3.8: PUNNETT SQUARE PRACTICE
ANSWER KEY

Punnett Square Practice

Case 1: The Cat with Extra Toes
Some cats have a quirky mutation that gives them extra toes—called polydactyly. While most cats have 18 toes, polydactyl cats might have 20 or more!

- Dominant: P = polydactyl - extra toes
- Recessive: p = normal toes.

Complete a Punnett square to predict the results of a cross between a **heterozygous parent (Pp)** and a **homozygous dominant parent (PP).** The genotypes of each parent have been filled in for you. Note that the underline indicates a lower-case "p" - it can be hard to tell it apart from the capital "P" when they are not side-by-side.)

	P	**P**
P	PP	PP
p	Pp	Pp

What percentage of offspring are expected to have **extra toes**? 100%

Case 2: The Milk Mystery
Some people can drink milk their whole lives, while others feel sick because they're lactose intolerant. This trait is linked to the LCT gene, which helps the body break down lactose.

- Dominant: L = lactose tolerant
- Recessive: l = lactose intolerant

Complete a Punnett square to predict the results of a cross between **two heterozygous parents (Ll).**

	L	l
L	LL	Ll
l	Ll	ll

What percentage of offspring are expected to be **lactose tolerant**? 75%

Case 3: The Snow-White Squirrel
Albinism is a genetic condition that causes animals (and humans) to have no melanin pigment. This results in white fur and pink eyes.

- Dominant: A = normal pigment
- Recessive: a = albino.

Complete a Punnett square to predict the results of a cross between a **homozygous dominant parent (AA)** and a **homozygous recessive parent (aa).**

	a	a
A	Aa	Aa
A	Aa	Aa

What percentage of offspring will have **albinism**? 0%

Case 4: The Cilantro Soap Taste Buds
Some people think cilantro tastes fresh and delicious, while others say it tastes like soap! This difference is due to a single gene called OR6A2.

- Dominant: S = soap taste
- Recessive: s = normal taste

Complete a Punnett square to predict the results of a cross between a **heterozygous parent (Ss)** and a **homozygous dominant parent (SS).**

	S	S
S	SS	SS
s	Ss	Ss

What percentage of offspring are expected to taste **soapy cilantro**? 100%

Case 5: The Muscular Cow
A mutation in the MSTN gene can cause animals (and even humans) to grow much bigger muscles.

- Dominant: M = normal muscle
- Recessive: m = super muscle.

Complete a Punnett square to predict the results of a cross between **two heterozygous parents (Mm).**

	M	m
M	MM	Mm
m	Mm	mm

What percentage of offspring are expected to have **super muscles**? 25%

Case 6: The Fainting Goat Farm
Fainting goats have a rare condition where their muscles stiffen when they get startled, causing them to fall over!

- Dominant F = normal
- Recessive: f = faints.

Complete a Punnett square to predict the results of a cross between a **homozygous dominant parent (FF)** and a **homozygous recessive parent (ff).**

	f	f
F	Ff	Ff
F	Ff	Ff

What percentage of offspring are expected to be **fainting goats**? 0%

Extension Challenge: Designer Doodle Dilemma
A breeder is crossing two types of designer dogs—Poodles and Golden Retrievers—to create the next generation of Goldendoodles. The breeder is interested in **two** traits:

Fur Texture

- C = curly (dominant)
- c = straight (recessive)

Shedding Level

- S = non-shedding (dominant)
- s = sheds (recessive)

The breeder wants to know the possible outcomes of crossing two heterozygous Goldendoodles. **Each parent is CcSs.**

1. What is the phenotype of the two parents? Both parents have curly, non-shedding fur.

2. The following Punnett square has been filled in to show the possible combinations of fur texture and shedding level alleles that each parent could pass on to the offspring. Complete the Punnett square to show the possible outcomes of this cross. The first box has been filled in for you.

	CS	**Cs**	**cS**	**cs**
CS	**CCSS**	CCSs	CcSS	CcSs
Cs	CCSs	CCss	CcSs	Ccss
cS	CcSS	CcSs	ccSS	ccSs
cs	CcSs	Ccss	ccSs	ccss

3. The breeder would like puppies with curly, non-shedding fur. What percentage of puppies from these two parents are expected to have **curly, non-shedding fur**?
   9 out of 16 puppies, or 56%, would have curly, non-shedding fur.

Investigation Reflection

1. Is it possible for an organism to carry a gene for a trait without showing it? Support your answer with an example from this activity.
   Yes, it is possible! That's called being a carrier. A carrier has one dominant and one recessive allele, so they don't show the

trait but can pass it on. For example, in the albinism scenario, an animal with the genotype Aa looks normal because the dominant "A" form of the gene covers the recessive "a" form of the gene. But they can still pass the "a" allele to their offspring.

2. If a Punnett square shows a 25% chance of a trait, does that mean exactly 1 out of every four offspring will have it? Why or why not?
No, it doesn't mean exactly 1 out of 4 will have the trait. It means each offspring has a 25% chance of having the trait, like rolling a four on a die. You might get 0, 1, 2, or even 4 with the trait–just by chance. Punnett squares show probability, not exact numbers.

3. How could scientists or breeders use Punnett squares in the real world—even if the outcomes aren't guaranteed?
They can use Punnett squares to predict the chances of traits showing up in order to make decisions about which parents to breed.. For example, animal breeders might want more cows with the super muscle gene or fewer goats with the fainting gene. Even though it's not guaranteed, they can use Punnett squares to increase the chances of getting the desired traits by choosing the right parents to breed.