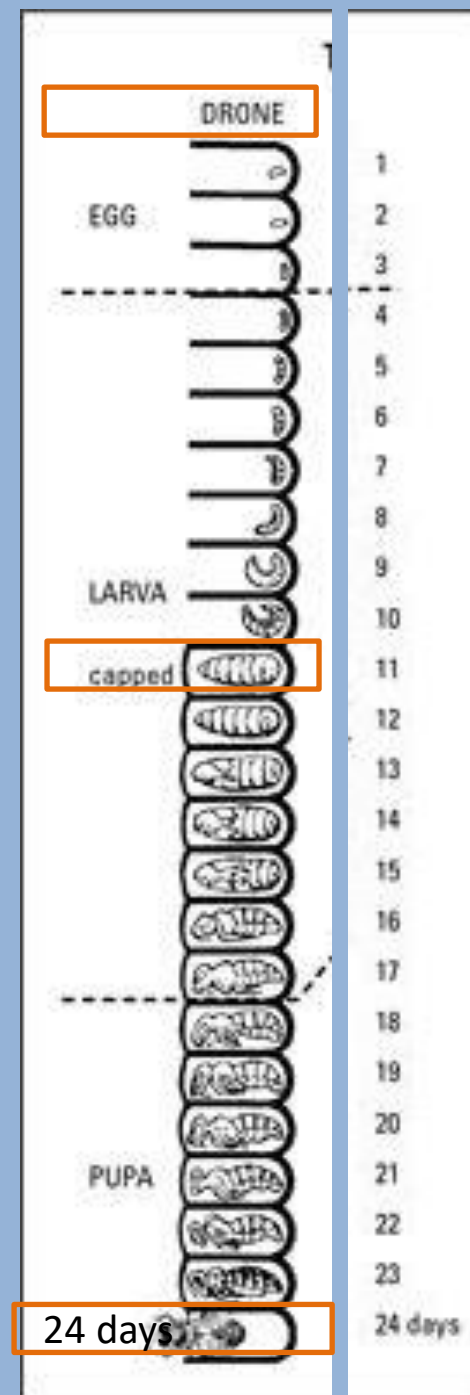
The days the
Foundress mite
is with the
worker in the
pupal stage.

$$\begin{array}{r} 21 \text{ days} \\ - 8.5 \text{ days} = \\ \hline 12.5 \text{ days} \end{array}$$



Bonus question:
How many days for
drone cell?

14 days



You are requeening a hive. How many days will it take before you know if you missed another queen in the hive?

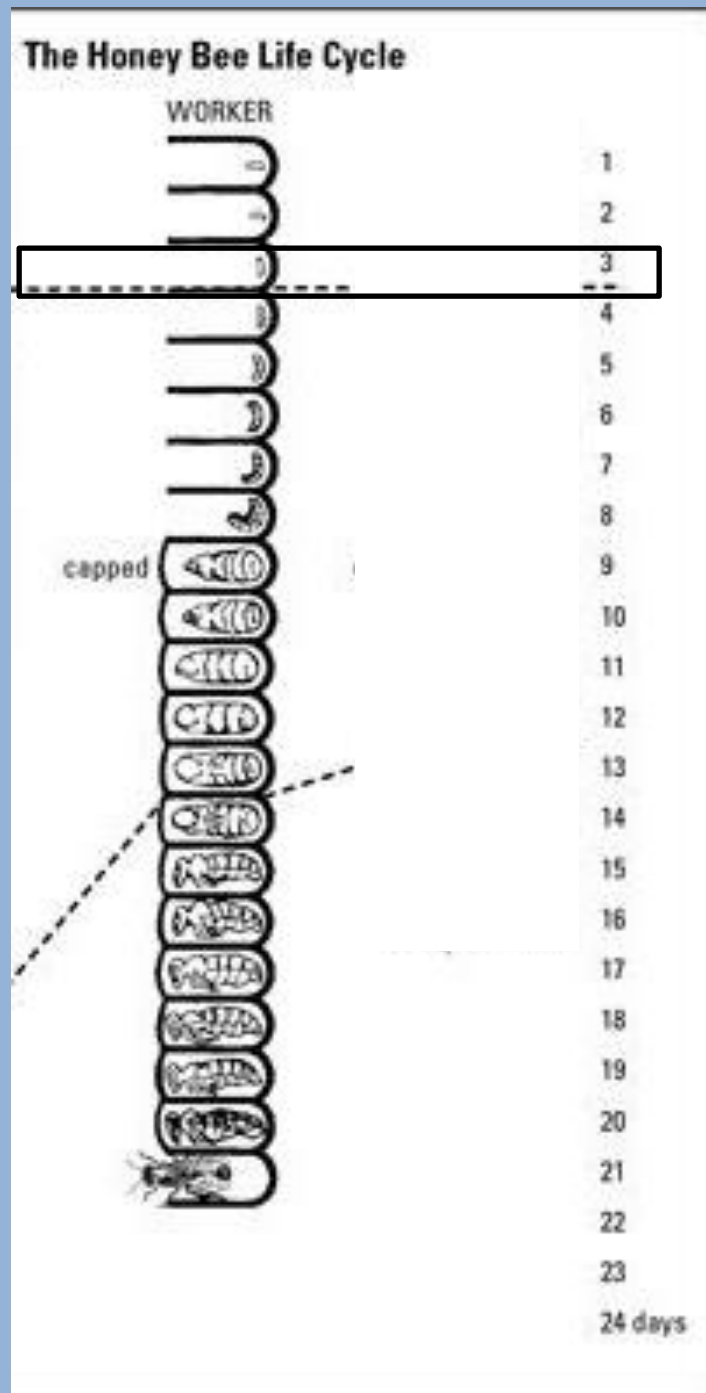
1

2



3

4



The egg hatches
on day 3

By day 4 there
should not be
any eggs

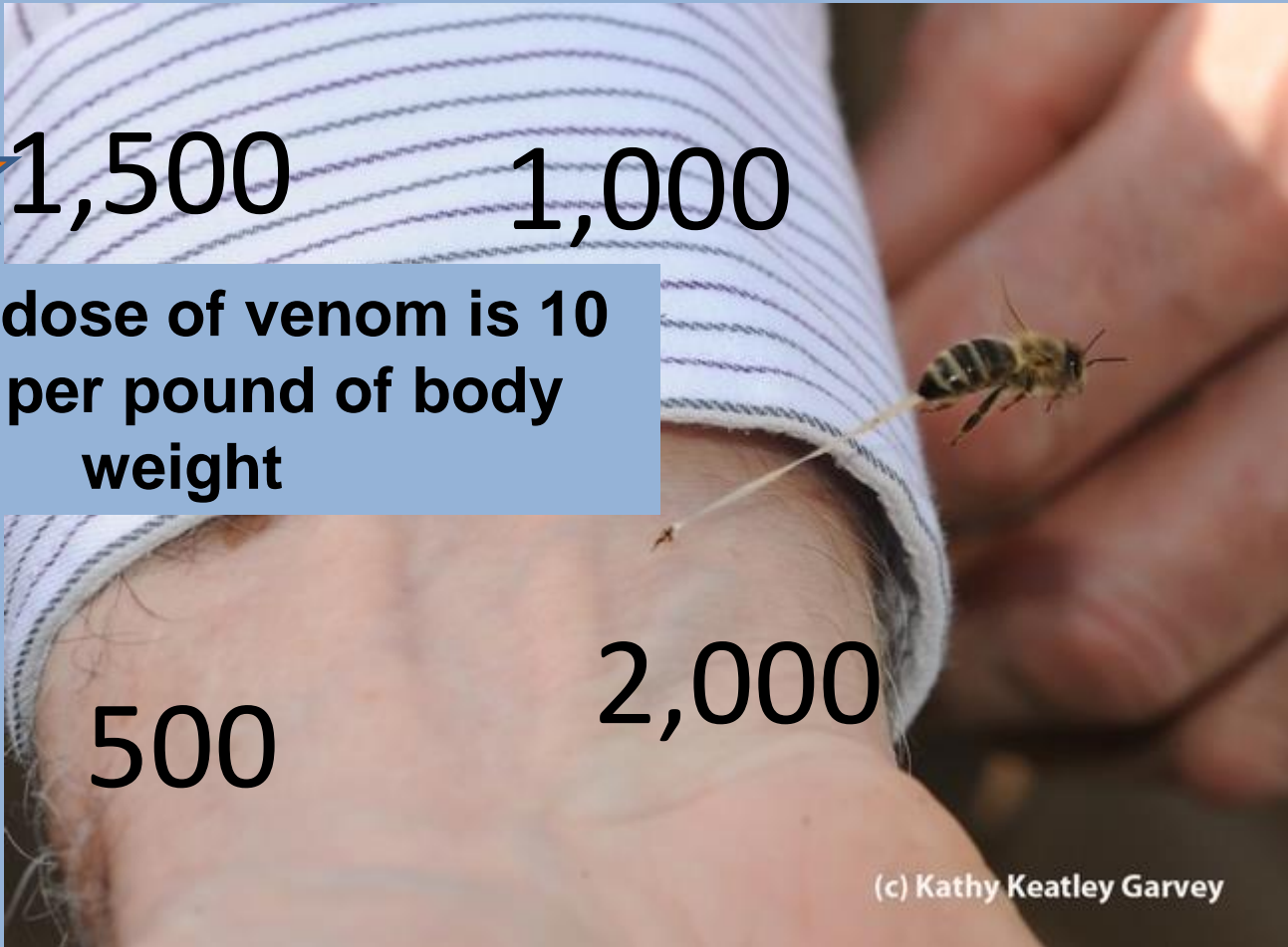
Math question #16: How many stings would be lethal for a 150 pound person?

★ 1,500 1,000

A lethal dose of venom is 10 stings per pound of body weight

500 2,000

(c) Kathy Keatley Garvey



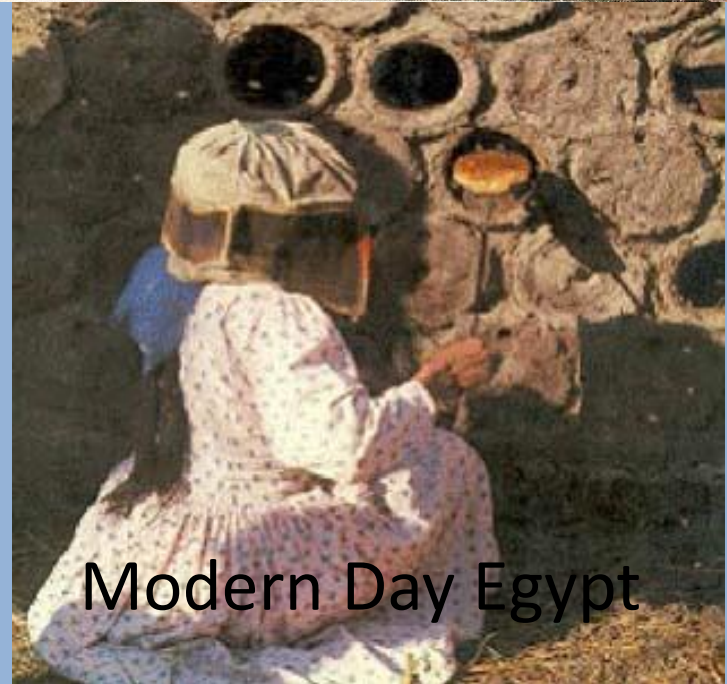
Math question #17: For how many years have people been sustainably keeping bees?



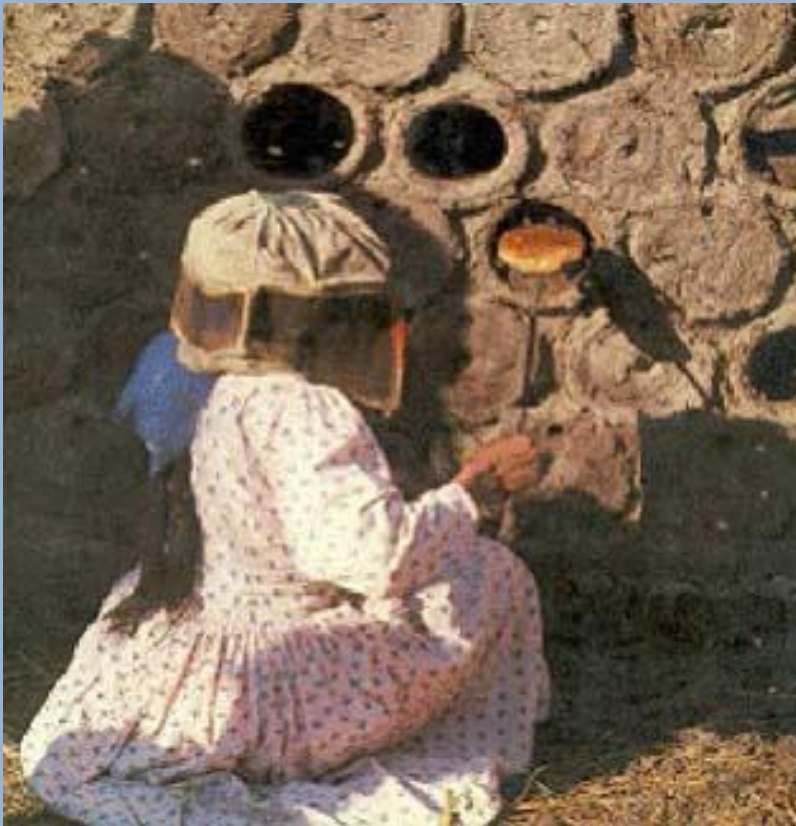
Sustainable Beekeeping: Then and Now



4,000 – 4,500 years ago



Bonus question: What does this shape of honey comb remind you of?



Ross Rounds

Final Question:

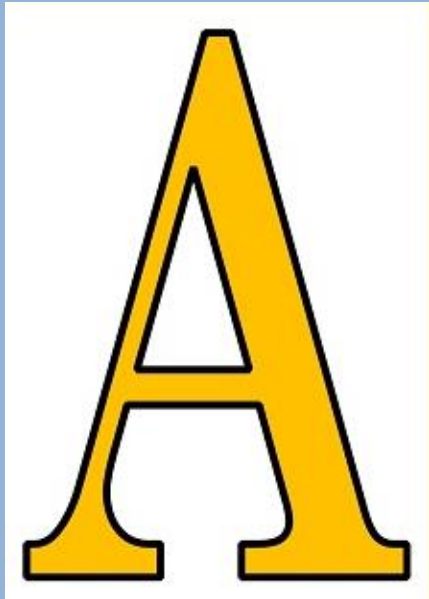
According to recent research what portion of Varroa mites are removed by burning cannabis in your smoker?



Unknown; The researcher can't remember where he left his notes.



SO How did you do w/ BEE MATH?



Questions?



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